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Food and Nutrition Security Status in India

Opportunities for Investment Partnerships

T. Nandakumar, Kavery Ganguly, Pravesh Sharma, and Ashok Gulati

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T. Nandakumar is a former secretary of agriculture, Government of India, and currently Member, National Disaster Management Authority.

Kavery Ganguly is a senior research analyst of International Food Policy Research Institute-New Delhi Office (IFPRI-NDO).

Pravesh Sharma is a former principal secretary of agriculture, Government of Madhya Pradesh, special commissioner, Government of Madhya Pradesh, and currently, managing director for the Small Farmers Agri Business Consortium (SFAC), a specialized agency of the Ministry of Agriculture, Government of India.

Ashok Gulati is director in Asia of IFPRI-NDO.

Asian Development Bank

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org

November 2010
ISSN 2071-9450
Publication Stock No. WPS102475

Unless otherwise noted, “$” refers to US dollars.

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The authors of this paper would like to express their sincere thanks to Prof. Vijay Vyas and the team from ADB and the Food and Agriculture Organization (FAO) of the United Nations for their very helpful and constructive comments.

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Abbreviations

AAY	Antyodaya Anna Yojana
ADB	Asian Development Bank
AIBP	Accelerated Irrigation Benefit Program
APMC	Agriculture Produce Marketing Committee
BPL	below poverty line
CGIAR	Consultative Group on International Agricultural Research
CSO	Central Statistical Organization
FAO	Food and Agriculture Organisation of the United Nations
GDP	gross domestic product
ICAR	Indian Council of Agricultural Research
ICDS	Integrated Child Development Scheme
IFPRI	International Food Policy Research Institute
KBK	Koraput-Bolangir-Kalahandi
MNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
NASA	National Aeronautics and Space Administration
NFHS	National Family Health Survey
NFSM	National Food Security Mission
NHM	National Horticulture Mission
NREGA	National Rural Employment Guarantee Act
PDS	Public Distribution System
R&D	research and development
RKVY	Rashtriya Krishi Vikash Yojana (National Agriculture Development Programme)
SRR	seed replacement rate

Abstract

Ensuring food and nutrition security is a challenge for India, given its huge population and high levels of poverty and malnutrition. India is a net agricultural exporter, particularly of milk, fruits and vegetables, and cereals. However, food availability is threatened by the effects of climate change and declining water resources on agriculture output. Economic access to food by about a fourth of the population living below the poverty line is problematic, despite impressive economic growth in the recent years. The level of food absorption is also low. About 44% of children under the age of 5 are underweight, around half of pregnant women are anemic, and the majority of women do not have access to toilet facilities and safe drinking water.

This paper provides an overview of the various government programs and policies that seek to tackle food and nutrition security in India. Finding that government efforts alone and a business-as-usual approach have been inadequate to meet the challenges, the paper explores opportunities for investment and knowledge partnerships among various players to help improve the status of food and nutrition security in India.

Executive Summary

Food and Nutrition Security in India: A Backdrop

With a population approaching almost 1.2 billion in 2010, India is likely to be the most populous country on this planet by 2030 with 1.6 billion people. It currently accounts for more than 17% of the global population and 456 million poor, or 41.6% living on less than $1.25 a day (Chen and Ravallion 2008). Ensuring food and nutrition security is thus a challenge for India.

Food security concerns can be traced back to the experience of the Bengal Famine in 1943 during British colonial rule. With the launching of major reforms in 1991, although liberalization was already under way since the 1980s, India has grown out of a period of acute shortages and heavy dependence on food aid to self-sufficiency, or broadly, self-reliance in food. The agriculture sector in India has had quite a revolutionary past with the Green Revolution in the late 1960s and 1970s, White Revolution (Operation Flood) in the 1970s and 1980s, and efforts to usher in a second Green Revolution to re-energize the food grain sector in 2010. India's agriculture system is also undergoing a structural transformation, especially the high-value segment. Production patterns are diversifying toward high-value commodities such as fruits and vegetables, milk, eggs, poultry, and fish, in response to changing demand patterns fuelled by a growing economy and rising income levels. While the achievements of Indian agriculture since the early 1970s, together with a robust economy and buoyant external sector, have helped to ensure macro-level food security to a large extent, a considerable number of people continue to live in poverty and hunger.

The key question is, can India feed itself in the near and medium-term future? Can it enhance agricultural productivity in an environmentally sustainable manner, exploit the untapped potential of eastern India, and play on the world agricultural markets to satiate domestic demand? Raising productivity of staples like rice and wheat is a challenge as the area under these grains is likely to remain constant or even decrease due to increasing pressure on land for nonagricultural uses. Unlike in the past when the country had to suffer foreign exchange constraints and depend heavily on food aid, India today is in a much better position to enter the global markets with $296.4 billion (as 15 October 2010) in foreign exchange reserves. While increased investments and technological breakthrough can improve availability, these may not necessarily translate into increased accessibility and absorption of food. With nearly 43.5% of children under the age of 5 being underweight (the highest rate in the world), and 50% of pregnant women being anemic (comparable to African countries), the nutritional security of children and women is a serious issue that needs to be addressed urgently (World Bank 2009).

Food and nutrition security is broadly characterized by three pillars: availability, accessibility, and absorption (nutritional outcomes). In an effort to attain these, it is almost certain that it will be necessary to innovate and consider out-of-the-box policy options. The role of various stakeholders and partnerships among them will be critical. These include public and private sectors, community groups, multilateral agencies, and philanthropic foundations as well as bilateral collaboration between nations. In analyzing the past trends of food and nutrition security status in India, this paper provides an overview of the extent of public sector intervention through various programs and also explores opportunities for future investment and knowledge partnership between various stakeholders.

Availability of Food (Physical Access)

The policy goal to attain self-sufficiency in food grains in a sustainable manner resulted in a major effort led by the national government in partnership with domestic partners and international agencies to mobilize technical, administrative, and financial resources to launch the Green Revolution. While all-India production of wheat grew at 3.8% in the triennium ending (TE) 1959–1960, it registered a growth of 10.3% in the triennium ending in 1969–1970. The trends observed in Haryana (from –1.1% to 27.2%) and Punjab (from 3.8% to 25.1%) were spectacular. Between 1950–1951 and 2008–2009, production of food grains and its categories (rice, wheat, coarse cereals, and pulses) increased but the growth patterns have been volatile. Food grains comprise nearly 64% of the gross cropped area and account for less than 25% of the total output value of agriculture in TE 2007–2008 (which in India is defined as crop, livestock, and fisheries). Yet cereals (probably for food security reasons) continue to dominate the policy debate in agriculture. The high-value segment accounts for 48.4% of the value of agricultural output in triennium ending in 2008–2009 and is likely to drive future growth in agriculture.

India has emerged as the largest producer of milk (108.5 million tons in 2008–2009) and the second largest producer of fruits and vegetables (197.6 million tons in 2008–2009). Production of fish has also nearly doubled since 1990–1991. Agricultural trade in India has been growing steadily, especially during 1990–2009. Net agricultural exports increased from $2.7 billion in 1990–1991 to $10.7 billion in 2008–2009. Between 2001–2002 and 2008–2009, India has exported a cumulative total of 33.2 million tons of rice. Despite volatility in production patterns, there have been times when India accumulated large stocks of rice and wheat. As of 30 April 2010, the central pool has nearly 60 million tons of rice and wheat.

One of the issues pertaining to the ongoing debate on food security is the per capita availability of food. The overall trend in per capita availability of food grains, though fluctuating has been marginally negative (with per capita availability gradually coming down). It should be noted that while availability is a concern, changing demand patterns, especially diversifying toward high-value commodities, have to be taken into account. The issue of food security is not so much about availability of food grains but the composition of the overall food basket as observed from changing consumption patterns. As economic growth picks up, it is common to observe a change in dietary patterns wherein people substitute cereals with high-value food.

Given the present policy imperative of seeking self-sufficiency in food production, as revealed in the five-year plans, India will have to largely feed itself. The challenge, therefore, is to do it in an environmentally and financially sustainable manner. Issues related to the impact of climate change on agricultural production systems and depleting water reserves need to be addressed. The government's flagship programs such as the National Agriculture Development Programme (Rashtriya Krishi Vikash Yojana or RKVY) and National Food Security Mission (NFSM), and programs related to irrigation like the Accelerated Irrigation Benefit Program, Integrated Watershed Management Program, Micro Irrigation Mission are geared toward providing the much needed boost to enhance agricultural productivity and, thereby, higher agricultural growth. For high-value agriculture, the National Horticulture Mission (NHM) is an initiative by the public sector.

The private sector has a greater role to play in terms of investments in value chains and strengthening the firm–farm linkages critical for scaling up processing and retailing operations. The issue of huge post-harvest losses (nearly 20%–30% in the case of fruits and vegetables)

and poor processing levels arising from fragmented value chains will require large investments and knowledge partnerships. Several private players, both domestic and multinational, are venturing into agriculture and developing models of better firm–farm linkages. The private sector has already emerged as a significant player in the seed market and there is opportunity for its greater presence in other input services related to high-value agriculture.

Accessibility (Economic Access)

Alongside the rising middle class in India steering the changes in consumption patterns and driving up demand for quality food, there is a large section of the population dwelling below the poverty line. Although the proportion of poor people has come down from 55% in 1973–1974 to 27.5% in 2004–2005, the rate of decline has somewhat slowed down in the post-reform period and more than 300 million people continue to live in poverty. Food accounts for more than 50% of the monthly per capita expenditure in India and even more for the low income groups. Hence, economic access to food is an issue for the poor and vulnerable groups. However, a dietary transformation is under way, with the consumption of cereals declining and that of high-value food increasing. Consumption of cereals has declined over time: per capita monthly consumption of cereals has come down from nearly 15 kg in 1983 to 12 kg in 2004–2005 in rural areas, while it has declined in urban areas from 11.3 kg in 1983 to almost 10 kg in 2004–2005 during the above period. The change in consumption pattern is observed across income classes in both rural and urban areas.

Growth alone may not be able to ensure food security for the poor and vulnerable. Social safety net programs and employment-generating programs will play an important role in improving accessibility of food to the poor and vulnerable.

The Public Distribution System (PDS) is the largest public sector-managed network for the distribution of essential commodities, primarily rice, wheat, sugar, and kerosene. The functioning of the PDS is a joint responsibility of both central and state governments. The PDS imposes an enormous financial burden on the public exchequer, which is quite visible from the rising food subsidy bill (Rs555.8 billion in 2010–2011). The efficacy of the system in terms of targeting and coverage varies from state to state and is often questioned. One of the most critical questions is targeting and identifying the poor. Innovations such as social audits for identification of the poor, food coupons to reach out to the beneficiaries, or even direct cash transfers are being discussed and experimented on in some cases. The National Rural Employment Guarantee Act (NREGA) of 2005 aims at improving the livelihood security of rural households by providing at least 100 days of guaranteed wage employment in a financial year to every household whose adult members volunteer to undertake unskilled manual work. The Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) has helped create rural job opportunities, which has an impact on the supply of agricultural laborers. The latest effort made by the national government to promote food security is through the National Food Security Bill. The government proposes to ensure that every family below the poverty line in the country shall be entitled to 25 kg (or 35 kg) of wheat or rice per month at Rs3 per kg.

Absorption (Nutritional Outcomes)

An interrelated and important aspect yet to be effectively addressed is nutritional security. Despite intervention through several food-based social safety net programs, some of them running over decades, malnutrition levels continue to be severe and persistent. There is an urgent need to envisage an integrated nutrition and health program for all vulnerable groups,

focusing on the role of gender and governance. Poor nutritional outcomes of infants and children arise from the poor health status of women, overall poverty and lack of hygiene, and inadequate health facilities. In particular, women's access to clean drinking water, toilet facilities, and clean cooking fuel influence their health outcomes, which are critical for child health and nutrition. Over 53% of women do not have access to toilet facilities, 55% do not have drinking water in their premises, and only 29% have access to clean fuel. In India, 35.6% of women suffer from chronic energy deficiency, indicated by a body mass index below 18.5 (Jose and Navaneetham 2010). Micronutrient deficiencies alone may cost India $2.5 billion annually (Gragnolati et.al. 2005).

What is the relation between agricultural performance and nutritional outcomes? Gulati and Shreedhar (2010) observe a negative correlation between value of agricultural output per hectare and malnutrition status across Indian states. The Integrated Child Development Scheme and Mid Day Meal Scheme are two flagship public programs directed toward addressing the nutritional outcomes for women and children. There are other food-based programs targeted to ensure the nutritional security of the vulnerable groups.

Opportunities for Linkages and Synergy for Investment Partnerships

Recognizing the importance of augmenting food production and improving economic access to food for better nutritional outcomes, the Government of India has stepped up agricultural investments through the RKVY, NFSM, and other initiatives; introduced major programs like NREGA; and is thinking of coming up with a food security bill. It also carries a large subsidy account together with the planned expenditures. The central plan outlay for 2010–2011 of the agriculture department stands at Rs118.8 billion or approximately $2.5 billion, and additional central assistance in the form of RKVY of Rs67.22 billion or approximately $1.4 billion for 2010–2011.The outlay from the Indian Council for Agricultural Research is Rs23.0 billion or approximately $480 million (planned) and Rs15 billion or approximately $312.8 million (non-planned).[1] Apart from this, the outlay for the Accelerated Irrigation Benefit Program for 2010–2011 stands at Rs115 billion or about $2.4 billion. The state governments have also stepped up their expenditure share, with Rs180 billion or $3.7 billion in 2009–2010.

In this effort, the role of private sector participation and investment opportunities is also recognized. There is scope for creating synergies with civil society organizations and the multilateral, bilateral, and philanthropic foundations. It is well understood that the scale of the issues related to food and nutrition security in a country like India is quite high and so are the levels of public programs aimed at addressing them. If investments have to increase manifold, it cannot be brought in by the public sector alone; there is need for partnerships. It is likely that a large part of investments will come from the private sector out of their business plans and strategies. While the public sector can incentivize private investments by creating an enabling policy environment, the multilateral and bilateral agencies can bring in innovative models of better monitoring and management that can improve the delivery of output per unit of money invested.

