GURU ARJAN DEV INSTITUTE OF DEVELOPMENT STUDIES

Productivity of Indian Agriculture

GROWTH AND DETERMINANTS

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FOREWORD

It is estimated that by 2050, global agriculture must double the food production to feed the nine billions. This can be achieved only by wisely harvesting the modern tolls of science, technology and innovation.

India's smallholder farmers comprise 78 per cent of the country's farming population and produce 41 per cent of the country's food grains. Yet this sector of agricultural community owns only 33 per of the total cultivated land and together with landless agricultural labourers constitutes the bulk of India's rural poor. Moreover, despite agriculture's significant contributions to India's economic growth, the smallholder's farmers, including many female farmers, continue to face a number of critical challenges to produce food in a sustainable and profitable manner, particularly in the context of climate change.

It is indeed timely efforts by the Guru Arjan Dev Institute of Development Studies, Amritsar (Punjab) to have come out with this useful volume on Productivity in Indian Agriculture. This volume has addressed all aspects of agriculture from production to market linkage and has some strategic benefit share mechanism by conceiving a group approach in agricultural market sector.

I am sure, the book will be as useful to the audience and I congratulate the authors for bringing out such a wonderful synthesis.

(S Ayyappan)

Dated 25th December 2012
New Delhi

PREFACE

Recent Indian growth story has been service-led. Services sector has completely replaced agriculture, which was traditionally the largest contributor to India's GDP. No doubt, agriculture has the smallest share in GDP (14 per cent) today from a high of more than 50 per cent, but does not belittle its importance for the Indian economy. This is because first, agriculture remains the largest employer having a share of around 60 per cent. Secondly, it holds the key to creation of demand in other sectors and remains by far an important indirect contributor to India's GDP growth. The agriculture sector needs to grow at least by 4 per cent for the economy to grow at 9 per cent. Thus, though having a small share, the fluctuations in agricultural production can have large and significant impact on overall GDP growth. Thirdly, since food is an important component in basket of commodities used for measuring consumer price indices, it is necessary that food prices are maintained at reasonable levels to ensure food security, especially for the deprived sections of our society. In fact, food security is emerging as an important policy concern, and the role of agriculture in ensuring equitable access to food has added a new perspective for policy makers.

As is well-known, the year 1968 marked the beginning of a turning point in Indian agriculture. The country was dependent on agricultural imports for almost two decades after independence. This was the first time that such high growth in production and yield of both rice and wheat was witnessed in the country and remain one of the highest achieved so far. The development of high-yielding variety (HYV) of seeds in mid 1960s and the subsequent use of the ***seed-fertilizer-pesticides-irrigation*** *package and education of farmers led to quantum jumps in the productivity. High growth in production and yield continued during the subsequent decades of 1970s and 1980s which were much higher than the average annual rate of growth of population of 2.2 per cent. This enabled the country to achieve self-sufficiency in terms of wheat and rice.*

The productivity of Indian agriculture, however, witnessed a fatigue with the average growth rate coming down due to stagnancy in yield of wheat, rice and food grains. As a result, the per capita net availability of food grains per day came down from 510.1 grams in 1991 to 444.0 grams in 2009. The corresponding figures for pulses were 41.6 grams and 37.0 grams,

respectively. Low yield per unit area across major crops has become a regular feature of Indian agriculture in recent years. This can be attributed to structural weaknesses of the agriculture sector reflected in low level of public investment, exhaustion of the yield potential of new high yielding varieties of wheat and rice, unbalanced fertilizer use, low seed replacement rate, an inadequate incentive system and post harvest value addition. Some of the other reasons that can be attributed to the low agricultural productivity in our country are (i) Lack of irrigation facilities in major part of the cultivated land; (ii) Small and fragmented land holding with the cultivators; (iii) Lack of timely availability of quality seeds, fertilizers for providing all major and minor nutrients for the crops and insecticides in many parts of the country; (iv) Lesser availability of photo period as compared to countries like those in Mediterranean sea areas.

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EXECUTIVE SUMMARY

Slow agricultural growth is a concern for policymakers as nearly two-thirds of India's people depend on rural employment for a living. Current agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are quite low. Poorly maintained irrigation systems and almost universal lack of good extension services are the major factors responsible. Furthers, farmers' access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation. Even though, India has shown remarkable progress in recent pasts and has attained self-sufficiency in food staples, the productivity of Indian farms for most of the crop is very low compared to farms in Brazil, the United States, France and other nations. Indian wheat farms, for example, produce about a third of wheat per hectare per year in contrast with wheat farms in France. Similarly, the productivity of rice farms in India was less than half the china's productivity of rice farm. Other food staples productivity in India is similarly low, suggesting a major opportunity for growth and future agricultural prosperity potential in India. Indian total factor productivity growth remains below 2 per cent per annum; in contrast, China has shown total factor productivity growths of about 6 per cent per annum, even though China too has smallholding farmers. If India could adopt technologies and improve its infrastructure, India could eradicate hunger and malnutrition within India, and be a major source of food for the world.

With a population of just over 1.2 billion, India is the world's largest democracy. In the past decade, the country has witnessed accelerated economic growth, emerged as a global player with the world's fourth largest economy in purchasing power parity terms, and made progress towards achieving most of the *Millennium Development Goals*. India's integration into the global economy has been accompanied by impressive economic growth that has brought significant economic and social benefits to the country. Nevertheless, disparities in income and human development are on the rise. Going forward, it will be essential for India to build a productive, competitive, and diversified agricultural sector and facilitate rural, non-farm entrepreneurship and employment. Encouraging policies that promote competition in agricultural marketing will ensure that farmers receive better prices.

The low growth rates may constitute in part a response to inadequate returns to Indian farmers. India has very poor rural roads affecting timely supply of inputs and timely transfer of outputs from Indian farms, inadequate irrigation systems, crop failures in some parts of the country because of lack of water while in other parts because of regional floods, poor seed quality and inefficient farming practices in certain parts of India, lack of cold storage and harvest spoilage causing over 30 per cent of farmer's produce going to waste, lack of organized retail and competing buyers thereby limiting Indian farmer's ability to sell the surplus and commercial crops. The Indian farmer receives just 10 to 25 per cent of the price the Indian consumer pays for exactly the same produce, the difference going to losses, inefficiencies and middlemen traders. Farmers in developed economies of Europe and the United States, in contrast, receive 64 to 81 per cent of the price the local consumer pays for exactly the same produce in their supermarkets.

More than 80 per cent of India's farmers are small and marginal farmers with an area share of more than 40 per cent. The support systems and policy changes have to support in raising productivity and incomes of the small and marginal farmers. *National Commission on Enterprises for Unorganized Sector* (NCEUS, 2008) suggests special programmes for small and marginal farmers. Principal activities proposed under this include promotion of marginal-small farmer's groups, enabling greater access to institutional credit, training and capacity building, support for strengthening and non-farm activities, gender-focused activities and planning for development of marginal and small farmers.

One major reform needed in agriculture sector relates to reduction in subsidies and increase in investments. Agricultural subsidies are fiscally unsustainable and encourage misuse of resources, leading to environmentally malignant developments. There is trade-off between subsidies and investments. Public investment declined from 3.4 per cent of agri.GDP in the early 1980s to 1.9 per cent in 2001-03. At the same time subsidies increased from 2.9 per cent to 7.4 per cent of agri.GDP. Rise in public and private investment is crucial for enhancing agricultural growth. As a proportion of the value added by agriculture to GDP, Gross Capital Formation (GCF) in agriculture and allied sectors rose to 20.1 per cent in 2010-11 from 13.5 per cent in 2004-05 at 2004-05 prices. This is a positive trend. However, the share of agriculture and allied sectors' GCF in overall GCF of the economy at 2004-05 prices shows a mixed trend during the same

period. There is need to significantly step up investment in agriculture, both by the private and public sector to ensure sustained growth of around 4 per cent. In this context, the announcement of *Bharat Nirman* programme in 2005 by the Government of India in order to improve agriculture and rural infrastructure is in the right direction. However, the pace of this programme has to be improved.

Water is the leading input in agriculture. Development of irrigation and water management are crucial for raising levels of living in rural areas. Major areas of concern in irrigation are: decline in real investment, thin spread of investment, low recovery of costs, decline in water table, wastages and inefficiencies in water use and, non-involvement of users Both investment and efficiency in use of water are needed. Major areas of reforms needed in irrigation are: stepping up and prioritizing public investment, raising profitability of groundwater exploitation and augmenting ground water resources, rational pricing of irrigation water and electricity, involvement of user farmers in the management of irrigation systems and, making groundwater markets equitable. Watershed development and, water conservation by the community are needed under water management. New watershed guidelines based on *Parthasarathy Committee's* recommendations were accepted by the Central Cabinet in March 2009. The implementation has to be stepped up in order to obtain benefits in rainfed areas. *National Rainfed Area Authority* has big responsibility in matters relating to water conservation and watershed development. Assets created under NREGS can help in improving land and water management.

The yield growth for many crops has declined in the recent past. Technology plays an important role in improving the yields. The National Commission on Farmers indicates that there is a large knowledge gap between the yields in research stations and actual yields in farmer's fields. The yield gaps given by the Planning Commission (GOI, 2007 a) range from 5 per cent to 300 per cent depending on the crop and State.

National Food Security Mission (NFSM) launched in 2007 to increase 20 million tonnes of food grains during the 11th plan period has shown some results by increasing yields in different regions. There is a need to strengthen this mission to increase productivity.

The issue of technology fatigue in agriculture is well known now. There is a need to shift away from individual crop-oriented research focused essentially on irrigated areas towards research on crops and cropping systems in the dry lands, hills, tribal and other marginal areas. In view of high variability in agro-climatic conditions in such unfavourable areas, research has to become increasingly location-specific with greater participation or interaction with farmers. Private sector participation in agricultural research, extension and marketing is becoming increasingly important especially with the advent of biotechnology and protection being given to intellectual property. However, private sector participation tends to be limited to profitable crops and enterprises undertaken by resource rich farmers in well endowed regions. Therefore, the public sector research has to increasingly address the problems facing the resource-poor farmers in the less endowed regions. The new agricultural technologies in the horizon are largely biotechnologies.

Similarly, there is a need to strengthen extension. Agricultural Technology Management Agency (***ATMA)*** scheme was launched in 2005 to support state government's efforts to revitalize the extension. This scheme gives an opportunity to improve extension system. The returns to investment on research and extension will be much higher on agricultural growth as compared to other investments.

According to the ***Expert Group on Financial Inclusion*** only 27 per cent of farmers have access to institutional credit though there have been some improvements in flow of farm credit in recent years. However, the Government has to be sensitive to the four distributional aspects of agricultural credit. These are: (a) not much improvement in the share of small and marginal farmers; (b) decline in credit-deposit (CD) ratios of rural and semi-urban branches; (c) increase in the share of indirect credit in total agricultural credit and; (d) significant regional inequalities in credit.

There has been diversification of Indian diets away from food grains to high value products like milk and meat products and vegetables and fruits. Since risk is high for diversification, necessary support in infrastructure and marketing are needed. Price policy should also encourage diversification. The Government wants to have second green revolution by diversifying agriculture in crop sector and allied activities. To promote holistic growth of the horticulture

sector through area based regionally differentiated strategies, the National Horticulture Mission (NHM) was launched in the country during 10th Plan. The impact has to be strengthened further to improve productivity in horticulture sector.

The true benefit of diversification will come if more emphasis is given to allied activities like animal husbandry and fisheries. The livestock sector contributes 5.4 per cent to GDP and 22.7 per cent to total output from agriculture sector. Ownership of livestock is more equitable than that of land and women play significant role in animal husbandry.

For small and marginal farmers, marketing of their products is main problem apart from credit and extension. In recent years, there has been some form of contract arrangements in several agricultural crops such as tomatoes, potatoes, chilies', gherkin, baby corn, rose, onions, cotton, wheat, basmati rice, groundnut, flowers, and medicinal plants. There is a silent revolution in institutions regarding non-cereal foods. New production –market linkages in the food supply chain are: spot or open market transactions, agricultural co-operatives and contract farming .Contract farming in India is neither backed up by law nor by an efficient legal system. This has to be strengthened as legal system is the single most constraint to widespread use of contract farming in India.

There is a need to revamp some of the legal hurdles for agro processing and APMC Act. Several State Governments have already amended their APMC Acts allowing varying degrees of flexibility. However several States are yet to notify the relevant rules that would make the amendment fully operational. These steps should be speedily completed to provide a boost to promotion of direct marketing, contract farming, and setting up of markets in private and co-operative sectors.

Most important problem for the farmers is output price fluctuations. There is a big gap between producer prices and consumer prices. There are different models for marketing collectively by the small and marginal farmers. These are: self help group model, co-operative model, small producer co-operatives and contract farming. *Apni Mandi* in Punjab, *Rytu Bazaars'* in Andhra Pradesh, dairy co-operatives are some of the successful cases in marketing. The real challenge lies in organizing the small and marginal farmers for marketing and linking them to high value agriculture. Thus, group approach is needed for getting benefits from marketing.

PRODUCTIVIY OF INDIAN AGRICULTURE
Growth and Determinants

The policy of self-sufficiency in food in India which led to Green Revolution had served the country well. The country currently has sufficient stocks of wheat and rice which are above buffer stock norms and food security reserve requirements. However, in the medium to long term, concern over food security is likely to become more intense. This is because land is scarce and its supply is limited. Further, sustained dependence on food imports is not an option that is viable in Indian context. Therefore, food safety net for the present and future population requires enhanced agricultural production and productivity. The recent Indian growth story has been service-led. Services sector has completely replaced agriculture, which was traditionally the largest contributor to India's GDP. However, the fact that agriculture has the smallest share in GDP of only about 14 per cent today from a high of more than 50 per cent , does not belittle its importance for the Indian economy. This is because first, agriculture remains the largest employer having a share of around 60 per cent. Secondly, it holds the key to creation of demand in other sectors and remains by far an important indirect contributor to India's GDP growth. The agriculture sector needs to grow at least by 4 per cent for the economy to grow at 9 per cent. Thus, though having a small share, the fluctuations in agricultural production can have large and significant impact on overall GDP growth. Thirdly, since food is an important component in basket of commodities used for measuring consumer price indices, it is necessary that food prices are maintained at reasonable levels to ensure food security, especially for the deprived sections of our society. In fact, food security is emerging as an important policy concern, and the role of agriculture in ensuring equitable access to food has added a new perspective for policy makers. Apparently, agriculture is the backbone of the Indian economy and the villages are the life lines of growth of India.

Agriculture in India has a significant history. Today, India ranks second worldwide in farm output. Agriculture and allied sectors like forestry and fisheries accounted for 16.6 per cent of

the GDP in 2009, about 50 per cent of the total workforce. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. Agriculture is a very important sector for the sustained growth of the Indian economy. About 70 per cent of the rural households and 8 per cent of urban households are still primarily dependent on agriculture for employment. Since some three-quarters of the population live in rural areas, a majority of households thus depend principally on this sector. Though industrialization of the Indian Economy has adversely affected the share of agriculture in the GDP, the fact cannot be ignored that India has undergone a series of successful agricultural revolution starting with the green revolution in wheat and rice in the 1960's and 1970's the white revolution in the milk to the yellow revolution in oilseeds in 1980's.

