

Agriculture Diversification and Food Security Concerns in India

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Abstract: Agriculture diversification is considered as one of the important components of growth and development of agricultural sector in India. It can be defined as the shift of resources from the regional dominance of one crop or livestock to a large mix of crops or livestock. Diversification of agriculture in favour of non-cereals and high-value commodities such as fruits, vegetables, milk, meat, eggs, fish etc. are emerging as a promising source of income augmentation, employment generation, poverty alleviation and export promotion (Jha, Ramesh chand, Vyas, 1996; Delgado and Siamwalla, 1999; Ryan and Spencer, 2001; and Joshi et al., 2002). Agricultural diversification is increasingly being considered as a panacea for many ills in the agricultural development of the country. After independence, Indian economy was confronting with the problem of food insecurity. Both the market and technology were under developed and these were responsible for low income and higher variability in the returns of food and non-food crops (Rudra, 1982). At that time, diversification was looked primarily from the angle of risk and food security. Diversification, in terms of diversity of cropping pattern, was considered as one of the important means to minimise risk and overcome food insecurity (MEHTA, MAY 2009). This paper aims at analyzing the trends and patterns of agriculture diversification and its impact on food security in India.

I. Introduction

Nature and Pattern of Agricultural Diversification in India

The nature of diversification are broadly described as a shift of resources from farm to non-farm activities, use of resources in a larger mix of diverse and complementary activities within agriculture and a movement of resources from low value agriculture (crops and livestock) to high value agriculture (Hayami and Otsuka, 1992; Vyas 1996; Delgado and Siamwalla 1999). This follows that diversification of agriculture is a process of moving away from subsistence food crops to a diversified market oriented production system, triggered by improved rural infrastructure, rapid technological change in agricultural production and diversification in food demand patterns (Rosegrant and Hazell, 1999).

In India, agriculture diversification is gradually taking place in favour of high-value crops and livestock activities. Diversification has occurred both across and within the crop, livestock, forestry and fishery sectors. Within the agriculture, the share of output and employment in the non-crop sectors, i.e. animal husbandry, forestry and fisheries, has been gradually increasing. Consumption patterns are fast changing from staple food such as rice, wheat and coarse cereals to high-value food commodities like fruits, vegetables, eggs, meat and fish products, mainly because of rising per capita income, fast growing urbanization, changing tastes and preferences of consumers and sustained economic growth. The demand and supply of these high value products have grown much faster than those of food-grains (Kumar et al. 2003 and Joshi et al. 2004).

The Indian economy has marked a shift in consumption patterns in favour of high-value food commodities not only in the urban areas and in the high-income groups but also in rural areas among the poorest section of the population. This shift in consumption patterns reveals an on-going process towards agricultural diversification. This process of diversification is also reflected in the rising exports of high-value agricultural products (Government of India 2003). The shift in consumption patterns and rising exports of high-value agricultural products has forced the farming community and policy makers to search for a more remunerative and viable crop options (Sati, 2012). Diversification of agriculture in favour of high-value commodities are emerging as a promising source of income acceleration, employment generation, poverty alleviation and export promotion (Jha, Ramesh Chand, Vyas, 1996; Delgado and Siamwalla, 1999; Ryan and Spencer, 2001; and Joshi et al., 2002). Thus, diversification is taking place in terms of moving away from crop production to other agricultural activities (N.P. Singh, 2006). Most remarkable changes are occurring within the crop sector which can be perceived from the changes in cropping pattern in India. Diversification, in terms of diversity of cropping pattern, was considered as one of the important means to minimize risk and overcome food insecurity (Mehta P, 2009).

II. Objectives

The objective of the paper is to analyze the trends and patterns of agriculture diversification and its impact on food security in India.

III. Cropping Pattern in India and the Process of Diversification

The changes in cropping pattern have been taking place as a result of substitution of low productivity crops by those which have shown impressive performance in productivity growth such as rice, wheat, maize, groundnut, sugarcane, rapeseed and mustard. Changes in the cropping pattern had contributed to output growth despite a steady decline in the area of coarse cereals and pulses. Table 1 shows that the cropping pattern in India has underwent significant changes during the period of planning. With the introduction of new technology during the mid-1960's, area under non-food crops as a proportion of the total cropped area has increased but still there is dominance of food crops. At the beginning of the economic planning in India, 76.7 percent land was put under food crops and about 23.3 percent on non-food crops. By 2011, area under food crops had come down to 64.56 percent and under non-food crops has increased to 35.44 percent (Agricultural Statistics at a Glance, 2011-12).