If India were to bring down poverty to less than 5% in a decade, what types of investments will be needed to achieve this target and how much will these cost? Will it be enough to boost investments by 25% and can that ensure a 4% agricultural growth? Or will it need an almost

[1] Planned expenditure comprises of demand for grants by various ministries and hence a large part of the total expenditure budget of the government. Non-planned revenue expenditure includes interest payments, subsidies (mainly on food and fertilizers), loans, etc.

100% increase in investments related to agriculture, which can accelerate the growth of agriculture to 6% or 7%, and is widespread geographically and socially, to ensure food and nutritional security for India's masses? If so, where are these investments going to come from? Looking into the role of the various stakeholders, the public sector can enhance investments by rationalizing subsidies as these have much lower rates of return than investments in, say, agriculture research and development, rural roads, and irrigation. The private sector can take the lead in investments in value chains, be it by farmers or corporate players. The role of the multilateral and bilateral agencies can be supporting many of the public sector initiatives and also private ventures through better technology, innovative models of program management, and knowledge partnerships.

Given India's size and the magnitude and diversity of its challenges, there is space for multilateral agencies, the private sector, and civil society organizations to play meaningful and effective roles.

1. Backdrop and Conceptual Framework for Food and Nutrition Security

With a population approaching almost 1.2 billion in 2010, India is likely to be the most populous country by 2030 with 1.6 billion people. It currently accounts for more than 17% of the global population and 456 million poor, or 41.6% living on less than $1.25 a day (Chen and Ravallion 2008). Ensuring food and nutrition security is thus a challenge for India.

Food security concerns in India can be traced back to the Bengal Famine in 1943 at the time of British colonial rule, during which about 2 million to 3 million people perished owing to starvation. Since obtaining independence, an initial rush to industrialize while ignoring agriculture, two successive droughts in the mid-1960s, and dependence on food aid from the United States exposed India's vulnerability to several shocks on the food security front.

With the launching of major reforms in 1991, although liberalization had been under way since the 1980s, India has grown out of a period of acute shortages and heavy dependence on food aid to self-sufficiency, or broadly, self-reliance in food. With some bold thinking and organized state action, the country's planners were able to usher in a Green Revolution in the late 1960s and early 1970s, enabling India to overcome productivity stagnation and to improve food grain production from 51 million tons in 1950–1951 to 108.4 million tons in 1970–1971 and 234.47 million tons in 2008–2009.[2] Despite its success, the Green Revolution is often criticized for being focused on only two cereals, wheat and rice; being confined to a few resource-abundant regions in the northwestern and southern parts of the country that benefited mostly rich farmers; and putting much stress on the ecology of these regions, especially soil and water. However, it is important to realize that it was because of the Green Revolution that India was able to come out of dependence on imports and food aid and meet demands through domestic production.

The Green Revolution was followed by the so-called White Revolution, which was initiated by Operation Flood during the 1970s and 1980s. This national initiative has revolutionized liquid milk production and marketing in India, making it the largest producer of milk (108.5 million tons in 2008–2009). Of late, especially during the post-2000 period, hybrid maize for poultry and industrial use and *Bacillus thuringiensis* (Bt) cotton have shown great strides in production, leading to sizeable exports of cotton, which made India the second largest exporter of cotton in 2007–2008.

While the achievements of Indian agriculture for at least 3 decades since the early 1970s, together with a robust economy and buoyant external sector, have helped to ensure macro-level food security to a large extent, broad sections of the population continue to suffer from hunger. At the same time, driven by rising income levels, food demand is increasing and diversifying. The key question is, can India feed itself in the near and medium-term future? Can it enhance agricultural productivity in an environmentally sustainable manner, exploit the untapped potential of eastern India, and play on the world agricultural market to satiate domestic demand? The challenge is to raise the productivity of its basic staples, such as rice and wheat, as the area used for grains is likely to remain constant and even decrease under the increasing pressures of urbanization and industrialization. However, unlike in the past when the country had to suffer foreign exchange constraints and depend heavily on food aid, India today is in a

[2] According to the fourth advance estimate for 2009–2010, food grain production has declined to 218.2 million tons primarily due to a decline in the *kharif* output owing to a severe drought in 2009 (Government of India 2010).

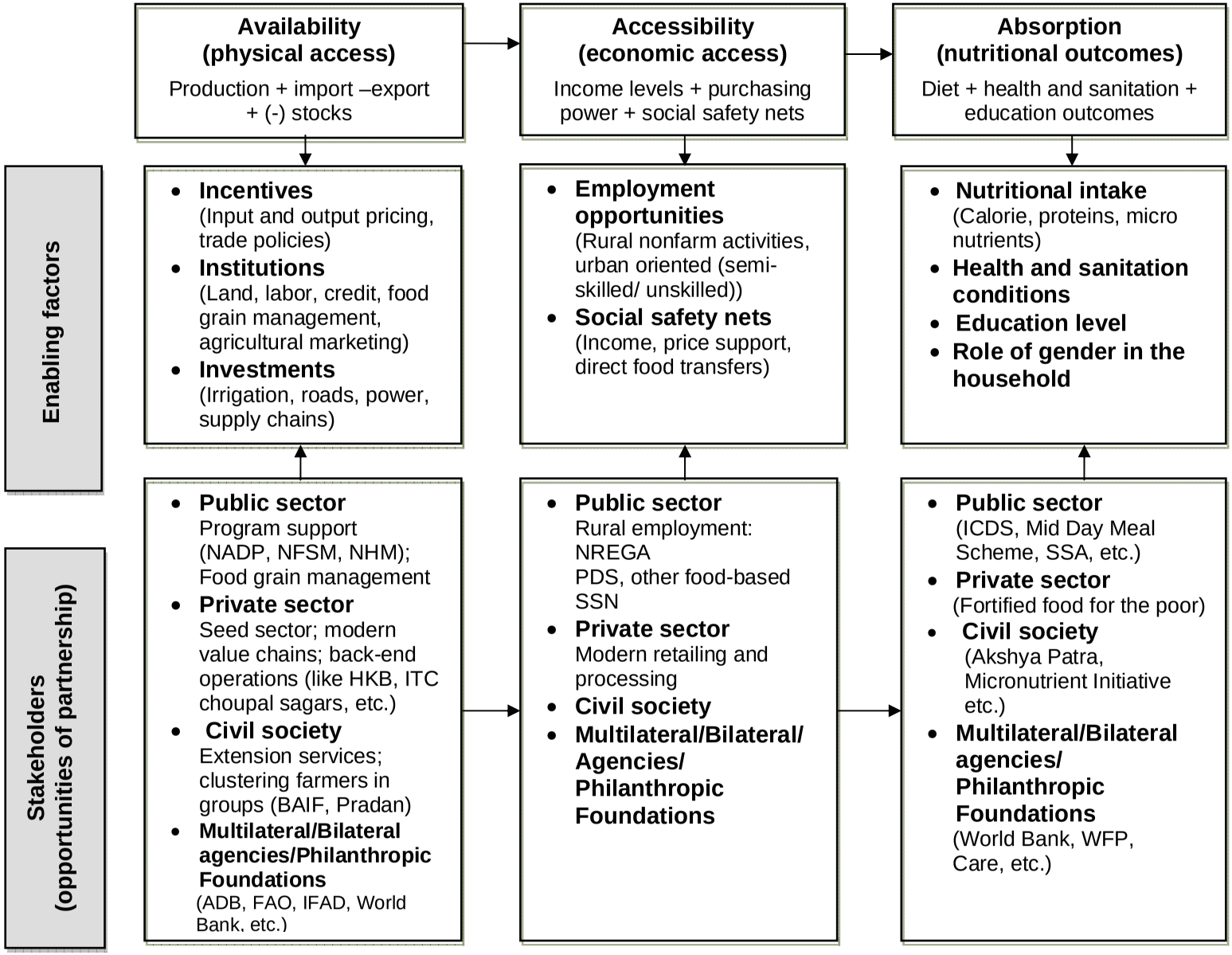
much better position to enter the global market with $296.4 billion in foreign exchange reserves as of 15 October 2010. The concern has moved beyond self-sufficiency in food to being self-reliant in food. Being self-reliant in food implies not only domestic production but also import of food, where necessary. However, large imports at short notice by large countries, such as India or the People's Republic of China, can also trigger a global price rise in those commodities.

While increased investments and technological breakthroughs can improve availability, they may not necessarily translate into increased accessibility and absorption of food. With nearly 43.5% of children under the age of 5 being underweight (the highest rate in the world) and 50% of pregnant women being anemic (comparable to African countries), the nutrition security of children and women are serious issues that need to be addressed urgently (World Bank 2009). Nutrition security is often an outcome of food security and access to sufficient and nutritious food and basic health and sanitation facilities, along with good education about hygiene and dietary issues.

As defined by *The State of Food Insecurity* (Food and Agriculture Organization of the United Nations [FAO] 2002): "Food security (is) a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."

Following this definition, the paper reexamines past trends and the underlying policy environment, disaggregated at availability, accessibility, and absorption. This provides a backdrop to analyze the existing policy gaps and options to ensure food and nutrition security for India's billion-plus population. While it is almost certain that it will be necessary to innovate and consider out-of-the-box policy options, the roles of various stakeholders and partnerships among them will be critical. These include public and private sectors, community groups, multilateral agencies, and philanthropic foundations, as well as bilateral collaborations between nations (Figure 1).

Figure 1: A Conceptual Framework of Food and Nutrition Security: Opportunities for Partnerships



(–) = negative, ADB = Asian Development Bank, BAIF = Bharatiya Agro Industries Foundation, EX = imports, FAO = Food and Agriculture Organization, HKB = Hariyali Kisaan Bazaar, ICDS = Integrated Child Development Scheme, IFAD = International Fund for Agricultural Development, IM = imports, ITC = Indian Tobacco Company, NADP = National Agriculture Development Program, NFSM = National Food Security Mission, NHM = National Horticulture Mission, NREGA = National Rural Employment Guarantee Act, PDS = Public Distribution System, SSA = Sarva Shiksha Abhiyan, SSN = Social Safety Nets, WFP = World Food Programme.
Source: Authors' contribution.

2. Availability of Food (Physical Access)

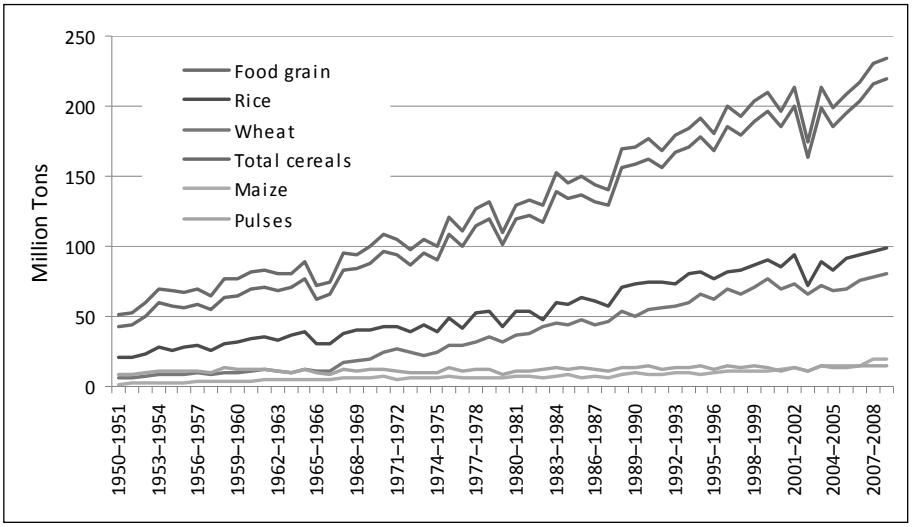
2.1. Domestic Production (Cereals and Other High-Value Commodities)

Performance of the Food Grain Sector

The goal to attain self-sufficiency in food grain in a sustainable manner resulted in a major effort led by the national government to mobilize technical, administrative, and financial resources to launch the Green Revolution. This was enabled significantly by the technological breakthroughs in wheat yields achieved by Consultative Group on International Agricultural Research (CGIAR) institutions working in collaboration with national and international partners in Mexico. The so-called miracle seeds found their way to the fields of Indian farmers, thanks to a unique coalition of actors spanning the technical, political, and administrative spheres. Coordinated policy action on the part of the Indian government, addressing issues of timely water availability, input supplies, credit, and an effective extension system, resulted in the rapid increase in adoption of high-yielding variety seeds for wheat and paddy. This led to a sizeable increase in the production and productivity of both these crops.

While the all-India picture improved, with Punjab and Haryana leading the way, the success was not evenly distributed in the less-endowed central and western regions of the country. Lack of adequate institutional capacity also prevented the potential of the lower Gangetic valley, especially in eastern Uttar Pradesh and Bihar, from being fully realized. While the two states of Punjab and Haryana have consistently held the leadership position in productivity, this has been at the cost of immense stress on soil and water. While all-India production of wheat grew at 3.8% in the triennium ending in 1959–1960, it registered a growth of 10.3% in the triennium ending in 1969–1970. The trends observed in Haryana (from –1.1% to 27.2%) and Punjab (from 3.8% to 25.1%) were spectacular. Between 1950–1951 and 2008–2009, production of food grain and its categories (rice, wheat, coarse cereals, and pulses) has increased but the growth patterns have been volatile (Figure 2).

Figure 2: Production of Food Grain Crops in India, 1950–1951 to 2008–2009

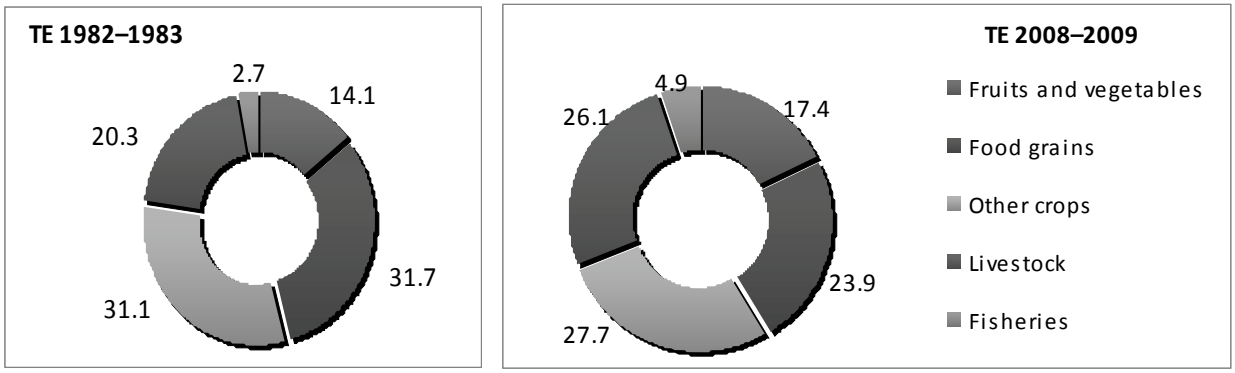


Source: Government of India, Ministry of Agriculture. 2009a. *Agricultural Statistics at a Glance 2009*. New Delhi.

