Chapter-I

Introduction

The importance of the estimation of agricultural productivity, the inter-relationship between productivity and institutional reforms, institutional reforms as a carrier of agricultural development and economic development, has not received much attention in various development discourses in social sciences, particularly in economics. Rather, it was felt that the evolution of the theoretical discourse on development and the status of agriculture there in, was a contested issue. Therefore, the evolution of theoretical discourses on agriculture-related development and how agriculture as a basic economic activity has been placed therein, needs to be verified. Looking back at the classical age of economics, agriculture was identified as one of the prime economic activities of human civilisation that ensured food security and a way to enlarge livelihood opportunities. The interplay between agriculture and population growth was brought into debate by Malthus and Ricardo in the late 18th century and early 19th century. According to the classical paradigm, additional population is absorbed by agricultural growth at the extensive and intensive margins, both of which result in diminishing returns to labour. Extensive growth occurs through the expansion of cultivated land, which Ricardo (1817) presumed to be more distant from or of poorer quality than land already in use. Growth at the intensive margin likewise results in diminishing returns, due to the greater amount of labour and other inputs employed on the fixed quantity of previously cultivated land. As a consequence, Ricardo (1817) and Malthus (1798) theorized that wages would eventually decline towards a subsistence level, where population growth would cease due to 'positive checks' such as starvation and disease.

Cursory look at literature on economic development made it clear that if the1950s and early 1960s were dominated by the planning approach, then the rest of the 1960s was in the sway of 'dualism'. The various models on 'dualism' justified the import protection of industry on the ground that marginal product of labour in agriculture was relatively low. A. W. Lewis formulated a structural change model (1954) that explained how a 'capitalist' sector could develop by drawing labour from a non-capitalist 'subsistence' sector. The existence of 'surplus labour' in the subsistence sector ensured that during an extended period, wages in the capitalist sector remain constant because the supply of labour to the capitalist sector exceeds demand at this wage rate. The surplus of output over wages is

captured by the capitalists as profits. Within the capitalist sector, growth occurs as the share of profits in national income rises and is directed to profitable investment. Unlimited supplies of labour (opposed to the classical assumption of fixed supply of labour) ensure that capital accumulation is sustained over time, but the dynamics of the economic forces play a vital lead towards economic transformation.

Dualistic models conceived by Lewis (1954), Ranis-Fei (1961), Jorgenson (1961, 1966) etc. also treated agriculture as catalytic agent for industrial development vis-à-vis economic development. Industrialisation was considered as synonym of development and agriculture was treated as mere agent for its 'product contribution', 'factor contribution' and 'market contribution' (Kuznets, 1961). However, it has increasingly been felt that achieving high industrial growth does not always help to remove the problems of unemployment and poverty in many less developed countries. Dependence of many people on agriculture and less emphasis on agricultural development might be one of the causes among many for the persistence of unemployment and poverty in many less developed countries (Todaro, 1977). As a consequence, role of agriculture on economic development had started gaining importance in economic literature on 'dualism'. Works of Coale and Hoover (1958), Dovring (1959), Johnston and Mellor (1961), Mosher (1966), Mellor (1966), Myrdal (1968) are few among many that can be cited for ready references. It was argued by them that standard of living of the poor would not be raised if terms of trade moves against the people who derive livelihood from agriculture. In their studies, it was identified that agriculture can potentially contribute in providing firstly, food and fibre for an expanding population with increase in purchasing power; secondly, providing capital for economic transformation; thirdly, helping out to enhance rural welfare; and finally, protecting the prospect of business cycle of foreign trade and industrial production.

Walras (1874) and Pareto (1906), on the other hand, had shown that transaction helps free competitive market to reach equilibrium through a process of efficient resource allocation and redistribution of resources, thus enabling the economy to reach a socially optimum point. Here institutions are taken as sacrosanct and emphasis was only on achieving market perfection.

Mellor and Lele (1973) and Mellor and Johnston (1984) formulated their development model where the major emphasis was given on the inter linkages between agriculture and non-agricultural sector. There are production linkages – backward and forward. Backward linkages relate to the demand of farmers for inputs while forward linkages are linked to the

need for processing of agricultural commodities. Moreover, there are consumption linkages. As agricultural income rises, it creates higher demand for non-farm goods produced locally or in neighbouring villages or towns. Finally, there are linkages through the supply of labour and capital. As agricultural productivity rises, either labour is released or wages go up. Also, agricultural surpluses could finance expansion of the non-farm sector. And the latter in turn could stimulate agricultural production through lower input costs, technological change and reinvestment of profits into farming.

Keith Griffin (1974) then rightly pointed out that debate was no longer moving around industry versus agriculture rather, a whole gamut of analysis started evolving around in conceptualizing different strategies for agricultural development, especially in less developed countries. The outcome though varies considerably because each country is having her own specific structure with own political power specificity.

Development economics remained preoccupied with 'growth with equity' during the decade of seventies and failure of market was endorsed. Integrated Rural Development backed by subsidies and government intervention was mostly advocated for agricultural development, although accountability of subsidies became questionable (Binswanger, 2004). Confiscatory land reform with wide range of input subsidies was used by many countries to ensure agricultural growth and equity. Rising factor productivity and introduction of new technologies ensured growth in agriculture (Federico, 2005). As a matter of fact, prior to the publication of Schultz's *Transforming Traditional Agriculture* (1964), the general belief was that peasant farmers were tradition-driven, ignorant, lazy and backward. Schultz showed that limited resources including human capital, stagnant technology caused poverty among peasants, while slow decision making had never been the case. And in late sixties, high-yielding varieties of rice and wheat were introduced in Asia and Latin America and rapid adoption of these varieties by the farmers and concomitant changes in foodgrain yield was popularised as Green Revolution. But in the eighties, government failure in production and distribution became a much talked issue and 'privatisation and getting price right' regained prominence in development thought. Trade-led growth and outward orientation of agriculture gained more importance in developmental policies (Clarete and Roumasset, 1987; Krueger *et al.*, 1988, Gardner 1996).

While developing the above models for economic development as well as agricultural development, market has always been considered as sacrosanct.

International Fund for Agricultural Development (IFAD, 2001) rued on the fact that whole question of poverty needs to be looked at in the context of rural world and to them, 'current development efforts grossly and increasingly neglected agriculture and rural people.' Aid for agricultural development in least-developed countries was reduced by two-thirds during 1987 to 1998; in spite of the fact that world's 85 percent poor are living in least-developed countries. It was observed that since 1980 and onwards, economics of agricultural development lost its importance in development economics (Roumasset, 2006). De Soto (1989, 2000), Ostrom (1990, 1992), Dixit (2006) to name only a selected few, were of the view that mark*et* alone cannot take care of everything until the institutions are becoming perfect. They also opined that property rights need to be defined properly to achieve the goal of Walras and Pareto per se.

Now from institutional perspective, agrarian structure may be defined as the subset of institutions governing the distribution of rights in agriculture means of production, precisely land. These rights include not only ownership but also such arrangements as tenancy and mortgage which create a divergence between ownership and actual operation. And this divergence between ownership and actual production or putting it in larger perspective, the agrarian structures more than often affects the agricultural production. To deal with land tenure system, share cropping which is considered as integral part of feudal society has emerged as one of the most dominant agrarian relations and was in prevalence in some pre-capitalist and pre-socialist societies from ancient period. It was and it is most prominently visible in most of the third world countries. Marquis de Mirabean observed that share tenancy is a 'deplorable method of cultivation, the daughter of necessity and mother of misery' (quoted in Higgs, 1894). The high degree of variability of effective resource endowment among the peasantry gave birth to labour-hired capitalists and rich peasants, self employed middle and small peasants and poor and hired peasants (Patnaik, 1994:156). Pearce (1983) had explained share cropping from the Marxist perspective. According to him, share cropping is a method of surplus appropriation by which surplus labour is transferred to the landlord in the form of surplus product. Even though share tenancy has always been identified as inefficient system[1] by the early neo-classical economists like Adam Smith (1937:367) and Alfred Marshall (1948:648), but to them, peasants are a homogeneous category and consist of owner and tenants.

It is, however, perceived that fixed rent tenancy (either in cash or kind) is a better option for a tenant[2]. Bhaduri (1973)[3] showed that semi-feudal landowners preferred to keep the

tenants in perpetual indebtedness and to keep the income of tenant low, they did not want to invest in technological innovation in agriculture.

To remove the inefficiency and inequity that share cropping entailed, redistributive policy was envisaged in the form of land reform or agrarian reform. In broader perspective, land reform means redistribution or reallocation of rights to establish a more equitable distribution of farm land (Boyce *et al.*, 2005:1). In addition to this, state sponsored land acquisitions, communal or collective forms of farming, and changes in land tenure pattern, that is, changes in the rent sharing arrangement between land owners and actual tillers of the land, are considered as different variants of land reforms (Griffin *et al.*, 2002: 3-4). In recent past, 'market led agrarian model' (Deninger and Binswanger, 1999:247-76) and 'negotiated' land reform that relies on voluntary land transfers between buyers and sellers with government's role restricted to establishing necessary framework for negotiation and making land purchase grant available to eligible beneficiaries, is gaining importance (Deininger, 1999:3, Ghonemy, 1999, Reidinger *et.al.*, 2000).