Table 1: Changes in Cropping Pattern in India since 1950-51 (In Percent)

Crops	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2010-11
Rice	23.5	22.3	22.6	23.3	23	24.03	21.84
Wheat	7.6	8.5	11	12.8	12.9	13.84	14.81
Coarse cereals	29.9	29.4	27.7	24.6	19.6	16.5	14.44
Total cereals	61.1	60.2	61.4	60.8	55.5	54.43	51.57
Total pulses	15.6	15.5	14	13.2	13.5	11.4	13.45
Total foodgrains	76.7	75.7	75.4	73.9	68.9	65.83	64.56
Sugarcane	1.3	1.6	1.6	1.7	2.1	2.49	2.49
Condiments&spices	0.9	1	1.1	1.2	1.3	1.5	1.7
Fruits & vegetables	1.7	1.9	2	1.7	3.6	4.39	6.24
Total oilseeds	8.3	8.3	8.9	9.1	13.5	13.56	13.87
Total fibres	5.1	5.7	5.5	5.3	4.7	5.22	5.53
Tobacco	0.3	0.3	0.2	0.3	0.2	0.16	0.19

Source: Agricultural Statistics at a Glance (2011-12)

This shift in the allocation of area from food crops to non-food crops reflect a change from subsistence cropping to commercial cropping. This shifting of land from food crops to non-food crops was mainly influenced by the prevailing price in market and profitability per hectare. Also there is dominance of cereals; about 51.57 percent of the area is devoted to the production of cereals, while only 13.45 percent is devoted to pulses in year 2011. Though, the area under both cereals and pulses is decreasing but the rate of decrease in area under cereals is greater than that of pulses. It means whatever cropped area increased as a result of irrigation facilities, chemical fertilizer, and high yielding varieties of seeds, a greater part of it is devoted to foodgrains. Within cereals, area under coarse cereals is gradually declining since 1950-51. This is due to the fact that coarse cereals are inferior goods. The table also shows that area under fruits and vegetables and oilseeds is gradually increasing since 1950-51. This is because of the change in consumption pattern from cereals to non-cereals.

Table 2: Changes in Cropping Pattern in India (Area in million Hectares)

Year	1990-91	2003-04	2009-10
Total Area Under Crops	185.74	189.67	192.20
Net area sown	143.00	140.71	140.02
Cropping Intensity (percent)	129.89	134.80	137.26
Area under Food Crops	141.03	142.12	141.06
Area under Non-Food Crops	44.71	47.55	51.14
Net Irrigated area	48.02	57.05	63.26
Gross Irrigated Area	63.20	78.04	86.42

Source: State of Indian Agriculture (2012-13)

The above table shows that while the net sown area has come down from 143 million hectares in 1990-91 to 140 million hectares in 2009-10, the total area under crops has gone up from 186 to 192 million hectares during the same period due to increase in the cropping intensity from 130 to 137 percent. The table clearly reveals that area under food crops has remained almost stagnant during the same period i.e. from 141.03 to 141.06 million hectares. However, there is significant increase in area under non-food crops from 44.71 million

ha in 1990-91 to 51.14 million hectares in 2009-10. There is also marked increase in net irrigated area and the gross irrigated area during the period 1990-91 to 2009-10.