Rising Share of High-Value Commodities

Food grain constitutes nearly 64% of the gross cropped area and accounts for less than 25% of the total output value of agriculture (which in India is defined as crops, livestock, and fisheries). Yet cereals (probably for food security reasons) continue to dominate the policy debate in agriculture. It is true that the agricultural production basket is diversifying although not at the desired pace. While fruits and vegetables account for 17.4% of the value of output, the share of livestock is 26.1% and that of fisheries is 4.9%. In aggregate, the high-value segment accounts for 48.4% of the value of agricultural output in the triennium ending 2008–2009 (Figure 3).

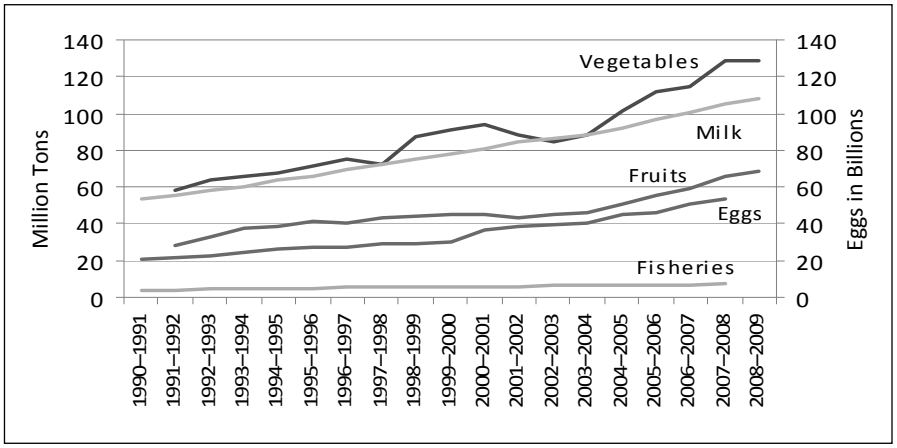
Figure 3: Rising Share of High-Value Agricultural Commodities in India (%)



TE = triennium ending.
Source: Government of India, Central Statistical Organization. 2009b.National Accounts Statistics. New Delhi

Supply patterns are responding to the changing demand and the high expenditure elasticity of high-value commodities. India is the largest producer of liquid milk (108.5 million tons in 2008–2009) and the second largest producer of fruits (68.5 million tons, 12% of global production) and vegetables (129.1 million tons, 13% of global production). Production of fish (marine and inland combined) increased from 3.8 million tons in 1990–1991 to 7.3 million tons in 2008–2009 (Figure 4). Inland fish account for nearly 62% of the total fish production in India.

Figure 4: Production of High-Value Commodities, 1990–1991 to 2008–2009



Source: Government of India, Ministry of Agriculture Agricultural Statistics at a Glance 2009a. New Delhi. Government of India. Ministry of Agriculture. National Horticulture Board. 2009c. Indian Horticulture Database 2009. Gurgaon.

The milk revolution in India, achieved under the Operation Flood program which began in the 1970s, resulted in an increase in the production of liquid milk from 17 million tons in 1950–1951 to 108.5 million tons in 2008–2009. This has improved the per capita availability of milk from 124 grams to 258 grams per day over the same period. India produces more than 55.6 billion eggs per year, with a per capita availability of 47 eggs per annum. According to FAO estimates for 2008, India produces about 2.5 million tons of chicken meat and the demand for poultry meat is increasing (Government of India 2010b). With the advantage of diverse agro-climatic zones, India currently grows 41% of the world's mangoes and 23% of bananas, while the global share of cashew nuts is 24%, that of green peas is 36%, and that of onions is 10%. However, it accounts for just 1.4% of the global fresh produce market (*Asiafruit* 2009). Processing levels are also quite low; less than 3% of fruits and vegetables are processed and wastage in the value chain between the farm gate and the consumer is huge.

While the production basket is diversifying toward high-value commodities, large post-harvest losses (20% to 30% for fruits and vegetables) and poor value addition continue to pose challenges. Most of the existing marketing systems for high-value commodities, particularly fruits and vegetables, are quite fragmented and the supply chains are not adequate for handling perishable commodities. Although the Indian agricultural system is undergoing structural transformation, it still requires large investments and strategic allocation of resources to accelerate the process. Here, the role of organized processing and retailing is crucial as these sectors generate demand for quality produce and it is in the interest of the players to strengthen firm–farm linkages.

While organized retailing is unfolding rapidly despite the recent slowdown in the face of the food and financial crises, it has yet to attain the scale that can have a perceptible impact on availability and accessibility of food. Total food and grocery retail accounts for nearly 60% of the aggregate retail pie, while the organized segment accounts for about less than 2% of total food retail. However, emerging changes are quite promising and it will require a favorable policy environment to unleash potential gains. As observed in the case of the milk revolution in India, when production of liquid milk increased following Operation Flood, the market played an important role in successfully linking the smallest milk producer through the cooperative network.

International experience shows that organized food markets have had a positive impact by offering assured prices and buyback arrangements to farmers and competitive prices to consumers through increased competition and opportunity for co-opting, as with the existing traditional markets (Reardon and Gulati 2008). This is not to overlook the costs of adjustment that result in potential gainers and losers. Economies like the People's Republic of China, Philippines, Singapore, the and Taipei,China (under the 2006 200 Markets Upgrading Program in 2006) benefited from the upgrade and modernization of traditional markets as a spillover effect of the growth of organized food markets. In India, it is observed that competition among organized retailers results in lowering of prices, many times lower than those offered in the traditional market (Indian Council for Research on International Economic Relations 2008). An International Food Policy Research Institute (IFPRI) study shows that prices of vegetables are 33% cheaper in organized outlets compared to traditional markets, while that of fruits were 15% cheaper in Delhi (Gulati and Reardon 2008). Poor coordination and fragmented chains result in inefficiencies and wider price spreads.

A World Bank study on the value chains of mangoes, lychees, and potatoes in Bihar shows that a significant amount of the consumer price is lost in transport and wastage; for mangoes, the farmers receive 34%, for lychees 42% and for potatoes 16% of the consumer price (World

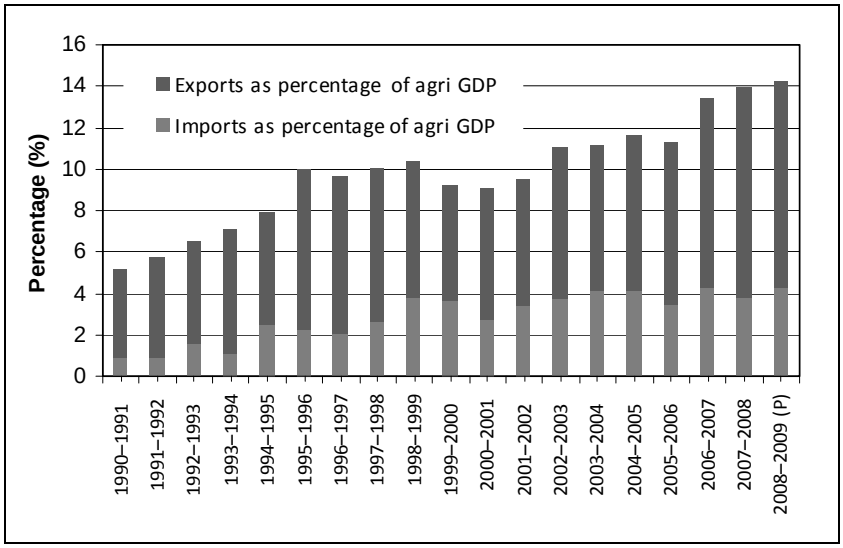
Bank 2007). For instance, a farmer selling in the Azadpur market in Delhi has to pay a 6% fee to the commission agent, while a farmer in the Vashi market in Mumbai has to pay 8.5%, in addition to a market fee of 1%. These are the official rates (quite high for the services delivered by the commission agents); unofficially, the fees go up to 12%–16%. Hence, efforts to promote direct farm–firm linkages and strengthen supply chains would help enhance the process of value addition. As the organized segment grows, so does the need for tightening the supply chain, identifying the role of each player, and developing and improving the existing business strategies.

2.2. Agricultural Trade and Stocking

Agricultural Trade

Agricultural trade in India has been growing steadily, especially during 1990–1991 to 2008–2009. Net agricultural exports increased from $2.7 billion in 1990–1991 to $10.7 billion in 2008–2009. The share of trade in the gross domestic product (GDP) of agriculture increased from 5.2% in 1990–1991 to 14.2% in 2008–2009 (Provisional) (Figure 5). Strong foreign exchange reserves have put India in a better position to play on the world food market.

Figure 5: Trade as a Proportion of Agricultural Gross Domestic Product, 1990–1991 to 2008–2009 (Provisional)

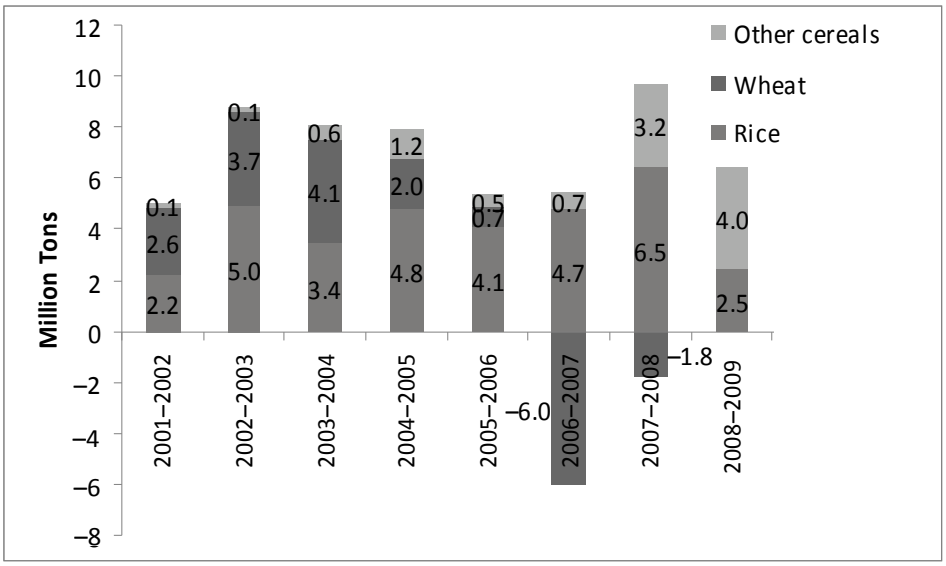


% = percentage, GDP = gross domestic product, P = provisional.
Source: Government of India, Ministry of Agriculture. Agricultural Statistics at a Glance. Various Issues. New Delhi.

The top five agricultural export items account for nearly 50% of the total export basket, while the top two import items account for more than 60% of India's total imports. Export of rice, oil meals, and marine produce increased substantially during the 2000s, while export of cotton rose dramatically. Export of fruits and vegetables (fresh and processed) has picked up. Edible oils and pulses dominate the import basket of India—$1.3 billion worth of pulses and $2.6 billion worth of edible oils in 2007–2008, with no significant change in 2008–2009. On the input side, India imported fertilizers worth $12 billion in 2008–2009, up from $445 million in 2000–2001. Given the global food and financial crises, the impacts of which can be seen on fertilizer imports, 2008–2009 was an exceptional period.

Despite food security concerns and policy flip-flops in trade decisions, India has been a cumulative net exporter of cereals at 49 million tons for the period 2001–2002 to 2008–2009. From 2001–2002 to 2008–2009, India has exported a cumulative total of 33.2 million tons of rice, 5.3 million tons of wheat, and 10.5 million tons of other cereals. Except for 2006–2007 when India imported 6 million tons of wheat, India has been largely a net exporter of cereals (Figure 6).

Figure 6: Net Export of Cereals from India: 2001–2002 to 2008–2009 (Provisional)



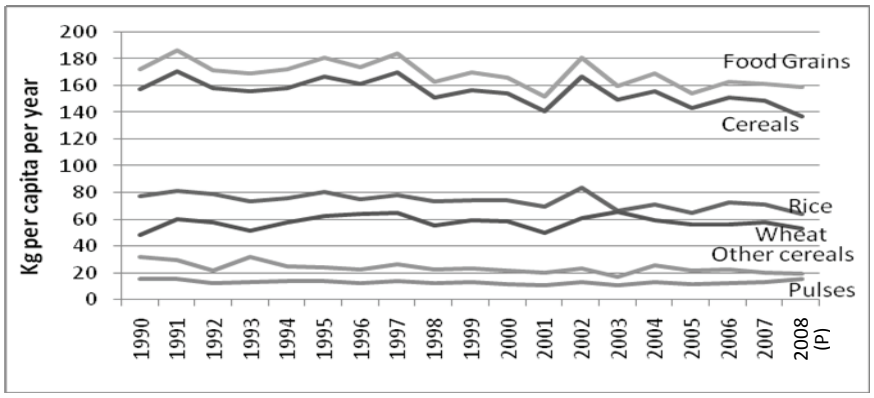
Source: Government of India, Ministry of Agriculture Agricultural Statistics at a Glance 2009a. New Delhi.

Among other cereals, export of maize picked up since 2007–2008 and India exported 3.5 million tons of maize in 2008–2009 (Government of India 2010c).