In the context of Indian agriculture, especially in the post-independence period, many attributes of aforementioned theoretical discourses find strong relevance on changing agricultural policies in India. Most of the dualistic models though either proved to be incompatible in the Indian context but development through planning and bringing in institutional changes to ensure 'growth with equity', strong government intervention in redistribution of scarce resources, and bringing in techno-biological changes in agriculture, influenced the policy formulations in the first two and half decades in post independence period. India resorted to a policy of comprehensive economic reforms in June 1991. The reforms brought significant changes in macro economic policy including trade and exchange policy, especially in the external sector. It is assumed that once the prices were be corrected through the free play of market, farmers would be able to realised a better price for their agricultural produce and they would be encouraged to produce more.

1.1 Background of the Study

1.1.1. Agricultural Systems in pre-Colonial and Colonial Period

The agrarian structure during British administration emerged with a strong historical background (Baden Powel, 1974; Dutt, 1976; Appu, 1996). The possible beginning of the systematic efforts (measurement, classification and fixation of rent etc.) to manage the land could be traced back to Akbar's regime and was implemented by Todar Mal. Under the various pre- British regimes, land revenues collected by the state confirmed its right on land. The central feature of agrarian system in pre-British India was the extraction of surplus produce from the peasants by means of land revenue. People were primarily agriculturists or land tillers (*raiyats*) and semi agriculturalists (rural artisans, professionals) who derived their living from land. Low productivity of labour and production for survival forced the people to be tied up with the land. The pre-colonial village economy was characterised by low productive in agriculture and low forms of industries and was organised hierarchically within the framework of the subsistence economy. In agrarian structure, *zamindars* were placed at the top and *raiyats* were at the bottom and the in between place was occupied by *taluqdars* and *ijaradars*. Whatever agricultural surpluses were generated thus was extracted by the government through taxation. Therefore, capital accumulation and exchange were ruled out and *raiyats* were left with no option but to remain confined within simple reproduction system of self-subsistence village system. The manufacturers and artisans, who settled or were asked to settle in the Mughal cities, were allowed to do so for not to cater to the need of the expanded market but to cater the needs of aristocracies and cantonment regiments. Unlike Europe, exchange of rural surpluses with urban manufacture never evolved, as a result of which village society was subject to exploitation and urban aristocracies did not provide any protection or benefit to the village society (Islam, 2009:38-41).

British rulers took a cue from this system and allowed the existence of non-cultivating intermediaries (Deshpande, 2003). The existence of these parasitic intermediaries served as an economic instrument to extract high revenues (Dutt, 1947) as well as sustaining the political hold on the country. Three land revenue systems were used by the British where the primary intention was to define who had the liability for paying land tax to the British and consequently who had the property rights on the land. In Bengal, Bihar, Orissa, the Central Provinces (modern Madhya Pradesh State), and some parts of Madras presidency (modern Tamil Nadu and Andhra Pradesh States), landlord systems were introduced and

landlords were put in charge of collecting revenue. In Madras and Bombay Presidencies as well as in Assam, revenue collecting process had directly been settled with the *raiyat* or cultivator and this system was known as *raiyatwari* system. The village-based or *mahalwari* system was advocated in North-West Provinces and Punjab and where village bodies that jointly owned the village were responsible for revenue collection. Irrespective of type of land revenue system in practice, land revenue continued to be the major source of government revenue, as a matter of fact in 1841, land revenue constituted 60 percent of total British government revenue. As a matter of fact, the consolidation and expansion of British rule over India was started from Bengal. One of the major reasons of the British East India Company to pursue revenue collecting right in Bengal presidency was to establish a monopoly over the lucrative textile trade in Bengal and highly productive fertile land of Bengal. The statement made by Lord Cornwallis, the then Governor-General of Bengal in 1790 corroborated this fact, by stating, 'we have, by a train of most fortunate events, obtained the dominion of one of the most fertile countries on the face of globe, with a population of mild and industrious inhabitants, perhaps equal to, if not exceeding in number, that of all other British possessions put together' (Firminger, 1917: 542). Introduction of Permanent Settlement in 1793 and subsequent changes in land settlements by the British government did not succeed to bring in the private investment for agricultural development in Bengal and also failed to break the spiral of exploitation meted to the sharecroppers by the *zamindars*, *jotedars*, intermediaries of varied nature and money lenders. This adversely affected the agricultural production and productivity in Bengal. Therefore, during the British rule, the agrarian structure was controlled by parasitic, rent-seeking intermediaries, under different land revenue and ownership systems across regions. It was further characterised by few land holders holding a large share of the land, a high density of tenant cultivators, many of whom had insecure tenancy, and exploitative production relations (Appu, 1996).

1.1.2 Agricultural Systems in post-Independence Period

To achieve greater productivity and production and to ensure distributive justice for landless farmers in the post independence period till pre- Green Revolution period (1964-1965), major policy thrust revolved around land reforms. These objectives were to be achieved by 'abolishing all intermediary interests between the State and the tiller of the soil, regulating rent, conferring quasi rights to tenants to ensure security of tenure, and, eventually, ownership rights, imposing ceiling on agricultural holdings, distributing

surplus land among the landless and the small holders and bringing about the consolidation of holdings' (Report of the Task Force on Agrarian Relations of the Planning Commission). It is evident that possible inverse relationship between operational holding and output per acre (Sen, 1962), provided a logical basis for arguing that small farms exhibited higher allocative efficiency and favoured a redistribution of land to landless. In spite of the fact that the ceiling legislations which were passed by most states by 1961, till the end of 1970 not a single acre was declared surplus in large states like Bihar, Mysore, Kerala, Orissa and Rajasthan. In Andhra Pradesh, a mere 1400 acres was declared surplus but no land was distributed (Chandra *et al.*, 2007: 538). Few states indeed performed relatively better in distributing surplus land, Jammu and Kashmir has redistributed 17 percent of its operated area, West Bengal 6 percent and for Assam the figure stands at 5 percent. Expansion of minor irrigation also got the prominence. In the First Five Year Plan, about 17.5 percent of plan outlay was allocated to agriculture and about 22 percent to irrigation, multi-purpose irrigation and power projects. Therefore, between 1949-50 and 1964-65, the rise in production was mostly driven by rise in area under cultivation (Narain, 1977; Vaidyanathan, 1986). In the second Five Year Plan, however, the focus shifted from labour-intensive agriculture and small scale production to large-scale capital intensive heavy industry (Dantwala, 1986). The slow growth of irrigation contributed to the slow growth of productivity in Indian agriculture.

As a consequence, foodgrain production during the first three five year plan remained static and country was facing crisis in foodgrain production. To avert the famine like situation and to make the country self sufficient in foodgrain production through the introduction of land saving biological innovation was introduced in 1965-66. The High Yielding Varieties (HYVs) of wheat developed at CIMMYT in Mexico was introduced in the North-Western states like Punjab, Haryana and Western Uttar Pradesh. Subsequently, rice from International Rice Research Institute (IRRI), Manila and the Phillipines was introduced which made the beginning of Green Revolution in India. Government also provided incentives to expand private tube-wells and chemical fertilisers since assured irrigation and chemical fertilisers are prerequisites for HYV varieties. Since the first Green Revolution in the 1960s, the country's foodgrain production has increased significantly from 74.2 million tonnes in 1966-67 to 129 million tonnes in 1980-81. This helped the country to meet out food security and attain self sufficiency especially in the production of our staple food, rice and wheat. The period of 1980s was also identified as the period of

'wider technology dissemination' (Chand, 2004) to larger areas and more crops. In 1980s, a healthy upsurge in agricultural growth rates was observed and the rise in growth was driven by major rise in rice production in the eastern region or more precisely in West Bengal and there was major improvement in the production of oilseeds in the central Indian region. The high growth rate in foodgrain production and productivity achieved during 1980s though could not be sustained during 1990s. Growth of most of the crops was decelerated. Fall in productivity had pulled down the growth of production of rice. Wheat and pulses also experienced fall production and productivity. Consequently, the country experienced fall in the growth rate in area, production and productivity of foodgrains in the 1990s.

If turn around in Indian Agriculture is much attributed to Green Revolution, then the agricultural success story in West Bengal is primarily driven by land reforms, more precisely by the tenancy reform which is commonly known as operation *barga*. It was revealed in various studies that although the legislations of land reform were in place there was a tendency of underreporting and concealment of the tenancy status during the 1960s and 1970s (Bandopadhyay, 2003: 879; Ghosh and Dutt, 1977).

