



Indian Agriculture in the Globalization Era: The Performance and Determinants

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I. Introduction

India has been following liberalized and open economic policies since the initiation of wide-ranging economic reforms and structural adjustment program in 1991. There is a general consent on the desirability of economic reforms in India, though the opinion is divided on sequencing, pace, implementation and impact. A continuous debate is taking place in this regard particularly in view of benefits and costs of globalization. The debate has become highly polarized (Kumar, 2000), as there are two camps of scholars arguing in favour and against of economic reforms. In brief, the performance of Indian economy under the reforms as executed until now shows a mixed picture of notable achievements and failures (Ferro et al., 2004; Wadhwa, 2003). On the achievement side, increasing trade openness and inflows of FDI, stability in inflation and current account BOP, accretion of foreign exchange reserve, reduction of poverty and increasing economic growth are most important. On the failure side, growing fiscal deficit with revenue deficit, declining tax-GDP ratio, infrastructural bottlenecks and its regional variation, low human development and social sector expenditure, falling growth of agriculture and jobless growth, particularly, rural employment (Landes and Gulati, 2004) are mainly imperative. But it is to be noted that every thing may not be attributed to the reforms program only.

Keeping in above view, present paper seeks to examine the performance of Indian agriculture and their causes and determinants thereof during the era of 1990s. The rest of paper is in four sections. Section II presents the performance of India's agriculture and its problems in the 1990s. Section III examines the determinants of yield per

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hectare of foodgrains during the pre- and post- globalization era. Section IV concludes.

II. The Performance of Indian Agriculture in the Globalize Era of 1990s

Agriculture occupies most strategic position in the Indian economy and views as a 'way of life'. It is a tradition that shaped the- thought, outlook, culture and economic life of the people in the country. Even though, India being a developing country, the role of agricultural sector is more important than others. It considers one of the largest private enterprises in India and continues to dominant the change in the economy through its casual links with factor and product markets (Radhakrishna, 2002). On the whole, it is a pre-requisite in the Indian economy, although industrialization has come to stay as synonyms of economic growth.

The structure of Indian economy has changed significantly during the globalization era of 1990s. The country has received higher economic growth at an average rate of 5.8% in the 1990s, which is comparably higher to 5.6% in the 1980s. This is mostly due to service sector growth, as it has grown at a superior rate than other segments of the economy (See Figure 1). Service sector has started contributing nearly 50% to GDP and is followed by industry and agriculture. The most important here is the declining share of agriculture to GDP. It has substantially worsened from a high of 34.9% in 1990-91 to about 24% in 2003-04 (See Figure 2). This is, nonetheless, no indication of real importance of agriculture in the Indian economy. Its importance considerably lies on rural employment and rural livelihood only (Hashim 2004). It provides livelihood to over 60% of population and employs about 60% of total workforce of the country (Ranganathan, 2003).

There has been substantial change in employment growth in the Indian agricultural sector (Dhanasekaran, 2005). During 1983-1994, employment in agriculture was increasing at the rate of 1.51% per annum as against total employment growth of 2.04%. But the growth rate of employment has been substantially negative in agriculture during 1994-2000. That is 0.34% (-) per annum against the total employment growth rate of 0.98% (See Figure 3). Usually Indian employment growth has been less contrary to overall growth of labour force and hence, unemployment has been increasing in the 1990s. The trend also signify that diversification of employment away from agriculture is not significant enough, even though the relative incomes in agriculture keep declining. In case of female, their diversification is substantially low contrary to men (See Figure 4). Mostly, the share of agricultural employment to total employment in the India economy remains same or may decline a little. The tertiary sector's growth, which has made major contribution to GDP growth during 1990s, has

not absorbed manpower in sufficient numbers. Consequently, agriculture has carried out the major load of employment in the economy.