Per Capita Availability of Food and the Issue of Stocking

One of the issues in the ongoing debate on food security is the per capita availability of food. Is the country producing enough, and are government stocks adequate to feed the billion-plus population? Per capita availability of food grain went down from 172.5 kg per year in 1990 to 159.2 kg per year in 2008 (Provisional). It declined for cereals and for rice from 1990–1991 to 2008–2009. The per capita availability of wheat increased from 48.4 kg to 53 kg and that of pulses has practically remained stagnant at 15 kg per year during the same period (Figure 7). The overall trend in per capita availability of food grain, though fluctuating, has been marginally negative (with per capita availability gradually coming down).

Figure 7: Per Capita Availability of Food Grain Crops, 1990–2008 (Provisional)



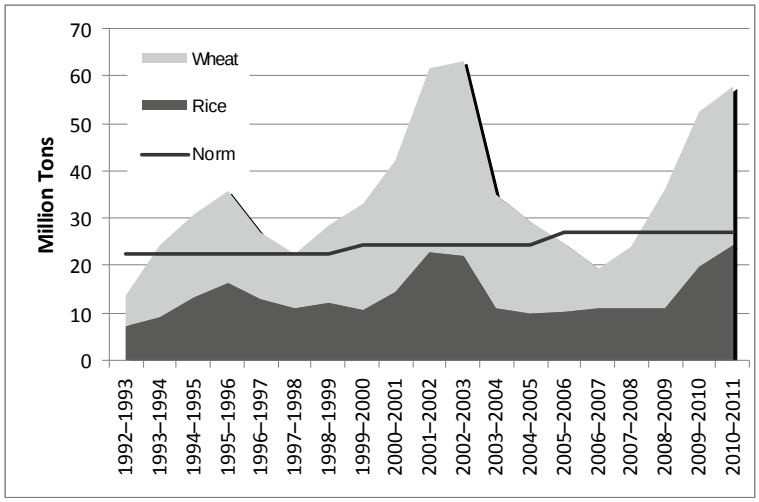
kg = kilogram, P = provisional.
Source: Government of India, Ministry of Agriculture. 2009. Agricultural Statistics at a Glance 2009. New Delhi.

The emphasis has been on enhancing production of food grain to keep pace with the population growth rate in order to ensure food security. However, it should be noted that while availability is a concern, changing demand patterns, especially diversifying toward high-value commodities, have to be taken into account. The issue of food security is not so much about availability of food grain but the composition of the overall food basket as observed from changing consumption patterns. A dietary transformation is under way in the country and demand for high-value, vitamin- and protein-rich foods, such as fruits, vegetables, milk, eggs, meat, and fish is increasing. At the same time, the high incidence of malnutrition and related health outcomes underscore the need to devise innovative instruments to target vulnerable sections of the population through specific interventions. Conditions in India vary highly from state to state as well as between different sections of the population. What may be necessary at this stage is a more nuanced food security strategy, which is less concerned with macro food grain availability and seeks more to address gaps and vulnerabilities.

During 1991–2005, consumption (availability) patterns in eight major countries of South and Southeast Asia (Bangladesh, India, and Pakistan from South Asia; and the People's Republic of China, Indonesia, the Philippines, Thailand, and Viet Nam from Southeast Asia) showed that average annual consumption of meat went up by 3.9%, vegetables by 3.7%, eggs by 3.1%, milk by 2.7%, fish by 2.4%, and fruits by 1.9%, while the consumption of grains went down by –0.4%. The biggest changes were in the People's Republic of China, which experienced the fastest rate of overall per capita GDP growth in the region during this period. Consumption of milk and eggs increased by more than 8%, fish and meat by more than 6%, fruits by 9.5%, and vegetables by 8% (Gulati and Reardon 2007). As economic growth picks up, it is common to observe a change in dietary patterns wherein people substitute cereals with high-value food.

The issue of food security at large and availability in particular is more about proper food grain management rather than just production systems. Despite volatility in production patterns, there have been times when India accumulated large stocks of rice and wheat. These in turn had to be disposed of by providing an export subsidy. Rice and wheat stocks touched an unprecedented peak of 63 million tons in July 2002. In subsequent years (until 2004), government subsidized exports (by waiving off a part of the freight and stocking costs) at a price 50% lower than its procurement costs. As a result, stocks plummeted to just 16 million tons by April 2007 (Kumar et al. 2007a). In July 2009, stocks shot up to 53.2 million tons against a norm of 26.9 million tons and a storage capacity of 27.7 million tons (Figure 8). As of July 2010, the central pool had nearly 58 million tons of rice and wheat.

Figure 8: Rice and Wheat Stocks at the Central Pool in India (as of July each year)



Source: Government of India and Food Corporation of India. 2010. Economic Survey. Various Issues.

Against this backdrop, it is relevant to ask the question: who will feed India?[3] To be able to answer this, there is a need to look into the state of future demand for food. There are variable estimates projecting the future demand for cereal commodities for 2020, 2025, or 2030. The estimates range from 223.6 million tons of cereal demand in 2020 (Dyson and Hanchate 2000) to 374 million tons (Bhalla, Hazel, and Kerr 1999). This runs the risk of causing panic but gives very little idea of what the future demand is likely to be. A review of these studies reveals that the estimates vary because of the differences in the underlying assumptions. While differences pertaining to economic growth, population and urbanization trends do not seem to affect the results, expenditure elasticity seems to have a significant impact. The projections on food grain demand range from 253.3 million tons in 2020 (Kumar et al. 2009) to 334.9 million tons (Mittal 2008).

It is quite evident that the demand for food will increase in the near future. Therefore, India will either have to increase domestic production or enter the world markets to meet increasing demand. Given its present policy of seeking self-sufficiency in food production, as revealed in the 5-year plans, India will have to largely feed itself. Enhancing domestic production would mean increased pressure on natural resources, especially soil and water. Hence, efforts would have to be made to ensure that production systems are environmentally sustainable. For the cereal and food grain sector, it is observed that the Green Revolution is running out of steam and there is an urgent need to adopt new technologies. Currently, the states of Punjab and Haryana, which spearheaded the success of the revolution, are under tremendous stress of depleting groundwater reserves and deteriorating soil health. The average fertilizer consumption is very high (210 kg per hectare compared to an all-India average of 117 kg per hectare), yields are higher than the national average, and hence the net gains from any technological breakthroughs in cereals will not produce very good results in these states. However, India has untapped advantages in the eastern belt, where water is abundant, yield levels are quite low, and there is a potential to enhance cereal productivity. The government has taken some distinct measures in rejuvenating the food grain sector in recent years. Surely, there is a felt need of augmenting domestic supply as dependence on food imports makes the country uncomfortable and the government has undertaken various measures to re-energize the supply lines.

[3] As put by Lester Russell Brown (1995), “Who will feed China?”.

2.3 Major Challenges and Opportunities

Availability of food depends upon a combination of factors, such as domestic production, trade, and stocks. It is a continuous effort to ensure that the country has enough food to meet increasing demand, be it increasing domestic production, playing on the global food markets, or carrying an inventory of food grain. The emphasis has been on re-energizing the food grain sector, against a backdrop of stagnating or declining productivity of food grain crops (varying across regions) owing to technology fatigue, climate change effects, and the like.

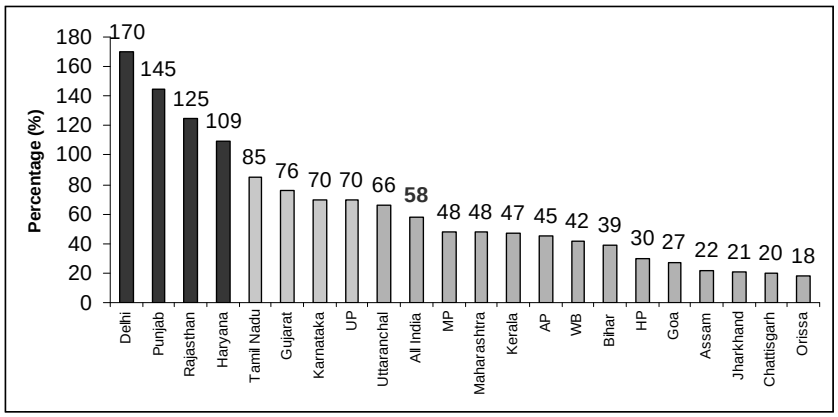
Climate change affects not only agricultural production systems and thereby food availability, but also people's ability to access food, which in turn has implications on nutritional concerns. It is observed that the frequency of droughts and erratic climatic conditions are increasing and one wonders if this is an outcome of climate change. The Inter-Governmental Panel on Climate Change and the India Meteorological Department reports a 2- to 4-degree increase in mean temperatures (FAO–Government of India 2009) and this is likely to adversely impact the production of food crops. Production losses in wheat is likely to be around 6 million tons for every 1 degree increase in temperatures, which turns out to be around 7% of the current wheat output (FAO–Government of India Mission 2009). Based on various assumptions, the IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) model (Nelson et al. 2009) shows that South Asia is likely to be the region worst hit by climate change, taking a heavy toll on its irrigated crops. The decline in production of irrigated wheat in South Asia is likely to be from 44% to 49% in 2050 due to climate change relative to 2050 with no climate change (under different scenarios). By 2050, declining yields of production will result in a price rise, jeopardizing the food and nutrition security of the masses, and children in particular.

Against these potential impacts, comprehensive adaptation measures over different time horizons are needed. It has been advocated that the farmers should be educated about climate change and the damage it can do to agricultural systems. This will help them adopt preventive measures as coping strategies in their households and communities. At the policy front, there is an urgent need to conserve water and undertake better management of water resources, and even incentivize the agriculture sector to replace water-intensive crops with water-efficient crops. From this perspective, it may be a good policy to put an export tax on rice and sugar to discourage export of "virtual" water. Investments in research and development (R&D) to develop new heat-resistant seed varieties and advanced farming practices will be important to overcome the inevitable impact of rising temperatures. Among other things, climate change has brought with it a lot of uncertainty in crop behavior and overall agricultural production. The impact of climate change on small farmers, particularly in rain-fed regions, is likely to be adverse and beyond their capacity for adjustment. Hence, as a coping mechanism, the importance of weather-based insurance for crops needs to be revisited. Innovations such as index-based weather insurance for both crops and livestock that are based on a proxy and not actual losses of the policyholders can be useful. Such a pilot program has been tested in India, among other countries, and should be scaled up as we learn from these pilot programs (Von Braun 2009). The Asian Development Bank (ADB) and The Energy Research Institute suggest that investments to the tune of $1.3 billion to $1.5 billion per year will be needed for adaptation to climate change from 2010 to 2050.

The key concern in trying to push the production frontier further is to target it in an environmentally sustainable manner. Agriculture in India is highly dependent on monsoons; nearly 43.4% of the net sown area is irrigated (2006–2007 [Provisional]). In the food grain

sector, cereal crops in particular are highly irrigation intensive, nearly 57% of the area for rice is irrigated, and more than 90% in the case of wheat. Also, sugarcane is highly irrigation intensive, with more than 93% of the area under irrigation. The increasing stress on available water resources, particularly groundwater, which is a major source of irrigation in India, is quite evident. Satellite maps released by the National Aeronautics and Space Administration (NASA) showed that north-western India's aquifers fell by a foot a year from 2002 to 2008 (*The Economist*, 10 Sept. 2009). More than 109 cubic kilometer (or 26 cubic miles) of groundwater disappeared from 2002 to 2008. The situation of groundwater withdrawal is quite alarming in some of the northern states, such as Punjab, Haryana, Delhi, and Rajasthan (Figure 9).

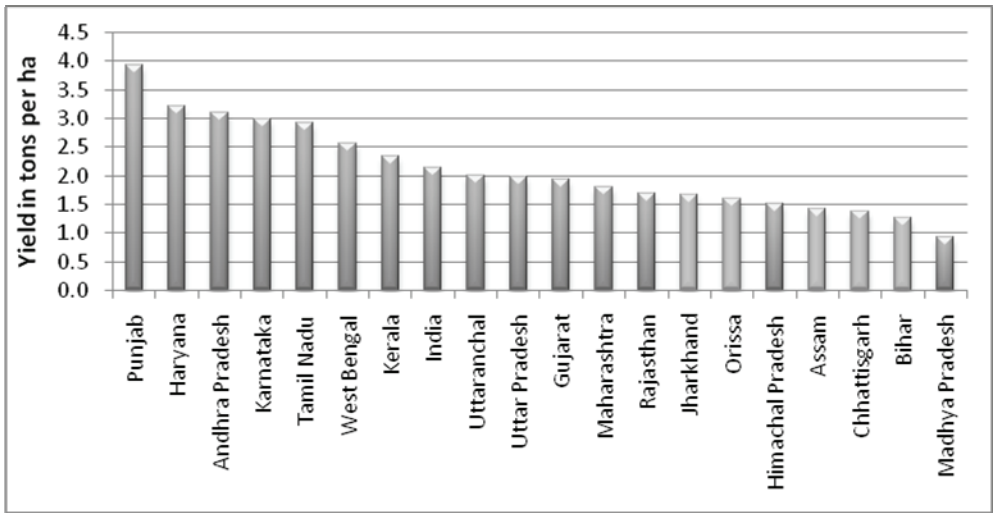
Figure 9: Pace of Groundwater Withdrawal across States (2004): Stage of Groundwater Development (%)



AP = Andhra Pradesh, HP = Himachal Pradesh, MP = Madhya Pradesh, UP = Uttar Pradesh, WB = West Bengal.
Source: Gulati, et al. 2010. Punjab agriculture: where do we go from here? Presentation to the former Chief Minister of Punjab at the Indian Council for Research on International Economic Relations, 25 February. New Delhi. The stage of groundwater development (%) is defined as annual groundwater draft/net annual groundwater availability x 100, where annual groundwater draft is groundwater extraction from all existing groundwater structures during the monsoon as well as non-monsoon period, and net annual groundwater availability is annual replenishable groundwater resource less natural discharge during the non-monsoon season.