The tenancy reforms in West Bengal got impetus after the Left Front Government led by the Communist Party of India (Marxist) assumed power in 1977. In the late-1970s and early 1980s, under operation *barga*[4] the names of the thousands of unregistered sharecroppers have been recorded and redistribution of surplus land over legal ceiling among the landless rural people have been carried over through the process of vesting of '*Patta*' or a quasi land-right. The process got further impetus with the introduction of rural local self-governance through elections to three-tier *Panchayat* system (Bhattacharyya, 2001). In quantitative terms, over 1.6 million sharecroppers were recorded and got the hereditary right to cultivation. About a million acres of vested land were distributed among 2.5 million beneficiaries who were landless or land-poor peasants. Half a million households were given title to homestead plots. Land reform thus directly benefited a significant proportion of the rural population in West Bengal (Bandyopadhyay, 2003). While carrying out agrarian reforms (distribution of ceiling surplus land and tenancy reform) within the framework of three-tier *panchayat* or grass root level governance, minimum wages for agricultural labourers were also ensured (Bhattacharyya and Bhattacharyya 2007: 65). *Panchayats* also played an important role in conflict resolutions at grass root level and they resolved the matters relating to water, labour use or wage and

social disputes (Gazdar and Sengupta, 1996:175; Rawal and Swaminathan, 1998:2601; William, 1999:235). *Panchyats* also played an active role in executing centrally sponsored schemes of employment, expanding rural infrastructure, especially rural roads maintained by the *Zilla Parishads*, ensuring distribution of package of seeds, fertiliser and pesticide and maintenance of tube-wells for irrigation of both high and medium capacity. All these activities carried on by *panchayats* were bound to have an impact to enhance agricultural production and productivity in the state (Chakraborty, 2002, Bardhan and Mookherjee 2004).

However, West Bengal passed through a long spate of agricultural stagnation till the beginning of 1980s. The path-breaking study of James Boyce (1987) explored the nature and causes of agricultural stagnation in West Bengal and Bangladesh and estimated that between 1949 and 1980, the agricultural output grew at much lower rate annually in comparison to the rate of growth of rural population and total population of West Bengal and this resulted in an impasse in agricultural production and had unfavourable distributive impact on the rural population. The abysmal growth of aman rice was identified as the root cause of agricultural stagnation in West Bengal by Boyce. The Green Revolution technology also made late inroads in eastern region including West Bengal. A. Vaidyanathan (1987: 2259) based on his study on eastern region in 1977-78, reported high incidence of poverty with accompanied by sluggish performance in agriculture. However, since 1980s, a significant improvement in agricultural growth was observed in eastern region, especially in West Bengal. Studies by various scholars reaffirmed that post-eighties can be treated as the end of 'agricultural impasse' in West Bengal.

A phenomenal increase in rice production was observed during late-eighties in West Bengal. Saha and Swaminathan (1994), Rawal and Swaminathan (*op.cit.*) found that the rapid growth in rice production in West Bengal was driven by an expansion in the boro crop (which is an irrigated crop based on HYV seeds). Preliminary studies show that the share of boro rice production increased in total rice production, primarily due to expansion in area under cultivation; the yield growth was however, modest. Yield increases were significant for the aman crop, while aus (rabi) crop saw a decline in the area under cultivation. Agricultural growth performances, if it is disaggregated at district level, it was observed that during 1965 to 1980, the growth rate in foodgrain production primarily remained high in the districts which were mostly falling in Gangetic plains of West

Bengal. However, districts of Jalpaiguri, Darjeeling, Cooch Behar and West Dinajpur of northern sub-Himalayan region continued to lag behind in comparison to southern districts of West Bengal (Saha and Swaminathan, *op.cit.*: A3, A4).

During 1981 to 1990, districts like Purulia, Birbhum, Bankura and Midnapore, Howrah and Nadia had shown spectacular growth of production and productivity of foodgrain and rice. Almost all the districts barring Darjeeling and Jalpaiguri, showed improvements in their agricultural growth performances. It should be pointed out that growth of foodgrains was primarily driven by the growth of rice output. An absolute domination of rice was found in foodgrain production in West Bengal, at state level vis-à-vis districts. Among non-foodgrains, potato and mustard and rapeseeds made significant improvements during 1980s and 1990s but production of jute and sugarcane declined. Preliminary work for the proposed research work further suggests that the decade 1990s and subsequent periods, especially after the introduction of economic reforms, India and many of her agriculturally prosperous states including West Bengal are experiencing deceleration in agricultural growth of income, production and productivity but growth performance of West Bengal remained much better in comparison to agriculturally prosperous states of North-West India and other states of Eastern India.

As a matter of fact, West Bengal is the largest producer of rice in India (West Bengal Economic Review, 2008). The high growth rate in foodgrain vis-à-vis agricultural growth is achieved mostly through yield expansion. Crop diversification has also played a vital role to enhance productivity in agriculture throughout the 1980s and 1990s (West Bengal Human Development Report, 2004). In West Bengal, unlike the rest of the states in India, the growth in agricultural production and productivity were driven by small farmers. If institutional reform played a positive role in breaking the stagnation in the eighties, the role of belated Green Revolution technology can not also be ignored (Gazdar and Sengupta 1996, Banerjee *et al.*, 2002).

1.2 Statement of the problem

There has been a structural transformation in the Indian economy during the past few decades with the decline in the share of agriculture in Gross Domestic product (GDP) and gradual increase in the share of industries and services. Although share of agriculture has come down to 17 percent in 2008-09 from 55.1 percent in 1950-51, the dependence of the rural workforce on agriculture has not diminished in proportion to share of agriculture to

the GDP. In spite of being tagged as one of the fastest growing economy in rural areas nearly 63 percent of the male workers and 79 percent of the female workers are still engaged in agriculture (GoI, 2011). Introduction of economic reforms in 1991 brought considerable increase in GDP. India's GDP grew at below 6 percent during the initial years of reforms and in recent years it increased at an annual average rate of 7 percent. On the contrary, agricultural growth moved in the opposite direction. Since Ninth Five-Year Plan (1996-97 to 2001-02), India targeted more than 4 percent growth rate in agriculture but it remained hovering around 2 percent. In fact, during the reforms era, gross capital formation also declined substantially (Reddy 2006).

Therefore, the gap between agriculture and non agriculture has been increasing in the post-reform period and this is accentuating the disparities between rural and urban areas. A slow down in agricultural growth became obvious in most of the agriculturally advanced states. Since the 1990s, stagnation became prominent both in the case of rate of growth as well as productivity growth in agriculture, making it imperative to obtain a closer review of crop wise and state wise estimation of growth of area, production and productivity. It also needs to be reviewed that whether the decline in growth of production and productivity in agriculturally prosperous states has been compensated by the rise in agricultural production and productivity of the states whose performance was earlier less satisfactory. Changes in crop-mix or increase in crop diversification may also prove to be beneficial to dampen the negative fallout.

If decline (or rise) in growth of crop production and productivity occur then it must have general impact on the over all agricultural scenarios of the state and country but impact shall vary considerably when it will be disaggregated at district level. Since there is wide variation in agro-climatic conditions across the state which injects natural heterogeneity towards the agricultural growth; spread and impact of institutional changes as well as diffusion of technological changes (precisely, spread of Green Revolution technology) also vary. Variation in population growth, growth of non-farm economy also adds variation on the extent of economic stress each districts shall pass through.

In this regard, West Bengal becomes a point of interest among the researchers, it is more so because in West Bengal, overwhelming agricultural growth took off after the 1980s. It became a leading state in terms of performance in foodgrain and rice production. The positive impact of operation *barga* on production and productivity has started dissipating in the nineties and is evident from the various research findings. The rate of growth of

foodgrains in West Bengal slackened in the 1990s to 2.39 percent from 5.15 percent in 1980-90. At state level, there was a decline in the annual growth rate in rice production, from 6.28 percent in the 1980s to 2.19 percent in the 1990s (Bandyopadhyay, *op.cit.*). Thus, it is evident that growth of foodgrain and rice production and productivity has started falling since the1990s and the success that was achieved in the 1980s become unsustainable. In spite of the fact that West Bengal's performance at all-India level remained relatively better in comparison to sluggishness experienced by the states that were identified as agriculturally prosperous states during the 1970s and 1980s. The above brings us to focus on West Bengal and the multi-dimensional nature of its problems in agriculture.