Agriculture remains a very important sector in India with significant implications in rural poverty (Jones and Sen, 2003; Datt and Ravallion, 1998; Ahluwalia, 1978) and income distribution. Agricultural growth needs to be uprooted in the interest of stable and sustainable growth of the economy. In fact, it has been observed that agricultural growth certainly determines GDP growth of the economy. The overall GDP growth was high, whenever agricultural growth was high and vice versa (See Figure 5). Unless agricultural growth is improved, country cannot achieve annual GDP growth of 8%, which has been set by the Planning Commission, and reduction in rural poverty. Industry and services also cannot grow on expected lines without agricultural growth, as they are some extent interrelated in India. Unfortunately, the performance of India's agriculture is somewhat deteriorated in the 1990s. The average trend growth rate of agricultural GDP is 3.05%, which is considerably low counter to 3.07% in 1980s. Among the agriculture and its allied, the growth rate of forestry and logging are shown positive only (See Figure 6). In the agriculture itself, there has been falling growth of production of foodgrains and all crops in the 1990s against 1980s. The growth rate in foodgrains production declined from 2.92% in the 1980s to 1.66% in the 1990s. Yield and area growth also declined drastically for foodgrains and non-foodgrains (See Figure 7). In the state-wise picture, there is falling growth of agricultural GDP in all the states except Andhra Pradesh, Karnataka and Uttar Pradesh (See Figure 8). This could have implications on farmers' income and employment in particular and overall GDP in general.

The main factors, besides host of others, that responsible for deceleration of agricultural growth are: inadequate irrigation coverage; improper adoption of technology; unbalanced use of inputs; decline public sector investment; and weakness in credit delivery system (RBI, 2003). The irrigation coverage, measured as net irrigated area as a percentage of net sown area, has been stagnant between 30-40% during 1990s (Figure 9). Though it has been increased over the years, but it is noticeably low as per agricultural need and country's other requirement. As compared to the target of 3.4 million hectares per annum, irrigation potential harnessed during the Ninth Plan was 1.8 million hectares per annum (Dev, 2004). This is mostly due to secular decline of public sector investment in the Indian agriculture. This has been a great concern in the economy, as its outlay is important for improving infrastructure and complementary to private investment, which has substantially increased in the 1990s and beyond. Likewise, public and private sector investments cannot be treated

as substitutes for each other as their compositions are different. More public investment is essentially needed in rain-fed and backward areas.

The public sector investment, as a percentage of agricultural GDP, has been declined from a high of 2.1% in 1990-91 to 1.2% in 2001-02 and substantially stagnant around 2% only (See Figure 9). Despite an increase in private investment, the share of total investment in agriculture to total GDP was only around 1.3% in 2003-04 and agricultural GDP was around 7% in the same year. This share is largely low in contrast to 1970s and 1980s (Dev, 2004). The investment in research and extension is also low and around 0.5% of GDP. This is very needful in India especially on dry land, hilly and marginal areas, diversification of the crop pattern and allied activities, post-harvesting technology and biotechnology. In fact, the return of public investment in terms of agricultural growth is also much higher in rainfed regions (Fan and Hazell, 2000; Fan et al., 2000). Though the involvement of private sector has increased particularly with the advent of biotechnology, public sector research has to increase especially to address the problems of resource poor farmers in the less endowed regions (Rao, 2005). It is true that the returns to investment on research and extension will be much higher on agricultural growth as compared to other investments.

The availability of credit for farmers is important for working capital and investment purposes in agriculture. However, despite having a wide network of rural branches and many schemes and programmes for the expansion of credit for agriculture and rural development, a large number of very poor people still continue to remain outside the fold of formal banking system. The credit should reach marginal and small farmers. But unfortunately, growth rate of agricultural credit for small and marginal farmers has been declined in 1990s contrary to 1980s (RBI, 2002) and in the same time, there was also no decline in growth of credit for large farmers. There is a declaration in the commercial bank's disbursements of direct finance to marginal farmers from 15% in 1980s to 11% in 1990s and simultaneously, its growth rate also decelerated to 13% from 18.1% during the same period. In addition, incremental credit-deposit ratio in the rural areas also declined from 106.1% in 1980s to 36% in 1990s (RBI, 2003).