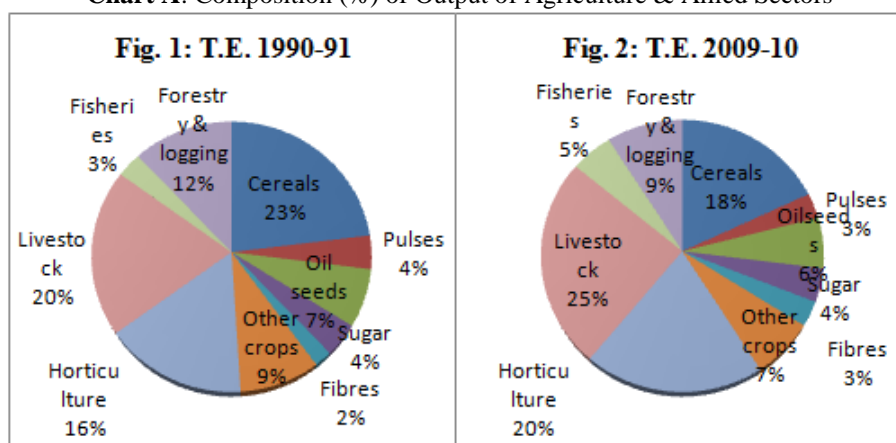
Table 3: Crop- Wise Share (%) in Area

Years	1990-91	2003-04	2009-10
Rice	23	22.3	22
Wheat	12.9	14.2	14.9
Coarse Cereals	19.5	16.5	14.5
Pulses	13.4	12.9	12.5
Sugarcane	2.1	2.4	2.4
Condiments & Spices	1.3	1.7	1.7
Fruits & Vegetables	3.6	4.9	5.4
Oilseeds	13.5	13.8	14.9
Cotton	4.1	4.2	5.2
Non-food crops	24.1	25.1	26.6

Source: State of Indian Agriculture (2012-13)

The table shows that 22 percent of the acreage is under rice which has remained stable during the last two decades. Area under wheat has slightly increased from 13 per cent in 1990-91 to 15 percent in 2009-10. Area under coarse cereals has come down significantly from 19.5 percent to 14.5 percent during this period. Area under pulses has also marked fall from 13.4 percent to 12.5 percent. The table however, reveals that there is remarkable increase in area under sugarcane, condiments & spices, fruits and vegetables, oilseeds, cotton and non -food crops.

Chart A: Composition (%) of Output of Agriculture & Allied Sectors



Source: State of Indian Agriculture (2011-12).

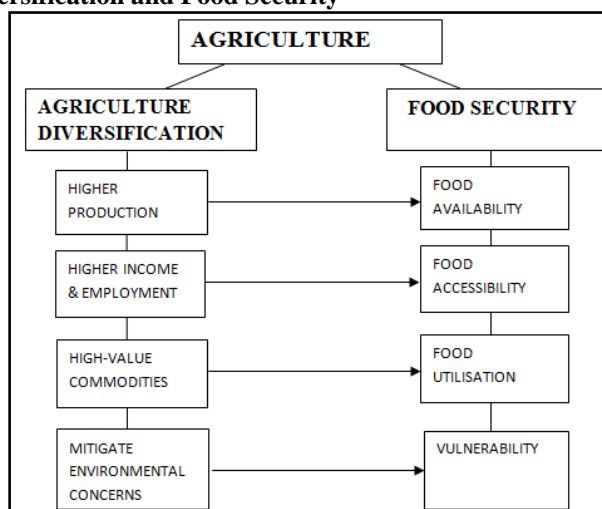
The chart shows that the share of horticulture and livestock have shown an increasing trend in recent years implying that they have been growing at a much faster rate than the traditional crops sector. The share of livestock in total output from the agriculture and allied sectors has increased from 20% in Triennium Ending (T.E.) 1990-91 to 25% in T.E. 2009-10 (at 2004-05 prices). Given the rising share of high value commodities in the total value of agricultural output and their growth potential, this segment is likely to accelerate agricultural growth in the near future. The high value commodities are perishable in nature and for better linkages between farm and firms several key institutional changes are required. In order to develop efficient and faster value chains, the linkages of logistics, processing, retail etc will require incentives to the entrepreneurs for infrastructure development.

IV. Food Security and Diversification of Agriculture in India

“Food security implies access by all people at all times to sufficient quantities of food to lead an active and healthy life”. Food security has four important and closely related dimensions, which are availability of food, economic access, utilization of food and vulnerability- the interactions among which determine how food secure a country is or how adequate, steady and risk-free food consumption is at the household and individual levels. The availability of food means desired quantities of food production within the country, food imports and the previous year stock stored in government granaries. Access has two dimensions, physical and economic, of which the later is more important. Economic access to food is largely determined by the household’s purchasing power and food subsidies through various programmes. The utilization dimension of food security is related