For West Bengal and for most her districts, foodgrain production was overwhelmingly dominated by rice, therefore, fall in rice production and productivity will be having a considerable impact on district wise growth of foodgrain production and productivity. It has already been seen that even in the period of agricultural stagnation (1970s) and in the 1980s, considerable inter-district variations were observed. The districts of Darjeeling, Jalpaiguri, Cooch Behar and Malda continued to lag behind in comparison to other districts in 1980s when West Bengal came out successfully from agricultural stagnation. In 1990s when over all growth of agricultural production and productivity was indicating a decline then the condition of those lagging districts was getting worse widening the gap with agriculturally prosperous districts. It has been observed that between 1980-81 and 1989-90, for foodgrain and rice production, most impressive growths were achieved by Purulia followed by Bankura, Midnapore, Howrah and Nadia, Birbhum, West Dinajpur and Burdwan. Success of Purulia and Bankura showed that agro-climatic barriers to achieve agricultural growth were successfully broken and Howrah, being traditionally an industrial district also achieved tremendous improvement in growth of production and productivity. But with a decline in growth in production and productivity of foodgrain and rice in the 1990s, a serious doubt was raised regarding the sustainability of impressive growth among the districts of Purulia, Bankura and Howrah. In addition, if the growth performances of agriculturally prosperous districts like Burdwan, Birbhum, Midnapore, 24 Parganas and West Dinajpur get worsened then over all agricultural scenario as well as the economy of the state as bound to get seriously affected. Since West Bengal and her districts predominantly produce rice and in spite of steady increase in boro rice from late-1990s, rice production and productivity is mostly dominated by local variety of aman

paddy and majority of the small and marginal farmers till date largely produce aman paddy. On the contrary, boro is a high yielding variety and is having higher yield rate but its growth of productivity remained much lower than aman and its growth of production was driven by growth of area.

Therefore, any fall in growth rate in production and productivity of aman paddy will be having a serious impact not only on over all growth and productivity of rice but it is bound to affect economic condition of small and marginal farmers. It is needless to say that more than 70 percent of the cultivators in West Bengal belong to this category. At the same time, boro, though a high yielding variety was making steady inroads, its growth of production and productivity remained a matter of concern. The doubt is also raised on the sustainability of the impact of Green Revolution technology. The impact of economic reforms on the agrarian sector became a subject of close scrutiny. Growth measurement through trend estimation of long time series certainly provides a logical basis to argue on the performance of a particular sector of an economy but functional interplay of different economic and non-economic variables remained obscured. Growth estimation along with estimation of sub-periods growth rates, nature and direction of long term acceleration or deceleration of growth, extent of stability and instability of growth which hardly get importance should get priority to make valid comments on what has been done, what ought to be done, how much has fallen short of the required result and how that required result can be reached. The magnitude of the impact of a decline in growth rate in foodgrain production and productivity in West Bengal could not be ascertained until and unless district wise acceleration and deceleration of crop wise growth, district wise status of instability and stability over a long time frame, estimation of sub-periods growth of production, area and productivity in tune with major institutional and policy changes are taken into consideration.

Since productivity is defined as the ratio of production to area, the productivity factor thus incorporates both pure yield effect and the effects of changes in cropping pattern such as a shift from low-yield to high yield crop. The area effect includes changes in net sown area and cropping intensity (ratio of gross cropped area and net sown area). Increase in agricultural production through expansion of land area under agricultural use is almost impossible in most of the districts of West Bengal because of population growth and increasing demand for land for non-agricultural uses. In a situation of fall in production and productivity growth of rice and foodgrain in West Bengal (where agriculture is largely

dominated by small and marginal farmers) and possibly in many of her districts, with continuous shrinkage in land holding size and reduction in profitability, it is observed that large farmers are in position to stick to rice since they can bear the rising cost of cultivation of input packages. But small holders may find it difficult to sustain only on rice and in that case opting for crop diversification or moving towards high valued crops by using family labour to their vantage point, can become a viable option and needs to be verified.

There are a wide array of economic and non economic factors that influence growth of production and productivity of agriculture. To be precise, agro-climatic condition including rainfall, institutional reforms especially operation *barga* and *panchayatraj* system, Green Revolution technology (use of high-yielding varieties, irrigation, fertiliser etc.,), size of holdings, land distribution pattern, rural infrastructure, credit and cooperatives, population density, area under non agricultural use, wages and many more, do have considerable impact on agricultural productivity. However, to estimate the impact of these factors on productivity often create statistical impediments because more than often these explanatory variables become collinear with each other. In addition, estimation of the impact of various components of agrarian reforms on productivity also entails various computational barriers because a long time series accommodates a number of effects simultaneously and segregation of them often becomes difficult. Moreover, there are factors like sense of security of tenants and noise-free communications of bureaucrats and technocrats to farmers through the *panchayat*s that are difficult to quantify (Mukherjee and Mukhopadhyay, 1996). Conflict resolutions by *panchayat*s, especially resolving the disputes regarding water use or use of agricultural labour is also difficult to measure (Raychaudhuri, 2004: 11). Possibly, these statistical obstacles often deters the researchers to undertake studies that may elucidate the impact of various economic, non-economic factors, including institutional reforms of varied nature and policy intervention, on agricultural productivity. And districtwise study on West Bengal could hardly be traced in this regard.

It has further been observed that in West Bengal (in various census years), share of cultivators has declined accompanied by rise in share of agricultural labourers with landlessness is on the rise. The main occupation of agricultural labourers is to work in other people's lands. Since number of agricultural labourers is on the rise their economic condition may become worse off if commensurate rise in wages do not take place. Study

conducted by the *State Institute of Panchayats and Rural Development* in the year 2000 observed that 14.4 percent of the *bargadars* and *pattadars* lost their land and this percentage was found to be much higher (30 percent) in the districts of Cooch Behar, Dakshin Dinajpur, Uttar Dinajpur and Jalpaiguri (Chakraborti, 2003). Given the fact that when land area is more or less fixed and population is increasing and if the development policies so followed fail to create commensurate opportunities in non-agricultural sector, then absolute number of persons and households dependent on agriculture will increase (Ghosh, 1998: 2988) and at the same time the problem is likely to accentuate wherein the absorption of labour force in non-agricultural sector is less or got truncated by slower expansion of non farm sector. Increase in landlessness, if any, may increase congestion of rural workforce in the urban informal sector.

The research problems thus we are confronting are multipronged. Keeping the agrarian nature of the state of West Bengal and dependence on large number of agrarian population on small sized fragmented land, critical evaluation of long term trends in agricultural production, productivity, crop-mix, both at state and disaggregated district level and its future ramifications on the economy and employment assume paramount importance. Identification of economic as well as non-economic variables and institutional changes, their positive and negative impacts on farm productivity also become a crucial issue to achieve the goal of sustainable agriculture and dispel the uncertainty, if any, regarding future food security.

1.3 A Review of Related Literature

In tune with the above research problems, a wide array of literature on various facets of agriculture needs to be reviewed to understand the temporal and spatial changes in agricultural scenario at nation level, state level and finally for the state of West Bengal disaggregated at district level. Certainly, long term trend analysis of growth of agricultural production, productivity and crop-mix would remain at the focal point along with sources of growth as well as instability of growth but at the same time major policy changes (institutional as well as technological) and concomitant impact on the growth of agricultural output and productivity also will receive equal emphasis. Precisely, studies dealing with the impact of land reform, tenancy reform, techno-biological changes or Green Revolution, introduction of grass root governance through *panchayat* and economic reforms on agricultural production and productivity demand special attention. The importance of agriculture, especially in a predominantly agrarian country like India, as

critical research agenda over the periods also need to be validated. Studies dealing with the impact of production and productivity gain on farm and non farm employment and inter linkages of agriculture with other sectors of economy shall help us to identify the development gaps among the states as well as within the state. A selected few have been cited below.

1.3.1 Research on Agriculture during Colonial Era

During pre-colonial period, colonial period as well as immediately after the post independent periods, agriculture remained the largest single sector of the economy in India. As agriculture continued to be the dominant economic activity, it attracted the attention of the colonial administrators and researchers during colonial and post colonial era. The process was initiated during the first half of the 19th century, when the administrators of the then East India Company and later the British Government in search of collection of taxes in terms of rent, felt an urgent need to investigate into soil productivity and tax bearing capacity of agriculture.

At the dawn of independence, an estimate on the net output data between 1948-49 and 1950-51, revealed that total agricultural output accounted for about 50 percent of national income and provided employment for about 70 percent of the work force (Indian Ministry of Finance, 1954:45 & 51). Over the years, the study of agriculture and agrarian structure assumed importance in the field of social science research. A survey of agrarian studies thus acquired a fundamental importance. It was said that 'problems do not respect frontiers between conventional academic "disciplines" ' (Andreski, 1964:60) and this most aptly fits in while dealing with agrarian problem.

Enquiries into the agrarian questions were primarily initiated by the British administrators because they were the same group of people on whom the formulation of land and revenue policies was rest upon. Later came the political agitators or activists, mostly as a critique (soft and strong) of the British land and revenue policies and they are the people who unleashed the freedom struggles in various forms in pre-independent India. In that sense, British administrators and political activists in colonial India were the first scientific researchers into the agrarian questions. Afterwards, the professional social scientists took up the initiatives (Joshi, 1975:4-6). Therefore, it can be said at the outset that agrarian problems as an area of research were offshoots of the British colonial rule. However, the relationship between economic backwardness and institutional structure created by the

British rule was conveniently bypassed in all the British led official enquiries and investigations. In most of the cases the role of British created institutional structure in reshaping India as a nation was strongly advocated.