In the 1990s, farmers' suicide seems to have increased in some states of India. This is particularly in Andhra Pradesh, Karnataka and Maharashtra and is one of the darker sides of Indian agriculture (Sainath, 2004). The crop failure and farmers' indebtedness emerge as the main and causative factors, while social and psychological factors of the farmers also add to this problem. According to Rao (2003), the sharper decline in absolute productivity, price uncertainty due to trade liberalization and rise

in costs due to domestic liberalization, decline in credit and non-farm work also intensified the crisis. Presently, many farmers are diverging to commercial crops, where input intensity is higher counter to subsistence crops. There is no break through in dry land technology and cultivation is being done in marginal lands also. The risk is, however, high in commercial crops and marginal lands. In such a situation, the main problems that have been faced by the Indian farmers are spurious input supply like seeds, fertilizers and pesticides; inadequate credit from institutional sources and more dependency on moneylenders; lack of water and drying up of groundwater; lack of extension services particularly for commercial crops; exploitation in marketing; lack of rural non-farm activities; and higher health expenditure. Since diversification is risky, the conditions have to be improved for the farmers to change the cropping patterns of the economy. The present government support system is mainly for rice and wheat. Unless other crops are given in the support systems, diversification on a large scale will be very difficult. In the recent budget, government has given some importance to agricultural diversification and allocated Rs. 630 crore for National Horticulture Mission (Dev, 2005).

One of the biggest difficulties in the present agricultural system is marketing. The recent example is chilly and cotton production in Andhra Pradesh and grapes production in Mizoram. This is also true for many other crops in India. There is volatility in prices due to globalization and substantially creates additional problem in agriculture. The current marketing systems are more or less trader-friendly rather than farmer-friendly. Private markets are also not farmer-friendly, unless proper regulatory structures are established. In short, present marketing infrastructure is not sufficient for agriculture. In this scenario, recent budget proposes to introduce a scheme called 'Development/Strengthening of Agriculture Marketing Infrastructure, Grading and Standardization'. An important agenda in agriculture during the 1990s is the share of its exports. The proponents of structural adjustment programmes expect agricultural products to play an important role in the field of exports. This is largely because of poor country's comparative advantage in agriculture. Agricultural exports are expected to be the mainstay of Indian exports, which can earn enough to cover increasing import costs (Sen, 2003). Really, agricultural exports have been deteriorated in the Indian economy during the 1990s. The percentage of agricultural exports to total exports has been declined from a high of 19.4% in 1990-91 to 11.7% in 2003-04 (Figure 10).

On the whole, India's agriculture determines the country's fate and thus, if agriculture goes wrong, nothing else would go right for the country and this cannot be

ignored. Almost all the aspects of the country's life and economy bear its stamp in such a way that the very existence of all economic activities of the nation is tied up with the state and health of this sector. Consequently, we presume that rapid growth of agriculture is effectively needed in the economy for her multi pronged objectives like self-reliance, food security, income distribution, poverty reduction, enthralling growing labour force and facilitating export. The importance of this sector is again enhanced in the country because of its rapidly growing population and its estimated food requirement of 235 million tones by 2020 contrary to the current availability of 203 million tones.