As a result, India has achieved self sufficiency in agriculture. The principle change in 20th century was green revolution during which all countries experienced a massive increase in yield per unit area in time owing largely to greater control of production factor. It is the 20th century that must be considered the century of science based agriculture. It is also characterized as blue print century in which more centralized engineering approach to agriculture including the setting of production targets was a central driver for increased agricultural output and 21st century will be marked by a return to a more location specific ecological approach to agriculture. However, conclusions about inter-state disparities in agricultural development based on single crop, group of crops or even crop sector can be misleading. There has been progressive diversification towards livestock production within agricultural sector which implies that exclusion of livestock sub sector while evaluating growth performance is not justifiable. Thus, interstate performance of agricultural sector should be analyzed based on domestic product from the total agriculture, that is, primary sector.

OBJECTIVES

The Indian agricultural sector has been undergoing economic reforms since the early 1990s in the move to liberalize the economy to benefit from globalization. This study traces this process, analyses its effects on agricultural productivity and growth and discusses the problems and prospects for globalization to draw policy implications for the future of Indian agriculture. Specifically objectives of the present study will be:

- To examine the trend in Gross Domestic Product as well as Net Domestic Product (NDP) during the reference period.
- To examine the trend in Gross Domestic Product as well as Net Domestic Product (NDP) from primary sector during the reference period.
- To identify the various determinants of GDP from primary sector
- To suggest ways and means to improve GDP from primary sector

DATA BASE AND METHODOLOGY

The present study deals with Productivity of Indian Agriculture Inter State Variation. This section discusses briefly the nature of the study and also explains the various statistical methods applied to interpret the data connected with the empirical testing of the structural changes in Agriculture Productivity. Agriculture Productivity was selected due to the fact that it is the most prosperous and productivity of the inter-state variation with the highest production. The nature of the problem suggested the use of primary data. The data on the volume of Gross domestic product and net domestic product by the origin of Agriculture have been taken from the estimates brought out by the Economic and Statistical Organization of Government of India, Department of Agriculture & Cooperation and Ministry of Agriculture. The estimates available are in two series, both at current and constant prices. The first one called revised series was worked out on 1990's.The new series are built upon 2000's in this study three revised series has been used because it will be more useful than the new series for showing the income distribution right from the base year 1990-91. The data relating to different parameters has been mainly taken from various issues of ***Agricultural Statistics*** - an annual publication of Department of Agriculture and Cooperation, Ministry of Agriculture, ***Hand Book of Indian Economy*** - an annual publication of Reserve Bank of India and ***Statistical Abstract of Punjab - an annual publication of Economic and Statistical Adviser, Government of Punjab***, ***National Income Statistics*** (CMIE), ***Agriculture*** (CMIE), ***Infrastructure*** (CMIE), ***Economic Survey***- an annual Publication of Ministry of Finance, Government of India and so on.

CHOICE OF PERIOD:

Time reference of the study is twenty years spanning with effect from 1990-91 through 2009-2010. The periods 1990-91 to 2009-10 have been chosen for analysis as a post reform period and divided into two equal sub-periods: 1990-91 though 1999 to 2000 defined as 1990's and 2000-01 through 2009-10 defined as 2000's. The purpose is also to see the extent to which the agricultural sector was a constraining factor during the nineties as compared to twenties. Trends

for the entire period 1990-91 to 2009-10 were also studied. Furthermore, three distinct phases has been identified as described below:

(i) Phase I: Period of wider dissemination (1990-91 to 1992-93)

(ii) Phase II: Post-Reform Period (2000-01 to 2002-03)

(iii) Phase III: Period of Recovery (2006-07 to 2009-10

STATISTICAL TOOLS:

Depending upon the nature of the data, various statistical techniques such as mean, standard deviation, variance, co-variance, coefficient of correlation, regression and factor analysis were applied. To test the level of significance, t-ratio, Z-ratio and F-ratio were worked out.

The arithmetic mean is written simply as ($\bar{X}$) and was computed by using the formula:

$$\bar{X} = \frac{\sum X}{N}$$

The limits of the summation were omitted. The summation was understood to extend over all available values of X.

The variance is written as

$$s^2 = \frac{\sum \left(X - \bar{X}\right)^2}{N-1}$$

$$= \frac{\sum \left(X^2 - \bar{X}^2 - 2X\bar{X}\right)^2}{N-1}$$

$$= \frac{\sum X^2 + N\bar{X}^2 - 2N\bar{X}^2}{N-1}$$

$$= \frac{\sum X^2 - N\bar{X}^2}{N-1}$$

In this derivation the summation of $\bar{X}^2$ over N is $N\bar{X}^2$; also the summation of $2X\bar{X}$ is $2\bar{X}\sum X = 2N\bar{X}^2$, since $EX = N\bar{X}$.

The standard deviation is given by

$$s = \sqrt{\frac{\sum X^2 - N\bar{X}^2}{N-1}}$$

Thus to calculate the standard deviation using this formula, we sum the squares of the original observations, subtract from this N times the square of the arithmetic mean, divide by N-1, and then take the square root. An alternative formula for the standard deviation which avoids the calculation of the arithmetic mean and is, therefore, useful for certain computational purposes is

$$s = \sqrt{\frac{N\sum X^2 - \left(\sum X\right)^2}{N(N-1)}}$$

This formula requires one operation of division only.

In situations where sets of observed and the theoretical frequencies are to be compared, Chi-square (X^2), is defined by

$$X^2 = \sum \frac{(0-E)^2}{E}$$

where 0 and E denote the observed the expected, or theoretical, frequencies respectively. Inspection of this definition shows that X^2 is a descriptive measure of the magnitude of the discrepancies between the observed and expected frequencies. The larger these discrepancies, the larger X^2 will tend to be. If no discrepancies exist, and the observed and expected frequencies are the same, X^2 will be 0. The value of X^2 in this definition is always 0 or a positive number. Negative values cannot occur.

Further, to test the difference in the average level of agricultural productivity, Z-statistics was used. Z value was calculated by using the formula

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{6_1^{\,2}}{n_1} + \frac{6_2^{\,2}}{n_2}}}$$

When the sample was large (N>30), t-statistics was estimated

The t-statistics for comparison of two population means is similar to the procedure of using the Z-statistics for comparison of two population means.

Two additional elements are considered when using the t-test. These are:

- The number of degrees of freedom is the sum of the degrees of freedom for each sample. When n_1 is the sample size from population 1, and n_2 is the sample size from population 2, the number of degrees of freedom would be expressed as:

$$df = (n_1-1) + (n_2-1)$$
$$= (n_1 + n_2 -2)$$

- The two standard deviations S_1 and S_2 calculated from the two samples of size n_1 and n_2 respectively, are pooled together to form a single estimate (s_p) of the population standard deviation, where (s_p) is calculated as:

$$s_p = \sqrt{\frac{(n_1-1){s_1}^2 + (n_2-1){s_2}^2}{n_1+n_2-2}}$$

Then, the t-statistics is calculated by the following formula.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{{s^2}_p\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$$

Where

x_1 = mean of the first sample

x_2=mean of the second sample

n_1=size of the first sample

n_2=size of the second sample

sp=pooled estimate of population

This calculated t-statistics is compared with the critical t-score from the table in a given level of significance and (n_1+n_2-2) degrees of freedom and a decision is made whether to accept or reject a null hypothesis.

1. To examine the relationship between job satisfaction and various variables, coefficient of correlation was computed using the formula.

$$r^2 = \frac{n\left(\sum XY\right) - \left(\sum X\right)\left(\sum Y\right)}{\sqrt{n\left(\sum X\right)^2 - \left(\sum X\right)^2}\sqrt{n\left(\sum Y\right)^2 - \left(\sum Y\right)^2}}$$

Where,

n=Number of paired observations

$\sum XY$ =Summation of Individual products of values of X and Y.

$\sum X$ =Summation of the X variable

$\sum Y$ =Summation of the Y variable

$\sum X^2$ =The X variable is squared and then summed.

$(\sum X)^2$ =The X variable is summed and then squared.

$\sum Y^2$ =The Y variable is squared and then summed.

$(\sum Y)^2$ =This Y variable is summed and then squared.

THE COEFFICIENT OF DETERMINATION:

The coefficient of determination ($R^{2)}$, the square of the coefficient of correlation (r), is a more precise measure of the strength of the relationship between the two variables and lends itself to more precise interpretation because it can be presented as a proportion or as a percentage.

The coefficient of determination (R^2) can be defined as the proportion of the variation in the dependent variable Y that is explained by the variation in dependent variable X, in the regression model.

In other words:

$$r^2 = \frac{Explained\ \ Variation}{Total\ \ Variation}$$

$$= \frac{\sum (Y_c - \bar{Y})^2}{\sum (Y - \bar{Y})^2}$$

$$= \frac{b_0 \sum Y + b_1 \sum XY - \frac{(\sum Y)^2}{n}}{\sum (Y)^2 - \frac{(\sum Y)^2}{n}}$$

For predicting the effect of various independent variables on the level of agricultural productivity, liner regression equation was estimated through ordinary least squares method

$$APs=b_0 + b_1 \times X_i$$

Where APs= level of agricultural productivity

And X_i= value of its independent variables

b_0 and b_1 are the two pieces of information called parameters which determine the position of the line completely. Parameter b_1 is known as the Y-intercept and parameter b_0 determines the slope of the regression line which is the change variables for each unit change in Y.

Following formula was used to estimate the value of b_0 and b_1

$$b_1 = \frac{n\left(\sum XY\right) - \left(\sum X\right)\left(\sum Y\right)}{n\left(\sum X^2\right) - \left(\sum X\right)^2}$$

$$\text{and, } b_0 = \frac{n\left(\sum Y\right) - \left(\sum X^2\right) - \left(\sum X\right)\left(\sum XY\right)}{n\left(\sum X^2\right) - \left(\sum X\right)^2}$$

To test the level of significance of b_1, t-value was estimated using the formula

$$t = \frac{b_1}{SE_{b1}}$$

Standard error of b_1 was estimated using the formula.

$$S_{yx} = \sqrt{\frac{\sum (Y)^2 - b_0\left(\sum Y\right) - b_1\left(\sum XY\right)}{n-2}}$$

DETERMINANTS OF STATE INCOME

The statistical analysis used for measuring the net influence of the selected causal factor on different aspects of state income, namely, net state domestic product and gross domestic product, income generated from one major sectors, via, primary sector.

In the first approach, state income was regressed upon each of the explanatory variables separately to study the extent to which each one of the selected variable (V_i) explained variations in state income. Two types of regression models namely linear and log-linear (Double log) were tried. The second was an approach of multi-variant regression analysis. Following two types of functional models were tried.

$$V_j = V_{o\ j+} \sum_{i=1}^{n} b_{ij} V_{ij}$$

$$V_j = V_{oj} \prod_{i=1}^{n} V_{ij}^{bij}$$

The final selection of the model was made on the basis of the following Statistical and Economic criteria:

(i) The Significance status of the individual regression coefficients;

(ii) The size of the coefficient of multiple determination; and

(iii) The ability of the function to provide economically meaningful results.

In multivariate regression analysis, only those variables which significantly affected the growth of state income where considered. However, all these selected variables could not be considered simultaneously due to various methodological limitations. These, *inter alia*, include the problem of multicollinearity, small sample size, most of regression coefficients carried improper sign and the explanatory power of the fitted models did not improve significantly.

However, these two techniques gave only limited information of the whole picture because the explanatory variables are highly correlated among themselves, that is, the pressure of multicollinearity. This necessitated the use of some more powerful technique which could not only take care of multicollinearity, but in which regression coefficients are not required independently. The technique of Factor Analysis based on the principle of mutual inter-dependence, seems to provide a simpler, though relatively crude, alternative. The basic structural features of the total situation under examination are reflected by a set of indices often referred in literature as Factors. These factors are in fact some linear combinations of original variables and between factors the variations are more than within the factors. The procedure of Factor Analysis attempts to estimate the values of regression coefficients where the original variables are regressed on the factors. These coefficients of regression are referred to as factor loadings. In the present study Principal Axes Method has been used to estimate these coefficients. These factor loadings are rotated in order to have a set of new factor loadings with better explanation and interpretation. However, in case of present study, unrotated factor loadings gave better results than the rotated ones. Therefore, unrotated factor loadings are listed and discussed.

FACTOR ANALYSIS

To identify the factors which influenced the level of determinants of Agricultural productivity in India and determinants of inter-state variation of Agriculture productivity factor analytic approach had been used. This is a statistical approach that could be used to analyze interrelations among a large number of variables and to explain these variables in terms of their common underlying dimensions (factors). The factor analysis is designated as the queen of analytical methods because of its power and elegance.

The general purpose of factor analytic technique was to find a way in condensing (summating) the information contained in a number of original variables into a smaller set of new, composite dimensions(factors) with a minimum loss of information, that was, to search for and define the fundamental constructs or dimensions assumed to underline the original variables.

The suitability of data for factor analysis can be tested on the basis of following criterion:

- A visual inspection of the correlation data matrix can reveal whether there were sufficient correlations to justify factor analysis.
- Anti-image correlation matrix showed the negative values of partial correlation among variables. In order for true factors to exit in data these values must be small.
- Kaiser-Meyer-Olin Measure of Sampling Adequacy (KMO) was another measure to quantify the degree of inter-correlations among the variables and appropriateness of factor analysis. The index ranged from 0 to 1. Small values for KMO measure indicated that a factor analysis of variables may not be a good idea, since correlation between pairs of variables cannot be explained by the other variables. A high value between 0.5 to1.0 indicated that the factor analysis was appropriate technique to be used.

There were two basic models that the analysis can utilize to obtain factor solutions. They were known as common factor and principal components analysis. The common factor and principal component analysis models were both widely utilized. Selection of the extraction method depends upon the analysts' objective. Principal component analysis was used when the objective was to summarize most of the original information (variance) in a minimum number of factors for prediction purposes. In contrast, common factor analysis was used primarily to identify underlying factors or dimensions reflecting what the variables share in common. In the present study principal components method of factoring has been used. This was the most common type

of factor analysis. It was a statistical technique that linearly transformed an original set of variables into a substantially smaller set of uncorrelated variables that represented most of the information in the original set of variables. A small set of uncorrelated variables was much easier to understand and use in further analysis than a large set of correlated variables.

Here linear combinations of variables were used to account for variation (spread) of each dimension in a multivariate space. The variance of the factors was called Eigen Values, characteristic root or Latent Root. Communality was the amount of variance an original variable shares with others. Factor loadings were the correlation between the original variable and the factor. Guidelines existed for identifying significant factor loadings based on simple size. Squared factor loadings indicated what percentage of the variance in an original variable was explained by a factor. When the set of variables was large, the analyst first extracted the largest and best combinations of variables and then proceeded to smaller less understandable combinations. Hence, the number of factors to be extracted became an important issue in the absence of any set criterion.