There is a huge pressure on groundwater resources in India and this is felt even more during periods of drought; hence, large investments are needed in "groundwater banking" (Shah et al. 2009). It is interesting to observe that Gujarat has invested in more than 100,000 check dams through the involvement of nongovernment organizations since 2000, and has been instrumental in recharging water tables. This has given rich dividends to Gujarat, which has registered the highest rates of growth in agriculture (above 9% per annum) among all states of India since 2000. Free and low-priced power compounds the problem and this needs to be replaced by pricing of power per usage and separation of feeder lines, as done in Gujarat (Shah and Verma 2008). Subsidies should be given to small farmers through "smart cards." To relieve the pressure on scarce water reserves, cultivation of rice needs to move toward the water-abundant regions, such as eastern Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, and Chhattisgarh. It is quite evident that paddy cultivation in these states may not be sustainable and it will be imperative to shift the production base to the eastern states. For instance, the potential to raise rice yields is very high in some of the eastern states (Figure 10).

Figure 10: Rice Yields by State, Triennium Ending in 2007–2008



ha = hectare.
Source: Authors' depiction based on yield data from www.indiastat.com.

However, to shift the Green Revolution to the eastern region, investments will be needed to build the required infrastructure and irrigation systems, and the current government initiative should rightly focus on this. The question is whether it will be the public sector alone that is going to bring in the required resources or could there be opportunities for partnerships with the private sector and multilateral agencies. The magnitude of these investments is not known, but it could easily be in billions of dollars, and the government alone may not be able to manage these from its own resources in the short to medium run. Hence, the need for partnerships with the private sector and multilateral agencies that can augment the resource base to usher in a second Green Revolution to increase availability of basic staples, especially rice, for the next 2 decades or so.

2.4 Major Programs and Partnerships to Augment Availability (Supplies) of Food

The National Agriculture Development Programme (Rashtriya Krishi Vikash Yojana or RKVY) is a flagship scheme with an outlay of Rs250 billion for 5 years, aimed at reorienting various agricultural strategies toward achieving the target growth of 4% and also incentivizing the states to allocate more resources to agriculture. State outlays have gone up from Rs167 billion in 2008–2009 to Rs186.35 billion in 2009–2010. The government rolled out the 5-year National Food Security Mission (NFSM) in 2007–2008 with an outlay of roughly Rs48.8 billion to enhance production of rice by 10 million tons, wheat by 8 million tons, and pulses by 2 million tons by the end of the Eleventh Five-Year Plan, 2007–2012. The NFSM targets those districts which have a potential to perform and have, at present, productivity levels below the state average in their respective crops. As part of the RKVY, a corpus of Rs4 billion has been pledged for extending the Green Revolution to the eastern region of the country comprising Bihar, Chhattisgarh, Jharkhand, Eastern Uttar Pradesh, West Bengal, and Orissa. The budget also includes a fund of Rs3 billion to organize 60,000 pulses and oil seed villages in rain-fed areas during 2010–2011 and provide an integrated intervention for water harvesting, watershed management, and soil health to enhance the productivity of the dry land farming areas. Further, Rs2 billion will be provided for sustaining the gains already made in the Green

Revolution areas through conservation farming, which involves concurrent attention to soil health, water conservation, and preservation of biodiversity (Government of India 2010b).

To improve potential utilization of irrigation and optimize agricultural production from irrigated land, the Government of India launched in December 1974 the Centrally Sponsored Command Area Development Program, an integrated and coordinated approach of efficient water management. The Accelerated Irrigation Benefit Program (AIBP), conceived in 1996, extends financial assistance for creating irrigation potential to the states for them to complete identified ongoing irrigation projects. Projects which had investment clearance from the Planning Commission were initially considered under the AIBP, but the program has been extended to cover other projects. It caters to the irrigation needs of the Bharat Nirman program, which also provides assistance to irrigation projects under the Prime Minister Package for agrarian-distressed districts. While groundwater is a primary source of irrigation in India, it is observed that a larger share of the outlay for irrigation goes into major and medium sources. The Advisory Council for Artificial Recharge of Ground Water was set up in April 2006 to popularize the concept of artificial recharge among all stakeholders. A subcommittee recommended initiating the 5,000-strong Farmers Participatory Action Research Program with the help of state agricultural universities, Indian Council of Agricultural Research (ICAR) institutes, and others to demonstrate the technologies available for enhancing the productivity and profitability of farming by creating synergy among water, crops, agronomic practices, soil nutrients, crop variety, implements, and so on. India is also a signatory to several water treaties and cooperations that are bilateral (with Bangladesh, the People's Republic of China, and Nepal) and multilateral (e.g., the Global Water Forum, the Hague Declaration). There are several externally funded irrigation projects, with ADB and the World Bank among the international funding organizations.

The concept of a water users' association and of participatory irrigation management has become popular. Civil society organizations play an important role in organizing farmer groups and issues related to water management. To check the declining productivity of wasteland areas and loss of natural reserves, the Department of Land Resources, Ministry of Rural Development administered a three-area-based watershed development program as well as the Drought Prone Areas Programme, Desert Development Program, and Integrated Wastelands Development Program. From 1995–1996 to 2007–2008, 45,062 projects have been sanctioned, covering an area of 32.3 million hectares. Funds released by the center were about Rs77.4 billion during this period. For the Drought Prone Areas Programme and Desert Development Program, this is shared between the center and the states in a ratio of 75:25. In the case of the Integrated Wastelands Development Program, the cost sharing between the center and the state governments is 11:1. Panachayati Raj institutions or civil society organizations are part of the project-implementing agencies. These programs now form part of the Integrated Watershed Management Program, the implementation of which has been decentralized to the states.

Micro-irrigation systems that include drips and sprinklers are being increasingly adopted in India, owing to their water saving and efficient use of technology. The micro-irrigation scheme has been in place since 2005–2006. Since its inception, an area of 1.8 million hectares of land across 18 states has been brought under micro-irrigation. This scheme has been recently upgraded to a national mission on micro-irrigation with an outlay of Rs80.3 billion in the context of climate change. Of the total outlay, the Department of Agriculture and Cooperation will contribute Rs34.1 billion, comprising a 40% subsidy for general farmers and 50% for small and marginal farmers.

While the government initiatives and vision for the food grain sector is a welcome development, it is only one part of the agricultural production system. Future growth in agriculture is more likely to be driven by the high-value segment and less by the cereal and food grain. India has a large production base of high-value commodities but the main challenge lies in augmenting production of value-added commodities. This will require better infrastructure and logistics to control post-harvest losses and produce quality products that conform to international food safety standards. The government effort in launching the National Horticulture Mission (NHM) in 2005–2006, worth Rs6.3 billion, provided the much-needed boost to the horticulture sector. The central plan outlay was increased to Rs10.6 billion in 2010–2011. The holistic development approach not only includes an increase in production but also ensures nutrition security and income support to farm households and others through an area-based regionally differentiated approach.

At the same time, however, legacy issues such as outmoded land management and tenurial systems, moribund rural finance institutions, lack of adequate technical support capacity in state-level extension systems, and agriculture marketing arrangements which inhibit free movement and trading of produce remain unaddressed. Lack of reform in these critical areas will prevent the full potential of public and private investments from being realized, reducing the possibility of achieving food security for all within this decade.

To start with, the public sector played a very proactive role in terms of providing price and market support during the Green Revolution, all "not-for-profit," in partnership with the CGIAR network. The success of the Green Revolution required a political commitment and the government struck an alliance with the CGIAR network to adopt high-yielding technology. However, higher production meant better pricing and marketing policies and this again saw the government assuming a prominent role in providing these services. In 1965, the Agricultural Prices Commission and the Food Corporation of India came into existence to ensure "remunerative prices" to the producers and to facilitate marketing and distribution of food grain (Gulati 2009).

The government has played an indirect interventionist role, facilitating the functioning of new institutions and participation of the private sector. Operation Flood was executed in three phases: phase 1 (1970–1980), phase 2 (1981–1985), and phase 3 (1985–1996). This was cofinanced by the sales proceeds of the grants provided by the European Commission (through the World Food Programme in the form of skimmed milk powder and butter oil), World Bank loans, and internal resources of the National Dairy Development Board (NDDB 2009). Although the public sector played an important role in channeling the grant to develop the dairy sector, it was not involved in providing direct support. Factors like technology and markets played a more dominant role and ensured the sustainability and scalability of this endeavor. During Operation Flood and thereafter, cooperatives operated under the licensing regime to protect them from competition with the private sector. However, the amendment of the Milk and Milk Products Order in 2002 marked the entry of the private sector and this is likely to overtake the cooperatives in the near future.

Not directly related to food security but critical in improving the income opportunities of farmers, one of the big developments in Indian agriculture has been the success of *Bacillus thuringiensis* (Bt) cotton. Amid much controversy and regulation, Bt technology was introduced by the private sector and adopted by the cotton growers in Gujarat in 2001, even before the official approval came in 2002. The government played an important role through the Technology Mission on Cotton in developing, ginning, and marketing cotton in India. With

the emergence of the private sector in the agricultural market to spearhead the newer revolutions, be it cotton or horticulture crops, a “for-profit” era has begun.

For food grain, private players have played an important role in the seed sector. Corporations, such as the Hariyali Kisaan Bazaar of DCM Shriram Consolidated Limited are engaged in the multiplication of seeds in collaboration with farmers. The technological innovation has made an impact on the seed replacement rate (SRR), which has improved in the case of staples. The SRR in paddy increased from 19% in 2001 to 25% in 2006, and that in wheat from 13% to 18% during the same period (Seednet India portal). The SRR in maize was the highest at 36.2% in 2006 as against 21% in 2001. For rice, farm-saved seed accounts for as much as 85% and for wheat, as much as 95%. The hybrid seed market is quite small but emerging, especially in the case of rice in India (Chaturvedi 2010). At present, more than 25 seed companies are involved in the production of hybrid rice seed. The Directorate of Rice Research of the ICAR and the International Rice Research Institute, in collaboration with the Maharashtra Hybrid Seeds Company Limited Research Foundation, has released more than 12 hybrid varieties. Eastern Uttar Pradesh, Bihar, Madhya Pradesh, Jharkhand, and Chhattisgarh account for 80% of the hybrid rice grown in the country (Chaturvedi 2010). In the case of maize, there are at least 70 companies involved in the seed business. The 1988 Seed Policy facilitated the growth of private seed companies. The investment in R&D by the private sector expanded from $1.2 million in 1987 to $4.7 million in 1995. However, it is important to note that many public institutions, including ICAR-led research organizations, the International Maize and Wheat Improvement Center and the International Crops Research Institute for the Semi-Arid Tropics, also played a major role in augmenting the R&D capabilities of private companies (Chaturvedi 2010). Civil society organizations, such as the Bharatiya Agro Industries Foundation (BAIF Development Research Foundation), Professional Assistance for Development Action (Pradan) and others are engaged in agricultural extension services and there could be possibilities of partnerships with the public sector in national flagship programs.

The other kind of investment that is required in developing modern supply chains and logistics services, such as cold chains, reefer vans, and warehouses, specialized to handle high-value commodities, can come from the private sector. Some big private companies that have ventured in agricultural retailing and processing are investing heavily in strengthening the supply chains. For instance, the Bharti group has tied up with Del Monte and WalMart under separate business ventures. Players, such as Futures Group and Reliance, have also invested in logistics and building up back-end operations. From 2001 to 2008, the top 10 organized food and grocery retailers in India have been growing at a rate of 67.2%, albeit from a small base (Planet Retail 2009). From 2005 to 2008, the sales area of the leading retailers increased from 857,000 square meters to 3.6 million square meters. The food processing sector is also undergoing a structural transformation, moving toward organized units. These trends are likely to attract greater investments in organized processing and retailing, both through green field ventures and in partnerships and joint ventures between domestic companies and multinationals.

However, lack of a clearly articulated policy on encouraging modern-format retailing, especially in fresh produce, as well as multiplicity of laws and regulations related to movement and storage of agricultural commodities, have inhibited any big-impact investments in this segment. A continuing debate on allowing foreign direct investment in the retail sector has now dragged on for quite some time without a consensus emerging from among the major political parties. While there are genuine concerns regarding the impact of the entry of large multinational corporations on the millions of mom-and-pop retail outlets, the potential benefits to an even larger number of farming households through back-end integration, reduction in

wastages and employment benefits, which together will boost overall food security, have not been understood clearly by the stakeholders.

3. Accessibility of Food (Economic Access)

3.1. Changing Consumption Patterns

Consumption of cereals has declined: per capita monthly consumption of cereals went down from nearly 15 kg in 1983 to 12 kg in 2004–2005 in rural areas, while in urban areas it declined from 11.3 kg to almost 10 kg. The weighted share of cereal consumption declined from 14 kg to 11.5 kg during this period. Further, the average quantity of cereals consumed per person per month in 2007–2008 was 11.7 kg in rural areas and 9.7 kg in urban areas (Government of India 2010d). Per capita consumption of fruits and vegetables increased from 48.8 kg in 1983 to 83.9 kg in rural areas in 1999–2000, while in urban areas it increased from 76.7 kg to 114.7 kg. Consumption of milk increased from 37 kg to 63.3 kg in rural areas, and 55.5 kg to 90.7 kg in urban areas during the above period. Consumption of meat, eggs, and fish increased in the urban areas from 1.4 kg to 9.5 kg, and that in rural areas from 3.9 kg to 6.7 kg (Kumar et al. 2007b). From 1993–1994 to 2004–2005, the increase in per capita per month consumption of high-value commodities is seen in Table 1.

