### ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AIDIS</td>
<td>All-India Debt and Investment Survey</td>
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<td>Bt</td>
<td>Bacillus thuringiensis</td>
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<tr>
<td>CAGR</td>
<td>Compound Annual Growth Rate</td>
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<td>CGIAR</td>
<td>Consultative Group on International Agricultural Research</td>
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<td>DFID</td>
<td>Department of International Development</td>
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<td>EFFCH</td>
<td>Efficiency Change</td>
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<td>FYM</td>
<td>Farm Yard Manure</td>
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<td>GSP</td>
<td>Generalized System of Preferences</td>
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<td>ICRISAT</td>
<td>International Crops Research Institute for the Semi-Arid Tropics</td>
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<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
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<td>IPCC</td>
<td>Inter Governmental Panel on Climate Change</td>
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<td>IPU</td>
<td>Irrigation Potential Utilized</td>
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<td>ISF</td>
<td>Irrigation Service Fees</td>
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<td>KI</td>
<td>Kendrick Index</td>
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<td>KKS</td>
<td>Kakwani, Khandker and Son</td>
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<td>NAAS</td>
<td>National Academy of Agricultural Sciences</td>
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<td>NBSS&amp;LUP</td>
<td>National Bureau of Soil Survey and Land Use Planning</td>
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<td>NCRB</td>
<td>National Crime Records Bureau</td>
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<td>NMSA</td>
<td>National Mission for Sustainable Agriculture</td>
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<td>PFXH</td>
<td>Pure Efficiency Change</td>
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<td>SECH</td>
<td>Scale Efficiency Change</td>
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<td>TC</td>
<td>Technical Change</td>
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<td>TECHCH</td>
<td>Technical Change Index</td>
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<td>UPSS</td>
<td>Usual Principal and Subsidiary Status</td>
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<td>WUAs</td>
<td>Water Users’ Associations</td>
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<td>WWF</td>
<td>World Wild Life Fund</td>
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Although India is considered one of the fastest growing economies in the world, the exclusion problems have not been addressed seriously. Real development in terms of growth shared by all sections of the population has not taken place in India as reflected in terms of poverty and unemployment, inequalities in access to credit, health care, and education (Dev, 2009). One of the excluded sectors during the reform period was agriculture which showed low growth and experienced more farmers’ suicides. Therefore performance of agriculture sector raises serious concerns as the annual growth has been less than 2 per cent during the 1990’s and was below the targeted growth of 4 per cent during all the five year plans during the post reform period.

Poverty in India is widespread, with India estimated to have a third of the world's poor. At the beginning of the new millennium, 260 million people in India were living below the official poverty line. Of these, 75 per cent were in rural areas (Planning Commission, 2001). Oxford Poverty and Human Development Initiative (TOI, 2010) stated that eight Indian states had more poor than 26 poorest African nations combined, which totals to more than 410 million poor in the poorest African countries. Such a high incidence of poverty is a matter of concern in view of the fact that poverty eradication has been one of the major objectives of the development planning process. As early as 1938, the Indian National Congress constituted a National Planning Committee (NPC) headed by Jawaharlal Nehru, which declared that the social objective should be “to ensure an adequate standard of living for the masses, in other words, to get rid of the appalling poverty of the people” (Dev, 2002).

The importance of reduction in poverty and provision of other basic needs has been emphasised in successive five year plans since independence, particularly since the 5th Five Year Plan. Speeches made in the Constituent Assembly just before midnight on 15 August 1947 reflected the vision of the country’s leaders, as those present dedicated themselves to the service of the nation and to the larger cause of humanity. The famous Tryst with Destiny speech by India’s first Prime Minister, Pandith Jawaharlal Nehru, recognised that working in the service of India meant working in the service of the millions who were suffering, and required a fight to end poverty, ignorance, disease and inequality of opportunity (India Chronic Poverty Report, 2011). The fact however is, that still much remains unaccomplished even after more than fifty years of independence.
Agricultural wage earners, small and marginal farmers and casual workers engaged in non-agricultural activities, constitute the bulk of the rural poor in India. Small land holdings and their low productivity are the cause of poverty among households dependent on land-based activities for their livelihood. Poor educational base and lack of other vocational skills also perpetuate poverty. Poverty alleviation has been one of the guiding principles of the planning process in India; therefore creation of employment opportunities for the unskilled workforce has been a major challenge for development planners and administrators (Planning Commission, 2001).

During the years of the British colonial rule, agriculture reached a situation of stagnation. Cultivation was done traditionally. Although farmers made small innovations, land productivity was low and rural society was characterized by widespread poverty and malnutrition. Famines ravaged the country quite regularly but the colonial administration paid little attention (Ray, 2005). During the colonial rule until the First World War, surplus was extracted from agriculture, which was partly transferred to the British economy, partly invested in the military and bureaucratic machinery to sustain the activities and partly to strengthen the sources of revenue through public investments in railways, canals, etc. (Patnaik, 1984). At the time of independence however, agriculture was the main source of national income and occupation; agriculture and allied activities contributed nearly 50 per cent to India’s national income with almost 72 per cent of total working population engaged in agriculture (Mallika, 2012). Hence confirming Indian economy at the time of independence was agriculture based underdeveloped economy.

The democratic governments after independence paid serious attention to widespread deprivation in society and attention was given to developing agriculture with modern practices. Immediately after Independence, the Nehru-Mahalanobis Plan placed more emphasis on industrialization by treating agriculture as ‘bargain basement’ (Posani, 2009). Many institutional and infrastructural changes have been introduced since Independence for the overall development of Indian agriculture. However, a decisive shift in agricultural policy took place after Pandith Jawaharlal Nehru. Agriculture became the focal point of State intervention under Agriculture Minister, Mr. C. Subramaniam. The face of agriculture changed since then, and famine conditions rarely haunted India ever since (Ray, 2007).
After sixty years of India’s Independence, the share of agriculture in total national income declined from 50 per cent (in 1950) to 18 per cent in (2007-08). More than 50 per cent of workforce however, is still engaged in agriculture. Since growth of other sectors and the overall growth of economy depend on the performance of agriculture to a considerable extent, agriculture continued to be the dominant sector in Indian Economy (Tripathi & Prasad, 2009). The decade of 1990s however, saw a steady decline in the level of per capita food availability at the national-level. The absolute per capita food availability during the year 2002-03 was even lower than during the Second World War years, when the Bengal famine took place (Patnaik, 2003). Forty years of successful effort in India to raise food grains absorption through Green Revolution and planned expansionary policies was wiped out in a single decade of deflationary economic reforms and the country was back to the food grains availability level of fifty years ago (Patnaik, 2005). Agriculture was marginalized in the national policy agenda. Reforms of the 1990s and shift in economic priorities of the Indian government led to stagnation in agriculture and more hardships for farmers (Posani, 2009).