Indian freedom struggle and emergence of Indian nationalism created another spurt in research on land problems and land policy. On the questions of India's poverty and backwardness, a sharp schism became prominent between the 'nationalist' viewpoint and the imperial viewpoint. Imperial viewpoint was primarily dictated by what Myrdal called 'colonial theory' of poverty and economic backwardness (Myrdal, 1970: 17). British explanation on rural poverty and backwardness in India had bypassed the agrarian structure created by them, as Myrdal did in his exposition of 'colonial theory' of poverty and economic backwardness. Colonial theory was aptly summarised by Nehru and he said, 'If India is poor that is the fault of her social customs, her *banias*, and money-lenders and above all her enormous population' (Norman, 1965:556).

Although, it was not always true that scholar-administrators during colonial era always justified the British policy, some of the studies indeed portrayed Indian agrarian situation with in depth precision. Harold H. Mann (1967:XXVII) and M.L. Darling (1925: 28) were two prominent names whose studies should be referred to Darling, by interrelating credit and land system explained the social and economic life of Punjab. Similarly, Harold Mann put stress on the institutional framework of Indian agriculture and identified it as an obstacle for rural progress. He also pointed out about the methodological inadequacies of many of the studies on agrarian society carried out in the colonial era.

Looking at the methodological aspects, the shortcomings of neo-classical economics also got exposed in the hand of Myrdal (1968). He pointed out the incapability of analysing the structure and functioning of an economy which was predominantly agricultural on the one hand and pre-capitalist on the other, eminent researchers and social scientists of India studied the economic condition of the nation and also constructed national accounts. The prominent among them were Dadabhai Naoroji (1901), G. Findlay Shirras (1936), K.T. Shah and K.I. Khambatta (1924), V.K.R.V. Rao (1940) etc. They tried to trace out the income of the agricultural sector as well as income of the country as a whole. R.C. Desai (1953) during 30s tried to measure the income of agricultural sector from the consumption point of view.

However, the problem of contextualisation of agrarian problem in Indian perspective by using scientific methodologies and techniques was successfully carried out by Radhakamal Mukherjee, P.C. Mahalnobis, N.K. Bose, D.N. Majumder, D.R. Gadgil, D. P. Mukherjee, V.K.R.V. Rao, G.S. Ghurye, etc. At theoretical level, Radhakamal Mukherjee highlighted the fundamental differences between the Western and the Institutional frameworks of economic activity. The important studies of Mukherjee were –'Land Problems of India' (1935), 'Democracies of East' (1923), 'Fields and Farmers of Oudh' (1929), 'Economic Problems of Modern India' (1939), and the 'Borderlands of Economics' (1925).

Some of the major studies carried out in pre-Independence period addressed the agrarian problems. They are: 'The Trends of Agriculture and Population in the Ganges Valley by Birendra Nath Ganguly (1938), 'The Indian Rural Problems' by M.B. Nanavati and J.J. Anjaraia (1945), 'Poverty and Social Change in India' by Tarlok Singh (1945) and 'Agricultural Labour Conditions in Northern India' by A. M. Lorenzo (1947). Indian Society of Agricultural Economics also commissioned few important studies on Indian agrarian problems and notable among those were: i) 'Land System in Bihar and Land Problems of Gujarat', ii) 'Problems of Land Tenure and Population in West Bengal', iii) 'The Economics of Estate Farming' and iv) Problems of Small Farmers-Report of an Enquiry into the Problems of Low-Income Farmers in Kodinar Taluka.

In brief, the research on agrarian issues in pre-independences period- especially after the East India Company made intrusion into Indian body polity – thus could be divided in four phases (Rath, 1960), as follows:

First Phase (Upto 1858): Various travel accounts, documents relating to survey and settlement reports and those were mostly helpful to gather information on land tenures, pattern and extent of land revenues in pre and post Permanent Settlement era.

Second Phase (1859-1880): In this phase, reports on enquiries into famines, Deccan riots etc., were available.

Third Phase (1880 to 1912-16): Most prominent sources of study during this phase were District Gazetteers and Voelker's Study (1893), Irrigation Commission Report.

Fourth Phase (1912-16 to 1939-40): During this phase systematic study of the village or regional economy, specific problems like conditions of labour, indebtedness of farmers, role of financial institutions etc., were initiated.

William Burns (1944) concluded that the fluctuations in output and acreage of subsistence crops were caused by the fluctuations in seasonal weather and it was fluctuation in prices that caused variation in the production of cash crops. Dr. Baljit Singh (1947) observed that between 1921 and 1941 foodgrain output per capita declined and it was primarily caused by variations in rainfall and extension of cultivation into inadequately irrigated lands. He also observed that higher prices may encourage the farmers to produce more cash crops but even if price declines, output did not decline and the reason being that farmers did require money to repay their debt.

On similar lines, three important studies were carried out to decipher the trend in foodgrain production vis-à-vis population. George Blyn (*op.cit.*) undertook a disaggregated study and analysed the trends in foodgrains and non-foodgrains separately and while doing so he divided the entire period (1891-1947) into five sub-periods. Kshitimohan Mukerji (1965) had covered a period up to 1952-53 and concluded that area under cultivation had increased but production did not show a rising trend. S.A. Shetty (1969), while building up the production series and measuring the long term trends, both at all-India level and at the regional level, concluded that, agriculture had expanded but not grown.

Most of the studies on trends in agricultural output during colonial period concluded that an absence of upward trend in foodgrain production became a common feature after 1930s. Much of the loss in foodgrain production was compensated by the rise in growth of non-foodgrains, more precisely the cash crops. The trend varied considerably during various sub-periods between 1921 and 1965. The growth of foodgrain production got absolutely stagnated during depression and war periods. An upward trend has observed only after 1952. However, the necessity to increase foodgrain production did not receive much attention in spite of the fact that the problems of agricultural production and distribution were two important determinants of the wellbeing of an agrarian economy, the studies in this regard were found to be very scant in numbers. As George Blyn (*op.cit.*) pointed out that upto the 1930s there was hardly any concern over the trend in crop output. The general impression was that there was favourable balance between growth of food crop output and population growth (Karve, 1936; Meek, 1937; Mukherjee, 1938; Thomas and Sastry, 1939; Dutt, 1949). A.R. Sinha's (1951) study of agricultural production covering 30 years (1921to1951) revealed that foodgrain production was getting stagnated while that of cash crop was rising.

1.3.2 Farm Size, Productivity and Land Reform

Among the observations made by Amartya Sen (1962: 243-246; 1964:323-326) while analysing the 'Studies in Economics of Farm Management' (1954-55 and 1955-56) produced by the Ministry of Food and Agriculture, one of the important observations is 'productivity per acre decreases with the size of holding'. He further justified his statement by stating that increased output is related to increased inputs including human labour. The smaller farms use more inputs per acre (at imputed market value) and as a result get more output as well. The total amount of family labour applied per acre increases outstandingly as the size falls, so that 'in spite of the fact that in some areas the amount of wage labour applied falls as the size get smaller, the total amount of labour per acre is inversely correlated with the size of the farm'. This opened up a new vista in the field of empirical research in agriculture and generated huge academic debates.

Subsequent studies made by Mazumdar (1965), Khusro (1968), Saini (1971), Berry (1972), Bardhan (1973), Berry and Cline (1979) reaffirmed the inverse relation between farm size and productivity and strongly advocated land reform or redistribution of ceiling-surplus land as well as ensuring security of tenants to support the small and marginal farmers to enhance allocative[5] efficiency and ensure equity or distributive justice. Irma Adelman (1980) sees the land reform as a guiding force towards the emergence of Asian Tigers. The successful countries all followed a process in which the asset that was going to be the major asset of production at each stage of development was redistributed before, rather than after its productivity was improved. Bhalla (1979), Cornia (1985),Taslim (1989), Binswanger and Rosenzweig (1986, 1993), Binswanger, Deininger and Feder (1993), Binswanger and Deininger (1997), Raghabendra, *et al.*, (2000) have shown through different studies that redistribution of land among landless rural people has helped to raise production and productivity in agriculture and also advocated that small farm size has enhanced agricultural productivity. Bell (1977), Sen (1981) has advocated the superiority of owner-cultivated farms over tenant farms.

Besley and Burgess (2000) concluded that land reform in India has contributed towards the reduction of poverty in Indian states. Ghimire (2001) has pointed out that if poor farmers cultivate their own land they would not compete with full time landless agricultural workers in the rural labour market and in the process it will raise rural wages. In addition to that, having a piece of land of their own will save them from various restrictive practices imposed by the landowner.

However, many researchers questioned the validity of inverse relationship and cited various reasons to invalidate or partially validate the hypothesis. Hanumanth Rao (1966) showed that the introduction of high yielding varieties in India initially had allowed the inverse relationship to disappear; over time, as farm sizes changed, the inverse relationship again resurfaced. Thus, inverse relationship might be a permanent feature of agriculture but it is also true that the farm size changes with the change in technology. Rudra (1968) said that 'there is no scope for propounding a general law regarding farm size and productivity relationship.'