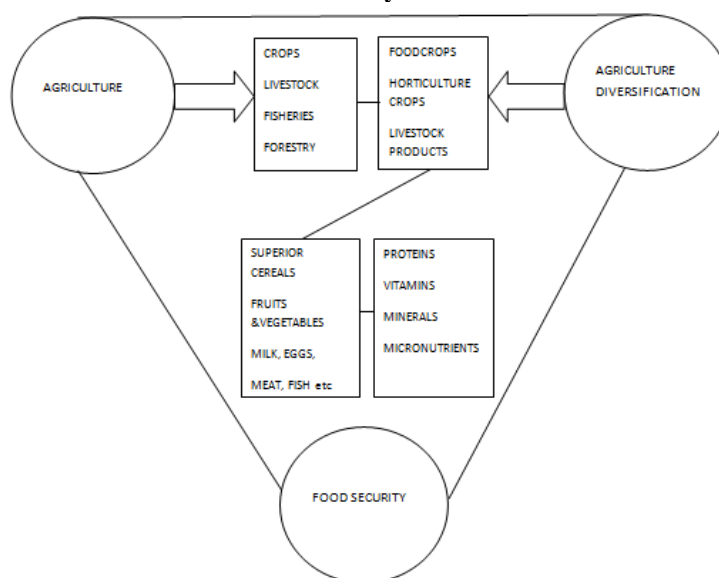
with the nutritional requirements of household members, based on their age and sex. The pattern of food utilization at the household level generally depends on the factors such as, diet preferences, nutrition knowledge, caring practices, sanitation, health and quality of food and water etc. Vulnerability refers to various external factors and risks such as environmental risks(floods, droughts, earthquakes, cyclones etc) and nutrition and health risks, which destabilize the food security of the population of the country (Sharma,2014) .

Chart B: Agriculture Diversification and Food Security



Food security is thus a multi-dimensional concept and extends beyond the production availability, and demand for food. It simply implies food as well as nutrition security. Recently, as we move up the development ladder, nutrition security becomes more relevant indicator of food security. To ensure nutritional security, increased availability of diverse types of food, such as millets, pulses, fruits and vegetables, foods of animal origin (milk, eggs, meat, fish), besides cereals, is essential. While fruits and vegetables are rich sources of micronutrients, animal-based foods abound in quality proteins as well(Diversification of Agriculture for Human Nutrition, 2001). M S Swaminathan has defined food security as "livelihood security for the households and all members within, which ensures both physical and economic access to balanced diet, safe drinking water, environmental sanitation, primary education and basic healthcare". Thus, providing drinking water for all has become an integral component of food security(Mujumdar, 2006). Food security at the national and household level is an important issue in the context of agricultural diversification. Producing additional food is a major challenge when population and incomes are rising, and natural resources are degrading. There are apprehensions that shift in crop portfolio from food to non-food crops may lead to food insecurity(P. K. Joshi, 2004).

Chart C: Agriculture Diversification and Food Security



India's strategy of agricultural development and approach to food security has proved its resilience in the wake of recent global food crisis, which has created political and social unrest in several countries of the developing world. Increasing agricultural production for achieving food security has been the central focus of India's agricultural development strategy since Independence. Driven by self-sufficiency motive, cropping patterns in India were confined to foodgrain production for a long time, with a few regions devoting some resources for commercial crops like cotton, sugarcane, groundnut, etc. With green revolution technology and high yielding varieties especially of rice and wheat, food grain production in India witnessed a steady increasing growth rate during the 1970s and 1980s. There seems to have been some diversification in food production in the 1980s on account of the impressive growth of output of oilseeds and livestock products. The buffer stocks of foodgrains kept swelling in 1990s and foodgrain production saturated the markets. In less than a decade, India was able to achieve reasonable food security. High growth in productivity of cereals spurred agricultural growth and incomes. The rising levels of income, changes in pattern of domestic demand and, to some extent, export demand in the wake of trade liberalization, resulted in changes in resource use and thus, diversification of agriculture in India. Diversification towards high value commodities like, vegetables, fruits, other specialty crops, livestock products, fisheries, value-added agricultural products etc has been considered as the new pathway for income growth in agricultural and rural sector in India. Later, Kumar (1997) has pointed out that diversification in the food basket due to urbanization will provide food security and improve the quality of life by adding to the nutritional status and welfare of the population.