Agricultural policy followed since independence can be distinguished in four phases: 1947 to mid-sixties; from mid-sixties to 1980; from 1980 to 1991; and 1991 onwards (Tripathi & Prasad, 2009). The first phase of agricultural policy witnessed tremendous agrarian reforms, institutional changes, and development of major irrigation projects and strengthening of cooperative credit institutions. The most important contribution of land reforms was abolition of intermediaries and giving land titles to the actual cultivators. This released productive forces and the owner cultivators put in their best to augment production from their holdings (Tripathi and Prasad, 2010). Land reforms were important in increasing agricultural production during this phase. The Community Development Programme, decentralised planning and the Intensive Area Development Programmes were also initiated for regenerating Indian agriculture that had stagnated during the British period. In order to encourage the farmers to adopt better technology, incentive price policy was adopted in 1964 and the Agricultural Price Commission was set up in January 1965 to advice the Government on the fixation of support prices of agricultural crops. Despite the institutional changes and development programmes introduced by the Government
during this phase, India remained dependent upon foreign countries for food to feed the rising population.

The second phase in Indian agriculture started in mid 1960s with adoption of new agricultural strategy. The new agricultural strategy relied on high-yielding varieties of crops, multiple cropping, the package approach, modern farm practices and spread of irrigation facilities. The biggest achievement of this strategy was attainment of self-sufficiency in food grains. Agrarian reforms during this period took a back seat while research, extension, input supply, credit, marketing, price support and spread of technology were the prime concerns of policy makers (Rao, 1996). India went for adoption of biochemical technology (since it was a land scarce economy), which was a combination of high yielding varieties (HYV), chemical fertilizers, insecticides, pesticides and irrigation. The HYV technology was prone to pest and insect attacks, and was heavily dependent on irrigation. The technology required a high working capital. Despite the increase in cost of cultivation, increase in profit was manifold. Subsidization of agriculture was a major policy of the Government of India after the introduction of the new technology. Subsidy was provided to ensure quick adoption of the new technology by the farmers and to reduce uncertainties in production (Web, 2013.http://www.slideshare.net). Some have argued that subsidies disturbed efficient allocation of resources. Others however argue if subsidies were removed, then investment in agriculture would go down, small and marginal farmers would get affected and prices of agricultural commodities would shoot up.

The next phase in Indian agriculture began in early 1980s. This period witnessed the process of diversification which resulted into fast growth in non-food grains output like milk, fishery, poultry, vegetables, fruits, etc., which accelerated growth in agricultural GDP during the 1980s (Chand, 2003). There was considerable increase in subsidies and support to agriculture sector during this period while public sector spending in agriculture for infrastructure development started declining in real terms but investment by farmers kept on moving on a rising trend (Mishra and Chand, 1995; Chand, 2001). The beginning of the fourth phase of agricultural policy coincided with the initiation of economic reform process in 1991. The economic reforms involved deregulation, reduced government participation in economic activities and liberalization. Although there were no direct reforms for agriculture but
the sector was affected indirectly by devaluation of exchange rate, liberalization of external trade and dis-protection to industry.

Another change that affected agriculture during this period was opening up of domestic market due to new international trade accord and World Trade Organization (WTO). This raised new challenges for policymakers and consequently the New Agricultural Policy was launched by the Government in July 2000. It aimed to attain output growth rate of 4 per cent per annum in agriculture sector based on efficient use of resources. It sought to achieve this objective in a sustainable manner and with equity. It was for the first time that the government released a National Agricultural Policy. Although the policy document discussed what ought to be done in agriculture it did not discuss the subsequent steps, how and when policy goals and objectives would be achieved (Chand, 2003).

Thus, there was a lop-sided approach to agricultural development in India during the past few decades (Dev, 2009). Growth may have been higher during the past two decades, but inclusive growth in terms of focus on agriculture was missing. The view of agriculture as an engine of growth attracted much attention after World Development Report, “Agriculture for Development” (World Bank, 2008) which got reinforced by the 2007-08 spike in world food prices. With the majority of poor people living in rural areas and depending on agriculture rather than any other sector suggests that they would benefit more from growth originating in agriculture (World Bank, 2007). The role of agriculture in economic development is well known. Agriculture not only contributes to overall growth of the economy but also provides employment and food security to majority of the population, which in turn reduces poverty in a developing country. Thus, if pro-poor growth and real development is to be achieved, high agricultural growth and rising incomes for farmers are essential. As economies develop, the share of agriculture in output and employment diminishes (Kuznets, 1966). The large and persistent gap between agriculture’s share in GDP and its share in employment suggests that poverty is concentrated in rural areas especially in agricultural sector. This implies that, as non-agricultural growth accelerates in some countries, much of the rural population remains poor, resulting in widening rural urban income disparities. Broad based growth in rural economy is therefore essential to reduce both absolute and relative poverty (Savanti and Elisabeth, 2008).
A new dimension to the debate about the relative role of agriculture versus non-agriculture sectors was added, as poverty reduction depends not only on the rate of overall economic growth, but also on the ability of poor people to connect to that growth (i.e. the ‘quality’ of growth). As majority of poor people in the developing world especially in Sub Saharan Africa (SSA) depend directly on agriculture for their livelihood, it is often argued that agricultural growth has a higher return in terms of poverty reduction (i.e. a higher ‘participation effect’) than an equal amount of growth in non-agriculture sectors. Therefore to achieve ‘pro-poor’ growth it would require policies and investments that support the development of agriculture (Ravallion and Chen, 2003; Kraay, 2006).

In recent decades, the context within which agriculture policy has to be developed and implemented has undergone fundamental changes. The relationships which operated for much of the 1960s and 1970s have changed. Globalization policies during the 1980s and particularly during 1990s and beyond have created many challenges for agriculture in developing countries (Dev, 2009). Some of the consequences and impacts of globalization in developing countries are: exposure of domestic agriculture to international competition, growth of non-agricultural sector and its impact on demand for agricultural products, urban middle class life-style changes, including diets, rising food imports, competitiveness and diversification of domestic production systems, vertical integration of the food supply chain, etc. (Prabhu, 2006). There has been a significant increase in small and marginal farm holdings because of demographic pressures. These farmers have to face the challenges of globalization. Risk and uncertainty have also increased as cultivation has spread to marginal lands. The diversification of agriculture has also raised concerns on food security. In recent years, there has been concern regarding increase in the global food prices (Dev, 2009). Rise in crude oil prices has increased agricultural costs also. Increased use of food crops for biofuels has also pushed up their demand. The USA uses 20 per cent of its maize production for biofuels; Brazil uses 50 per cent of sugarcane for biofuels; and the European Union uses 68 per cent of its vegetable oil production for biofuels. Such large usages, by reducing the availability of these products for food and feed, have exerted pressure on their prices (Dev, 2009). Food prices have also increased due to low output stocks. International prices of wheat, rice
and maize have increased significantly in the past two years. This is another challenge for India in maintaining its food security (Dev, 2009).