III. The Determinants of Agricultural Productivity

Usually growth of agriculture depends upon three important indicators, viz., increasing- area under cultivation, cropping intensity and agricultural productivity. But in India, increasing agricultural productivity is more important than others. This is mostly due to increasing pressure of urbanization and industrialization of the economy. The issue of increasing agricultural productivity is not something new in India. It was traced since her independence and consequently, the country always had some plans and policies. One of such policies was green revolution during 1960s. The strategy of this technology was in the form of a package of programmes woven around high yielding varieties along with high dosing of modern inputs like fertilizer and irrigation. In fact, these were considered as main determinants of agricultural productivity during 1970s and 1980s. But in 1990s, the whole economy has diversified because of globalization policy. Though it has substantial meant for trade, investment and financial flows, its impact should not be avoided in the agricultural sector. Accordingly, we examine the determinants of agricultural productivity during pre- and post- era of 1990s. A variety of model has been available in the literature of applied econometrics to capture the dynamic input-output relation. The present model here applies Cobb-Douglas production function, as it is pertinent in the agriculture. The model that used in the present study to observe the determinants of agricultural productivity is as follows:

$$AGP_t = a + b_1 NIA_t + b_2 HYV_t + b_3 FERT_t + b_4 ELECT_t + b_5 GCFA_t + b_6 AGCR_t + b_7 RAIN_t + U$$

Where, AGP = Yield per hectare of foodgrains (Kg/hectare); NIA = Net Irrigated Area as a % of Net Sown Area; HYV = HYV area as a % of area under food crops; FERT = Consumption of chemical fertilizer (Kg/hectare); ELECT = Electricity consumption in agriculture (in %to total consumption); GCFA = Gross Capital Formation in Agriculture (in % of GDP); AGCR = Flow of institutional credit to agriculture (in

thousand crore); RAIN = Actual rainfall as a % of normal rainfall; t = time periods; U = Stochastic term; other notations are parameters.

Data used under the study are secondary in nature and have been collected from various sources namely Hand Book of Statistics on Indian Economy, RBI (Mumbai); Comendium on Environment Statistics, CSO (New Delhi) and Economic Survey, GOI (New Delhi). The coverage of data is from 1980-81 to 2000-2001 and has been estimated under three parts: First part is covering overall data from 1980-81 to 2000-01; second part is from 1980-81 to 1990-91 and is termed as pre-globalization; and third part is from 1991-92 to 2000-01 and is called as post-globalization. Since the data under all the three periods are not sufficient enough for the feasibility of model (due to inclusion of more number of variables), we apply here step-wise regression. The idea is to capture the most significant variables only. The estimated results under step-wise regression are reported in Table 1. The results reflect that HYV and rainfall are very striking factors that influence India's per hectare yield of foodgrains during the entire 21 years. They positively determined the yield and statistically significant at 1% probability level. The coefficient determination (R^2) reflects that about 97% of systematic variations in yield of foodgrains is explained by these two factors. This is statistically supported by F-statistics, which is significant at 1%. The d-statistics (1.797) shows that the existence of autocorrelation is no more a problem for the present analysis.

During pre-globalization era, fertilizer and rainfall are the most key factors that influenced India's yield of foodgrains at the positive level. They are statistically significant at 1% and their systematic variations towards per hectare of yield are about 98%. There is presence of some autocorrelation and assumed that it would not create any problems for the present analysis. During post-globalization era, irrigation becomes the most vital factors that influence the yield of foodgrains in the economy. It influences the yield at a positive level and shows statistical significant at 1%. The R^2 (0.828) indicates that about 83% of systematic variations of yield is determined by irrigation. The d-statistics also reflects that the present analysis is not badly affected by autocorrelation. To sum up, irrigation is the key determinants of yield per hectare of foodgrains in the 1990s, while fertilizer and rainfall are the key determinants of the same in the 1980s.

Most interestingly, both fertilizer and HYV, which are most significant element in most of the studies and also in the present study through variance-covariance matrix, have not shown any substantial effect on yield of foodgrains in the Indian economy during all the three periods. This is probably due to potential effect of other variables

and that does not mean that they have no influence on yield. In fact, their role is no more effective without substantial availability of irrigation and rainfall. As per literature, it is well known that Indian agriculture is more or less bounded by gamble of monsoon. This is, in fact, true here since the major factors that influenced the yield of foodgrains are irrigation and rainfall. Between the two, irrigation is most vital element in the economy, as it is in the hands of researcher and policy makers while rainfall is not. In fact, an encouragement and availability of irrigation certainly attract the modern inputs like fertilizer and HYV and hence can increase the yield of foodgrains as per country's need and expectation.