The four possible criteria were: (I) In a Priori Criterion, the analysis already knew how many factors to extract and accordingly instructs the computer; (II) In Latent Root Criterion, only those factors which have latent roots greater than 1 were considered significant;(III) In percentage of Variance Criterion, the cumulative percentage of variance extracted by successive factors was considered. In social sciences, it was common to consider a solution satisfactory when it accounts for 60 per cent of the total variance (and sometimes even less); and (IV) In Scree Test Criterion, at least one factor more than latent root criterion was usually extracted. The later factors extracted in principal component factor analysis model, contain both common and unique variance- the proportion of unique variance was much higher in later than in earlier factors. The Scree Test was used to identify the optimum number of factors that can be extracted before the amount of unique variance begins to dominate the common variance structure. In the present study, exploratory efforts were made with all of the above methods. Initially, latent root was used as guideline and then the screen test was used. In all the attempts percentage of the explained variance was also taken into consideration. Further an interpretation and assessment of the structure matrix was made in each case. Thus, several factors solutions with different number of factors were examined before a satisfactory solution was reached.

FACTOR ROTATION

An important step in factor analysis was the rotation of factors. Loadings were rotated to make them more interpretable by making the loadings for each factor either large or small, not in between .For rotation; either Orthogonal or Oblique method can be employed. In Orthogonal Rotation method, the axis was maintained at 90 degrees so that the resulting factors were uncorrelated. In Oblique Rotation method, the axis was rotated, without maintaining the 90 degree angle between them. This makes the method more flexible. However, analytical procedure for oblique rotations was still controversial. Within orthogonal method, either Varimax or Quatrimax method can be employed. Varimax method simplified the columns in a matrix whereas Qutrimax method stressed on simplifying the rows. In the present study, Orthogonal Rotation along with the Varimax method of rotation of factors was used in order to have more clarity in factor solution. Varimax Rotation was probably the most popular Orthogonal Rotation Procedure. The Varimax criteria maximized the sum of the variances of the squared loading within each column of the loading matrix. This tends to produce some high loadings and some loading near zero, which was is one of the aspects of simple structure. This statistical approach had been used to condense the information collected by using questionnaires. On 10 selected variables to know the perception of the agriculture productivity on the important aspects related to pull and push factor of Agricultural Productivity.

SPECIFICATIONS OF VARIABLES

To isolate the factors affecting determinants of agriculture productivity following ten explanatory variables were selected. The specification and description of the variables used in this study are discussed below.

TPC (Total Power Consumption): It is measured as the total consumption of power in Giga Watt for agriculture purposes.

HPC (Per Hectare Power Consumption): It is measured as the consumption of power in Giga Watt for agriculture purposes per hectare of gross cropped area.

NIA (Net Irrigated Area): It is defined as the net area irrigated through any source once in a year for a particular crop. It is estimated using the formula:

$$NIA = \frac{Net\ Irrigated\ Area}{Net\ Sown\ Area} \times 100$$

GIA (Gross Irrigated Area): It defined as the total area under crop, irrigated once and/ or more than once in a year. It is estimated using the formula:

$$GIA = \frac{Gross\ Irrigated\ Area}{Gross\ Cropped\ Area} \times 100$$

CPH (Credit per Hectare): It is measured as credit advanced in rupees crore for agricultural purposes per hectare of gross cropped area.

TPH (Tractor per Hectare): It is measured as the number sale of tractors in thousand per hectare of gross cropped area.

TFC (Total Fertilizer Consumption): It is measured as the total consumption of fertilizer in nutrient kg, thousand tones.

PHF (Per Hectare Fertilizer Consumption): It is measured as the consumption fertilizer in nutrient kg, thousand tones for agricultural purposed per hectare of gross cropped area.

TRL (Total Road Surface length): It is measured as total length of total metalled road length in kilometer.

RD (Road Density): It defined as total length of metalled roads per 1000 sq. km. of area.

THE PROBLEM OF MULTICOLLINEARITY

When two or more independent variables are highly inter-correlated, there arises the problem of multicollinearity and becomes difficult to ascertain their separate effect on the dependent variable. Before, fitting appropriate functions, the problem of multicollinearity was looked into. For this purpose, Zero-Order Correlation matrix was worked out.

A set of variables are multicollinearity when one of them can be expressed as an exact linear combinations of the others. Inter-correlation between the explanatory variables is not said to be a serious problem unless it is high relative to the overall degree of multiple correlation among all variables simultaneously. In simple words, value of simple correlation coefficient is greater than the magnitude of coefficient of multiple determinations. In the present study, both the tests were satisfied before fitting the algebraic functions.

Besides this, wherever the data allowed, simple statistical analysis, like, compound growth rates, percentages, etc., and simple logical tabular analysis was done results were interpreted accordingly.

GROWTH OF DOMESTIC PRODUCT

State ***Domestic Product*** is a measure, in monetary terms, of the volume of all goods and services produced within the state, during a given period of time accounted without duplication. These estimates serve as a prime indicator of economic prosperity of the State. ***Gross Domestic Product (GDP)*** is the market value of all officially recognized final goods and services produced within a country in a given period. GDP per capita is often considered an indicator of a country's standard of living; GDP per capita is not a measure of personal income (*See Standard of living and GDP*). Under economic theory, GDP per capita exactly equals the gross domestic income (GDI) per capita (*See Gross domestic income*).GDP is related to national accounts, a subject in macroeconomics. GDP is not to be confused with Gross National Product (GNP) which allocates production based on ownership. GDP can be contrasted with gross national product (GNP) or gross national income (GNI). The difference is that GDP defines its scope according to location, while GNP defines its scope according to ownership. In a global context, world GDP and world GNP are, therefore, equivalent terms.

GDP is product produced within a country's borders; GNP is product produced by enterprises owned by a country's citizens. The two would be the same if all of the productive enterprises in a country were owned by its own citizens, and those citizens did not own productive enterprises in any other countries. In practice, however, foreign ownership makes GDP and GNP non-identical. Production within a country's borders, but by an enterprise owned by somebody outside the country, counts as part of its GDP but not its GNP; on the other hand, production by an enterprise located outside the country, but owned by one of its citizens, counts as part of its GNP but not its GDP.

On the other hand, the ***Net Domestic Product*** (NDP) equals the Gross Domestic Product (GDP) minus depreciation on a country's Capital (economics) goods. This is an estimate of how much the country has to spend to maintain the current GDP. If the country is not able to replace the capital stock lost through depreciation, then GDP will fall. In addition, a growing gap between

GDP and NDP indicates increasing obsolescence of capital goods, while a narrowing gap would mean that the condition of capital stock in the country is improving.

Given the enormous amount of work that goes into producing statistics on economic growth, it is understandable that those who produce them are prone to defend their quality and to argue that alternative measures only marginally alter the overall picture. That may be true in many cases. But we must keep in mind that statistics are often used to compare countries or periods of time, e.g. the acceleration or deceleration of economic growth between two dates. With that type of comparison, different measurement techniques can have a decisive influence on results and conclusions, and may even affect policy recommendations.

Our principal criticism of the growth measures that currently predominate has to do with the almost total fixation on Gross Domestic Product (GDP). In our view, there should be much less emphasis on GDP as the main yard- stick of economic growth, and a much greater emphasis on Net Domestic Product (NDP). The most basic measure of economic output is of course GDP, which includes all expenditures for investment, regardless of whether they are used to add to the capital stock, or simply to replace worn out or obsolete equipment and software. The portion of investment spending that is used to replace worn out and obsolete equipment — depreciation — while essential for maintaining the level of output, does not increase the economy's capacities in any way. If GDP were to grow simply as a result of the fact that more money was being spent to maintain the capital stock because of increased depreciation, it would not mean that anyone had been made better off. There would be no more resources available for consumption. Nor would there be any more output available in future periods, because the size of the capital stock would not have increased. In such a scenario, since equipment is wearing out more quickly, it is necessary to run harder just to stay in the same place. The economy must devote more resources every year to replace worn out and obsolete equipment, just to keep the capital stock intact. The additional resources used to replace this equipment are recorded in the national accounts, but it does not imply that anyone is better off.

GROWTH OF GROSS DOMESTIC PRODUCT

The growth of Growth Domestic Product (GDP) in India during the last 20 years spanning from 1990-91 through 2009-2010 is reported in Tables 1 and 2 and depicted graphically in Figures 1 and 2 both at current and constant prices respectively.

Table 1: Gross Domestic Product at Factor Cost In India at Current Prices: 1990-91 through 2009-10

(Amount in Rs. crores)

Year	***Gross Domestic Product from***								***Total GDP***
	Agriculture		***Forestry & logging***		***Fishing***		***Primary Sector***		
	Amount	***percentage***	***Amount***	***percentage***	***Amount***	***percentage***	***Amount***	***percentage***	
1990-91	*137925*	*91.46*	*8244*	*5.47*	*4631*	*3.07*	*150800*	*29.28*	*515032*
1991-92	*162403*	*92.19*	*8506*	*4.83*	*5257*	*2.98*	*176166*	*29.64*	*594168*
1992-93	*181799*	*92.02*	*9198*	*4.65*	*6572*	*3.33*	*197569*	*28.99*	*681517*
1993-94	*210518*	*91.86*	*10410*	*4.54*	*8244*	*3.60*	*229172*	*28.93*	*792150*
1994-95	*241990*	*91.70*	*11789*	*4.47*	*10116*	*3.83*	*263895*	*28.52*	*925239*
1995-96	*263446*	*91.81*	*12190*	*4.25*	*11310*	*3.94*	*286946*	*26.49*	*1083289*
1996-97	*318410*	*92.29*	*13206*	*3.83*	*13404*	*3.88*	*345020*	*27.37*	*1260710*
1997-98	*334713*	*91.42*	*14855*	*4.06*	*16557*	*4.52*	*366125*	*26.11*	*1401934*
1998-99	*386922*	*92.02*	*16240*	*3.86*	*17325*	*4.12*	*420487*	*26.02*	*1616082*
1999-00	*409660*	*91.75*	*17916*	*4.01*	*18939*	*4.24*	*446515*	*24.99*	*1786526*
2000-01	*408932*	*90.96*	*19298*	*4.30*	*21336*	*4.74*	*449566*	*23.35*	*1925017*
2001-02	*442464*	*90.93*	*20913*	*4.30*	*23240*	*4.77*	*486617*	*23.19*	*2097726*
2002-03	*425521*	*90.14*	*21048*	*4.46*	*25491*	*5.40*	*472060*	*20.87*	*2261415*
2003-04	*483030*	*90.57*	*23374*	*4.38*	*26938*	*5.05*	*533342*	*21.01*	*2538170*
2004-05	*501415*	*90.77*	*23351*	*4.23*	*27656*	*5.00*	*552422*	*19.19*	*2877701*
2005-06	*567897*	*90.77*	*26481*	*4.23*	*31257*	*5.00*	*625635*	*19.06*	*3282385*
2006-07	*625161*	*91.12*	*27904*	*4.07*	*32980*	*4.81*	*686045*	*18.15*	*3779385*
2007-08	*718278*	*91.78*	*29069*	*3.71*	*35250*	*4.51*	*782597*	*18.11*	*4320892*
2008-09	*746883*	*86.07*	*80410*	*9.27*	*40452*	*4.66*	*867745*	*17.59*	*4933183*
2009-10	*878714*	*86.27*	*84833*	*8.33*	*55027*	*5.40*	*1018574*	*17.77*	*5731990*

Sources: 1. Various issues of ***National Income Statistics***, Centre for Monitoring Indian Economy (CMIE), Mumbai

2.Various issues of ***Agricultural Statistics***, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

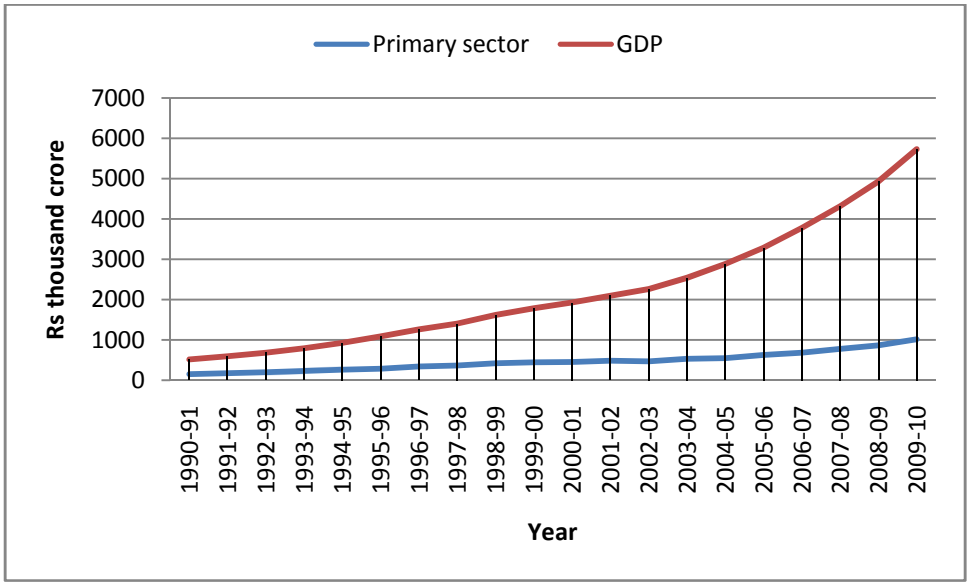

Fig .1: Gross Domestic Product and GDP from Primary Sector at Factor Cost in India at Current Prices: 1990-91 through 2009-10

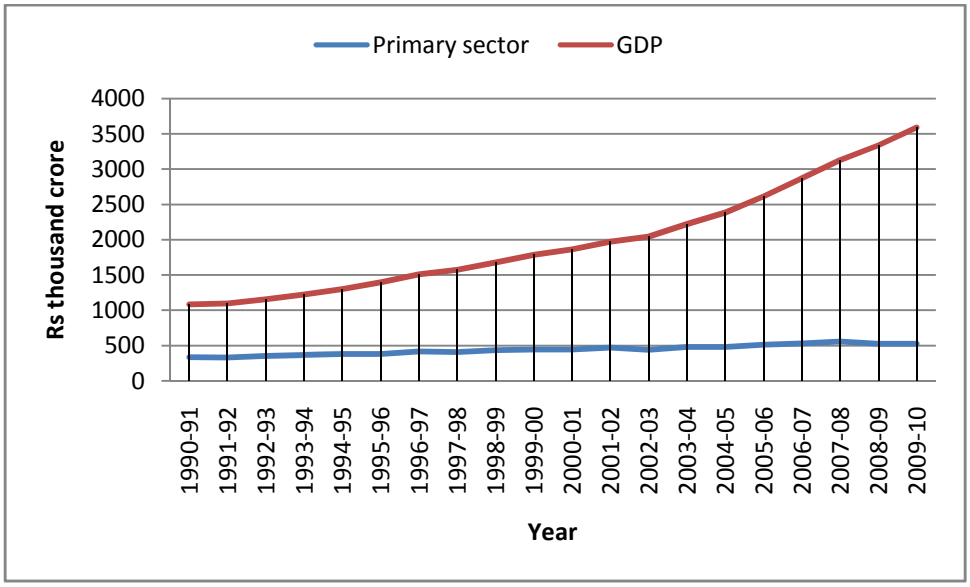

Fig.2: Gross Domestic Product and GDP from Primary Sector at Factor Cost in India at Constant Prices: 1990-91 through 2009-10

Table 2: Gross Domestic Product at Factor Cost In India at Constant Prices: 1990-91 through 2009-10

(Amount in Rs. crores)