Agriculture growth started declining since the reforms and became worse in the post-WTO period. From 3.62 in 1990-91, agriculture growth came down to 1.97 by 2004-05 and the share of agriculture in the gross domestic product registered a steady decline from 36.4 per cent in 1982-83 to 18.5 per cent in 2006-07 (Chand et al., 2007). Yet, this sector continues to support more than half a billion people providing employment to 52 per cent of the total workforce. The slowdown occurred in all the sub-sectors of agriculture, including livestock and horticulture which were the main drivers of agricultural growth in the immediate past. The slowdown since the mid-1990s however adversely impacted the livelihood base of majority of the farming community (Reddy and Mishra, 2009). Thus majority of the India’s people engaged in agriculture are in the grip of a severe agrarian crisis. The present crisis in Indian agriculture is considered unparalleled since independence and reminiscent only of the agrarian crisis of pre-world war and world war days (Patnaik, 2005).

Given the relevance of this sector for employment and rural development the declining trend in agricultural growth is a major concern for researchers and policymakers. Farmers’ suicides have become a major issue in recent times only, and are being widely discussed in academic and policy circles as well as in everyday discourses. The beginning of agrarian crisis however can be located much earlier to the beginning of suicides. Some features of the crisis started manifesting themselves in certain parts of India during the late 1980s, when the terms of trade were going against agriculture (Bose, 198; Balagopal, 1988), urban-biased policies (Lipton, 1980) were dominating the state policies, and farming was becoming a losing proposition. The crisis however, assumed serious dimension since the middle of the 1990s. According to, Report of the Expert Group on Agricultural Indebtedness, 2007 the large number of suicides committed by the farmers in some parts of India is one of the tragic manifestations of the crisis. One of the paradoxes of the Indian economy is that the decline in the share of agricultural workers in total workers has been slower than the decline in the share of agriculture in GDP. With the result, the labour productivity in agriculture increased only marginally, while that of non-agricultural workers increased rapidly (Dev, 2009). Declining productivity, poor irrigation and water management, declining agricultural research and extension activities, distorting
markets due to government intervention, declining public and private investment, unorganized agricultural credit and insurance, poor infrastructure development, inefficient supply chain and marketing strategies and slow development of agro-processing units are the issues and challenges that Indian agriculture faces today.

It is widely felt that present crisis in agriculture is the result of deflationary public policies and trade liberalization (with falling global prices), which slowed output growth, contributed to rising unemployment, income deflation for the majority of cultivators and labourers, enmeshing of cultivators in un-repayable debt, and loss of assets, including land, to creditors. Another reason given for the agrarian crisis is the drastic reduction in the state’s spending on rural development which has led to loss of purchasing power for rural population. Expenditures in rural development, especially in agriculture, rural development, special areas programmes, irrigation and flood controls, and village and small scale industry, have been slashed to an all-time low of 0.6% of Net National Product (NNP) in 2004 (Reddy and Mishra, 2009). Thus large number of factors contributed to the decline of agriculture. The most important among them was the reduced investment in irrigation, flood control, research, extension, and institution building in the context of liberalizing agriculture. Further the liberalization of agricultural trade exposed commercial agriculture to the volatility in the world commodity markets (Reddy and Mishra, 2009).

The sustainability issue of the crop productivity is fast emerging, since the post-Green Revolution phase was characterized by high input-use and decelerating total factor productivity growth (TFPG) (Kumar and Mittal, 2006). In recent years, agriculture experienced diminishing returns to input-use and a significant proportion of the gross cropped area faced stagnation or negative growth in TFP. Productivity attained during the 1980s however could not be sustained during the 1990s. In many irrigation project areas problems of waterlogging and soil salinity arose due to over-irrigation and deep percolation and seepage losses in the absence of a suitable drainage system. Due to the degradation problems, growth in TFP could not make headway across most parts of the country. Thus, sustainable agricultural practices have to balance environmental health and economic profitability in order to promote social and economic equity.

According to National Mission for Sustainable Agriculture (NMSA, 2010) ‘Sustainable Agriculture’ should involve processes that would help meet the current
and long term societal needs for food, fibre and other resources, while maximising benefits through the conservation of natural resources and maintenance of ecosystem functions. The United States Department of Agriculture defined ‘Sustainable agriculture’ as a management system for renewable natural resources that provides food, income and livelihood for present and future economic productivity and ecosystem services of these resources. Sustainable agriculture systems are those that are economically viable and meet society’s need for safe and nutritious food while maintaining or enhancing natural resources and the quality of the environment for future generations (Baier, 1990). Thus, Sustainable agriculture would help meet the needs of the present generation without endangering the resource base of the future generations. A comprehensive view of sustainable agriculture must therefore involve many factors, and there is a broad consensus that these factors should incorporate three elements: environmental, economic and social (Vanloon et al., 2005). It is beyond question that agriculture is one of the most fundamental and essential of all human activities. Therefore, sustainable agriculture must consider and bring together sound practices in the environmental, economic and social spheres.

1.2: Review of literature

Historically, only a few issues have attracted as much attention as the role of the agriculture in economic development and poverty reduction. While on one hand the dual economy models inspired by Lewis (1954) viewed agriculture as a backward, unproductive subsistence sector, from which labour and resources were to be drawn to encourage development of the dynamic productive industrial sector; Much of the early development economics literature was thus interpreted as supporting an industrialization strategy. On the other hand, an alternative view of agriculture as a leading sector also emerged. Johnston and Mellor (1961) and Schultz (1964) emphasized the critical contributions of agricultural sector to growth in the non-agricultural sectors, implying that investments and policy reforms in agriculture might actually yield faster overall economic growth, even though agriculture itself might grow at a slower pace than non-agriculture. Christiaensen and Demery (2007) pointed out that the contribution of economic growth to poverty reduction might differ across various sectors, because the benefits of growth might be easier to obtain for the poor people if growth occurred where they were located. This reasoning assumed that transferring of income generated in one economic sector or geographic location to
another sector or location was difficult, because of the market segmentations or considerations of political economy. They too found that growth originating in agriculture was on average significantly more poverty reducing than growth originating outside agriculture. Mellor (2001) also stated that it was not economic growth in general that reduces poverty in developing countries, but the direct and indirect effects of growth in agriculture.