Figure 1: India's Economic Growth during 1990s

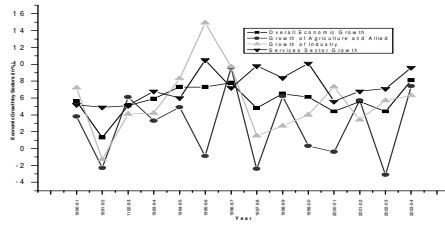
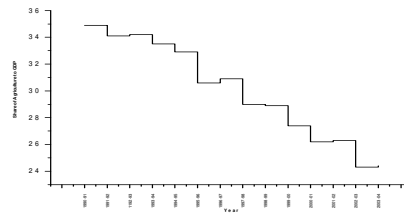


Figure 2: India's Share of Agriculture to GDP during 1990s



Source: Indian Economic Survey, Government of India

Source: Statistical Outline of India, Government of India

Figure 3: India's Employment Growth (Usual Status): Pre and Post Globalization Era

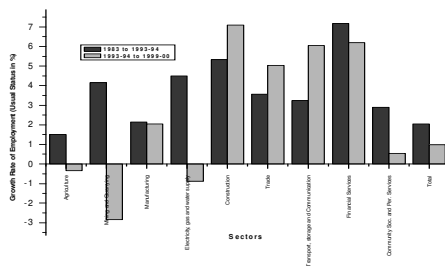
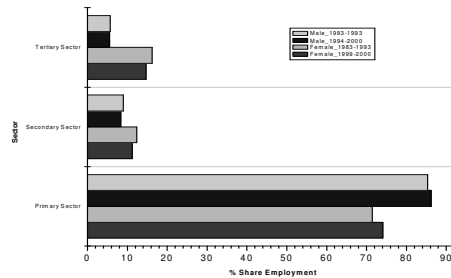


Figure 4: India's Employment Diversification: Pre and Post Globalization Era



Source: Planning Commission, Government of India

Source: NHDR, Government of India

Figure 5: India's Agricultural Growth and GDP Growth during the Planning Periods

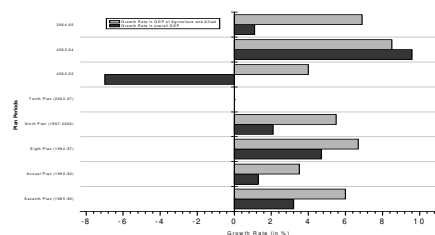
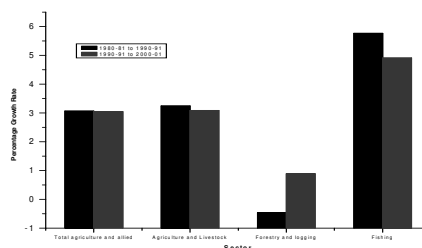


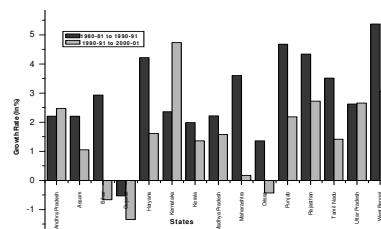
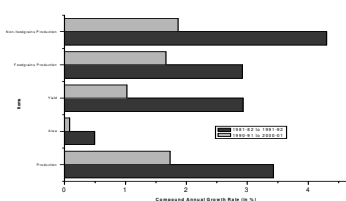
Figure 6: Trend Rates of Growth for GDP in the Indian Agricultural Sector



Source: Indian Economy Survey, Government of India

Source: EPW, Mumbai

Figure 7: Compound Annual Growth Rates in Area, Figure 8: State-wise Trend Growth Rates of GDP Agriculture and Allied Activities