Table 1: Consumption of High-Value Commodities, 1993–1994 and 2004–2005 (per capita, per month)

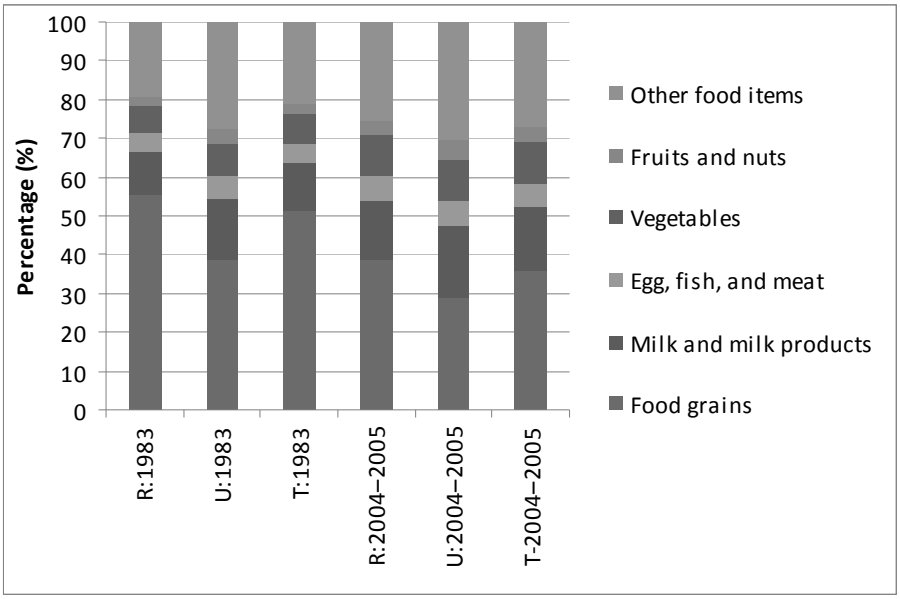
		1993–1994		2004–2005		% change	
Commodities	**Units**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**
Meat	kg	0.12	0.20	0.14	0.22	14.2	9.0
Eggs	number	0.64	1.48	1.01	1.72	57.7	16.2
Vegetables[a]	kg	3.04	3.34	5.20	5.84	71.1	74.9
Milk	liter	3.94	4.89	3.87	5.11	-1.8	4.4
Fish	kg	0.18	0.20	0.20	0.21	11.7	3.0

kg = kilogram.
[a] Data for vegetables are available for those reported in kilograms (kg) only. Data on fruits are not included due to problems in aggregation as obtained from the National Sample Survey reports.
Source: Government of India, National Sample Survey Organization. Reports on Household Consumer Expenditure Surveys. Various Issues. New Delhi.

The data on cereal consumption do not include the amount consumed in the form of cooked meals purchased from markets or meals taken at restaurants. Food purchased in the form of cooked meals from hotels, restaurants, and canteens is reported under the processed food category, which is included in the broader category of "beverage, refreshments, and processed foods." Thus, it is not possible to be absolutely certain if total (human) cereal consumption in all forms (direct or indirect) has declined. However, instances of eating out have increased, which could have a large impact on the actual assessment of cereal consumption. The share of beverages, refreshments, and processed food in the monthly per capita consumption expenditure on food increased from 11.6% in 1983 to 16.1% in 2007–2008 in urban areas. It increased from 5% to 10.6% in rural areas for the same period. In 2004–2005, cooked meals accounted for 13.5% of the monthly per capita consumption expenditure incurred on beverage, refreshments, and processed food in rural areas and 23.5% in urban areas. Food consumption expenditure as a percentage of total expenditure declined from 64.1% in 1983 to 51.5% in

2004–2005 (Figure 11). The expenditure on cereals as a percentage of food expenditure also declined while that on high-value commodities increased during the same time period.

Figure 11: Changing Consumption Expenditure Patterns, 1983 to 2004–2005



R = rural, U = urban, T = total.
Source: Government of India, Ministry of Statistics and Programme Implementation. National Sample Survey Organization. 2006. Level and Pattern of Consumer Expenditure, 2004–2005. Report No. 508/(61/1.0/1). New Delhi.

The dietary transformation from cereals to high-value commodities is observed across all income classes, and in both rural and urban areas in India (Kumar et al. 2007b). However, poor nutritional outcomes, particularly among women and children, are a concern. There is a debate on how to interpret the impact of declining calorie consumption. It is argued that with changing lifestyles and less manual labor, the dietary needs of people have changed and this justifies the decline in calorie intake (Rao 2000). Per capita calorie consumption declined from 2,221 kCal in 1983 to 2,047 kCal in 2004–2005 in rural areas, a nearly 8% decline. This is higher than that in urban areas where it declined by 3.3%, from 2,089 kCal to 2,020 kCal during the same period. While malnutrition is widespread, the incidence of obesity is also an emerging concern, particularly among the urbanites. Nutritional implications of consumption diversification are an important aspect that needs to be adequately addressed—not just for calorie and protein intake but also for the impact of micronutrients on consumption.

The consumption statistics reported by the household survey data differ from the private final consumption expenditure data reported by the Central Statistical Organization (CSO). In the 1970s, consumption measured by the National Sample Survey was 87% of that measured by the national income statistics of the CSO. In 2004–2005, consumption reported by the survey was just 49% of that reported by the CSO. This has raised questions about the credibility of the numbers that are being reported to represent the changing consumption trends in India.

3.2. Poverty and Levels of Purchasing Power

The economy's growth at an average rate of more than 9% from 2005–2006 to 2007–2008 and the projection to continue at high rates are likely to stimulate demand further. By sheer

population size and rising income levels, India is likely to account for a major portion of global demand. In a recent study by McKinsey Global Institute (2010), it is estimated that the "seekers" with an income of $4,380 to $10,940, and "strivers" with an income of $10,940 to $21,890, together constituting 5% of the population and about 13 million households and 50 million people in 2005, will increase to 41% of the population and 128 million households and 583 million people in 2025.

While the rising middle class in India is observed to be steering the changes in consumption patterns and driving up demand for quality food, a large section of the population is dwelling below the poverty line. Although the proportion of poor people went down from 55% in 1973–1974 to 27.5% in 2004–2005, the rate of decline has somewhat slowed down in the post-reform period and more than 300 million people continue to live in poverty. Global estimates show that nearly 41.6% of the population in India lives on less than $1.25 a day (Chen and Ravallion 2008). Hence, poverty poses a serious challenge in ensuring smooth access to food by millions of people. The Tendulkar Committee re-estimated poverty using a new methodology. Accordingly, urban poverty is 25.7% while that of rural areas is 41.8% (Government of India 2009c).[4] Also, there is considerable variation in the poverty levels across states, which has implications on the attainment of human development goals (Table 2). Some of the states with high poverty levels are the worst performers in terms of education, health, and nutritional outcomes. As per the IFPRI's India State Hunger Index 2008, the scores for Indian states vary, ranging from 13.6 for Punjab to 30.9 for Madhya Pradesh. Punjab ranks 34th in the Global Hunger Index 2008 country rankings, and Madhya Pradesh, 82nd (Menon, Deolalikar, and Bhaskar 2008).[5]

[4] "There has been a growing concern on the official estimates of poverty as released by the Planning Commission of India. In view of this, the Planning Commission set up an expert group under the chairmanship of Professor Suresh Tendulkar to examine the issues and suggest a new poverty line and estimates. The expert group has considered this issue in detail and has suggested a new methodology to arrive at state wise and all-India rural and urban poverty lines for 2004–2005, the latest available major National Sample Survey round on household consumer expenditure which provides the data base for the calculation of poverty estimates by the Planning Commission" (Government of India 2009c).

[5] The methodology for ISHI is similar to that of the Global Hunger Index which is to capture three interlinked dimensions of hunger—inadequate consumption, prevalence of underweight children, and child mortality (Wiesmann 2006).

Table 2: Selected State-Level India State Hunger Index Scores and Poverty Levels

States	ISHI Score, 2008	Percentage of Population Living below Poverty Line, 2004–2005
Punjab	13.6	8.40
Haryana	20.0	14.00
Kerala	17.6	15.00
Andhra Pradesh	19.5	15.80
Gujarat	24.7	16.80
Assam	19.8	19.70
Rajasthan	21.0	22.10
Tamil Nadu	20.9	22.50
West Bengal	21.0	24.70
Karnataka	23.73	25.00
India	23.30	27.50
Maharashtra	22.80	30.70
Uttar Pradesh	22.13	32.80
Madhya Pradesh	30.87	38.30
Jharkhand	28.67	40.30
Chhattisgarh	26.63	40.90
Bihar	27.30	41.40
Orissa	23.80	46.40

ISHI = India State Hunger Index.
Sources: P. Menon, A. Deolalikar, and A. Bhaskar, 2008. India State Hunger Index: Comparisons of Hunger Across States. International Food Policy Research Institute. Washington, DC/Welthungerlife, Bonn/University of California, Riverside; Government of India, Ministry of Agriculture. 2009. *Agricultural Statistics at a Glance, 2009*.

Despite robust economic performance and a rising middle class, the accessibility of food is still a concern, particularly for the poor and vulnerable groups. This section of the population is also more vulnerable to sudden economic shocks and fluctuations in income, which have a direct impact on their food security status. Growth alone may not be able to ensure food security of the poor and vulnerable; hence, the social safety net programs play an important role in improving accessibility of food to the poor and vulnerable.

3.3. Major Programs and Partnerships to Improve Economic Access to Food

Public Distribution System

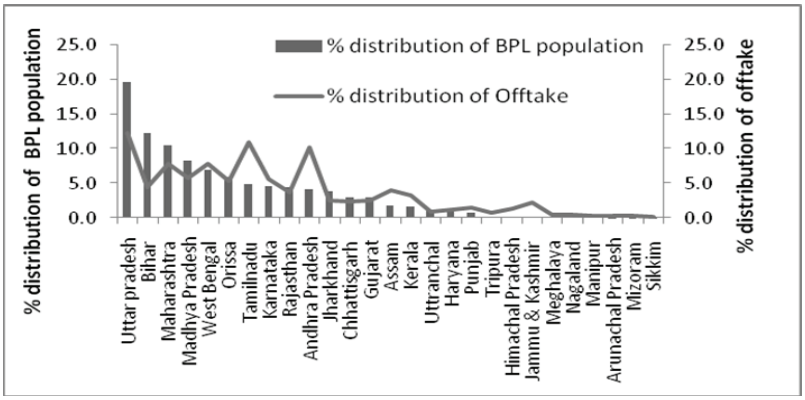
The Public Distribution System (PDS) is the largest public sector-managed network for distribution of essential commodities, primarily rice, wheat, sugar, and kerosene. To better target people below the poverty line vis-à-vis above the poverty line, the PDS was revamped into the Targeted PDS (TPDS) in 1997. Allocations for below-poverty-line (BPL) families were increased from 10 kg to 20 kg of food grain and then to 35 kg per family per month at 50% of the economic cost. The allocation for the households above the poverty line was the same but at 100% of the economic cost. To target the poorest of the poor (25 million people), the government launched the Antyodaya Anna Yojana (AAY) Scheme in December 2000.[6] At present, the PDS network covers almost half a million fair price shops and 65 million families below the poverty line (including AAY). The functioning of the PDS is a joint responsibility of the

[6] AAY Scheme is targeted to provide food to the poorest of the poor households living below the poverty line.

central government, which is engaged in procuring, transporting, and storing food grain, and the state governments, which are responsible for identifying BPL families, issuing ration cards, and supervising the functioning of the fair price shops in the states.

The PDS imposes an enormous financial burden on the exchequer and this is quite visible from the rising food subsidy bill (Rs555.8 billion in 2010–2011). The efficacy of the system in terms of targeting and coverage has been often questioned. There are reports of considerable leakages and that the cost of transferring the benefits to the target groups exceeds the welfare gains. The performance of the PDS varies from state to state and it is observed that the states with sizable poor and vulnerable populations do not fare so well on the PDS or other safety net programs, although there are exceptions to this observation (Figure 12).

Figure 12: Distribution of Poverty and Total (Public Distribution Systems, Targeted Public Distribution System, and Antyodaya Anna Yojana) Offtake by State, 2008–2009 (Provisional)



BPL = below poverty line, %= percentage.
Source: http://fcamin.nic.in/dfpd_html/index.asp

One of the most critical questions thus remains targeting and identifying the poor. One option is to work out innovative criteria that can work at the ground level, such as social audits based on certain identifying criteria, e.g., households with a motorized vehicle, and electricity or telephone billed consumption of a minimum amount. Since such people are officially registered, they can be marked as non-BPL families in the computerized master list and revised over a period of time. For the remaining families, social audits with village councils are an option (Gulati 2009).

Mahatma Gandhi National Rural Employment Guarantee Scheme

The National Rural Employment Guarantee Act, 2005 (NREGA) aims to improve the livelihood security of rural households by providing at least 100 days of guaranteed wage employment in a financial year to every household whose adult members volunteer to undertake unskilled manual work. The act was implemented through the National Rural Employment Guarantee Scheme (NREGS) in three phases. Phase 1, was introduced in 200 of the most backward districts of the country; 130 districts were added in phase 2 in 2007–2008; and the remaining 285 rural districts of India were notified in phase 3 on 1 April 2008. The scheme turned out to be an important buffer in rural areas during the global financial crisis in 2009, to absorb unskilled and semiskilled rural and urban migrant labor. The central plan outlay for NREGS in 2010–2011 is Rs401 billion.

The scheme also aims to create durable assets and to strengthen the livelihood resource base of the rural poor. The nature of the work is to address the causes of chronic poverty, such as drought, deforestation, and soil erosion to ensure that employment generation is sustainable. In 2008–2009, 45.1 million households were provided employment and 2,163.2 million person-days of employment were generated. In post-NREGA, there has been a revision of minimum wages across the country. Average household earnings increased from Rs2,795 in 2006–2007 to Rs4,060 in 2008–2009. Women participation was 48% in 2008–2009. In 2008–2009, 2.8 million public works were undertaken, consisting of 46% water conservation, 18% rural connectivity, 15% land development, and 20% irrigation works. The NREGS has helped to create rural job opportunities, which has had an impact on the supply of agricultural laborers. Some of the states are facing severe shortages in farm labor, exerting an upward pressure on agricultural wages. Some of the states where the minimum wages have increased after the implementation of the NREGS are Maharashtra, from Rs47 to Rs72; Uttar Pradesh, from Rs58 to Rs100; Bihar, from Rs68 to Rs81; Karnataka, from Rs62 to Rs82; West Bengal, from Rs64 to Rs75; Rajasthan, Rs73 to Rs100; Madhya Pradesh, from Rs58 to Rs91; Himachal Pradesh, from Rs65 to Rs100; Nagaland, from Rs66 to Rs100; Jammu and Kashmir, from Rs45 to Rs70; and Chhattisgarh, from Rs58.73 to Rs72.23 (Government of India, 2010e).