The view of agriculture as an engine of growth has attracted much attention after World Bank’s (2008) World Development Report, “Agriculture for Development”, which got reinforced by the 2007-08 spike in world food prices. According to World Investment Report (2009) agricultural production is a very special social and economic activity. Agriculture has features distinct from manufacturing and services sectors in terms of its importance to an economy. It is central as provider of food, a channel to eradicate poverty and hunger, a significant agent for mass and rural employment, a major contributor to national economic growth and a considerable foreign exchange earner for many developing countries. According to World Bank (2005) the adoption of the Millennium Development Goals (MDGs) by the UN member states at the turn of the millennium added a new dimension to the on-going development debate. It shifted the focus from fostering economic growth per se to maximizing poverty reduction, or achieving ‘shared’ growth—growth with a maximum pay-off in terms of poverty reduction. This added a new dimension to the debate about the relative role of agriculture versus non-agriculture; as poverty reduction not only depends on the rate of overall economic growth, but also on the ability of poor people to connect to that growth (i.e. the ‘quality’ of growth). As majority of poor people in the developing world and especially in Sub Saharan Africa (SSA) depend directly on agriculture for their livelihood, it is often argued that agricultural growth has a higher return in terms of poverty reduction (i.e. a higher ‘participation effect’) than an equal amount of growth in non-agriculture.

Christiaensen et al. (2006) argued that the experience of Green Revolution in Asia, whereby traditional agriculture was rapidly transformed into a fast growing modern sector through the adoption of science based technology, provided confidence in the proposition of agriculture as an engine of growth. Ravallion and Chen (2003) and Kraay (2006) observed that achieving ‘pro-poor’ growth would call for policies
and investments that support the development of agriculture. Savanti and Elisabeth (2008) observed that the large and persistent gap between agriculture’s share in GDP and its share in employment suggested that poverty was concentrated in rural areas especially in agricultural sector. This implied that, as non-agricultural growth accelerated in some countries, much of the rural population remained poor, resulting in widening rural urban income disparities. Broad based growth in rural economy was therefore essential to reduce both absolute and relative poverty. Timmer (2002) identified a positive correlation between growth in agricultural GDP and its lagged values and non-agricultural GDP growth and stated that this correlation can be explained by “first-order” effects of agricultural growth on lower food prices, labour migration and capital flows from agriculture, as well as “second-order” effects such as improved nutritional intake, which improved workers’ productivity.

Ahluwalia (1978) observed a statistically significant inverse relationship between rural poverty and agriculture for India as a whole, which implied that agricultural growth by itself tends to reduce the incidence of poverty, with the incidence of poverty falling in periods of good agricultural performance and rising in periods of poor performance. Datt and Ravallion (1996 and 1998) found that higher farm productivity reduced both absolute as well as relative poverty. This is partly due to a direct channel of higher household income operating in the short run and partly due to indirect channels, such as higher wages and lower food prices in the longer run. These were the main channels for poverty reduction not labour migration from agriculture into other sectors. This strengthened the argument for supporting agricultural growth.

Datt and Ravallion (1997) were of the opinion that pro-poor growth meant growth in the agriculture sector. Their study has rejected the previous view that “Green Revolution” had not brought any change. This study confirms that it had led to poverty reduction and that the pro-poor growth had a trickledown effect. A strong negative relationship holds between poverty in rural area and agricultural development. Higher productivity had delivered both absolute and relative gains to the rural poor in India. The channels through which these gains passed were via the growth component or wages and lower food prices rather than improved distribution. Mellor (2001) stated that another channel through which agricultural growth can reduce poverty is employment generation in the non-agricultural sector. This effect is
mostly driven by increased consumption demand and not so much by production linkages.

Palmer et al. (2003) by extending the earlier work of Datt and Ravallion (1998) established a strong correlation between the growth of agriculture sector and poverty reduction. Their study found that high growth in agriculture during the period of 1962-90, brought significant decline in poverty. Furthermore, they found a strong negative correlation between agriculture growth and poverty alleviation. Korangkaew (1985) while investigating the nature, courses and contribution of agriculture in economic development of Thailand in general, and the relationship between agriculture development and rural poverty and income inequalities in particular, had indicated that during 1960's, increase in agriculture production brought about a decrease in the rate of poverty. During 1962-63 to 1968-69 the agriculture production in Thailand increased at a rate of 5.5% per annum and the rural poverty fell to 43 per cent from 61 per cent.

Srinivasan (1993) discussed the strong interaction between agriculture and rural poverty in Pakistan and found it to be quite higher than urban poverty, Montalvo and Ravallion (2009) found that the primary sector, rather than the secondary (manufacturing) or tertiary sectors, was the real driving force in China’s spectacular success against absolute poverty. They concluded that the idea of a trade-off between these sectors in terms of overall progress against poverty in China was moot, given how little evidence they found of any poverty impact of non-primary sector growth. Ghosh (1996) studied the impact of agriculture development on rural poverty and the impact of other factors on rural poverty in the Indian states. Using cross section data, the study showed an inverse relationship between agriculture production and rural poverty. He further argued that if the performance of the agriculture sector was improved it would certainly reduce rural poverty and this development would have a trickledown effect in India. Mathur (1985) studied the correlation between agricultural productivity and poverty alleviation in India, and found that agricultural growth reduced rural poverty.

Pradhan and Saluja (1998) found that among the different factors like agricultural output, agricultural real wages, inflation, and relative food prices, etc., the agricultural output and the public expenditure were still the dominant factors affecting the incidence of poverty. They also felt that agricultural growth was still the most
dominant factor for poverty reduction. Pant and Pradhan (1998) observed that the agricultural dependent household groups (self-employed in agriculture and agricultural labourers) experienced worsening of poverty situation in 1995-96 as compared to 1994-96, due to slow down of agricultural growth. Radhakrishna (2002) observed that agriculture dominated the change in India through its links with factor and product markets. It employed 60 per cent of the labour force and contributed 26 per cent of the gross domestic product. In the poorer states, its contribution to the domestic product was close to 40 per cent. Low productivity in agriculture led to the concentration of poor in this sector. Due to the sheer size of the agricultural economy and the importance of its major products (cereals) in the diet of the poor, gains in agricultural productivity had significant potential impact on poverty. According to Radhakrishna (2002) theoretically, it was possible to reduce poverty as well as expand the domestic market for industry by raising labour productivity in agriculture and spreading its gains among the low income groups. Cervants and Dewbre (2010) also acknowledged that growth in per capita income economy-wide was driven by growth in agricultural sector income, i.e. agriculture was the engine of economy-wide performance because agricultural sector growth exhibited a higher multiplier than growth in other sectors.

Poverty in India was widespread more of the world’s income poor lived in India than any other country. According to Sen and Himanshu (2004) however the decade of 1990s was generally considered as a lost decade for poverty reduction. Himanshu (2007) & Dev (2007) while accepting that poverty was lower in the post economic reforms period than before the economic reforms of 1991, they however argue that the extent of decline in poverty in the post-reform period is not higher compared to the pre reform period. Himanshu (2007) believed that the somewhat faster post-reform GDP growth had not been accompanied by more rapid poverty reduction. It had, in fact, been accompanied by an increase in inequality. Datt, Gaurav et al. (2003) concluded that the rate of poverty reduction in the 1990s was slightly lower than the 1980s and lower than one would have expected given the growth in the 1990s.