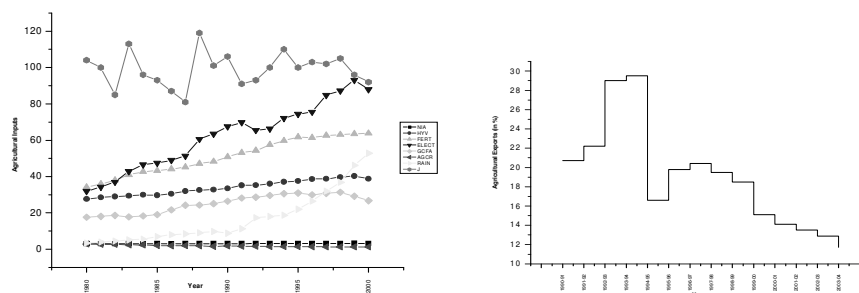


Source: Economic Survey, Government of India

Source: Economic Survey, GOI

Figure 9: Trends of India's Agricultural Inputs: The Pre- and Post Reforms Era

Figure 10: India's Agricultural Exports during the Globalization Era



Source: Hand Books of Statistics on Indian Economy

IV. Conclusion

The paper discusses the performance of Indian agriculture during the globalization era of 1990s and its problem thereof. It also examines the determinants of yield per hectare of foodgrains during the 1980s and 1990s. In the first part, the paper observes that agriculture is not cheering in the era of 1990s contrary to other sectors of the economy. The problems associated with this sector is falling growth rate of agricultural GDP. It includes both food and non-food crops and with respect to its area, yield and production. The other related problems of agriculture are declining share of agriculture to overall GDP, diminishing trends of agricultural exports, stagnant and falling public sector investment in agriculture, inadequate irrigation, unbalanced use of inputs, improper adoption of technology, weakness in credit delivery system, slow crop diversification, farmers' suicide, lack of marketing and low attention to agricultural research.

Table 1: Regression Results of India's Yield Determinants of Foodgrains Production

Periods	Variables	Estimated Coefficients	t-Statistics	Probability Level
I	Constant	2.668	75.20	0.000
	HYV	0.007	22.38	0.000
	Rainfall	0.001	02.91	0.009
	R ²	0.967 (0.964)		
	F	265.7		0.000
	DW	1.797		
	Constant	2.812	122.6	0.000
	Fertilizer	0.004	15.95	0.000

II	Rainfall	0.001	3.374	0.010
	R²	0.975 (0.969)		
	F	155.92		0.000
	D-W	2.903		
=====				
	Constant	2.669	31.422	0.000
	Irrigation	0.014	6.1990	0.000
II	R²	0.828 (0.806)		
	F	38.43		0.000
	D-W	2.166		
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Note: Case I: 1980-81 to 2000-01; Case II: 1980-81 to 1990-91; Case III: 1991-92 to 2000-0; R²: Coefficient of determination; F: F-statistics; D-W: Durbin-Watson d statistics; and the parenthesis indicated the value of adjusted R².

In the second part, we first consider some important factors such as irrigation, HYV, fertilizer, GCFA, electricity consumption, institutional credit and rainfall to catch the key determinants of India's yield per hectare of foodgrains. Among them, most significant are irrigation, fertilizer and rainfall. Fertilizer and rainfall are very vital in the pre-globalization era, while irrigation is the most critical in the post-globalization era. However, irrigation and rainfall are most imperative during the entire period of this study. Since rainfall is not controllable, major attention should be given to irrigation coverage. It can automatically solve the improper adoption of modern technology and unbalanced use of agricultural inputs. In this context, government has already given attention to these issues from time to time. Furthermore, emphasis is also to be given on other existing problems of agriculture specifically rural infrastructure and crop diversification. This requires more and more public investment in agriculture along with private sector participation. To conclude, there is need of vigorous policy decisions to recover the present problems of Indian agriculture.

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