National Food Security Bill

As announced by Her Excellency, the President of India, during her address to the joint session of Parliament on 4 June 2009, the government has proposed to enact a national food security act which envisages, among other things, that every BPL family in the country shall be entitled to 25 kg of wheat or rice per month at Rs3 per kg. The law is also proposed to be used for bringing about systemic reforms in the PDS. (Press Information Bureau, 24 February 2010)

The latest effort made by the national government to promote food security is through the national food security bill. There are two important issues to be resolved for the proposed bill to be truly successful: firstly, the proper identification of BPL families entitled to benefit from the food security law, and secondly, the cost burden. The bill proposes that the number of entitled families in each state will be fixed by the revised Planning Commission estimates based on the Tendulkar Committee Report (Government of India, Planning Commission 2009d) (according to which the all-India poverty head count ratio is 37.2%, i.e., more than 80 million households). The process of consultation between the central government and the states on this issue has not been successfully concluded, mainly on account of widely differing perceptions on the numbers which ought to be entitled to benefit under the bill. As noted earlier, despite a revision of poverty figures, there is still a large gap between the poverty statistics reported by states and the estimate made by the center.

4. Absorption of Food (Nutritional Outcomes)

4.1. Status of Nutrition among Adults and Children

The nutritional outcomes for India clearly indicate that there are gaps in linking the three pillars of food security, i.e., availability, accessibility, and absorption. An interrelated and important aspect yet to be effectively addressed is nutrition security. Despite intervention through several food-based social safety net programs, some of them running over decades, malnutrition levels continue to be severe and persistent. There is an urgent need to implement an integrated nutrition and health program for all vulnerable groups, focusing on the roles of gender and governance. The extent of India's malnutrition problem can be observed from

Table 3. India ranks the lowest in terms of prevalence of underweight children under age 5. Although the under-5 mortality rate has improved—7.6% in 2006 from 11.5% in 1990—the pace of reduction has not been very impressive. Poor nutritional outcomes of infants and children arise from the poor health status of women, overall poverty, and lack of hygiene and proper health facilities. According to the third National Family Health Survey (NFHS-3), in 2005–2006, nearly 56.2% of married women and 57.9% of pregnant women in the age group (15–49) are anemic, as against 51.8% for married women and 49.7% for pregnant women in 1998–1999 (NFHS-2). Anemia among children in the age group 6–35 months also worsened from 1998–1999 to 2005–2006, from 74.2% to 78.9%.

Table 3: Indicators of Malnutrition in South Asia

Country	Proportion of Undernourished in the Population (%)		Prevalence of Underweight Children under 5 years (%)	Under-5 Mortality Rate (%)	
	1990–1992	2002–2004	2000–2006	1990	2006
Bangladesh	35.0	30.0	39.2	14.9	6.9
India	**25.0**	**20.0**	**43.5**	**11.5**	**7.6**
Nepal	20.0	17.0	38.8	14.2	5.9
Pakistan	24.0	24.0	31.3	13	9.7
Sri Lanka	28.0	22.0	22.8	3.2	1.3
South Asia	26.0	21.0	41.0	12.3	8.3

Source: World Bank. 2009. World Development Indicators. Washington, DC: The World Bank Group.

Access to health care and sanitation facilities is among the key determinants of nutrition security. In particular, women's access to clean drinking water, toilet facilities, and clean cooking fuel influences their health outcomes, which are critical to child health and nutrition. The impact is measured in terms of both the health effects and the time they spend in coping with the lack of these facilities. Over 53% of women in India do not have access to toilet facilities, 55% do not have drinking water in their premises, and only 29% have access to clean fuel. Meanwhile, 35.6% of women suffer from chronic energy deficiency, indicated by a body mass index below 18.5 (Jose and Navaneetham 2010). Child malnutrition is responsible for 22% of India's burden of disease. Undernutrition also affects cognitive and motor development and undermines educational attainment, which ultimately impacts productivity at work and at home, with adverse implications for income and economic growth. Micronutrient deficiencies alone may cost India $2.5 billion annually (Gragnolati et.al. 2005).

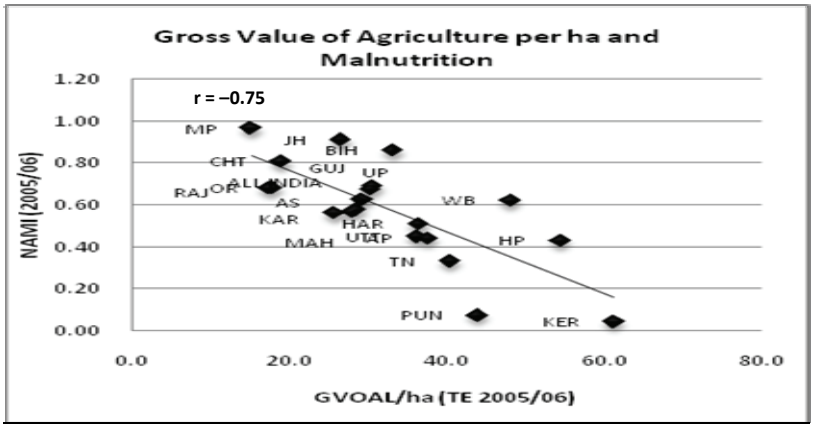
4.2 Linkages between Agriculture Performance and Nutrition

The linkage between agricultural performance and nutritional outcomes is of interest in the context of economic and human development. Gulati and Shreedhar 2010 provides some useful insights on this topic, however, to understand the causality accurately, a much more detailed analysis is needed than is attempted here.

Agricultural performance can be looked at in different ways: by its growth rates, its land productivity, labor productivity engaged in agriculture, total factor productivity, and so on. Growth rates at the state level are highly volatile. Therefore, looking at growth rates and relating these to nutritional outcomes for a particular year is not likely to yield any strong relation. Moreover, there could be a long time lag between the agricultural growth rates and their impact on nutritional outcomes. Also, there could be other missing factors, especially on health and sanitation or gender education, which could influence the nutritional outcomes. Therefore, a

better way perhaps to capture the prosperity of agriculture is to look at the land productivity (value of agriculture output on a per hectare basis). This is because there may be states where agricultural growth is currently low, but their agricultural output has reached high levels due to past high growth rates, for instance, or they switched over from low-value crops to high-value crops. It is this level of agricultural output at any particular time that may be more relevant for nutritional outcomes. Gulati and Shreedhar (2010) tested this hypothesis and found the following interesting relationship between value of agricultural output per hectare and malnutrition status across Indian states for the triennium ending in 2005–2006 (Figure 13).

Figure 13: Value of Agricultural Output per Hectare and Malnutrition Status across Indian States, Triennium Ending in 2005–2006



AP= Andhra Pradesh, AS = Assam, BIH = Bihar, CHT = Chhattisgarh, GUJ = Gujarat, GVOAL = Gross Value of Output from Agriculture and Livestock, ha = hectare, HAR = Haryana, HP = Himachal Pradesh, JH = Jharkhand , KAR = Karnataka, KER = Kerala, MAH = Maharashtra, MP = Madhya Pradesh, NAMI = Normalized Adult Malnutrition Index, r = correlation coefficient, RAJ = Rajasthan, OR = Orissa, PUN = Punjab, TE = triennium ending, TN = Tamil Nadu, UP = Uttar Pradesh, UT= Uttarakhand, WB = West Bengal.
Source: A. Gulati and G. Shreedhar. 2010. Agriculture, Poverty, and Malnutrition: Linkages and Synergies. Unpublished draft paper. International Food Policy Research Institute, New Delhi.

It is interesting to observe the correlation between the gross value of output from agriculture and livestock per hectare and malnutrition status (measured as normalized average nutrition index, the normalized adult malnutrition index is –0.75), i.e., the higher the level of agricultural output on a per hectare basis, the lower the malnutrition index in the country. Kerala and Punjab, for example, have one of the highest levels of agricultural output per hectare in the country and their malnutrition rates are the lowest. Madhya Pradesh is at the other extreme, with the lowest agricultural output per hectare and the highest malnutrition level.

It should be noted here that, although there is a strong negative correlation between the two parameters, it does not give a full causality. There are obviously many other factors that go into determining this outcome, and one needs to test the strength of each one of these through a more rigorous analysis. Yet the above picture shows clearly that the prosperity of agriculture does have a strong influence on nutritional outcomes.

4.3. Major Programs and Partnerships to Improve Nutrition Security

Other food-based safety net programs are aimed at ensuring better nutrition and health outcomes of target groups, particularly women, children, and the elderly. Introduced by the Department of Education under the Ministry of Human Resource Development on 15 August 1995, the Mid Day Meal Scheme currently covers students of classes I–VIII in government

primary and upper primary schools, schools aided by the government, and schools run by local bodies. The Integrated Child Development Scheme (ICDS) is a flagship nutrition program of the Ministry of Women and Child Development. It aims to provide nutritious or energy food to children below 6 years of age and expectant or lactating women from the disadvantaged section of the population. The ICDS has been operational for more than 3 decades. Apart from the government, international agencies, such as CARE, the World Bank, and the World Food Programme, are involved in some of these programs. Crafted to deliver nutrition and health care, the ICDS program is often criticized for not having delivered many of these services; hence, its impact on the nutritional outcomes of the target group has not been impressive. The central plan outlay for 2010–2011 for ICDS is Rs87 billion (about $1.8 billion) and for the Mid Day Meal Scheme is Rs94 billion (about $2 billion).

Among other food-based social safety net programs, the Annapurna Scheme of the Ministry of Rural Development introduced in 2000–2001 caters to senior citizens 65 years of age and above who are eligible for old-age pension under the National Old Age Pension Scheme but are not getting the pension. A ration of 10 kg of food grain per person per month is supplied free under the scheme. The Nutritional Program for Adolescent Girls, a pilot project initiated by the Planning Commission for the years 2002–2003 and 2003–2004, and subsequently taken over by the Ministry of Women and Child Development in 2005–2006, targets adolescent girls (aged 11–19 years) as identified by prescribed weight, irrespective of the financial status of the family. Some 6 kg of food grain per beneficiary per month is provided free to adolescent girls (with a weight of less than 35 kg) initially for a period of 3 months. An emergency feeding program was launched in the eight Koraput-Bolangir-Kalahandi districts in Orissa by the state government in 2001, with special central assistance from the Planning Commission. Under this program, cooked food is served on a daily basis to the old, infirm, and destitute persons belonging to BPL households.

The total offtake of these programs as a percentage of the allocation of rice and wheat is 74.4%, compared to 89.2% in the case of PDS (Table 4).

Table 4: Allocation and Offtake of Rice and Wheat in Other Food-Based Social Safety Net Programs

	Allocation (1,000 tons)	Offtake (1,000 tons)	% Offtake
Mid Day Meal Scheme	2,626	2,019	76.9
WBNP ICDS	810	607	74.9
Scheme for supply of food grain to SCs/STs/OBC hostels/welfare institutions	408	284	69.6
Annapurna Scheme	169	95	56.2
Nutritional Program for Adolescent Girls	111	59	53.2
Emergency feeding program	18	17	94.4
Total	**4,142**	**3,081**	**74.4**

OBC = Other Backward Classes , SC = Scheduled Caste, ST = Scheduled Tribe, WBNP ICDS = Wheat Based Nutrition Program Integrated Child Development Scheme.
Source: Government of India, Department of Food and Public Distribution. 2010f.

5. Opportunities for Linkages and Synergy for Investment Partnerships

5.1. Role of Public Sector Programs related to Food and Nutrition Security

Recognizing the importance of augmenting food production and improving economic access to food for better nutritional outcomes, the Government of India has stepped up agricultural investments through the RKVY, National Food Security Mission (NFSM), and other schemes; has introduced major programs, such as NREGA; and has made known its desire to enact a food security act. The government also carries a large subsidy account together with the plan expenditures. It recognizes the role of private sector participation and investment opportunities. Also, there is scope for creating synergies with civil society organizations and the multilateral, bilateral, and philanthropic foundations.

Table 5 summarizes the central plan and nonplan outlay for some of the key programs for 2010–2011, giving an idea of the magnitude of the public programs. Categorized under the three pillars of food and nutrition security, these programs broadly address related issues.

Table 5: Key Public Programs in India and their Central Plan and Nonplan Outlay, 2010–2011

Key Programs	Outlay (Rs billion)	Outlay ($ billion)[a]
Availability		
National Agricultural Development Programme (Rashtriya Krishi Vikas Yojana)	67.22	1.4
National Food Security Mission	13.5	0.3
Accelerated Irrigation Benefit Program	115.0	2.4
Micro-irrigation	10.0	0.3
National Horticulture Mission	10.6	0.2
Fertilizer Subsidy	499.8	10.4
Accessibility		
National Rural Employment Guarantee Scheme	401.0	8.4
Food Subsidy	555.8	11.5
Absorption		
Integrated Child Development Scheme	87.0	1.8
Mid Day Meal Scheme	94.0	2.0
Sarva Shiksha Abhiyan	150.0	3.1
National Rural Health Mission	154.4	3.2

[a] $1 approximately equivalent to Rs47.94 for 2010–2011.
Source: Government of India. 2010g. Union budget documents.

The central plan outlay for 2010–2011 of the agriculture department stands at Rs118.8 billion or about $2.5 billion, and additional central assistance in the form of RKVY of Rs67.22 billion or about $1.4 billion for 2010–2011.The Indian Council of Agricultural Research (ICAR) outlay is Rs23 billion or $480 million (plan) and Rs15 billion or about $312.8 million (nonplan). The outlay for the Accelerated Irrigation Benefit Program (AIBP) for 2010–2011 stands at Rs115 billion or about $2.4 billion. The state governments have also stepped up their expenditure share, at Rs180 billion or $3.7 billion in 2009–2010. The size of the programs is huge, and partnerships in terms of program and approach support to help enhance the efficacy

and outreach of many of these programs can be explored. The government has placed a high priority on augmenting the incomes of farmers by launching programs that help raise their productivity, such as the NFSM, or help them switch to high-value crops, such as through the NHM.