Dev and Ravi (2007) observed that in spite of higher overall growth, the extent of decline in poverty in the post-reform period (1993-2005) had not been higher than in the pre-reform period (1983-1993). Further there was increasing concentration of
poor and very poor in few states like Bihar, MP, Orissa and UP. Inequality had increased significantly in the post-reform period which apart from other factors seemed to have slowed down the rate of poverty reduction. The paper strongly emphasised higher inclusive growth that increased agriculture and non-farm sector growth, and a reduction in regional, rural-urban and social disparities as important for a faster reduction in poverty. Himanshu (2007) made somewhat similar observations concluding that although poverty did reduce during 1993-2005 the annual rate of reduction in this period was lower than in the 1970s and 1980s. More importantly, the bulk of this decline occurred in 1999-2005, with little or no reduction in poverty in 1993-2000, confirmed that the 1990s were indeed the lost decade for poverty reduction.

Sengupta, Arjun et al. (2008) defined the common people of India in terms of levels of consumption and further examined their socio-economic profile since early 1990s with a view to assess how the economic growth process had impacted the lives of these common people. They concluded that despite high growth, more than three-fourths of Indians were poor and vulnerable with a level of consumption not more than twice the official poverty line. This proportion of the population, which can be categorised as the “common people”, was much higher among certain social groups, especially for scheduled castes and scheduled tribes. They also found that inequality was widening between the common people and the better-off sections of society. Chand et al. (2007) observed widening income disparities between workers in non-agricultural and agricultural activities. This was especially emphasised due to sharp deceleration in the growth of agricultural sector against an impressive growth of the larger economy which adversely affected the welfare of majority of the population dependent on agriculture.

With the objective to see how far different social and economic groups shared the overall decline in poverty in the 1990s, Sundaram and Tendulkar (2003) examined the levels and changes in poverty indicators of the rural and urban population among social and economic groups. The social groups most vulnerable to poverty were scheduled caste and scheduled tribe households with both these groups having ‘above average levels’ of poverty indicators in the rural and the urban population. Among the economic groups, the most vulnerable groups were the agricultural labour households (rural) and the casual labour households (urban) each having the highest levels of
poverty indicators in their respective population segments. In terms of changes in poverty in the 1990s, it was found that while scheduled caste, agricultural labour (rural) and casual labour (urban) households experienced declines in poverty on par with the total population, scheduled tribe households fared badly in both the segments. Among the economic groups, those dependent on casual daily wage labour in an environment of uncertain and fluctuating employment (agricultural labour households in rural India and casual labour households in urban India) reported the highest levels of poverty in rural India. Regular wage/salary earner households in urban India and the residual means of livelihood category of others (included rural wage/salaried households and those sustained on non-participatory income), reported the lowest levels of poverty. The agricultural labour households in the Scheduled Tribe (ST) population had the highest headcount ratio (HCR) (close to or above 60 per cent) for poverty in both years studied in rural India. Similarly, casual labour households in the (Scheduled Cast) SC population in 1993-94 and in the ST population in 1999-2000 reported the highest HCR of 64 per cent in urban India. This meant double disadvantage, of being an asset less casual wage labour household in the socially disadvantaged social groups of the scheduled castes or the scheduled tribes, accentuated the prevalence, depth and severity of poverty.

Bhagwati (2001) a strong supporter of the reform process observed that India long suffered from a mindless commitment to policies that were advertised in the public policy domain as remedies for poverty and destitution but instead of doing any good. They accentuated these tragic phenomena over decades. The economic reforms from 1991 onwards were meant to reverse the situation and made a successful contribution. But according to Bhalilah and Singh (2009) the initiation of economic reforms in India in 1991 brought about fundamental changes in the macroeconomic policy frame-work that existed in India during 1950-51 to 1990-91. This, in turn, was supposed to boost exports leading to rapid agricultural growth. But despite the changes in the macroeconomic policy frame-work and trade liberalisation, the agricultural sector in India neither experienced any significant growth nor did it derive the expected benefits from trade liberalisation. In fact when compared with the immediate pre-liberalisation period (1980-83 to 1990-93), agricultural growth in India recorded a visible deceleration during the post-liberalisation period (1990-93 to 2003-06).
Chand et al. (2007) held the view that more challenging than growth in total GDP was the sectorial composition of growth, which was related to the well-being of a very large segment of population. Agriculture, which accounted for more than 30 per cent of total GDP at the beginning of reforms failed to maintain its pre-reform growth or keep pace with growth in the non-agricultural sector. On the contrary, it witnessed a sharp deceleration in growth after the mid-1990s. This happened despite the fact that agricultural productivity in most of the states was quite low and there was a lot of scope and potential for the growth of agricultural output. Rao (2003) observed that the slowing down of agricultural growth in the post-reform period, despite the favourable macroeconomic environment, could be explained by the neglect of reforms directly affecting agriculture. Agriculture could be expected to derive the full benefits of reforms introduced so far only when reforms directly affecting agriculture were put in place. The role of government by way of public policies, programmes, and investment was going to be extremely important. Success depends crucially on effective governance at the grass roots level, as many of these programmes were going to be location specific.

Singh (2011) blamed the new economic policy regime in India since 1991 and concluded that agriculturists in general and the small and marginal farmers in particular were the worst sufferers from the onslaught of globalization. Putting the share of non-institutional sources of credit at about 40 per cent charging anywhere between 30-40 per cent interest per annum, the farmers are in a tough situation. The seriousness of challenges faced by farmers was highlighted by the large scale suicides committed by farmers one of the worst human tragedies.

Gulati and Bathla (2001) and Chand and Kumar (2004) studied impact of capital formation on Indian agriculture and they found that growth in capital formation was significantly related with growth of agriculture. Although capital formation in Indian agriculture had been either stagnating or falling since the beginning of 1980s macro-economic reforms further squeezed public investment, though there was rise in private investment it was not enough to meet the requirements. Vakulabharanam (2005) argued that the state had offered various input subsidies, especially in the provision of fertilizers, electricity and credit. It had provided infrastructural support (primarily in irrigation and electricity) and extension services to cultivators. It had also provided minimum support prices for agricultural
output. The policies after 1990, withdraw this support to the farming community. The reduction of domestic support in terms of subsidy and credit on the one hand and drastic price fall of agricultural commodities in the international market on the other hand led to distress in the farming class.