Year	***Gross Domestic Product from***								***Total GDP***
	Agriculture		***Forestry & logging***		***Fishing***		***Primary Sector***		
	Amount	***percentage***	***Amount***	***percentage***	***Amount***	***percentage***	***Amount***	***percentage***	
1990-91	*311500*	*91.65*	*16280*	*4.79*	*12113*	*3.56*	*339893*	*31.37*	*1083572*
1991-92	*304301*	*91.31*	*16407*	*4.92*	*12549*	*3.77*	*333257*	*30.32*	*1099072*
1992-93	*325777*	*91.66*	*16023*	*4.51*	*13621*	*3.83*	*355421*	*30.69*	*1158025*
1993-94	*336136*	*91.53*	*15946*	*4.34*	*15149*	*4.13*	*367231*	*30.01*	*1223816*
1994-95	*352069*	*91.55*	*16370*	*4.26*	*16111*	*4.19*	*384550*	*29.53*	*1302076*
1995-96	*348626*	*91.29*	*16307*	*4.27*	*16943*	*4.44*	*381876*	*27.33*	*1396974*
1996-97	*384886*	*91.70*	*16553*	*3.94*	*18319*	*4.36*	*419758*	*27.83*	*1508378*
1997-98	*373446*	*91.30*	*16959*	*4.15*	*18634*	*4.55*	*409039*	*26.00*	*1573263*
1998-99	*400030*	*91.99*	*17159*	*3.94*	*17703*	*4.07*	*434892*	*25.91*	*1678410*
1999-00	*409660*	*91.75*	*17916*	*4.01*	*18939*	*4.24*	*446515*	*25.00*	*1786526*
2000-01	*407176*	*91.42*	*18399*	*4.13*	*19828*	*4.45*	*445403*	*23.89*	*1864301*
2001-02	*433475*	*91.59*	*18964*	*4.01*	*20810*	*4.40*	*473249*	*23.99*	*1972606*
2002-03	*398206*	*90.71*	*19090*	*4.35*	*21671*	*4.94*	*438967*	*21.43*	*2048286*
2003-04	*441360*	*91.44*	*18872*	*3.91*	*22444*	*4.65*	*482676*	*21.71*	*2222758*
2004-05	*441647*	*91.46*	*19276*	*3.99*	*21987*	*4.55*	*482910*	*20.21*	*2388768*
2005-06	*467984*	*91.56*	*19536*	*3.82*	*23594*	*4.62*	*511114*	*19.54*	*2616101*
2006-07	*487010*	*91.66*	*20005*	*3.77*	*24300*	*4.57*	*531315*	*18.50*	*2871118*
2007-08	*511274*	*91.77*	*20432*	*3.67*	*25416*	*4.56*	*557122*	*17.80*	*3129717*
2008-09	*444136*	*84.61*	*53763*	*10.24*	*27048*	*5.15*	*524947*	*15.73*	*3339375*
2009-10	*442544*	*84.20*	*55003*	*10.47*	*28041*	*5.33*	*525588*	*14.62*	*3594994*

Sources: 1. Various issues of ***National Income Statistics***, Centre for Monitoring Indian economy (CMIE), Mumbai
2.Various issues of ***Agricultural Statistics***, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

During the 20 year, viz., 1990-91 through 2009-2010, Gross Domestic product (GDP) at current prices continuously increased from Rs.515032 to Rs. 5731990 showing an annual compound growth rate of 12.838 per cent. This growth rate was significant at 0.01 level of significance. Likewise during the same period, Gross Domestic product (GDP) at constant prices also continuously increased from Rs. 1083572 crores to Rs. 3594994 crores. It increased at the annual Compound Growth Rate (ACGR) of 6.578 per cent which was very highly significant. However, during 1990's, GDP at current prices continuously increased from Rs. 515032 crores to Rs. 1786526 crores with an annual compound growth rate of 15.206 per cent. This growth rate was also significant at 0.01 level of significance. Likewise during the same period, GDP at constant prices had continuously increased from Rs 1083572 to Rs. 1786526. It increased at the annual compound growth rate of 6.050 per cent. This growth rate was significant at 0.01 level of significance.

During the 2000's, GDP at current prices had continuously increased from Rs. 1925017 to Rs. 5731990. It increased at the annual compound growth rate of 15.206 per cent. This growth rate was significant at 0.01 level of significance. Likewise during the same period, GDP at constant prices had continuously increased from Rs. 1864301 to Rs. 3594994. It increased at the annual compound growth rate of 7.918 per cent. This growth rate was significant at 0.01 level of significance.

GROWTH OF GDP FROM PRIMARY SECTOR

During the last two decades, viz., 1990-91 through 2009-2010, GDP from Primary Sector at current prices continuously increased from Rs.150800 crores from Rs 1018574 crores showing an annual compound growth rate of 9.303 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, GDP from Primary Sector at constant prices had also continuously increased from Rs.339893 crores to Rs. 525588 crores with annual compound growth rate of 2.717 per cent which was very highly significant.

Growth of GDP from primary sector was also examined for different decades. During the 1990's, GDP from Primary Sector at current prices had continuously increased from Rs. 150800 crores to Rs. 446515 crores at the annual compound growth rate of 13.061 per cent. This growth rate

was significant at 0.01 level of significance. Likewise during the same period, GDP from Primary Sector at constant prices had continuously increased from Rs.339893 crores to Rs. 446515 crores at the annual compound growth rate of 3.336 per cent. This growth rate was significant at 0.01 level of significance.

During the 2000's, GDP from Primary Sector at current prices had continuously increased from Rs. 449566 crores to Rs. 1018574 crores showing annual compound growth rate of 9.363 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, GDP from Primary Sector at constant prices also continuously increased from Rs. 445403 crores to Rs. 525588 crores at the annual compound growth rate of 2.627 per cent. This growth rate was significant at 0.01 level of significance**.**

SECTORAL SHARE:

The share of primary sector in total Gross Domestic Product (GDP) during the period under review, that is, 20 years spanning from 1990-91 through 2009-2010 is reported in Tables 1 and 2 and depicted graphically in Figures 3 and 4 both at current and constant prices respectively. During the 20 year, the share of Primary Sector at current prices had declined continuously from 29.28 per cent to 17.77 per cent- a decline of 39.34 per cent. During the ***Period of wider dissemination (1990-91 to 1992-93)*** the share was 29.31 per cent which declined to 22.47 per cent during the ***Phase II: Post-Reform Period (2000-01 to 2002-03)*** which further declined to 17.82 per cent during ***Phase III: Period of Recovery (2006-07 to 2009-10).*** Apparently, the decline in the share of primary sector was sharper during 1990's (23.34 per cent) as compared to 2000's (20.69 per cent)**.**

Likewise, the share of primary sector in GDP at constant prices during the 20 year, under review, at constant prices had declined continuously from 31.37 per cent to 14.62 per cent- a decline of 53.39 per cent. Primary sector share in GDP during the period of wider dissemination was 30.79 per cent which declined to 23.10 per cent during the period of post reform and further to 16.46 per cent during the period of recovery. Apparently, the decline in the share of primary sector was sharper during 2000's (28.75 per cent) as compared to 1900's (24.98 per cent)**.**

SUB SECTORAL GROWTH

Growth of GDP from different sub sectors of primary sector was also examined. During the 20 year, viz., 1990-91 through 2009-2010, GDP from ***Agriculture*** at current prices had continuously increased from Rs.137925 crores to Rs. 878714 crores at the annual compound growth rate of 9.078 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, GDP from Agriculture at constant prices had increased from Rs.311500 crores to Rs. 442544 crores at the annual compound growth rate of 2.393 per cent which was very highly significant.

Growth of GDP from agriculture was also examined for different decades, that is, during 1990's and 2000's. During the 1990's, GDP from Agriculture at current prices had continuously increased from Rs. 137925 crores to Rs. 409660 crores at the annual compound growth rate of 13.059 per cent. This growth rate was significant at 0.01 level of significance. Likewise during the same period, GDP from Agriculture at constant prices had continuously increased from Rs. 311500 crores to Rs. 409660 crores at the annual compound growth rate of 3.364 per cent. This growth rate was also significant at 0.01 level of significance.

During the 2000's, GDP from agriculture at current prices continuously increased from Rs. 408932 crores to Rs. 878714 crores showing an annual compound growth rate of 8.898 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, GDP from Agriculture at constant prices had continuously increased from Rs. 407176 crores to Rs. 442544 crores at the annual compound growth rate of 1.540 per cent. This growth rate was significant at 0.10 level of significance**.**

SECTORAL SHARE:

Agriculture remained the major partner of the primary sector share in total GDP.The share of agriculture sector in primary sector Gross Domestic Product (GDP) during the period under review, that is, 20 years spanning from 1990-91 through 2009-2010 is reported in Tables 1 and 2 and depicted graphically in Figures 3 and 4 both at current and constant prices respectively. During the 20 year, the share of Primary Sector at current prices had declined continuously from 91.46 per cent to 86.32 per cent- a decline of 5.62 per cent. During the ***Period of wider dissemination (1990-91 to 1992-93)*** the share was 91.89 per cent which declined to 90.68 per cent during the ***Phase II: Post-Reform Period (2000-01 to 2002-03)*** which further declined to

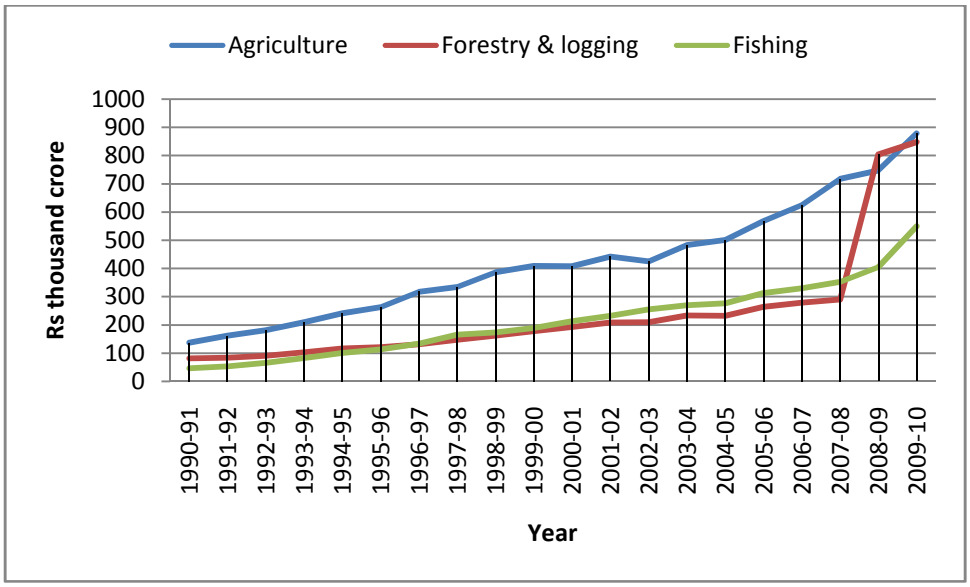

Fig. 3: Growth of GDP from Agriculture, Forestry & Logging and Fishing in India at Current Prices: 1990-91 through 2009-10

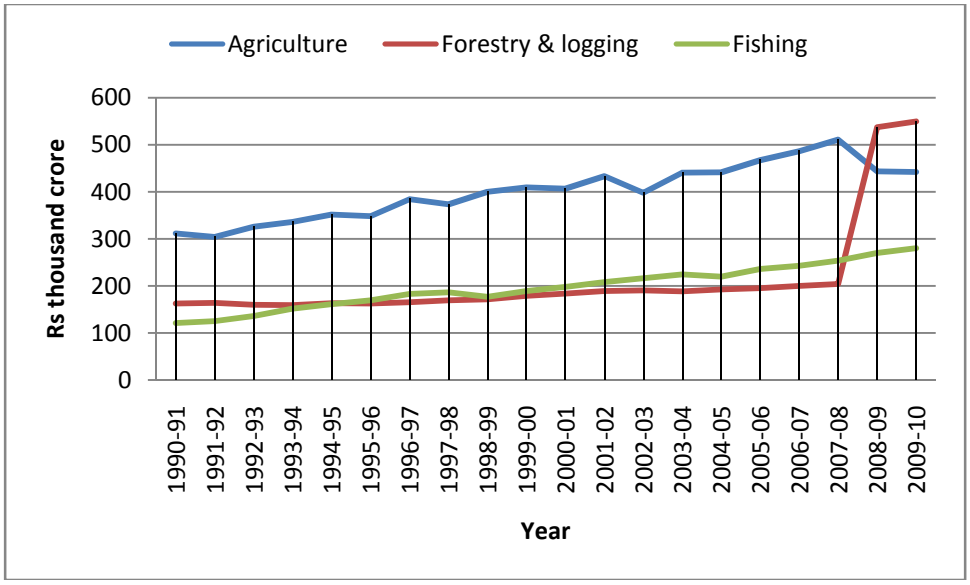

Fig.4: Growth of GDP from Agriculture, Forestry & Logging and Fishing in India at Constant Prices: 1990-91 through 2009-10

88.04 per cent during ***Phase III: Period of Recovery (2006-07 to 2009-10).*** Apparently, the decline in the share of agriculture sub-sector was sharper during 2000's (2.91 per cent) as compared to 1990's (1.33 per cent)**.**

Likewise, the share of primary sector in GDP at constant prices during the 20 year, under review, at constant prices had declined continuously from 31.37 per cent to 14.62 per cent- a decline of 53.39 per cent. Primary sector share in GDP during the period of wider dissemination was 30.79 per cent which declined to 23.10 per cent during the period of post reform and further to 16.46 per cent during the period of recovery. Apparently, the decline in the share of primary sector was sharper during 2000's (28.75 per cent) as compared to 1900's (24.98 per cent)**.**

FORESTRY & LOGGING

During the 20 year, viz., 1990-91 through 2009-2010, GDP from Forestry & logging at current prices continuously increased Rs. 8244 crores to Rs. 84833 crores with an annual compound growth rate of 11.912 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, GDP from Forestry & logging at constant prices had also increase from Rs. 16280 crores to Rs. 55003 crores with an annual compound growth rate of 4.236 per cent which was significant at 0.01 level of significance.

Growth of GDP from Forestry & logging was also examined for different decades, that is, during 1990's and 2000's. During the 1990's, Forestry and logging at current prices had continuously increased from Rs. 8244 to Rs. 17916. It increased at the annual compound growth rate of 9.289 per cent. This growth rate was significant at 0.01 level of significance.

Likewise during the same period, GDP from Forestry and logging at constant prices had continuously increased from Rs. 16280 crores to Rs. 17916 crores at the annual compound growth rate of 0.954 per cent. This growth rate was significant at 0.01 level of significance.

During the 2000's, Forestry and logging at current prices had continuously increased from Rs. 19298 to Rs. 84833. It increased at the annual compound growth rate of 11.6 per cent. This growth rate was significant at 0.05 level of significance**.**

Likewise during the same period, Forestry and logging at constant prices had continuously increased from Rs.18399 to Rs. 55003. It increased at the annual compound growth rate of 11.309 per cent. This growth rate was significant at 0.01 level of significance**.**

Apparently, the decline in the share of primary sector was sharper during 1990's (23.34 per cent) as compared to 2000's (20.87 per cent)**.**

Likewise, the share of primary sector in GDP at constant prices during the 20 year, under review, at constant prices had declined continuously from 31.37 per cent to 14.62 per cent- a decline of 53.39 per cent. Primary sector share in GDP during the period of wider dissemination was 30.79 per cent which declined to 23.10 per cent during the period of post reform and further to 16.46 per cent during the period of recovery. Apparently, the decline in the share of primary sector was sharper during 2000's (28.75 per cent) as compared to 1900's (24.98 per cent)**.**

FISHING

During the 20 year, viz., 1990-91 through 2009-2010, GDP from Fishing at current prices had continuously increased from Rs. 4631 crores to Rs. 55027 crores at the annual compound growth rate of 12.228 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, GDP from Fishing at constant prices had also continuously increased from Rs.12113 crores to Rs. 28041 crores at the annual compound growth rate of 4.124 per cent which was significant at 0.01 level of significance.