Over the years the economy has marked significant dietary changes leading to diversification of food towards fruits, vegetables, milk, meat, egg, fish etc. The diversified food basket has led to more diversification at the farm level and augments income of farmers which govern the access to food affordability. Thus, India has made considerable progress in improving food security at all levels. Recently, Economists have analyzed price inflation in terms of primary food articles such as cereals, pulses, fruits and vegetables, milk, meat, fish, spices etc and manufactured food articles like sugar, dairy products, vegetable oils, prepared food stuff and other processed products. The increasing diversification towards crop, livestock and fisheries has filled the demand gap to some extent in these commodities (State of Indian Agriculture, 2011-12). The increased awareness of the impact of food on health through research, mass media, and strong cross culture influences has resulted in greater emphasis not only on food quality reflected in improved nutrient balance of the diet but also on the attributes related to food safety (Barghouti et.al, 2004).

The diversification in majority of the states in India is coming as a result of expansion in cropping intensity. The crop substitution is also taking place, which is diverting area in favor of high-yielding cereals from low-yielding inferior cereals. Rice, wheat and maize has gained while sorghum and millets lost the area. With diversification, consumers are exposed to a wider choice of foods and they change their dietary pattern either due to a rise in income or fall in price. Per capita consumption of foodgrains has been declining and some of this decline indicates an increase in the consumer's welfare (Rao, 2000). This high-yielding nature of food grain crops has improved per capita availability in India (P. K. Joshi, 2004). With 200 million tonnes of foodgrains, calorie and protein deficiencies have largely been overcome. There is agreement that increased per capita availability of cereals and a number of other foods have contributed to greater food security at the national level.

Table 4: Per Capita Net Availability of Foodgrains (Grams per Day) in India

Year	Rice	Wheat	Other Cereals	Cereals	Gram	Pulses	Food- grains
1951	158.9	65.7	109.6	334.2	22.5	60.5	394.9
1961	201.1	79.1	119.5	399.7	30.2	69.0	468.7
1971	192.6	103.6	121.4	417.6	20.0	51.2	468.8
1981	197.8	129.6	89.9	417.3	13.4	37.5	454.8
1991	221.7	166.8	80.0	468.5	13.4	41.6	510.8
2001	190.5	135.8	56.2	386.2	8.0	30.0	416.2
2002	228.7	166.6	63.4	458.7	10.7	35.4	494.1
2003	181.4	180.4	46.7	408.5	8.5	29.1	437.6
2004	195.4	162.2	69.3	426.9	11.2	35.8	462.7
2005	177.3	154.3	59.4	390.9	10.6	31.5	422.4
2006	198.0	154.3	60.5	412.8	10.7	32.5	445.3
2007	194.0	157.8	55.5	407.4	11.9	35.5	442.8
2008	175.4	145.1	54.1	394.2	10.6	41.8	436.0
2009	188.4	154.7	63.9	407.0	12.9	37.0	444.0
2010	182.0	168.2	51.4	401.7	13.5	35.4	437.1
2011	181.5	163.5	65.6	410.6	14.6	43.0	453.6
2012	190.2	158.4	60.0	408.6	13.5	41.7	450.3
2013(P)	232.4	183.3	53.2	468.9	15.3	41.9	510.8

Source: Agricultural Statistics at a Glance (2014).

The table shows the net availability of food grain has declined from 469 gm per day in 1961 to 450 gm per day in 2012. This implies that significant increases in food grain production have not been able to keep up with the increase in population. It is important to mention here that there has been a steady decline in net per capita food grain availability in the post-economic reforms period of 1991 to 2012, with the levels falling from 511 gm per day in 1991 to only 450 gm per day in 2012. The table also reveals that while net availability of cereals declined from a level of 468.5 gm per day in 1991 to a level of 408.6 gm per day in 2012. The net availability of pulses which is a major protein source in the Indian diet declined significantly in the post-reform period. It was 41.6 gm per day in 1991, and fell to a level as low as 35.5 gm per day in 2007 but improved significantly to 41.8 gm per day in 2008 and again declined in the next two years. On the other hand the per capita net availability of gram has remained fluctuating in the post reform period.

Table 5: Per Capita Consumption of Emerging Food Items (Quantity in Kg/ litre/No.)