Hanumantha Rao (1975) and Subbarao (1982) observed a positive relationship between farm size and productivity and their study based on large-sized farms having adequate utilisation of fertiliser and other cash-intensive inputs. Ghosh (1979) observed that with the advancement of technology, inverse relationship disappears. According to Bhalla and Ray (1988), incorporation of soil quality makes the inverse relation between farm size and productivity ineffective. Lipton (1993) came out with his findings that until Green Revolution the inverse relationship was valid (at least for rice and wheat in Asia) but after Green Revolution the relationship was reversed.

Along similar lines, Dyre (1997), based on his study on Egypt argued that the inverse relationship becomes invalid in case of technical change in the farm sector and rich small farmers and big landlords generally capture the lion's share of the credit disbursed to collect new inputs as well as technology. Foster and Rosenzweig (2010) used a model incorporating supervision costs, risks, credit market imperfections and scale economies associated with mechanisations and analysed plot level panel data of the National Centre for Agricultural Economics and Policy Research (NCAER) for the period from 1999 to 2008 proved the inefficiency of smaller farms in India. Chand *et al.*, (2011) tried to find out the relevance of inverse relationship among the small farms of 21st century India and concluded that smallholders are not lagging behind in comparison to other farm size categories in adopting improved technologies, use of fertiliser and irrigation and they are using there efficiently. And they validate the inverse relationship in changing inputs-use scenario.

1.3.3 Trends in Agricultural Production and Productivity in post- Independence Period in India

T. N. Srinivasan (1979), by using log-linear regression and log-quadratic regression estimated the growth rates estimated growth rates as well as acceleration and deceleration of area, production and yield of both foodgrain and non-foodgrain during 1949-50 to 1977-78 which was divided to two sub-periods, namely, pre-Green Revolution (1949-50 to 1964-65) and post-Green Revolution (1964-65 to 1977-78) periods. According to his study, except wheat, there were not much change in the growth of output and yield per unit area for food crops and all crops with no evidence of either acceleration or deceleration in pre and post- Green Revolution period. A decline was observed in the rate of growth of gross sown area for non-foodgrains in post-Green Revolution period except wheat. He concluded that 'there is yet no Green Revolution but still only a wheat revolution'. Barker and Pal (1979) observed the stagnation of agricultural production in Eastern region.

Alagh and Sharma (1980) measured the trend in foodgrains and select non-foodgrains between 1960-61 and 1978-79. They divided the whole period into period-I (1960-61 to 1969-70) for pre- Green Revolution and period-II (1969-70 to 1978-79) for post- Green Revolution period, to capture the change in growth rates. In period-I, they observed that the regional spread of agricultural growth was limited to Punjab and Haryana, while in period-II, spread became much wider and growth peaked up in the states like Maharastra, Andhra Pradesh and Bihar. Growth had flattened relatively in Punjab and Haryana in period –II. It was further observed by them that growth rate in foodgrain output increased from 1.85 percent in period-I to 2.74 percent in period-II, indicating the impact of Green Revolution and for the whole period the growth rate was estimated at 2.77 percent. Consistent fluctuations in agricultural output deterred them to make any definite conclusion on acceleration or deceleration in growth rate in agricultural output. Nilkantha Rath (1980), while examining the agricultural production in India during 1955-1978 observed that total agricultural production in India grew at an average rate of 2.48 percent. The rate of growth was found to be higher, '2.95 percent, during ten years ending 1964-65, than during the subsequent period of 13 years, when it was only 2.42 percent'. And foodgrain growth for the whole period was dominated by the growth of cereals.

Ashok Rudra (1982) made an observation that there has indeed been a breakthrough in production conditions for some crops for some regions but no such thing has happened for

all crops for all regions. Rao and Deshpande (1986) also made a comparative study on growth of agricultural production, area and yield in pre- and post-Green Revolution phase. Their observations showed that in the first phase of Green Revolution (between 60s and 70s) growth rate in output improved marginally from 2.8 percent to 3.0 percent despite a decline in the growth rate in gross cropped area from 1.2 percent to 0.6 percent. On the contrary, Rao (1994) observed that first phase of Green Revolution accentuated inter-regional and inter-crop imbalances because of the restriction of high yielding variety seeds for only rice and wheat in the initial years and the adoption of these varieties only in well-endowed region.

S. Mahendradev (1988) ranked 289 districts across India on the basis of over all yields during the period 1962-65 to 1975-78 and identified the districts with compound rate of growth of less than 2 percent as low growth districts. They identified that 171 districts were falling under low growth category and among those districts, 84 were recorded either very low growth (less than 1 percent) or negative growth rates. They further noted that almost all the districts in Bihar, Orissa, West Bengal, Eastern Uttar Pradesh, Assam and Madhya Pradesh dominated the list of low growth districts.

In Acharya's (1998) observation, the policy package consisting of introduction of high-yielding varieties of wheat and rice, strengthening agricultural research and extension services, measures to increase the supply of agricultural inputs such as chemical fertilisers and pesticides, expansion of major and minor irrigation facilities, announcement of minimum support prices for major crops, government procurement of cereals to maintain a buffer stock and to meet foodgrains demand to sustain public distribution system and the provision of agricultural credit on a priority basis, had raised the rate of growth of productivity in India per hectare of all crops taken together from 2.07 percent in the decade ending 1985-1986 to 2.51 percent per annum during the decade ending 1994-1995. Similar evidence of an increase in yields, a partial measure of productivity gains given by output per unit of land area has also been observed.

Many researches though concluded that economic reform initiated in 1991 has primarily emphasised on price factors and infrastructure while institutional aspect of agriculture has grossly been neglected and as a consequence, deceleration in agricultural growth as well as decline in growth of output were accentuated since 1991 (Chadha, 2002; Majumdar, 2002; Bhalla, 2002; Kumar, 2002). A study by Kumar and Mittal (2006) observed that long term food security goal can only be attained if sustainable agriculture is practiced. At

the farmers' level, sustainability concerns are being expressed that the input levels have to be continuously increased in order to maintain the yield at the old level. This poses a threat to the economic viability and sustainability of crop production. In addition, after 1996-97, most of the states experienced decline in the area under cultivation as a consequence of urbanisation and industrialisation, stagnant crop intensity, slow progress of irrigation and fertiliser, decline in supply in electricity to agriculture and slow down in crop diversification (Chand *et al.*, 2007: 2528-30). Sharma Vijay Paul (2007) also observed that growth rates of production for most of crops were significantly lower during the period 1991-92 to 2004-05 compared to the 1970s and 1980s.

Bahlla and Singh (2009), observed that the period from 1980-83 to 1990-93 brought a turn around in India's agricultural development. At all-India level, the growth rate in crop output accelerated from 2.24 percent per annum during 1962-65 to 1980-83 to 3.37 percent per annum during 1980-83 to 1990-93. And agricultural growth penetrated to all regions in India. However, agricultural growth during 1990-93 to 2003-06 (post-reform period) decelerated both at national level as well as regional level. Except Gujarat, partly Maharashtra, all other states experienced sharp decline in their agricultural output growth rates in post reform period.

1.3.4 Sources of Growth of Agricultural Production and Productivity

In post independence period various attempts have been made to explain the growth in agricultural output in terms of area and yield components. Minhas and Vaidyanathan (1965) equated the changes in gross agricultural output to changes in four factors: area, yield, cropping pattern and the interaction of yield and cropping pattern. They decomposed agricultural growth for 28 states and 268 districts for the period 1951-54 to 1958-61. They estimated the total agricultural growth was 3.54 percent and 45 percent of the growth was attributed to area, 46 percent to yield increase, around 9 percent to cropping pattern and 1 percent to interaction effect[6]. It was further observed by them that states like Punjab, Rajasthan, Mysore and Madhya Pradesh area effect was high and agricultural growth was also higher than other states. Though Punjab was growing rapidly but yield did not improve and contribution of cropping to change in growth and output was also low. In the eastern states like Assam and West Bengal, area expansion was found to be zero, yield declined and growth of output was also found to be the lowest. Yield contribution remained substantially higher than national average.

Changes in cropping pattern though contributed substantially for the state like Gujarat, Madras and Andhra Pradesh. Same methodology of Minhas and Vaidyanathan was used by other scholars like Kaul (1966), Mishra (1971), Rojender and Karam (1975), Dharm Narain (1977), Saggar (1977, 1980), Venkataraman and Prohaladachar (1980) with minor modifications.

Vidya Sagar (1977) measured the growth of agricultural production during 1956-61 to 1969-74 by decomposing agricultural growth into area effect, yield effect, cropping pattern, price effect[7], and interaction of yield and cropping pattern, yield and price structure, cropping pattern and price structure, yield, cropping pattern and price and structure. Compound annual rate of growth of agricultural output was estimated at 2.4 percent per annum and yield increases alone contributed around 64 percent and around 39 percent was contributed by growth of area of the total output growth. Around 8 percent growth of output was contributed by changes in relative price.