Growth of Fishing was also examined for different decades, that is, during 1990's and 2000's. During the 1990's, Fishing at current prices had continuously increased from Rs. 4631 to Rs. 18939. It increased at the annual compound growth rate of 17.931 per cent. This growth rate was significant at 0.01 level of significance. Likewise during the same period, Fishing at constant prices had continuously increased from Rs. 12113 crores to Rs.18939 crores. It increased at the annual compound growth rate of 5.362 per cent. This growth rate was significant at 0.01 level of significance.

During the 2000's, Fishing at current prices had continuously increased from Rs. 21336 to Rs. 55027. It increased at the annual compound growth rate of 9.355 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, Fishing at constant prices had continuously increased from Rs. 19828 to Rs. 28041. It increased at the annual compound growth rate of 3.741 per cent. This growth rate was significant at 0.01 level of significance**.**

To sum up, the estimated result of GDP, Primary sector, Agriculture, Forestry & logging and Fishing at the current prices and constant prices were increased during study periods. It increased

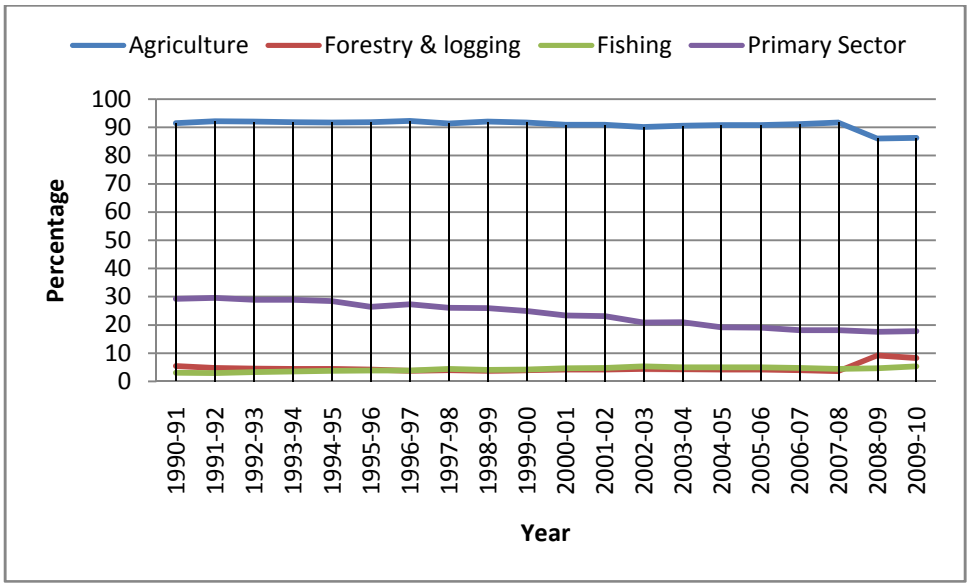

Fig. 5: Percentages Share of Primary Sector, Agriculture, Forestry & Logging and Fishing in Gross Domestic Product (GDP) at Current Prices: 1990-91 Through 2009-10

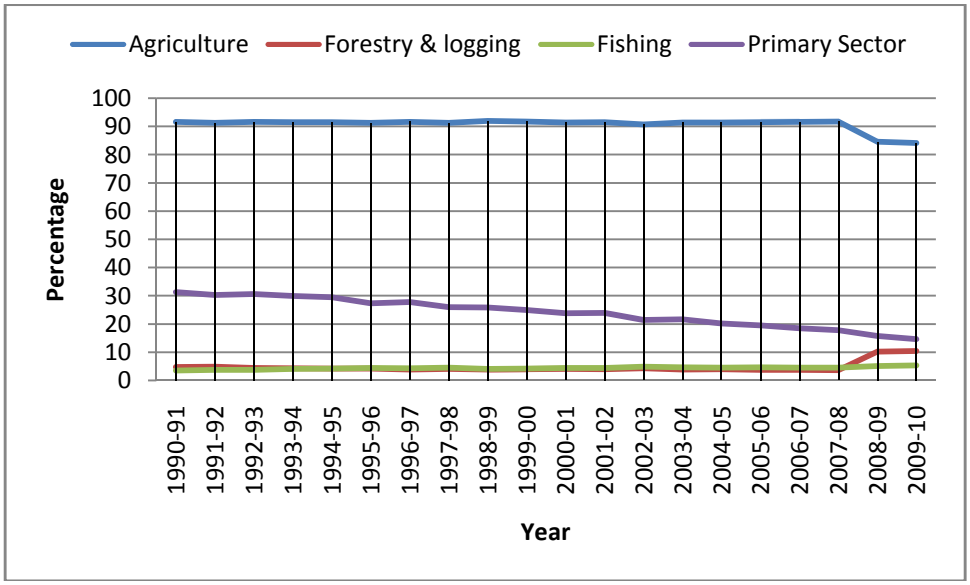

Fig. 6: Percentages Share of Primary Sector, Agriculture, Forestry & Logging and Fishing in Gross Domestic Product (GDP) at Constant Prices: 1990-91 Through 2009-10

at the annual compound growth rate per cent. These growth rates were significant at 0.01, 0.05 and 0.10 levels of significance. These are the very importance for SDP in India.

Apparently, the decline in the share of primary sector was sharper during 1990's (23.34 per cent) as compared to 2000's (20.87 per cent)**.**

Likewise, the share of primary sector in GDP at constant prices during the 20 year, under review, at constant prices had declined continuously from 31.37 per cent to 14.62 per cent- a decline of 53.39 per cent. Primary sector share in GDP during the period of wider dissemination was 30.79 per cent which declined to 23.10 per cent during the period of post reform and further to 16.46 per cent during the period of recovery. Apparently, the decline in the share of primary sector was sharper during 2000's (28.75 per cent) as compared to 1900's (24.98 per cent)**.**

GROWTH OF NET DOMESTIC PRODUCT

Net Domestic Product (NDP) equals the gross domestic product (GDP) minus depreciation on a country's capital goods. NDP accounts for capital that has been consumed over the year in the form of housing, vehicle, or machinery deterioration. The depreciation accounted for is often referred to as "*capital consumption allowance*" and represents the amount of capital that would be needed to replace those depreciated assets. Thus, NDP estimates how much the country has to spend to maintain the current GDP. If the country is not able to replace the capital stock lost through depreciation, then GDP will fall. In addition, a growing gap between GDP and NDP indicates increasing obsolescence of capital goods, while a narrowing gap means that the condition of capital stock in the country is improving.

Growth of NDP in India during 20 years spanning from 1990-91 through 2009-2010 is reported in Tables 3 and 4 and depicted graphically in Figures 7 and 8 both at current and constant prices respectively. During the period under review (20 year, viz., 1990-91 through 2009-2010), NDP at current prices had continuously increased from Rs. 463954 to Rs. 4392587. It increased at the annual compound growth rate of 12.484 per cent. This growth rate was highly significant at 0.01 level of significance. Likewise during the same period, Net Domestic Product (NDP) at constant prices had continuously increased from Rs. 983651 to Rs 3182889. It increased at the annual compound growth rate of 6.444 per cent which was very highly significant.

Growth of NDP was also explained for different decades, that is, 1990's and 2000's. During the 1990's, NDP at current prices had continuously increased from Rs. 463954 to Rs. 1605104. It increased at the annual compound growth rate of 15.223 per cent. This growth rate was significant at 0.01 level of significance. Likewise during the same period, NDP at constant prices had continuously increased from Rs. 983651 to Rs. 1605104. It increased at the annual compound growth rate of 5.969 per cent. This growth rate was significant at 0.01 level of significance.

During the 2000's, NDP at current prices had continuously increased from Rs. 1723199 to Rs. 4392587. It increased at the annual compound growth rate of 12.091 per cent. This growth rate

Table 3: Net Domestic Product at Factor Cost in India at Current Prices: 1990-91 through 2009-10

(Amount in Rs. crores)

Year	***Net Domestic Product from***								***Total NDP***
	Agriculture		***Forestry & logging***		***Fishing***		***Primary Sector***		
	Amount	***percentage***	***Amount***	***percentage***	***Amount***	***percentage***	***Amount***	***percentage***	
1990-91	*131781*	*91.46*	*8066*	*5.60*	*4243*	*2.94*	*144090*	*31.06*	*463954*
1991-92	*155246*	*92.22*	*8292*	*4.92*	*4812*	*2.86*	*168350*	*31.63*	*532197*
1992-93	*173652*	*92.04*	*8951*	*4.74*	*6075*	*3.22*	*188678*	*30.96*	*609389*
1993-94	*201528*	*91.89*	*10130*	*4.62*	*7648*	*3.49*	*219306*	*30.83*	*711268*
1994-95	*231717*	*91.75*	*11465*	*4.54*	*9383*	*3.71*	*252565*	*30.38*	*831417*
1995-96	*251674*	*91.88*	*11807*	*4.31*	*10442*	*3.81*	*273923*	*28.18*	*972163*
1996-97	*304904*	*92.38*	*12763*	*3.87*	*12387*	*3.75*	*330054*	*29.15*	*1132320*
1997-98	*319427*	*91.49*	*14349*	*4.11*	*15366*	*4.40*	*349142*	*27.75*	*1258185*
1998-99	*369796*	*92.15*	*15666*	*3.90*	*15831*	*3.95*	*401293*	*27.60*	*1453881*
1999-00	*390591*	*91.91*	*17286*	*4.07*	*17075*	*4.02*	*424952*	*26.48*	*1605104*
2000-01	*388831*	*91.16*	*18641*	*4.37*	*19059*	*4.47*	*426531*	*24.75*	*1723199*
2001-02	*420144*	*91.21*	*20199*	*4.38*	*20308*	*4.41*	*460651*	*24.64*	*1869429*
2002-03	*401295*	*90.46*	*20295*	*4.57*	*22048*	*4.97*	*443638*	*22.06*	*2010907*
2003-04	*456831*	*91.13*	*21559*	*4.30*	*22928*	*4.57*	*501318*	*22.20*	*2258122*
2004-05	*471876*	*91.24*	*22447*	*4.34*	*22834*	*4.42*	*517157*	*20.29*	*2548660*
2005-06	*535113*	*91.26*	*25506*	*4.35*	*25748*	*4.39*	*586367*	*20.20*	*2902074*
2006-07	*588773*	*91.66*	*26847*	*4.18*	*26729*	*4.16*	*642349*	*19.22*	*3342347*
2007-08	*676816*	*92.32*	*27865*	*3.80*	*28447*	*3.88*	*733128*	*19.23*	*3811441*
2008-09	*686095*	*85.88*	*78361*	*9.81*	*34391*	*4.31*	*798847*	*18.35*	*4353400*
2009-10	*700178*	*86.11*	*71599*	*8.81*	*41290*	*5.08*	*813067*	*18.51*	*4392587*

Sources: 1. Various issues of ***National Income Statistics***, Centre for Monitoring Indian economy (CMIE), Mumbai

2.Various issues of ***Agricultural Statistics***, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

Table 4: Net Domestic Product at Factor Cost in India at Constant Prices: 1990-91 through 2009-10

Year	Net Domestic Product from								Total NDP
	Agriculture		Forestry & logging		Fishing		Primary Sector		
	Amount	percentage	Amount	percentage	Amount	percentage	Amount	percentage	
1990-91	296590	91.58	15840	4.89	11438	3.53	323868	32.92	983651
1991-92	289015	91.24	15943	5.03	11827	3.73	316785	31.90	992932
1992-93	310041	91.62	15538	4.59	12830	3.79	338409	32.37	1045428
1993-94	320127	91.51	15441	4.41	14277	4.08	349845	31.68	1104168
1994-95	335786	91.55	15845	4.32	15157	4.13	366788	31.22	1174710
1995-96	331971	91.30	15762	4.33	15893	4.37	363626	28.85	1260376
1996-97	367856	91.74	15989	3.98	17147	4.28	400992	29.44	1362248
1997-98	355896	91.36	16373	4.20	17302	4.44	389571	27.49	1417045
1998-99	381957	92.11	16550	3.99	16179	3.90	414686	27.44	1511035
1999-00	390591	91.91	17286	4.07	17075	4.02	424952	26.47	1605104
2000-01	387365	91.63	17750	4.20	17641	4.17	422756	25.31	1670446
2001-02	412457	91.88	18291	4.08	18156	4.04	448904	25.44	1764137
2002-03	376116	91.05	18400	4.45	18555	4.50	413071	22.64	1824601
2003-04	418264	91.86	18147	3.99	18918	4.15	455329	22.98	1981317
2004-05	417493	91.95	18535	4.08	18015	3.97	454043	21.35	2126269
2005-06	442629	92.11	18775	3.91	19141	3.98	480545	20.63	2328675
2006-07	460244	92.28	19221	3.85	19303	3.87	498768	19.52	2554712
2007-08	483067	92.45	19624	3.75	19845	3.80	522536	18.79	2779648
2008-09	509258	87.06	52942	9.05	22774	3.89	584974	19.78	2957698
2009-10	404545	83.89	54427	11.29	23235	4.82	482207	15.15	3182889

Sources: 1. Various issues of ***National Income Statistics***, Centre for Monitoring Indian economy (CMIE), Mumbai

2.Various issues of ***Agricultural Statistics***, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

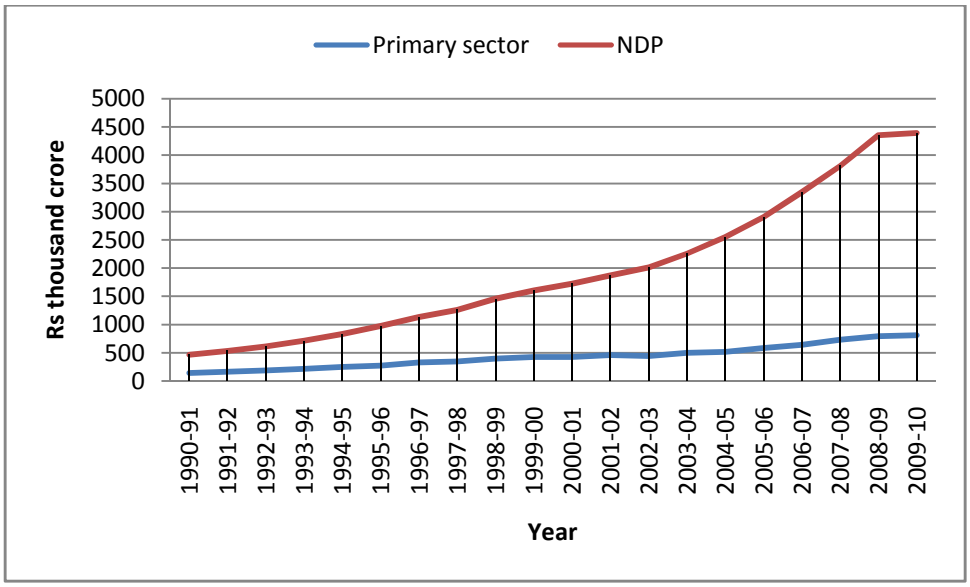

Fig.7: Net Domestic Product and Primary Sector at Factor Cost in India at Current Prices: 1990-91 through 2009-10