It is quite evident that while growth can ensure increased availability of food, it cannot automatically ensure accessibility and absorption of the same, unless growth is widespread and inclusive. It appears that, while agriculture is a necessary condition for improving nutritional standards, it is not a sufficient condition; and herein comes the role of social safety net programs aimed at providing income support and direct food transfers to the vulnerable groups. Future growth in agriculture is likely to come increasingly from high-value agriculture but this is less likely to happen in a business-as-usual scenario. Currently the markets for high-value commodities are quite fragmented and small and the existing supply chains are inadequate to handle perishable products. Despite a huge network for delivering key agricultural inputs and services (e.g., seed, fertilizer, farm management advice, etc.), the outreach is not adequate and the quality of the services is poor. Cutting across all the programs is a severe delivery deficit and a lack of accountability. Building synergies between the various stakeholders to overcome these problems is necessary. Table 6 summarizes some of the existing gaps and obstacles faced in the implementation and execution of the programs, the likely medium- to long-term solutions, and the scope for partnership in addressing these issues.

Table 6: Existing Gaps, Medium- to Long-Term Solutions, and Potential Partnerships

Gaps and Obstacles	Medium- to Long-Term Solutions	Potential for Partnerships
Availability		
Production shortfalls	Better water management	Government, private sector, civil society organizations, multilateral and bilateral agencies
Productivity gaps	Seed, soil health, pest and disease management, technology and extension	Government, private sector, civil society organizations, multilateral and bilateral agencies
Storage and transportation	Private sector participation, modern technology	Private sector, government
Inadequate value chain integration	Development of cold chains, strengthening of firm–farm linkages	Private sector, multilateral or bilateral agencies
Financial services	Strengthening of access to formal credit, warehouse receipt systems	Private sector, government, civil society organizations
Climate change mitigation	Improved awareness, technological innovations	Government, multilateral and bilateral agencies
Regional vulnerability	Area-specific strategies and investments	Government, multilateral and bilateral agencies
Accessibility		
Operational difficulties in PDS (FCI, FPS, etc.)	Greater decentralization, social audits, experimental food coupons, direct cash transfers	Government, civil society organizations, private sector, multilateral and bilateral agencies
Identification of beneficiaries and errors in targeting	Community participation, use of RTI	Government, civil society organizations

Issues of choice and preferences	Multiple options for delivery outcomes, option-based subsidies	Government, civil society organizations
Absorption		
Clean drinking water and sanitation facilities	Enhanced funding and maintenance of assets	Government, private sector, multilateral and bilateral agencies
Clean cooking fuels	Incentive use of clean energy sources	Government, private sector, multilateral and bilateral agencies, civil society organizations
Health services	Improved functioning and coverage	Government, private sector, multilateral and bilateral agencies, civil society organizations
Education	Improved functioning and coverage	Government, private sector, multilateral and bilateral agencies, civil society organizations
Gender	Incentivized women participation in workforce	Government, private sector, multilateral and bilateral agencies, civil society organizations

FCI = Food Corporation of India, FPS = Fair Price Shop, PDS = Public Distribution System, RTI = Right to Information.
Source: Authors' contribution.

It is well understood that the scale of the issues related to food and nutrition security in a country like India is quite high and so are the levels of public programs aimed at addressing them. If investments have to increase manifold, these cannot be brought in by the public sector alone; partnerships are needed. It is likely that a large part of these will come from the private sector. While the public sector can incentivize private investments by creating an enabling policy environment, multilateral and bilateral agencies can bring in innovative models for better monitoring and management that can improve the delivery of output per unit of money invested.

5.2 Creating Synergy by Forging New Partnerships

The food grain sector is typically managed by the public sector, partly because the seeds are open pollinated and also because basic staples (e.g., rice and wheat) are critical to the food security of the majority of the poor. The role involves large economic costs. Private participation in the sector, particularly in procurement and stocking, is quite limited due to food security concerns and the sector's being subject to policy flip-flops often. However, the high-value sector is fairly open to the private sector and many of the players have ventured into horticulture, livestock, and fisheries, bringing in huge investments. To contain post-harvest losses and ensure quality produce, investments in supply chains, warehouses, cold chains, and so on, are needed. These investments can come from the private sector, provided there is policy certainty and a congenial environment to do business.

Some recent initiatives toward public–private partnerships include the NHM investing in cold chain development but to be managed and operated by the private sector. While private sector retailing, specifically the entry of foreign multinationals, is caught in the policy uncertainty of foreign direct investments, a number of private players are entering the front-end retailing and processing activities. The amendment of the Agricultural Produce Marketing Committee (APMC) Act has facilitated contract farming between farmers and private players (e.g., Indian Tobacco Company, Pepsico, Keventer, Desai F&V, and several other private entrepreneurs). There are interesting examples of firm–farm linkages that are still evolving in the high-value sector, the experience of which has been a mixed bag (Appendix). To ensure the proper implementation of the Model Act, the Ministry of Agriculture issued a guideline that unless fruit and vegetable

marketing was exempted from the APMC, the NHM would not provide any subsidy on warehousing and cold storage to the concerned states.

The role of the civil service organizations comes in the functioning of several components of the flagship programs of the public sector. Given the extent of their outreach in the rural areas, they can be engaged in extension services, building linkages between farmers and companies through clustering. This can help improve the bargaining power of the farmers, particularly in contract farming arrangements and the like.

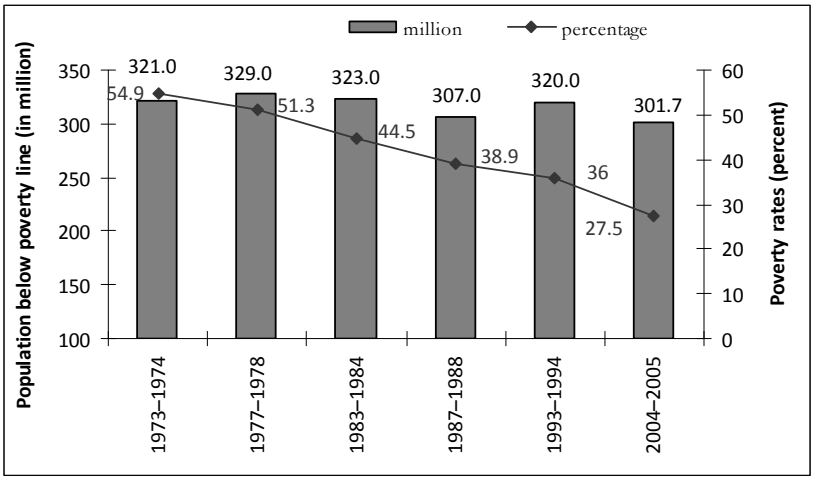
The multilateral, bilateral, and philanthropic foundations can be involved in improving the functioning and service delivery of some of the key programs. There are emerging partnerships at the state level, for instance, ADB and the International Fund for Agricultural Development in Maharashtra, and ADB in Bihar. More such partnerships need to be forged to create synergy among different stakeholders, cutting across various programs, to ensure sustainable food and nutrition security to the people of India.[7] The National Agricultural Innovation Project, worth $294 million, aims to facilitate accelerated and sustainable transformation of agriculture to support poverty alleviation and income generation through collaborative development and application of agricultural innovation. The project is an example of a collaboration among public research organizations, farmers' groups, the private sector, civil society organizations, and international agencies, such as the International Fund for Agricultural Development and the World Bank.

6. Where Do We Head from Here?

India still faces the challenge of ensuring food and nutrition security, given its high poverty and malnutrition levels. Although the poverty level went down from 55% in 1973–1974 to 27.5% in 2004–2005, more than 300 million people still live below the poverty line (Figure 14). While growth alone cannot take care of the vulnerable groups, and social safety net programs are needed, it is also true that higher growth resulting in better employment and income opportunities is a more sustainable solution to ending poverty and hunger. This is in line with the inclusive growth principle of the country.

[7] (i) The Asian Development Bank Technical Assistance Program, ADB TA-7195: The Agribusiness Infrastructure Development Investment Program is an ADB program aimed at addressing three main constraints to agriculture growth: outdated technologies, lack of public investment in basic infrastructure, and limited diversification. It is proposed that the program adopt an integrated value chain (IVC) approach, targeted at improving physical and institutional linkages along agricultural value chains through support of agribusiness market infrastructure, support infrastructure such as market intelligence, capacity building, and the like. Two districts each in Bihar and Maharashtra have been identified for the project. The funding is distributed among the producers or promoters, government, and ADB. (ii) World Bank Project-Multi-State Agricultural Competitiveness Project: Based on a World Bank study of agricultural marketing in India (2006), a concept note on Multistate Agricultural Competitiveness Project was prepared. In principle, approval of the Planning Commission was obtained in 2007. The proposal is to improve and develop market infrastructure for agricultural and allied items. The states to be covered had to be reformed (APMC reform) states and would cover Maharashtra, Rajasthan, Andhra Pradesh, Tamil Nadu, and Orissa. The average size of the project is $100 million. Maharashtra was the first one to complete the Project Implementation Plan and environmental impact assessment study, and has been taken up for pre-appraisal. The total cost of the project in Maharashtra is Rs6.55 billion. The World Bank component for funding would be 50% through the International Bank for Reconstruction and Development and 50% through the International Development Association. The World Bank will be shortly carrying out an appraisal of the project in Maharashtra, which will be on back-to-back state plan basis.

Figure 14: Poverty Levels, 1973–1974 to 2004–2005



Source: Government of India, Ministry of Agriculture. 2009. Planning Commission estimates from Agricultural Statistics at a Glance 2009. New Delhi.

The question is: can India afford to achieve it in a business-as-usual scenario, or will it require a major policy boost to revamp the existing investment scenario and create opportunities for partnerships? With the business-as-usual scenario, perhaps it would take India 25 to 30 years to alleviate poverty; to achieve it in a decade would require larger investments and a mission-mode operation involving the public sector, private players, and international agencies committed to supporting economic and human development.

If India were to bring down poverty to less than 5%, and that too in a decade, what types of investments would be needed and how much will it cost? Will it be enough to boost investments by 25% and can that ensure a 4% agricultural growth? Or does it need almost a 100% increase in investments related to agriculture, which can accelerate the growth of agriculture to 6% or 7%, and which is widespread geographically and socially to ensure food and nutrition security to its masses? If so, where will these investments come from?

Looking into the role of the various stakeholders, the public sector can enhance investments by rationalizing subsidies as these have much lower rates of return than investments in, say, agriculture R&D, rural roads, and irrigation. But ironically, today, quite a bit of the public resources going to agriculture are in the form of subsidies (Fan, Gulati, and Thorat 2008). The private sector can take an obvious lead in investments in the value chain; the investment can be as small as a farmer's investment in setting up a tube well to as big as a corporate player's investment in logistic services. The role of multilateral and bilateral agencies can come in supporting many of the public sector initiatives as well as private ventures.

But for this to happen, the government policy has to be friendly to private sector participation through better incentives and institutional (rules-of-the-game) changes. A multistakeholder system can ensure better accountability and address issues related to poor governance and transparency, which have a positive impact on the functioning of the program and, hence, the outreach. Gender (female) participation particularly needs to be recognized explicitly in this entire chain, especially the importance of empowering women through education and asset ownership.

Food security has always been very high on the policy agenda, and time and again, the government has been making efforts to augment domestic production of food grain through technological innovations and investments in irrigation, infrastructure development, and subsidies. No single actor can achieve as much as the synergy in partnerships that key stakeholders can give. These partnerships can be between government and the private sector, or with civil society organizations, or with multilateral agencies (including philanthropic foundations), and bilaterally between two countries through exchanges of information, analysis, technologies, and other resources. We hope this paper could help the stakeholders take a first step in this direction.

Appendix

SELECTED PLAYERS ENGAGED IN FIRM–FARM LINKAGES IN INDIA

Sl.No.	Company	Year	Highlights
	Livestock segment		
1	Mother Dairy (wholly owned subsidiary of National Dairy Development Board)	Dairy, 1974; F&V, 1988	Share in total revenue: fresh milk 62%, F&V 15%; targeting a Rs40 billion turnover in 2009–2010
2	National Dairy Development Board (cooperative)	1970	Result of Operation Flood (1970–1997): India is largest producer of liquid milk (108.5 million tons)
3	Nestle India Private Limited (multinational)	1961	Started in 1961 in Moga with 180 farmers, now links about 100,000 farmers to the milk markets
4	Hatsun Agro Private Limited (corporate)	1970; liquid milk marketing in 1993	With net sales of Rs10 billion in 2008–2009, likely to emerge as the largest private firm
5	Suguna Poultry (corporate)	1984	Number 1 broiler producer in India; 10th largest poultry enterprise in the world
6	PRADAN (NGO supporting poultry cooperatives, among other things)	1988	Supports 16 poultry cooperatives mostly consisting of women linked to self-help groups
7	Kesla Poultry Cooperative Society (cooperative)	1998	Provides a source of livelihood to tribal women in Madhya Pradesh
	Fruits and Vegetables Segment		
8	Mahindra Shubhlabh Services Limited (corporate)	2004	Largest exporter of grapes (318 containers, approx. 14 tons each)
9	Bharti Del Monte India Pvt. Ltd. (corporate)	2004	Largest exporter of baby corn (200 tons)
10	Desai Fruit & Vegetables (private sector)	2001	Known as Banana King. Largest exporter of bananas; sales worth $750,000 in 2006–2007
11	Kaybee Exports (private sector)	1989	Largest exporter of pomegranates
12	Fresh Acre Agri Private Limited (private sector)	2008	First exporter of packaged pomegranate seeds (100 tons) in 2009
13	Mahagrapes (cooperative)	1991	Export rejections have come down from 80% in the 1990s to less than 1% since 2001
14	Jain Irrigation Systems Limited (private sector)	2001	Contracting with 3,000 farmers covering an area of 6,000 acres for onion dehydration operations

F&V = fruits and vegetables, NGO = nongovernment organization, SI = .
Source: Gulati and Ganguly 2009.

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Food and Nutrition Security Status in India: Opportunities for Investment Partnerships

India is a net agricultural exporter but food availability is threatened by the effects of climate change and declining water resources on agriculture output. Economic access to food by about a fourth of the population living below the poverty line is problematic. The level of malnutrition, especially among women and children, remains unacceptably high. This paper gives an overview of the various government programs and policies that seek to tackle food and nutrition security in India. Finding that government efforts alone and a business-as-usual stance have been inadequate, this paper explores opportunities for investment and knowledge partnerships between various players to help improve the status of food and nutrition security in India.

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Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org/poverty
ISSN 2071-9450
Publication Stock No. WPS102475

Printed in the Philippines