Dharm Narain (*op.cit.*) studied the changes in inter-state changes in agricultural productivity during 1952-53 to 1972-73 by dividing the period into two sub-periods, one 1952-53 to 1960-61 and 1961-62 to 1972-73 to capture the effects in the pre and post-Green Revolution period. Contribution of changes in cropping pattern, locational shifts[8] of area under individual crops and pure increases in the yields of individual crops to the changes in growth of productivity was measured in the different states. The results of the study showed that in pre-Green Revolution phase, 70 percent increase in the productivity was contributed by the changes in cropping pattern and loactional shifts and the rest by yield effect. On the contrary, in post- Green Revolution period yield effect contributed 60 percent rise in productivity and cropping pattern and locational shifts helped to raise the productivity by 40 percent.

Alagh and Bhalla (1979) showed that among high growth districts which mostly concentrated in Punjab, Haryana and Western Uttar Pradesh, the yield constituted the major component in agricultural output growth and the contribution of change in cropping pattern have much smaller impact. Vidya Sagar (1980), while decomposing the growth of output of the cereals like wheat, bajra, etc., grown in different parts of Rajasthan, brought in the element of seasonality and he showed that 60 percent growth of output was contributed by yield alone. Bhalla and Tyagi (1989) showed that the rate of change in area and yield of all crops and their relative contribution to the growth of total output from early sixties to early eighties varied widely across the states. States experiencing rapid

growth of output also experienced higher rate of increase in crop per hectare. Not much of association was found between crop area growth and output growth.

Ray (1983) while dealing with sources of change in the average annual growth of crop output at national level suggested that changes in crop area became less important to bring in changes in aggregate output and rather changes in the cropping pattern became more important. A sharp increase in yield was observed during fifties and sixties but did not change much in the subsequent decade.

Sawant (1997) tried to measure the impact of growth of yield and area on the growth of agricultural output and found that the growth of output at national level had been moderate for cereals through out the Green Revolution period, though it moved up marginally from 2.56 percent in period I (1968-69 to 1980-81) to 2.84 percent in period-II (1981-82 to 1994-95). However, contribution of growth of area to the growth of output had been negative in period II while it was positive in period I. Significant increase was noticeable in the growth of yield between the two periods.

Sidhu and Bhullar (2005), Joshi *et al.*, (2006) reaffirmed that during the period of eighties and nineties, yield effect played the major role in increasing the growth of agricultural output with a shift from low-value crops to high-value crops in various states as well as at national level. Sekar and Pal (2012) examined the total change in production decomposed into three effects- yield effect, area effect and interaction of area and yield effect of wheat and rice in the Indo-Gangetic region (Punjab, Haryana, Bihar, Uttar Pradesh and West Bengal) for Green Revolution period (1966-91) and economic reform period (1992-2008). They observed that the rate of growth in rice productivity in indo-Gangetic plain was around 3.2 percent till 1980, however, the growth rate started decelerating after 1980s and the decline became more prominent in 1990s (0.37 percent). They also observed that yield effect contributed more to overall production growth of rice in upper, middle and the lower-Gangetic plains where area effect was stronger in trans-Gangetic plain.

1.3.5 Growth Instability in Crop Production

Instability is considered as the conflict between growth and stability measures and it deals with the linkage between growth and variability of agricultural output. A number of attempts have been made to examine the extent of instability in crop production both at national and inter state level. S.R. Sen (1967) analysed the production of foodgrains and other crops in undivided India from 1900-01 to 1947-48 and for Indian Union from 1936-

37 to 1965-66. He observed that variability in production increased as cultivation was extended to marginal lands. The variability increased due to fluctuations in weather and more intensive use of fertilisers on marginal lands.

C.H.H Rao (1975) concluded that variability in yields per hectare used to be higher than that of area, and productivity driven growth had added greater variability in output. Barker *et al.*, (1981) pointed out that it resulted in greater variability in yield. He further argued that irrigation might reduce moisture stress but it was frequently associated with an intensification of crop production and input use which might add instability. Studies conducted during 1980s concluded that after the introduction of Green Revolution technology, instability in production has increased. Factors like introduction of HYV seed-fertiliser, variability in rain fall and prices caused the rise in instability (Mehra, 1981; Hazell 1982; Dev, 1987, Rao *et al.*, 1988). Sharma *et al.*, (2006) compared variability in production and yield between 1980s and 1990s and concluded that production of foodgrains became more stable during 1990s in comparison to 1980s at all-India level and in most of the states.

Chand and Raju (2009) showed that in case of relatively longer period, technology diffused to larger areas and as a result, instability that was created at initial level disappeared, at least at national level. They further observed that the yield variability in foodgrains as well as for non-foodgrains was declined in the first phase of Green Revolution (extended up to 1988) compared to pre-Green Revolution period. Variations in yield were further declined during 1989 to 2007.

1.3.6 Farm and non-Farm Interaction

Various studies have been conducted for theorisation of the interdependence between farm and non-farm activities. Lanjouw and Lanjouw (2001) opined that in recent years, given the constraints on agricultural expansion, greater attention has been given to non-farm activities in view of their potential for economic development and poverty reduction. Kochar (1999), Kijima *et al.*, (2006) viewed that even if productivity and wages or incomes in non-farm activities are not higher than those in farming, the former as an option makes a difference, as it facilitates income diversification by farmers and agricultural labourers, and helps them cope with various shocks in a risky environment and reduce poverty *ex post* in a dynamic context.

Joshi *et al.*, (2004), Gaiha and Imai (2006), had shown through their study that given the high likelihood of seasonal unemployment in agricultural economies, total household income is likely to increase if there are more choices for workers or self-employed to work in non-farm activities that are not affected by seasonality. Studies of Chand and Chauhan (1999), Chandrasekhar and Ghosh (2000), Sen (2002), Gollin *et al.*, (2002), Reddy and Mishra (2008, 2009), Vaidyanathan (2010) conclusively remarked that the over all GDP growth in the country has continually been increasing but in case of agriculture a deceleration has been observed and it may widen the income differential between rural areas and urban areas as well as between farm and non farm sector.

1.3.7 Institutional Reforms in West Bengal

Till the late-1970s, Land Reform Acts of West Bengal were either ignored or contested in the court of law (Raychaudhuri and Chakraborty, 1981). In West Bengal, land reforms took a radical turn during 1969-70 when local peasants confiscated more than 5, 00,000 acres of 'benami' land and redistributed among the landless and this was termed as forced land reform carried on outside the government framework (Dasgupta, 1984). Agrarian reform in rural West Bengal gained real momentum after Left Front led Government assumed power in 1977. The tenurial reforms initiated by the then Left Front Government involved first serious implementation of existing legal provision (Bhaumik, 1993). The reform in West Bengal was confined to the redistribution of ceiling[9] surplus land among rural landless households and pursuance of tenurial reforms known as operation *barga* – the process of official recording of the sharecroppers or *bargadars* and providing them a legal sanction of security of tenure and higher share[10] of produce for them. There was also a provision that sharecroppers can use their cultivated land as collateral to get credit from institutional sources (Dasgupta, 2005:2). The second major institutional reform initiated by the Left Front government in 1977 that was taking governance to the grass root level by introducing local self-government or *panchayat* and first election was held in 1978. It was understood that this brought bureaucracy close to the villages which centred on operation *barga* and delegating financial planning activities at village level (Bhattacharya, 1999). Webstar (1999) commented that decentralized decision making through *Panchayat* would be having an impact on the agrarian scene once funds would be available to them and village people would be given the responsibility to undertake village planning and from late-eighties this process became visible in rural West Bengal (Datta, 2001). As opined by Raychaudhuri (*op.cit.*: 17), operation *barga* provided proper incentive and right kind of

power structure to enhance investment in land through better irrigation, seeds and increased labour use.

The study carried out by Sen and Sengupta (1995), the measured input growth is not sufficient enough to explain the extent of the trend break in output growth observed in 1980s. According to them, the rate of growth of fertilser use, percentage of area under high yielding variety (HYV) and irrigated area in West Bengal has declined in West Bengal in 1980s in comparison to 1970s. And they concluded that unmeasured part of growth of output was attributed to the implementation of tenancy reform or operation *barga* and local level governance or *panchayat*.

Studies by Mukherjee and Mukhopadhyay (*op.cit.*); Raychaudhuri and Sen (1996); Sanyal, Biswas and Bardhan (1998); Rawal and Swaminathan (*op.cit.*) highlight the role of operation *barga* in reversing the slow output growth in West Bengal. According to them, the acceleration in growth occurred during and after major changes in agrarian institutions and land relations. They argue that the establishment of the democratic *Panchayatiraj* institutions in West Bengal and the implementation of operation *barga* were the main factors behind the transition in West Bengal's agricultural performance. It also tried to ensure a just distribution of product between the landlords and sharecroppers. Quick recordings of *barga* rights and provisions for institutional credit to the sharecroppers and the assignees of vested land raised the access of the small operators to technological inputs.