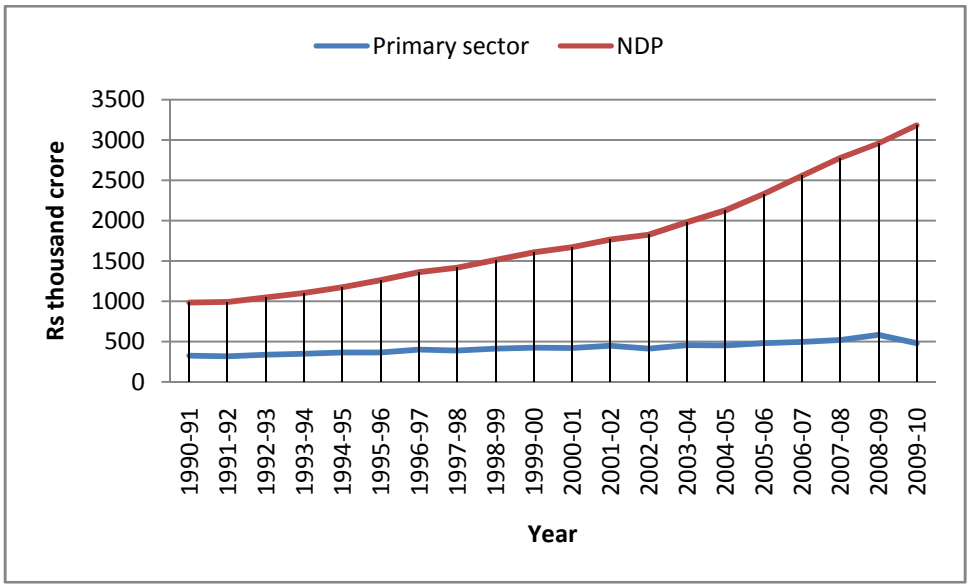

Fig.8: Net Domestic Product and Primary Sector at Factor Cost in India at Constant Prices: 1990-91 through 2009-10

was significant at 0.01 level of significance. Likewise during the same period, NDP at constant prices had continuously increased from Rs. 1670446 to Rs. 3182889. It increased at the annual compound growth rate of 7.790 per cent. This growth rate was significant at 0.01 level of significance.

PRIMARY SECTOR

During the 20 year, viz., 1990-91 through 2009-2010, the growth of Primary Sector at current prices had continuously increased from Rs. 144090 to Rs. 813067. It increased at the annual compound growth rate of 8.882 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, Primary Sector at constant prices had increase from Rs. 323868 to Rs. 482207. Primary Sector at constant prices was increase at annual compound growth rate 2.807 per cent. This growth rate was significant at 0.01 level of significance**.**

Growth of Primary Sector was also explained for different decades that is 1990's and 2000's. During the 1990's, Primary Sector at current prices had continuously increased from Rs. 144090 to Rs. 424952. It increased at the annual compound growth rate of 13.022 per cent. This growth rate was significant at 0.01 level of significance. Likewise during the same period, Primary Sector at constant prices had continuously increased from Rs. 323868 to Rs. 424952. It increased at the annual compound growth rate of 3.347 per cent. This growth rate was significant at 0.01 level of significance.

During the 2000's, Primary Sector at current prices had continuously increased from Rs. 426531 to Rs. 813067. It increased at the annual compound growth rate of 8.218 per cent. This growth rate was non- significant even at 0.01 level of significance. Likewise during the same period, Primary Sector at constant prices had continuously increased from Rs. 422756 to Rs. 482207. It decreased at the annual compound growth rate of (-1.360). This growth rate was non- significant at 0.01 level of significance.

AGRICULTURE SECTOR

During the 20 year, viz., 1990-91 through 2009-2010, the growth of Agriculture at current prices was continuously increased from Rs. 131781 to Rs. 700178. It increased at the annual compound

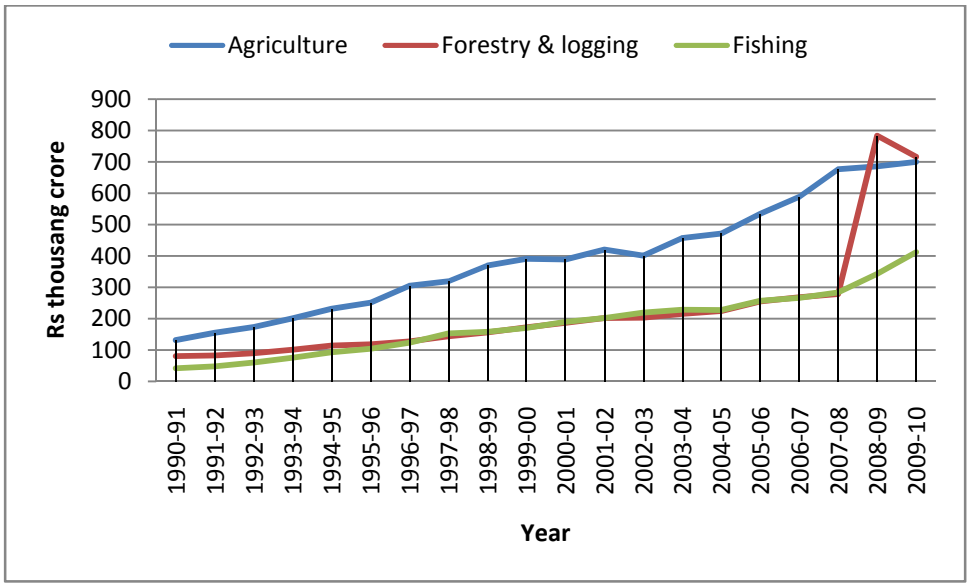

Fig.9: Growth of NDP from Agriculture, Forestry & Logging and Fishing in India at Current Prices: 1990-91 through 2009-10

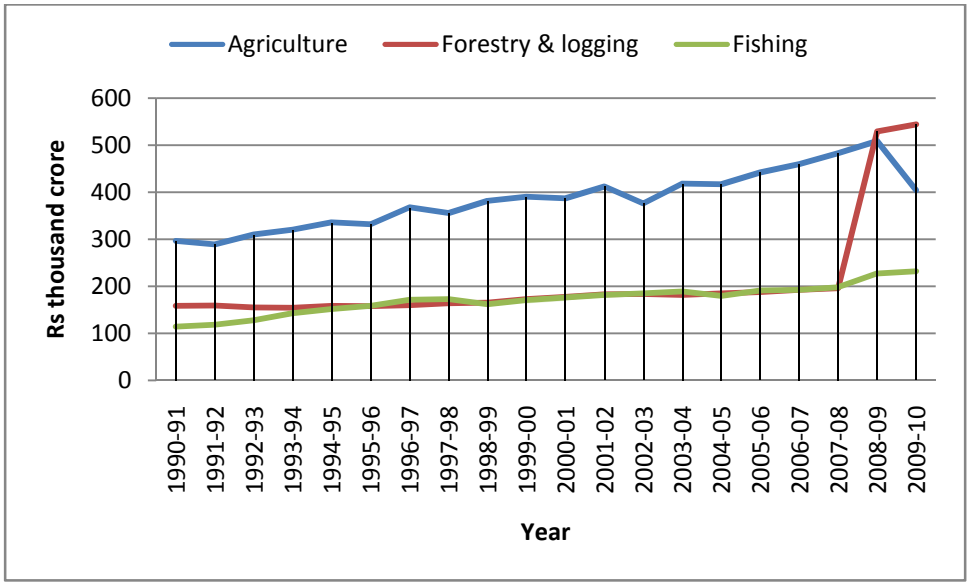

Fig.10: Growth of NDP from Agriculture, Forestry & Logging and Fishing in India at Constant Prices: 1990-91 through 2009-10

growth rate of 8.667 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, Agriculture at constant prices was increase from Rs.296590 to Rs. 404545. Agriculture at constant price was increase at the annual compound growth rate of 2.542 per cent. This growth rate was very significant at 0.01 level of significance.

Growth of Agriculture was also explained for different decades that is 1990's and 2000's.During the 1990's, Agriculture at current prices was continuously increased from Rs. 131781 to Rs. 390591. It increased at the annual compound growth rate of 13.041 per cent. This growth rate was significant at 0.01 level of significance. Likewise during the same period, Agriculture at constant prices had continuously increased from Rs. 296590 to Rs. 390591. It increased at the annual compound growth rate of 3.405 per cent. This growth rate was significant at 0.01 level of significance.

During the 2000's, Agriculture at current prices had continuously increased from Rs. 388831 to Rs. 700178. It increased at the annual compound growth rate of 7.619 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, Agriculture at constant prices had continuously increased from Rs. 387365 to Rs. 404545. It increased at the annual compound growth rate of 2.120 per cent. This growth rate was significant at 0.10 level of significance**.**

FORESTRY & LOGGING SECTOR

During the 20 year, viz., 1990-91 through 2009-2010, Forestry & logging at current prices had continuously increased from Rs.8066 to Rs. 71599. It increased at the annual compound growth rate of 10.283 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, Forestry & logging at constant prices had also increase from Rs.15840 to Rs. 54427. Forestry and logging at constant prices was increase at the annual compound growth rate of 4.247 percent was 0.05 significance.

Growth of Forestry & logging was also explained for different decades, that is, 1990's and 2000's. During the 1990's, Forestry and logging at current prices had continuously increased from Rs. 8066 to Rs.17286. It increased at the annual compound growth rate of 9.116 per cent. This growth rate was significant at 0.01 level of significance. Likewise during the same period, Forestry and logging at constant prices had continuously increased from Rs. 15840 to Rs.17286.

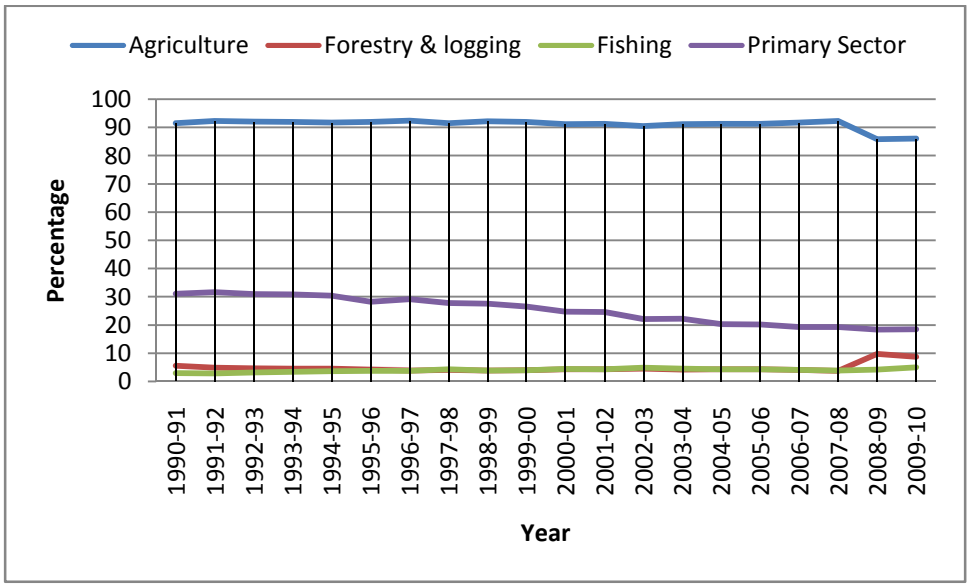

Fig. 11: Percentages Share of Primary Sector, Agriculture, Forestry & Logging and Fishing in Net Domestic Product (NDP) at Current Prices: 1990-91 Through 2009-10

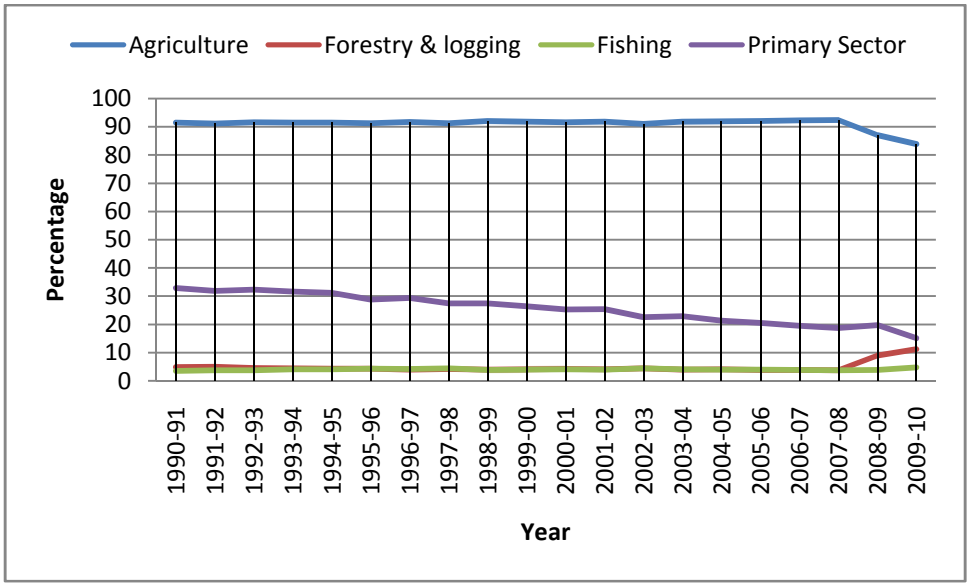

Fig. 12: Percentages Share of Primary Sector, Agriculture, Forestry & Logging and Fishing in Net Domestic Product (NDP) at Constant Prices: 1990-91 Through 2009-10

It increased at the annual compound growth rate of 0.857 per cent. This growth rate was significant at 0.05 level of significance.

During the 2000's, Forestry and logging at current prices had continuously increased from Rs. 18641 to Rs. 71599. It increased at the annual compound growth rate of 15.636 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, Forestry and logging at constant prices had continuously increased from Rs. 17750 to Rs. 54427. It increased at the annual compound growth rate of 11.547 per cent which was significant at 0.10 level of significance.

FISHING SECTOR:

During the reference period of 20 year, viz., 1990-91 through 2009-2010, Gross Domestic Product from Fishing at current prices was continuously increased from Rs.4243 to Rs. 41290. It increased at the annual compound growth rate of 11.207 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, Fishing at constant prices was also continuously increased from Rs.11438 to Rs. 23235. Fishing at constant prices was increase at the annual compound growth rate of 4.124 per cent was significant at 0.01 level of significance**.**

Growth of Fishing was also explained for different decades that is 1990's and 2000's.During the 1990's, Fishing at current prices was continuously increased from Rs. 4243 to Rs. 17075. It increased at the annual compound growth rate of 17.821 per cent. This growth rate was significant at 0.01 level of significance. Likewise during the same period, Fishing at constant prices was continuously increased from Rs. 11438 to Rs. 17075. It increased at the annual compound growth rate of 4.898 per cent. This growth rate was significant at 0.01 level of significance.