Patnaik (2005) tried to identify changing agrarian situation after reforms. He explained how neo-liberal policies introduced in the 1990’s affected peasant community by examining the fund allocation as proportion of Net National Product (NNP) to the rural development. This was expected to result in improving irrigation, and other heads of agriculture. According to the study this was reduced to 1.9 of NNP by 2001-02. Bhallah and Singh (2009) observed that by ending discrimination against tradable agriculture, economic reforms were expected to improve the terms of trade in favour of agriculture and promote its growth. It should be a matter of great concern for the policymakers that in this optimistic scenario, the agricultural sector should face a deceleration its growth rates of aggregate yield and output and the process of agricultural diversification should slow down. A more serious matter was that agricultural workers who constituted 58% of the total work-force faced deceleration in their productivity and income levels as well as distress during the post-reform period.

According to Kakarlapudi (2010), The remarkable rate of growth which was achieved by Indian economy since the inception of economic reforms process bypassed the agricultural sector, which showed sharp deceleration in the growth rate (3.62 per cent during 1984/85 - 1995/96 to 1.97 present in 1995/96 – 2004/05). Therefore rural areas, where majority of Indians lived was in severe agrarian crisis, which according to Patnaik (2005) was unparalleled since independence and reminded of the agrarian crisis of pre-war and war days. Mathur et al. (2006) observed that there had been a consistent decline in growth of the agriculture sector since 1990 compared to the 1980s. Instead of an average rate of 4 per cent per annum during the 1980s, the growth rate came down to 3.2 per cent during the 1990s. There was also a decline in the yields per hectare for a number of food crops in this period. This had serious implications on the nutritional status and food security of the country. According to the study the focus should have been on enhanced government expenditure particularly on investment in rural infrastructure comprising irrigation and water management, processing, storage and marketing, apart from timely supplies
of improved inputs, like credit, research and extension services etc. This was expected to have greater impact on value of food grain production and consequent implications for food security. Sharma (2011) observed that the major challenges faced by Indian agriculture were deceleration in growth rate, inter-sectoral and inter-regional equity, declining input efficiency, degradation of natural resources, etc., which in turn had adverse effects on food and nutritional security, food inflation and poverty reduction.

According to Thakur et al. (2005) India would be the most populous country of the world with more than 1.4 billion people by the mid twenty first century; in this context, agriculture and food security were the most important concerns of the 21st century. Swaminathan (1990, 1996a & b) believed that with the greying of green revolution, the Punjab agriculture as well as the overall Indian agriculture was in crisis. In his study on farmer suicides Mishra (2007) observed that Indian agriculture was in crisis. With the result, post-reform agrarian scenario was a story of distress, despair and death. An extreme form of response to this crisis was the increasing incidence of farmers’ suicides. He found that 40 per cent of the farmers did not want to continue in the profession.

Thakur and Sharma (2005) observed that inorganic farming system had made agriculture costly, risky, economically unviable and ecologically unsustainable. They suggested other methods like organic farming system as an effective cure for the ills and problems of inorganic farming system as it promoted activities of soil microorganisms, improved soil structure, soil health and soil productivity which led to increase yields, production, income and profits of crops on sustainable basis. Gopalan (2001) concluded that current methods of food production and consumption were imposing a severe burden on the environment and the constituent natural resources.

Singh (2000) in his study, 'Crisis in Punjab Agriculture' found that the factors for decline of Punjab agriculture were in the unsustainable technology, over mechanisation, monoculture, etc. adopted under Green Revolution in 1960s and 1970s. Singh and Joshi (1989) pointed out the problem of receding water table in Punjab. Gulati and Sharma (1995) were critical of subsidies on inputs which had resulted in skewed and unsustainable use of inputs. For instance, subsidies on urea have resulted in unbalanced use of nitrogen (urea), phosphorous (phosphate) and
potassium (Potash) fertilizers and aggravated deficiency in use of micro nutrients. Subsidies on irrigation through electricity and canal water led to the cultivation of water intensive crops such as rice in Punjab and sugarcane in Maharashtra. Moreover, subsidies on electricity and diesel encouraged big farmers to install large capacity pumps for drawing underground water. This had an adverse impact on the level of water table and the ability of small and marginal farmers to irrigate their farms.

Galab and Reddy (2006) considered technological, ecological, socio cultural and policy related factors responsible for the crisis in agriculture. Chand et al. (2007) and Chand (2005) observed that the main factors which led to a slowdown in agriculture at national level after 1996-97 were decline in the area under cultivation, which seemed to be a result of expanding urbanization and industrialisation, deterioration in the terms of trade for agriculture, stagnant crop intensity, poor progress of irrigation and fertiliser, decline in supply of electricity to agriculture, and slowdown in diversification.

Dhas (2009) observed that due to the on-going structural changes agricultural sector in India was facing a crisis. With the result India was moving towards a point of no return, from being a self-reliant nation of food surplus to a net importer of food. Non profitability of agriculture was the root cause of crisis. It also had adverse effects on food supply, prices of food grains, cost of living, health and nutrition, poverty, employment, labour market, land loss from agriculture and foreign exchange earnings. Giving a comprehensive coverage to the reasons behind present crisis in Indian agriculture Reddy and Mishra (2008) traced the roots of present crisis in Indian agriculture since mid-1980s. When agriculture fell from policy priority under the assumption that the country had achieved sustainable self-sufficiency in food grain production and therefore preferential and institutional interventions were not needed any more. Crisis in agriculture was well underway by the late 1980s and the economic reforms beginning in the 1990s only deepened it.

Suri (2006) outlined various reasons for the on-going agrarian crisis in the country. According to him one of the reasons for agrarian distress in India was the conjunction of the changing nature of agriculture and democratic politics. The inability of farmers to unite and bring pressure on the governments and a disjunction between the interests of the farmers and those of the political representatives, led to the neglect of agriculture and deterioration in the condition of farmers. Suri (2007)
observed that the agrarian distress was the result of the policies pursued by
governments over the years. Other factors such as changed cropping pattern due to a
shift to cash crops, liberalisation policies which prematurely pushed Indian agriculture
into the global markets without a level-playing field, heavy dependence on high-cost
inputs, growing costs of cultivation, volatility of crop output, market vagaries, lack of
remunerative prices, indebtedness, neglect of agriculture by the government and
decline of public investment further contributed to the agrarian crisis. Mishra (2007)
and (Reddy and Mishra, 2008) observed that the major reasons responsible for
agricultural distress were vagaries of nature (primarily, inadequate or excessive
water), lack of irrigation facilities, market related uncertainties such as increasing
input costs and output price shocks unavailability of credit from institutional sources
or excessive reliance on informal sources with a greater interest burden and new
technology among other.