Commodities	Year	Quantity Consumed Per Annum	
		Rural	Urban
All Cereals(kg)	1999-00	154.76	126.78
	2011-12	136.51	112.91
All Pulses (kg)	1999-00	10.22	12.17
	2011-12	9.53	10.96
All Edible Oils(kg)	1999-00	6.08	8.76
	2011-12	8.20	10.38
Apple(kg)	1999-00	0.00	0.97
	2011-12	0.71	2.32
Banana (No.)	1999-00	30.17	60.83
	2011-12	50.86	81.40
Vegetables (kg)	1999-00	40.15	42.46
	2011-12	52.71	52.61
Milk (litre)	1999-00	46.11	62.05
	2011-12	52.72	65.97
Eggs (No.)	1999-00	13.26	25.06
	2011-12	23.60	38.69
Fish (Kg)	1999-00	2.56	2.68
	2011-12	3.24	3.07
Chicken (Kg)	1999-00	0.49	0.73
	2011-12	2.17	2.91

Source: Agricultural Statistics at a Glance (2014).

The table shows that per capita consumption of all cereals and pulses has declined in both rural and urban areas during the period 1999-2000 and 2011-12, while that of fruits & vegetables and livestock products has increased during the same period. The data has revealed that per capita consumption declined absolutely in case of cereals, pulses and increased in case of edible oils and for all types of food, including fruits, vegetables, milk etc. The per capita consumption of all cereals in rural areas declined from 154.76 kg per annum in 1999-2000 to 136.51 kg in 2011-12, while in urban areas it declined from 126.78 to 112.91 kg per annum during the same period. This shows that the decline in per capita consumption in rural areas is higher as compared to urban areas. This is largely because in recent years, with the increase in income and changes in the dietary pattern, the rural families have been spending more on horticulture and livestock product as it provides more nutrients.

Table 6: Percentage Composition of Consumer Expenditure

Items	Rural			Urban		
	Share in total consumer expenditure			Share in total consumer expenditure		
	1999-000	2009-10	2011-12	1999-000	2009-10	2011-12
Cereal	22.2	15.6	12.0	12.4	9.1	7.3
Gram	0.1	0.2	0.2	0.1	0.1	0.1
Pulses & products	3.8	3.7	3.1	2.8	2.7	2.1
Milk & products	8.8	8.6	9.1	8.7	7.8	7.8
Edible Oil	3.7	3.7	3.8	3.1	2.6	2.7
Egg, fish & meat	3.3	3.5	3.6	3.1	2.7	2.8
Vegetables	6.2	6.2	4.8	5.1	4.3	3.4
Fruits & nuts	1.7	1.6	1.9	2.4	2.1	2.3
Salt & spices	3.0	2.4	2.4	2.2	1.5	1.7
Beverages, etc	4.2	5.6	5.8	6.4	6.3	7.1

Sources: Agricultural Statistics at a Glance (2014).

The above table reveals that per capita cereal consumption expenditure declined both in rural and urban areas during the period 1999-2000 and 2011-12, but the decline is more in rural areas than in urban areas. It is declined from 22.2 to 12.0 in 1999-2000 in rural areas, while in urban areas the decline was from 12.4 to 7.3 during the same period. The fall in cereal consumption was more than compensated by increased consumption of non-cereal food items such as, gram, edible oil, livestock products, fruits & nuts, beverages etc in rural area during the reference period. However, there has been steady decline in the consumption expenditure in all these non-cereal food items, except for beverages etc in urban areas. Per capita consumption on pulse & products, vegetables, salt and spices has continuously declined in both rural and urban areas during the same period. It is thus, clearly evident that in the post green revolution period there has been diversification in the food consumption patterns, and the share of cereal consumption in total household consumption has declined in rural and urban areas.

V. Conclusion

It may be concluded that a more favourable environment for diversification towards high-value commodities will not only ease the pressure of storing huge surplus of rice and wheat, but also accelerate growth of agricultural sector in India. Further, long-term food security goal can only be attained if there is sustainable agriculture i.e. the natural resources are managed in such a way that the potential yield and the stock of natural resources do not decline over time (Kumar and Mittal, 2006). The new strategy of agricultural growth and diversification of agriculture from traditional crop cultivation to horticulture, etc, would require investment in cold storage, rural roads, communication, warehouses, marketing network and facilities etc. Simultaneously, efforts should be made to revive agriculture through the introduction of biotechnology and other innovations. This would require a substantial increase in investment in research and development for agriculture. Such a broader approach can facilitate not only the achievement of food security in India but also the twin objectives of development i.e. accelerating growth of agricultural GDP and promoting equity through reduction in poverty.

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