During the 2000's, Fishing at current prices was continuously increased from Rs. 19059 to Rs. 41290. It increased at the annual compound growth rate of 7.869 per cent. This growth rate was significant at 0.01 level of significance**.** Likewise during the same period, Fishing at constant prices had continuously increased from Rs. 17641 to Rs. 23235. It increased at the annual compound growth rate of 2.778 per cent. This growth rate was significant at 0.01 level of significance**.**

To sum up, the estimated result of NDP, Primary sector, Agriculture, Forestry & logging and Fishing at the current prices and constant prices were increased during the study periods. It increased at the annual compound growth rate per cent. These growth rates were significant at 0.01, 0.05 and 0.10 levels of significance**.** These are very important in SDP in India.

IS GROWTH DECELERATING?

The issue of acceleration or deceleration of growth has been discussed in the literature with the use of dummy variables. The following test was applied to examine if the growth rates in the two periods are significantly different from each other.

$$t = \frac{b_1 - b_2}{\sqrt{(S.E_1)^2 + (S.E_2)^2}}$$

Where, b1 = growth rates for period I.

b_2 = growth rates for period II

$S.E_1$ = Standard error for period I

$S.E_2$ = Standard error for period II

The resulting estimates (reported in Table 5 and 6) reveal that there was significant difference in the growth rate of GDP between 1990's and 2000's both at current and constant prices. Furthermore, significant differences also existed in the estimated growth rates for primary sector as well as its all sub sectors, namely, Agriculture, Forestry & logging and Fishing both at current and constant prices. At current prices, growth of GDP, from primary sector as well as its sub sector has declined significantly with the only exception of forestry and logging where the growth has significantly increased. This may be due to the various initiatives undertaken by the government to green the economy. Similar results also hold true at constant prices with the only exception of increase in the growth of total GDP.

Table 5: Estimated Value of Growth Rates of Gross Domestic Product at Current Prices

Particular/Period	***Agriculture***	***Forestry & logging***	***Fishing***	***Primary Sector***	***GDP***
Growth Rate during 1990-2000	13.059*** (31.648)	9.289*** (31.021)	17.931*** (21.265)	13.061*** (33.343)	15.206*** (57.362)
Growth Rate during 2001-2010	8.898*** (14.006)	11.697** (1.266)	9.355*** (9.913)	9.363*** (13.204)	13.139*** (32.905)
Growth Rate during 1990-2010	9.078*** (24.031)	11.912*** (5.455)	12.228*** (21.059)	9.303*** (25.162)	12.838^{ns} (0.024)
Difference between two Growth Rate	4.161*** (160.038)	2.408*** (6.99)	8.576*** (184.436)	3.698*** (138.47)	2.067*** (139.659)

Note: Figures in brackets are t- values of the respective parameters.
****: significant at 0.01 level of significant for two tailed level*
**:significant at 0.10 level of significant for two tailed level*

Table 6: Estimated Value of Growth Rates of Gross Domestic Product at Constant Prices

Particular/Period	*Agriculture*	*Forestry & logging*	*Fishing*	*Primary Sector*	*GDP*
Growth Rate during 1990-2000	3.364^{***} (12.248)	0.954*** (3.948)	5.362*** 8.943)	3.336*** (13.127)	6.050*** (30.421)
Growth Rate during 2000-10	1.540^{*} (2.207)	11.309*** (3.124)	3.741*** (16.06)	2.627*** (5.622)	7.918*** (33.707)
Growth Rate during 1990-2010	2.393^{***} (11.617)	4.236*** (4.085)	4.124*** (22.246)	2.717*** (19.968)	6.578*** (47.537)
Difference between two Growth Rate	1.824*** (64.476)	10.355*** (76.529)	1.621*** (72.680)	0.709*** (38.950)	1.868*** (113.169)

Note: Figures in brackets are t- values of the respective parameters.
****: significant at 0.01 level of significant for two tailed level*
**: significant at 0.10 level of significant for two tailed level*

Table 7: Estimated Value of Growth Rates of Net Domestic Product at Constant Prices

Particular/Period	*Agriculture*	*Forestry & logging*	*Fishing*	*Primary Sector*	*NDP*
Growth Rate during 1990-2000	3.405***	0.857***	4.898***	3.347***	5.969***
	(11.795)	(3.425)	(7.133)	(12.531)	(27.943)
Growth Rate during 2000-10	2.120*	11.547*	2.778***	-1.360^{ns}	7.790***
	(2.482)	(3.095)	(5.195)	(-0.519)	(31.842)
Growth Rate during 1990-2010	2.542***	4.247**	3.067***	2.807**	6.444***
	(11.223)	(3.974)	(11.889)	(3.832)	(46.001)
Difference between two Growth Rate	1.285***	10.69***	2.12***	4.707***	1.821***
	(37.112)	(-76.751)	(67.096)	(45.067)	(-150.441)

Note: Figures in brackets are t- values of the respective parameters.
****: significant at 0.01 level of significance for two tailed level*
***: significant at 0.05 level of significance for two tailed level*
**: significant at 0.10 level of significance for two tailed level*

Table 8: Estimated Value of Growth Rates of Net Domestic Product at Current Prices

Particular/Period	*Agriculture*	*Forestry & logging*	*Fishing*	*Primary Sector*	*NDP*
Growth Rate during 1990-2000	13.041***	9.116***	17.821***	13.022***	15.223***
	(30.461)	(29.233)	(18.750)	(31.914)	(56.823)
Growth Rate during 2000-10	7.619***	15.636***	7.869***	8.218***	12.091***
	(13.030)	(4.479)	(9.345)	(14.326)	(27.225)
Growth Rate during 1990-2010	8.667***	10.283***	11.201***	8.882***	12.484***
	(21.444)	(11.207)	(17.195)	(23.204)	(48.584)
Difference between two Growth Rate	5.35***	6.52***	9.952***	4.804***	3.132***
	(195.218)	(50.782)	(294.437)	(185.492)	(189.850)

Note: Figures in brackets are t-value
****: Significant at 0.01 level of significance for two tailed level*

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Almost similar results also hold true in respect of net domestic product both at current and constant prices. The resulting estimates (reported in Table 7 and 8) revealed significant differences in the estimated growth rate pairs of 1990's as well as 2000's of NDP, from Agriculture, Forestry & logging, Fishing and Primary Sector both at constant prices and current prices. Most disturbing feature is that the growth of NDP from primary sector during 2000's had shown a deceleration of 1.36 per cent. All out efforts are required to pull up the growth of NDP from primary sector to grow the Indian economy at sustainable growth.

The low growth rates may constitute in part a response to inadequate returns to Indian farmers. India has very poor rural roads affecting timely supply of inputs and timely transfer of outputs from Indian farms, inadequate irrigation systems, crop failures in some parts of the country because of lack of water while in other parts because of regional floods, poor seed quality and inefficient farming practices in certain parts of India, lack of cold storage and harvest spoilage causing over 30 per cent of farmer's produce going to waste, lack of organized retail and competing buyers thereby limiting Indian farmer's ability to sell the surplus and commercial crops. The Indian farmer receives just 10 to 23 per cent of the price the Indian consumer pays for exactly the same produce, the difference going to losses, inefficiencies and middlemen traders. Farmers in developed economies of Europe and the United States, in contrast, receive 64 to 81 percent of the price the local consumer pays for exactly the same produce in their supermarkets.

DERTERMINANTS OF AGRICULTURE PRODUCTIVITY IN INDIA

Agriculture Productivity is a complex phenomenon and is measured as the ratio of agricultural outputs to agricultural inputs. In this section an attempt was made to identify the various factors associated with the level of agricultural productivity. No doubt, numerous variables contribute to agricultural productivity the contribution of each factor may vary widely. To find a set of independent variables and their relative contribution, initially, simple regression analysis/coefficients were computed. To isolate the combined effect of these variables, stepwise multiple regressions were used to extract the various factors. Two types of functional models, namely, linear and log-linear were tried to examine the impact of the selected variable. These models were selected based upon the following criteria:

- The significance status of the individual regression coefficient.
- The size of the coefficient determination.

However, Log linear regression analysis gave better results and hence reported and discussed in this section. Moreover it provides the measure of elasticity directly.

DETERMINANTS DURING 1990's:

The resulting estimated vales of the various regression coefficients of the regression analysis of log linear reported in Table 9. The result reveals that the highest elasticity of agricultural productivity was with respect to intensity of net area irrigated (NIA) and was estimated at 0.678. The fitted model explained 69 per cent of the total variations in agricultural productivity.

This elasticity was followed by elasticity with respect to GIA (Intensity of Gross Irrigated Area); being estimated at 0.556.The fitted regression model explained 74 per cent of the total variation.

The elasticity with respect to per hectare fertilizer consumption as well as total fertilizer consumption falls in the middle group being 0.359 and 0.192 respectively. The estimated model explained 56 and 44 per cent of the total variations respectively.

Table 9: Estimated Value of Regression Coefficient Affecting Agricultural Productivity in India During 1990's.

Model: Log Linear ***Nos. Of Observation: 10***

Variables	*Constant*	*Regression Coefficient*	R^{-2}	*F-ratio*	*DW*
TPC	+1.217*** (4.735)	+0.164** (3.108)	0.490	9.662	2.288
HPC	+1.567*** (10.537)	+0.172** (3.020)	0.474	9.126	2.29
NIA	+0.848*** (3.329)	+0.678*** (4.585)	0.689	21.03	2.420
GIA	+0.989*** (4.899)	+0.556*** (5.093)	0.735	25.979	2.61
CPH	+1.679*** (26.266)	+0.155*** (5.266)	0.748	27.741	3.126
TPH	+2.039*** (25.056)	-0.007^{ns} (-0.285)	-0.113	0.082	0.926
TFC	+1.437*** (8.736)	+0.269*** (3.523)	0.559	12.409	2.619
PHF	+1.516*** (8.833)	+0.266** (2.914)	0.454	8.499	2.267
TRL	+0.231^{ns} (0.544)	+0.293*** (4.204)	0.649	17.640	2.579
RD	+1.269*** (7.160)	+0.289*** (4.216)	0.650	17.756	2.881

Note: Figures in brackets are t-value.

****: significant at 0.01 level of significant for two tailed level*

***: significant at 0.05 level of significant for two tailed level*

**: significant at 0.10 level of significant for two tailed level*

ns: non- significant.

Elasticities with respect to all other factors were very low. However, farm mechanization defined as intensity of tractorization (number of tractor per hectare of gross cropped area) has detrimental effect on agricultural productivity in India during 1990's. However its elasticity/regression coefficient was non-significant and explained only 11 per cent of the variations.

Elasticities of agricultural productivity with respect to other remaining variables, namely, Road Density (RD), Total Road Length (TRL);Total Fertilizer Consumption(TFC)), Total Power Consumption (TPC), Per hectare Power Consumption (PHC), Per hectare Fertilizer consumption (PHF) were significantly positive in explaining the growth of agricultural productivity during 1990's. These elasticities explain more than 45 per cent but less than 70 per cent of the total variations in agricultural productivity individually.

To study the simultaneous effect of these selected variables in explaining interstate variation in agricultural productivity, multiple regressions were run. However resulting estimates did not yield any conclusive results due to problem of multi-collinearity and smaller number of observations .Hence these results are not discussed here.

DETERMINANTS DURING 2000's:

The resulting estimates of the regression analysis of log-linear model reported in Table 10 revealed that during 2000's also elasticity of agricultural productivity with respect to irrigation - both the net irrigation as well gross irrigated area were more than unity and was estimated at 1.170 and 1.059 respectively. These elasticities were highly significant but not significantly different from unity and explained nearly 65 per cent of the variations.

This was followed by elasticities with respect to availability of power as well as roads. Elasticity of agricultural productivity with respect to per hectare availability of power was 0.747 while with respect to total power consumption was 0.680. Likewise elasticity of agricultural productivity during 2000's with respect to road infrastructure measured as total length of the metalled road as well as road density estimated to be 0.679 and 0.677 and explained 60 and 51 per cent of the variations respectively.

Elasticity of agricultural productivity with respect to other remaining variables positive and varied in the range of 0.104 to 0.492, least bring for per hectare availability of credit. Elasticity of agricultural productivity with respect to availability of per hectare credit was estimated at

Table 10: Estimated Value of Regression Coefficient Affecting Agricultural Productivity in India during 2000's.

Model: Log Linear ***Nos. Of Observation: 10***

Variables	*Constant*	*Regression Coefficient*	R^{-2}	*F-ratio*	*DW*
TPC	-1.308 ^{ns} (-1.631)	+0.680*** (4.214)	0.650	17.745	1.510
HPC	+0.063 ^{ns} (0.111)	+0.747*** (3.541)	0.562	12.547	1.715
NIA	-0.003 ^{ns} (-0.007)	+1.170*** (4.075)	0.634	16.607	1.215
GIA	+0.044 ^{ns} (0.094)	+1.059*** (4.265)	0.657	18.209	1.295
CPH	+1.734*** (21.814)	+0.104*** (3.695)	0.584	13.657	1.199
TPH	+0.496** (1.637)	+0.492*** (5.206)	0.744	27.101	0.831
TFC	+1.208 ^{ns} (6.363)	+0.375*** (4.558)	0.687	20.778	1.432
PHF	+1.215*** (6.122)	+0.423*** (4.327)	0.663	18.721	1.489
TRL	-2.177^{ns} (-1.926)	+0.679*** (3.761)	0.593	14.109	1.132
RD	-0.007 ^{ns} (-0.010)	+0.677** (3.190)	0.505	10.179	1.205

Note: Figures in brackets are t-value.

****: significant at 0.01 level of significant for two tailed level*

***: significant at 0.05 level of significant for two tailed level*

**: significant at 0.10 level of significant for two tailed level*

ns: non- significant.

0.104 but explained 58 per cent of the variations. To study the simultaneous effect of these selected variables in determining the growth of agricultural productivity, multiple regressions were run. However resulting estimates did not yield any conclusive results due to problem of multicollinearity and smaller number of observations. Hence these results are not discussed here.

DETERMINANTS DURING STUDY PERIOD:

The resulting estimates of the regression analysis of log linear reported in Table 11 revealed that the elasticity of agricultural productivity of India with respect to all the selected variables were positive and significant with varying degree of effect. Highest elasticity was with respect to net area irrigated estimated at 1.026.It explains 80 per cent of the variations. This was followed by elasticity with respect to Gross Irrigated Area estimated at 0.829 and explains 81 per cent of the total variations. Again third highest elasticity was with respect to farm and its value was estimated at 0.601 but explains only 4 per cent of the variations.

Elasticities of agricultural productivity of India with respect to power both in terms of total consumption as well as per hectare consumption were estimated at 0.368 and 0.386 respectively. Both these elasticities were positively significant and explain 56 and 53 per cent of the variations respectively.

Next group belongs to fertilizer consumption. Both the variables were also positively significant explaining each more than 80 per cent of the variations. This was followed by the road infrastructure variables. Least elasticity of agricultural productivity was estimated to be with respect to per hectare availability of credit. Its value was estimated at 0.089 but was highly significant and explains nearly 79 per cent of the variations.

To study the simultaneous effect of these selected variables in explaining growth of agricultural productivity, multiple regressions were run. However resulting estimates did not yield any conclusive results due to problem of multi-collinearity and smaller number of observations .Hence these results are not discussed here.