Climate change and its potential impacts on agriculture were addressed by
several studies. Seshu and Cady (1984) estimated a decrease in rice yield at the rate of
0.71 ton/hac with an increase in minimum temperature from 18°C to 19°C and a
decrease of 0.41 ton/hac with a temperature increase from 22°C to 23°C. Sinha and
Swaminathan (1991) showed that a 2°C increase in mean air temperature could
decrease rice yield by about 0.75 ton/hectare in the high yield areas and by about 0.06
ton/hectare in the low yield coastal regions. Also, a 0.5°C increase in winter
temperature would reduce wheat crop duration by seven days and reduce yield by
0.45 ton/hectare. Additionally an increase in winter temperature of 0.5°C would
thereby result in a 10% reduction in wheat production in the high yield states of
Punjab, Haryana and Uttar Pradesh. The study by Achanta (1993) concluded that the
impact on rice production would be positive in the absence of nutrient and water
limitations. Rao and Sinha (1994) in their crop-simulation study estimated that under
a 2 times carbon dioxide climate change scenario, the wheat yields could decrease by
28%–68% without considering the carbon dioxide fertilization effects. Aggarawal and
Sinha (1994) showed that in North India, a 2°C increase would reduce yields in most
places.

Roy (2013) emphasised the importance of agriculture for developing
economies, as the core sector providing a livelihood to a significant proportion of the
population, especially in rural areas. He suggested that there was a need to increase
yields to their technically highest levels through appropriate investment in basic infrastructure, human development, and research and extension services. In a country like India agriculture continued to be the core sector of the economy, on which over 60 per cent of our population was dependent for their livelihood. Ramakrishna and Rao (2008) observes that availability of land was an important constraint for Indian agriculture, therefore future of India's food security depended on productivity however at farmer's level sustainability concerns were being expressed because the input levels had to be continuously increased in order to maintain the yield at the previous level which posed a threat to the economic viability and sustainability of crop production.

Fan et al. (1998) estimated Total Factor Productivity (TFP) for agriculture at state-level using Tornqvist-Theil index for the period 1970-1994. The study found that total factor productivity for India grew at an average annual rate of 0.69 per cent between 1970 and 1995. While total factor productivity improved rapidly in the seventies at 1.44 per cent per annum, it grew faster in the 1980s (1.99 per cent per annum). Since 1990 however total factor productivity growth in Indian agriculture declined by 0.59 per cent per annum. The study reported state-level estimates- for whole period 1970 to 1994, the states with TFP growth rate in the range 0-1 per cent per annum were Andhra Pradesh, Karnataka, Uttar Pradesh, Himachal Pradesh and Kerala; with TFP growth rate greater than one are Punjab, Bihar, Orissa, Maharashtra, West Bengal and J&K. The states with negative TFP growth were Haryana, Madhya Pradesh, Gujarat, Assam and Rajasthan.

In examining the critical issue of long-term productivity and sustainability of irrigated agriculture in the Punjab regions of Indian and Pakistan Murgai et al. (2001) found that India experienced much higher and more rapid growth of yields for food crops. Most of India's higher growth however was attributed to rapid growth of inputs. The study also raised serious concerns about the long-term sustainability of intensive irrigated Green Revolution systems due to resource degradation and stagnation of cereal output in recent years. Kumar and Mittal (2006) showed concern about the sustainability of crop productivity. Agriculture in recent years, experienced diminishing returns to input-use and a significant proportion of the gross cropped area had faced stagnation or negative growth in TFP. The problems of waterlogging and soil salinity developed sooner or later in many irrigation project areas due to over-
irrigation and deep percolation and seepage losses in the absence of a suitable drainage system. Due to the degradation problems, growth in TFP did not make headway across a substantial area of the country.

Kumar et al. (1998) considered sustainability of the Rice Wheat Cropping System (RWCS) in the Indo-Gangetic Plains (IGP) critical for the country's public distribution system and food security. According to them production system was under due to stagnating or declining crop productivity, and adversely impacting sustainability. The found yield growth was more input based. The use of modern inputs (for example, adoption of high-yielding varieties, irrigation, chemical fertilisers, pesticides, etc) in IGP had already been achieved. The organic sources of nutrients, like organic manure and legumes area, were rapidly declining in the RWCS. Further scope of increasing yield of rice and wheat from modern inputs and area expansion seemed remote.

According to Kumar et al. (2004) the TFP index of the crop sector in IGP rose by 1.2 per cent annually during 1981-1997. It was the highest in the LGP (3.1 per cent) followed by the TGP (1.4 per cent), UGP (0.9 per cent) and lowest in the MGP (0.4 per cent) respectively. Productivity alone contributed one-third to the total output growth in the IGP, however the performance of TFP was more impressive during the 1980s than in 1990s. The sustainability issue of the crop sector in IGP is fast emerging being more serious in the MGP. The ecological problems have cropped-up in a large number of districts in the IGP as a result of depletion/pollution of groundwater resources, build-up of soil salinity and waterlogging, nutrient mining, micronutrient deficiencies, deteriorating water quality, formation of subsoil compaction, and increased pest build-up. At the farm level, long-term changes in the biophysical environment have manifested in terms of declining TFP growth. Dev, (2009) identified many policy challenges for Indian agriculture like improving productivity and moving towards high-value agriculture and promoting rural non-farm sector by maintaining food security for reducing poverty and hunger. Deficiency in agricultural and rural infrastructure is the biggest problem for agricultural development. India's large numbers of farmers and poor can benefit if there are right policies and effective implementation.
Research Gap:

The vast amount of literature available on Indian agriculture showed that although there were various studies on sustainability of Indian agriculture. They were mostly restricted to certain states or specific crops. There was hence a need to carry out a study on sustainability of agriculture which would look at the issue across all states and for all crop groups. The present study is an attempt to fill this gap. Moreover, an attempt has been made to establish an association between agriculture productivity and poverty reduction for the country as a whole.

Raising the Questions:

The study looks at Indian agriculture in the backdrop of changing structure of Indian economy after the initiation of economic reform programme. While the economic reforms lead to unprecedented economic growth, questions were raised on the inclusiveness of this growth process, where by some sections in the society and some sectors in the economy were left behind. Consequently, reduction in poverty reduction was not as expected, instead there was a fall in the rate of poverty reduction compared to earlier periods. Moreover performance of agricultural sector was disappointing which was reflected in the slow growth of this sector and growing number of suicides by farmers as a result of indebtedness. Following questions have been addressed in the present study; how Indian agriculture performed during the reform period? What kind of the crisis was Indian agriculture facing? Was Indian agriculture sustainable? Was the post reform economic growth inclusive in terms of poverty reduction? And was there any relationship between agricultural sustainability and poverty reduction in India?

Rationale of the Study:

India achieved unprecedented growth of 7-9 per cent annually in the past several years. While it had some of the world’s richest billionaires it also had millions and millions of people still living in poverty, especially in rural areas. India however had a huge poverty problem with a third of the world's poor living in India. To aggravate the situation average income in the richest states of India was five times the average in the poorer states. The resulting growing economic inequality had many social and political implications. Productive employment and human development were necessary to achieve economic and social empowerment of the poor. This
requires rapid broad based labour intensive growth. India’s recent reforms, unlike China’s were not directed at agriculture. Today there is a renewed policy focus on agriculture in India, because many believe that the full poverty reduction potential of agriculture in India has yet to be tapped. Despite impressive growth and poverty reduction in the 1990s, the picture of overall welfare gains was compromised by the existing income inequalities. The World Development Report (2008) on agriculture, and food crisis of 2007-08 pushed issues of agriculture growth and food production to the top of development agenda. The Millennium Development Goals (MDGs) will not be achieved without improvement in the growth and productivity of agriculture as majority of the poor were still dependent on this sector. Indian agriculture is facing the challenges of falling productivity, climate change, rising input costs resulting in fall of profits, increasing number of farmers suicides (256913). Generally the growth in the agriculture sector remained less than the overall growth in the economy throughout the planning period. The situation in ninth and tenth plans was however even worse, with agricultural sector registering a growth rate of mere 2.8 per cent per annum (at 1999-2000 prices). Since agriculture in India even today supports more than half a billion people by providing employment to 52 per cent of the workforce, urgent measures are required to arrest the decelerating trend.

**Objectives of the Study:**

On the basis of issues raised the study has following objectives

- To study the performance of Indian agriculture during the reform period;
- To examine the crisis faced by India agriculture;
- To measure the sustainability of Indian agriculture;
- To ascertain whether post-reform growth process had been inclusive in terms of poverty reduction;
- To empirically study the relationship between agricultural productivity and poverty reduction in India.

**Sources of Data:**

The study is based on secondary sources of data collected from different official sources of the government of India. The various sources included are publications and official websites of GOI, National sample Survey Organization
Sustainability of Indian Agriculture was measured using state level data input use and outputs, collected under the comprehensive scheme for studying cost of cultivation of principal crops by the Directorate of Economics and Statistics, Ministry of Agriculture. The missing year data were predicted using the interpolation based on the trends available in the data. The output and inputs used in the study were in quantities to avoid the anomalies in price information. This was also in accordance with the non-parametric (Data Envelope Analysis) DAE approach. In fact one of the important advantages of non-parametric DEA approach is that price information is not needed.

In order to establish an empirical relationship between productivity and poverty, the study used 2004-05 estimates of poverty and yield. Poverty was measured in terms of (Head Count Ratio), i.e., proportion of population living below poverty line. While yield was taken as Tonnes per Hectare of Rice district wise. The poverty estimates were calculated from the unit level data of National Sample Survey Organization’s Consumer Expenditure Survey held in 2004-05. The yield is taken from the data published by Directorate of Economics and Statistics government of India. The year 2004-05 was a normal Agricultural year while 2009-10 was a drought year that is why this study is based on a distant year even when we had more recent data available. The study also uses percentage of SC/ST population, level of literacy in the country both were taken from NSSO’s Employment Unemployment Survey for the year 2004-05.

**Period of the Study and Limitations**

In order to empirically measure the sustainability of Indian agriculture the time period selected was 1996-1997 to 2009-2010. The logic here was to restrict the
study to time period after the signing of the agreement of World Trade Organization (WTO) in 1995. Since economic reforms programme initiated in 1991 had no direct impact on agriculture but the signing of WTO directly influenced agriculture though with a time lag involving of coming into force of various agreements signed. Therefore was assumed that post WTO period was uniform in terms of policy followed. For empirically establishing an association between agricultural sustainability and poverty reduction year 2004-05 was selected. As it was a normal agricultural year and poverty estimates were also available for this year from 60th round of NSSO survey. Year 2010 was not chosen because it was a drought year.

As the analysis involved the study on sustainability of Indian agriculture and included many crops which involved lot of data entry and evaluation therefore time period selected for the study is comparatively shorter. For analysing sustainability of wheat Uttar Pradesh an important Wheat producing state could not be included because of missing data on inputs used and output produced. For studying the relationship between productivity and poverty reduction, the study is based on a single year cross section data set.

The study deals with the post-reform period starting from 1991 mainly up to the year 2010. To make comparisons between the two time periods i.e., pre-reform and post reform periods, the decade of 1980s was however considered as pre – reform time period.

Organization of the thesis

The thesis comprises of seven chapters. A brief outline of the chapters is as follows:

Chapter one is an introduction of the study. It includes review of literature of studies pertinent to the topic of the thesis, and research gaps. The chapter also gives the rationale of study, the limitations and time period of the study, and the objectives of the study.

The second Chapter deals with the concept of sustainable agriculture and various methods used for measuring agricultural sustainability, the chapter explains the concepts of technical progress, productivity growth, efficiency, the concept of total factor productivity (TFP) and various methods used for measuring (TFP), which
broadly include (i) parametric approach, (ii) accounting approach and the (iii) Non-
parametric approach. The chapter also deals with the methods used in present study.

Chapter three deals with various aspects of Indian agriculture during the
reform period giving a detailed account of the process of structural adjustment and its
influence on agriculture, it deals with growth performance of agriculture in terms of
contribution to GDP and crop wise growth performance in Indian agriculture. The
chapter also assesses capital formation, irrigation potential generated, fertilizer
consumption and agricultural credit during the reform period. The process of
diversification and sources of growth in Indian agriculture have also been examined.

Chapter four deals with the crisis faced by Indian agriculture and give a
detailed account of various types of issues and challenges in Indian agriculture, viz,
population and employment burden on agriculture, declining size of holdings, farmer
suicides, farmer indebtedness. The chapter also gives a detailed account of various
types of ecological crisis faced by Indian agriculture like degradation of resources i.e.,
depletion and degradation of land and water resources. Issues in irrigation and
vulnerability of Indian agriculture to climate change were also examined.

Chapter five mainly deals with the measurement of sustainability of various
crop groups cultivated in India. It also looks at productivity and sustainability of
Indian agriculture.

Chapter six deals with the issues of poverty and sustainable agriculture
development in India the concepts of poverty; poverty trends in India are discussed.
Moreover an assessment of distribution of poor in India across various states and
sections of the society, various poverty alleviation strategies during different five year
plans was also done. The concept of pro-poor and inclusive growth is also explained
finally the chapter explains relationship between agricultural sustainability and
poverty reduction. An attempt was also made to explain the relationship between
agricultural sustainability and poverty reduction by using an empirical analysis of the
relationship between agricultural productivity and poverty reduction.

Chapter seven is a summary of the findings of the study. It also gives some
suggestions on the basis of the findings of the study for improving the linkages
between sustainable agriculture and poverty reduction.