To sum up, all the selected variables significantly effect the growth of agricultural productivity in India during the period under review though to varied degree.

Table 11: Estimated Value of Regression Coefficient Affecting Agricultural Productivity in India During the Study Period.

Model: Log-Linear ***Nos. of Observation: 10***

Variables	*Constant*	*Regression Coefficient*	R^{-2}	*F-ratio*	*DW*
TPC	+0.229 ^{ns} (0.634)	+0.368 *** (5.002)	0.558	25.007	0.855
HPC	+1.023 *** (4.738)	+0.386 *** (4.730)	0.529	22.379	0.893
NIA	+0.249 ^{ns} (1.210)	+1.026 *** (8.693)	0.797	75.585	1.201
GIA	+0.483 ** (2.750)	+0.829 *** (8.899)	0.805	79.265	1.201
CPH	+1.821 *** (68.029)	+0.089 *** (8.478)	0.789	71.924	1.378
TPH	+1.854 *** (13.132)	+0.601* (1.353)	0.042	1.839	0.550
TFC	+1.257 *** (15.175)	+0.354 *** (9.525)	0.825	90.755	1.759
PHF	+1.315 *** (15.743)	+0.374 *** 8.743	0.799	76.484	1.759
TRL	-0.074 ns (-0.265)	+0.343 *** (7.396)	0.738	54.671	1.153
RD	+1.684 *** (24.797)	0.127 *** (5.329)	0.591	28.427	1.022

Note: Figures in brackets are t-value.

****: significant at 0.01 level of significant for two tailed level*

***: significant at 0.05 level of significant for two tailed level*

**: significant at 0.10 level of significant for two tailed level*

ns: non- significant.

FACTOR ANALYSIS

The whole exercise/ above discussion gave inconclusive results. Most of the variables were not significant and majority of the regression coefficients had improper signs in multi-variate analysis. Furthermore, the lower size of the coefficient of multiple determination; non-significant status of the individual regression coefficients and the ability of the function to provide economically meaningful result compelled to have alternative solution to the problem.

Factor analytic approach was used to extract the various factors responsible for interstate variations in agricultural productivity. It was generally used to analysis inter- relationship among a large number of variables and explain these variables in terms of their common underlying dimensions (factors). It is designed as the queen of analytical method because of its power and elegance. The general purpose of Factor Analytic technique is to find a way in condensing(summarizing) the information contained in a number of original variables into a smaller set of new composite dimensions(factors) with a minimum loss of information, that is, to search for and define the fundamental constructs or dimensions assumed to underline the original variables.

In order to test the suitability of data for Principal Component Analysis, the correlation matrix was computed and enough correlations were found to go ahead with factor analysis. Further Anti- image correlations calculated revealed that partial correlations were low, indicating that true factors existed in the data. Hence, the data was found fit for factor analysis.

EXTRACTION METHOD AND NUMBER OF FACTORS EXTRACTED

Principal component Analysis was agriculture productivity for extracting factors and the number of factors to be extracted were finalized on the basis of 'Latent Root Criterion' i.e. variables having Eigen values greater than 1. Finally, the principal component Analysis with Orthogonal Rotation has been used in the present study. In Orthogonal Rotation, it was assumed that factors operated independently of each other. Varimax rotated factor Analysis which was the most popular method of Orthogonal rotation had been used. The results were obtained through than 0.5(ignoring signs) were retained. The resulting estimates of Principal component analysis with Varimax rotation for respondent variables were presented in Table 12, 13 and 14 reported besides factor loadings, two additional sets of information. In the last column, it was the

communality of each variable and in the last row, it was the percentage variation explained by each factor. The percentage of total variance was used as an Index to determine how well a particular factor solution accounted for what all the variables together represented. The communalities had been shown at the far right side of the tables which showed the amount of variance in variables that was accounted for by one or two factors taken together. The size of communality was a useful index for assessing how much variance in a particular variable was accounted for by the factor solution. Higher communalities indicated that large amount of variance in a variable had been extracted by the factor solution. Smaller communalities showed that a substantial portion of the variance in a variable was not accounted for by the factor solution.

TYPES OF FACTORS

A Factor loading represented the co-relation between the original variables and its factors. The signs were interpreted just like any other correlation coefficients. On each factor, 'like signs' of factor loadings mean that variables were negatively related. The factors and the loadings were summarized in Table 12; 13 and 14 and discussed as below:

Factor Loading during 1990's.

Rotated correlation matrix in respect to the determinants of Agricultural productivity during 1990's was reported in Table 12 and discussed as below. Only one factor had been extracted and emerged as a significant factor accounting for 84.304 per cent of the total variance. All the ten statements were loaded on this factor of which nine were highly correlated. Only one statement, namely, farm mechanization defined as number of tractors per hectare of grossed cropped area have had detrimental effect on the growth of agricultural productivity during 1990's.The high positive loading on this factor of other nine variables, namely, Road infrastructure both in terms of total as well as density; Irrigation infrastructure both Net as well as gross irrigated Area; Power Consumption both total as well as Per hectare Power Consumption, Credit Per hectare, Fertilizer Consumption both total as well as Per hectare Fertilizer pulls the determinants in agricultural productivity in India during 1990's. All these loadings played an important for the productivity in agriculture.

Table 12 Determinants (Factor Loading) of Agricultural Productivity in India during 1990's

Variable(s)	Factor loading of factor I	Communality
TRL (Total Road Length)	0.989	0.977
NIA(Net Irrigated Area)	0.987	0.974
RD(Road Density)	0.987	0.973
GIA(Gross Irrigated Area)	0.985	0.970
TPC(Total Power consumption)	0.958	0.918
HPC (Hectare Power Consumption)	0.952	0.907
CPH (Credit Per Hectare)	0.949	0 .901
TFC(Total Fertilizer Consumption)	0.941	0.885
PHF (Per Hectare Fertilizer)	0.919	0.845
TPH (Tractor Per Hectare)	-0.283	0.080
Eigen Value	8.430	
Variance Explained (%)	84.304	
Cumulative Variance Explained (%)	84.304	

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

Factor Loading During 2000's

Rotated correlation matrix in respect to the determinants of Agricultural productivity during 2000's was reported in Table 13 and discussed as below. Here again, only one factors had been extracted which explained 91.115 per cent of the variations. All the ten statements were loaded on this factor of which were highly correlated. The high positive loading on this factor of other nine variables, namely, Road infrastructure both in terms of total as well as density; Irrigation

infrastructure both Net as well as gross irrigated Area; Power Consumption both total as well as Per hectare Power Consumption, Credit Per hectare, Fertilizer Consumption both total as well as Per hectare Fertilizer pulls the determinants in agricultural productivity in India during 1990's. All these loadings played an important for the productivity in agriculture. Thus, this factor had a high potential for determinant in agricultural productivity in India during 2000's.

Factor Loading during Study Period

Rotated correlation matrix in respect of agriculture productivity during study period was reported in Table 14 and discussed as below. Two factors had been extracted which together explained 91.529 per cent of the total variance.

Factor I:

First factor had emerged as a significant factor accounting for 80.452 per cent of the total variance for determinant of agriculture productivity during study period. Two statements were loaded on this factor which was highly and positively correlated. In these factor nine out of 10 statements, namely, Gross Irrigated Area, Per hectare Fertilizer Consumption, Net Irrigated Area, Total Fertilizer Consumption, Total Road Length, Credit Per hectare, Total Power Consumption, Per Hectare Power Consumption and Road Density were highly correlated. Thus, this factor had a high potential for determinant in agricultural productivity in India during 1990-2010(study period).

Factor II:

Second factor had emerged as a significant factor accounting for 11.077 per cent of the total variance for determinant of agriculture productivity during study period. Two statements were loaded on this factor which was highly and positively correlated. In this factor one out of 10 statements, namely, Tractor per hector was highly correlated. Thus, this factor had a high potential for determinant in agricultural productivity in India during 1990-2010(study period). From the above facts, it is clear that determinants namely, Total Power Consumption, Per hectare Power Consumption, Net Irrigated Area, Gross Irrigated Area, Credit Per Hector, Tractor Per Hectare, Total Fertilizer Consumption, Per Hectare Fertilizer, Total Road length and Road Density, emerged as leadings factor affecting agricultural productivity during 1990's, 2000's and study period to improve the level of agricultural productivity in India are equally correlated. These variables were needed for new technology, good fertilizer, improvised tractors etc.

Table 13: Determinants (Factor Loading) of Agricultural Productivity in India during 2000's

Variable(s)	Factor loading of factor I	Communality
CPH (Credit Per Hectare)	0.995	0.990
TFC(Total Fertilizer Consumption)	0.988	0.976
TPC (Total Power consumption)	0.985	0.969
PHF (Per Hectare Fertilizer)	0.984	0.968
TRL (Total Road Length)	0.977	0.954
GIA(Gross Irrigated Area)	0.962	0.926
RD (Road Density)	0.960	0.921
NIA(Net Irrigated Area)	0.953	0.908
HPC (Hectare Power Consumption)	0.929	0.862
TPH (Tractor Per Hectare)	0.798	0.636
Eigen Value	9.111	
Variance Explained (%)	91.115	
Cumulative Variance Explained (%)	91.115	

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

Table 14: Determinants (Factor Loading) of Agricultural Productivity in India during Study periods

Variable(s)	Factor loading of factor		Communality
	I	II	
GIA(Gross Irrigated Area)	.983	-.059	.969
PHP (Per Hect. Fertilizer)	.980	.064	.964
NIA(Net Irrigated Area)	.979	-.065	.963
TFC(Total Fertilizer Consumption)	.976	.060	.955
TRL(Total Road Length)	.976	-.025	.952
CPH (Credit Per Hect.)	.928	.142	.881
TPC(Total Power consumption)	.907	-.254	.887
HPC (Hect. Power Consumption)	.892	-.255	.861
RD (Road Density)	.882	.069	.783
TPH (Tractor Per Hect.)	-.004	.968	.937
Eigen Value	8.058	1.095	
Variance Explained (%)	80.452	11.077	
Cumulative Variance Explained (%)	80.452	91.528	

Extraction method: Principal Component Analysis
Rotation method: Varimax with Kaiser Normalization

Following measures are suggested to increase the productivity of Indian agriculture:

1. The farmers should be provided with a stable price for their agricultural products at a remunerative level.

2. There should be an expansion of adequate marketing facilities to sell the agricultural product.

3. The land tenure system should be changed in favour of the cultivator.

4. There should be a provision of cheap credit on reasonable terms especially to small farmers for better techniques of production.

5. The modern inputs like fertilizers. Pesticides and improved seeds should be made available to the farmers at reasonable prices.

6. There should be provisions of education, research and extension of agro-economic services to spread the knowledge of improved methods of farming.

7. The State should make provision for the development of resources which are not possible in the part of individual farmers e.g. large scale irrigation, land reclamation or resettlement projects.

8. There should be an extension of land used and intensification and utilization of land already in use through improved and scientific implements.

ANNEX TABLES

Table 1: Zero Order Correlation Matrix of Factor Affecting Growth of Agriculture in India during 1990's.

Variable	*AP*	*TPC*	*HPC*	*NIA*	*GIA*	*CPH*	*TPH*	*TFC*	*PHF*	*TRL*	*RD*
AP	*1.00*	*.743**	*.736**	*.853***	*.878***	*.886***	*-.294*	*.780***	*.710**	*.832***	*.837***
TPC	×	*1.00*	*.999***	*.969***	*.941***	*.836***	*-.318*	*.827***	*.838***	*.935***	*.942***
HPC	×	×	*1.00*	*.965***	*.937***	*.833***	*-.300*	*.817***	*.823***	*.927***	*.939***
NIA	×	×	×	*1.00*	*.990***	*.918***	*-.237*	*.894***	*.889***	*.971***	*.966***
GIA	×	×	×	×	*1.00*	*.947***	*-.228*	*.911***	*.897***	*.962***	*.965***
CPH	×	×	×	×	×	*1.00*	*-.202*	*.947***	*.860***	*.946***	*.957***
TPH	×	×	×	×	×	×	*1.00*	*-.148*	*-.105*	*-.301*	*-.335*
TFC	×	×	×	×	×	×	×	*1.00*	*.955***	*.931***	*.912***
PHF	×	×	×	×	×	×	×	×	*1.00*	*.898***	*.961***
TRL	×	×	×	×	×	×	×	×	×	*1.00*	*.989***
RD	×	×	×	×	×	×	×	×	×	×	*1.00*

**. Correlation is significant at the 0.05 level (2-tailed).*

***. Correlation is significant at the 0.01 level (2-tailed).*

Table 2: Zero Order Correlation Matrix of Factor Affecting Growth of Agriculture in India during 2000's

Variable	*AP*	*TPC*	*HPC*	*NIA*	*GIA*	*CPH*	*TPH*	*TFC*	*PHF*	*TRL*	*RD*
AP	1.00	.832**	.783**	.830**	.841**	.827**	.809**	.837**	.825**	.755*	.783**
TPC	×	1.00	.966**	.902**	.915**	.979**	.751*	.977**	.986**	.972**	.970**
HPC	×	×	1.00	.780**	.796**	.933**	.716*	.924**	.954**	.929**	.922**
NIA	×	×	×	1.00	.997**	.943**	.693*	.922**	.893**	.913**	.936**
GIA	×	×	×	×	1.00	.950**	.721*	.939**	.912**	.920**	.938**
CPH	×	×	×	×	×	1.00	.725*	.979**	.979**	.987**	.991**
TPH	×	×	×	×	×	×	1.00	.756*	.747*	.683*	.687*
TFC	×	×	×	×	×	×	×	1.00	.995**	.972**	.968**
PHF	×	×	×	×	×	×	×	×	1.00	.975**	.968**
TRL	×	×	×	×	×	×	×	×	×	1.00	.994**
RD	×	×	×	×	×	×	×	×	×	×	1.00

**. Correlation is significant at the 0.05 level (2-tailed).*

***. Correlation is significant at the 0.01 level (2-tailed).*

Table 3: Zero Order Correlation Matrix Of Factor Affecting Growth Of Agriculture In India During Study Period

Variable	*AP*	*TPC*	*HPC*	*NIA*	*GIA*	*CPH*	*TPH*	*TFC*	*PHF*	*TRL*	*RD*
AP	1.00	.789**	.769**	.900**	.904**	.885**	-.007	.910**	.899**	.877**	.787**
TPC	×	1.00	.992**	.923**	.916**	.763**	-.168	.851**	.859**	.846**	.673*
HPC	×	×	1.00	.894**	.891**	.711*	-.162	.827**	.841**	.839**	.679*
NIA	×	×	×	1.00	.996**	.879**	-.049	.941**	.936**	.947**	.827**
GIA	×	×	×	×	1.00	.876**	-.047	.945**	.942**	.957**	.847**
CPH	×	×	×	×	×	1.00	.069	.956**	.950**	.892**	.833**
TPH	×	×	×	×	×	×	1.00	.032	.039	-.052	-.002
TFC	×	×	×	×	×	×	×	1.00	.993**	.930**	.827**
PHF	×	×	×	×	×	×	×	×	1.00	.939**	.846**
TRL	×	×	×	×	×	×	×	×	×	1.00	.952**
RD	×	×	×	×	×	×	×	×	×	×	1.00

**. Correlation is significant at the 0.05 level (2-tailed).*

***. Correlation is significant at the 0.01 level (2-tailed)*

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