Banerjee and Ghatak (1996) based on their field surveys in West Bengal in the mid-1990s have concluded that a 17-18 percent increase in productivity has been observed in the plots operated by registered sharecroppers and this is in conformity with the hypothesis that security of tenure and fair crop sharing with sharecroppers, ensures incentive to increase production. Banerjee, Gertler and Ghatak (1999 & 2002) have argued that protection of sharecropper against forceful eviction has helped West Bengal to increase the agricultural yield. The agrarian reform ensured the minimum wage rate of agricultural labourers within the framework of *panchayatiraj* institution (Govt. of West Bengal 2004).

Bhattachayya (2005), in his studies showed that operation *barga* was proved to be beneficial in breaking the interlinkage and weaken the exploitative share tenancy itself. According to Bhattaycharyya and Bhattyacharyya (2007:66) the increased land productivity in West Bengal during 1980s is the result of the increased labour intensity in

family farms belonging to small and marginal farmers and they were capable of doing so because land reform enhanced their purchasing power and enabled them to access Green Revolution technology.

1.3.8 Trends in Production and Productivity in West Bengal

Most of the studies on trends in agricultural output during colonial period concluded that an absence of upward trend in foodgrain production became a common feature after 1930s. Much of the loss in foodgrain production was compensated by the rise in growth of non-foodgrains, more precisely the cash crops. The trend varied considerably during various sub periods between 1921 and 1965. The growth of foodgrain production stagnated during the depression and war periods. An upward trend was observed only after 1952. At regional level, Punjab emerged as a progressive region, on the contrary agricultural production in Bengal and Bihar had either deteriorated or stagnated (Shah, 1975: 20-22). The trend continued even in post-independence period.

James Boyce (*op. cit.*) while exploring the nature and causes of agricultural stagnation in West Bengal and Bangladesh between 1949 and 1980, observed that agricultural output grew at a rate of 1.73 percent per annum and rural population and total population of West Bengal grew at 2.31 percent and 2.42 percent per annum respectively over the same period.

Commenting on East India (comprising East UP, Bihar, West Bengal and Orissa) and analysing the economic scenario in 1977-78, A Vaidyanathan (1987: 2259) observed that 'not only is poverty incidence high in this region but its overall agricultural performance has been disappointing. The Green Revolution Technologies do not seem to have made much of an impact here. The overall growth rate in agricultural production has averaged barely 2 percent per annum over the last 20-30 years which is in fact less than the rate of population growth'.

The limited spread of Green Revolution technology in its initial phase and poor status of eastern region also get reaffirmed in the Report of the Committee headed by S.R. Sen on Agricultural Productivity in Eastern India, Reserve Bank of India (1984), Report of Study Group on Agricultural Strategies for the Eastern Region of India, Planning Commission, Government of India (1985). It was noted in the Seventh Five-Year plan that the gap between the potential and actual yields of rice in eastern India was the highest in India (GoI, 1985).

However, a turn around in agricultural growth occurred in Eastern region, precisely in West Bengal since the 1980s. Studies by various scholars reaffirmed that the period of post-1980s can conclusively be treated as end of 'agricultural impasse' in West Bengal. Studies of Mridula Saggar and Sundar Raghaban (1989) identified the increase in agricultural growth in eastern India in the 1980s as most notable feature in India's agricultural scenario. Harris (1993) also observed a break in stagnation in agricultural production in West Bengal through his micro level study of three villages in the districts of Birbhum and Burdwan. Abhijit Sen and Ranja Sengupta for West Bengal, Orissa and Bihar observed that a trend break was observed in the rate of growth production and productivity of rice and foodgrain in 1981-82 (Sen and Sengupta, *op.cit.*).

In another study conducted by Centre for Monitoring Indian Economy (CMIE), observed that the rate of growth of foodgrain production was highest among seventeen major states of India during the period 1980-81 to 1992-93. Saha and Swaminathan (*op.cit.*) also concluded in their district wise and crop wise study on agricultural growth in West Bengal in the 1980s that, agricultural growth was accelerated in West Bengal since 1980s and with the exception of Darjeeling and Jalpaiguri, index of aggregate crop production increased at a rate of 5 percent per annum between 1981-82 and 1990-91.

Bhalla and Singh (1997) estimated the over all growth of agricultural production during the period 1980-83 to 1992-95 and the figure stood at 5.39 percent. Rogaly *et al.*, (1995:1864) concluded that rapid growth of agricultural output since 1980s with an average rate of 4 to 5 percent. Rawal and Swaminathan (*op. cit.*) also arrived at similar conclusions while estimating the growth of agriculture in West Bengal from 1950 to 1996. Gazdar and Sengupta (*op. cit.*) observed that the turn around in agricultural growth in West Bengal is a result of belated Green Revolution, personal initiative and private investment, operation *barga*, distribution of surplus land and *panchayati raj*.

Manoj Kumar Sanyal, Pradip Kumar Biswas and Samaresh Bardhan (1998) while measuring the growth of foodgrain (disaggregated at district level) observed that between 1977-78 and 1993-94, all-crop production grew at an annual rate of 4.10 percent and yield per hectare grew at 4.97 percent and surpassed the growth of population and hence agriculture in West Bengal came out from long stagnation. They also showed that some western and central Bengal districts experiencing severe decline in agriculture during 1949-65 and a slow recovery during the period 1966-80 were finally placed at high growth trajectory. In a study that covers a period from 1977-78 to 1999-2000, it was estimated

that the production of rice and foodgrains grew at a rate of 3.2 percent and 2.6 percent respectively. It was further observed that the growth rate was marginally higher for both rice and foodgrain (3.7 percent and 3.3 percent per annum respectively) between the period 1980-81 and 1999-2000 (Chattopadhyay, 2005).

1.4 Research Gap

From the above literature survey it is evident that possible inverse relationship between farm size and productivity provided a logical basis and favoured redistribution of lands to landless and brought substantial improvement in production and productivity. Land was the only resource that such farmers did not have secured access to. Providing access to land, either through redistribution or through a secure tenancy contract would have been effective in increasing the productivity of agricultural practices. However, at all-India level as well as at regional level, impact of land reform on agricultural productivity substantially diminished since late-sixties and most of the studies got solely preoccupied with Green Revolution. The situation has however changed significantly with the introduction of economic reform in 1991 that altogether altered the basis of the input supply system facing a farmer. They are to be purchased from market, be it seeds, fertilisers, water and even labour. The poor tenants, small and marginal farmers faced a difficult situation not only in procuring the complementary inputs at affordable prices but also realizing the optimum value for the output produced.

Empirical studies to decipher long term growth pattern of agricultural production and productivity on West Bengal and disaggregated at district level as well as long term changes in crop mix are neither sufficient nor exhaustive (especially from late-90s). Most of the studies regarding trends in agricultural production and productivity remained confined to the state level in post 80s barring from the studies made by Saha and Swaminathan (*op. cit.*), Rawal and Swaminathan (*op. cit.*), Sanyal *et al.*, (*op. cit.*) and Chattopadhyay (*op. cit.*). Among these studies, Rawal and Swaminathan have dealt with relatively longer period. Sub-periods growth in tune with major institutional and policy changes did not receive adequate attention. Their studies mostly remained confined to examine the trend in productivity with an *a priori* assumption that turn around was caused by introduction of land reforms, operation *barga* and introduction of grass root level governance through *panachayat*. Very few studies feel the urgency to study the simultaneous impact of institutional reforms, Green Revolution and economic reforms on farm production and productivity.

Rising pressure of population on land, little scope for area expansion for agriculture, a decline in productivity, the negative fall out of Green Revolution technology, consistent rise in percentage of agricultural labourers as well as marginal workers, variation in the absorption capacity in non-farm sector among the districts of West Bengal, have provided the researchers as well as policy makers to undertake a composite study wherein the sustainability of agriculture will be taken care of and at the same time, the mechanism for creating employment opportunities for incremental population in the agricultural sector will be devised.

The above observations have allowed us to raise some fundamental research questions and would be addressed through this research.

1.5 Research Questions

1. How did tenancy system evolve during colonial period and what were the possible impacts of change in tenancy rules on agrarian relations and agricultural productivity in Bengal?
2. Did growth rates of production, area and productivity of foodgrain and non-foodgrain change along with the change in crop-mix in every decade started from 1960-61 and till 2007-08 in India and in her states in accordance with the introduction of land reform, Green Revolution and economic reforms?
3. If so, then how far have these changes been influenced by the changes in the rate of growth of production area and productivity of foodgrain and non-foodgrain in Eastern region or precisely West Bengal?
4. Has the growth rate in agricultural production, area and productivity of foodgrains in West Bengal and disaggregated at district level, undergone a change during 1970-71 to 2008-09 and in four sub-periods, viz. 1970-71 to 1979-80, 1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-2001 to 2008-09?
5. What was the nature and extent of acceleration and deceleration and instability of growth of foodgrains in West Bengal and her districts and non-foodgrains in the state from 1970-71 to 2008-09 and in four sub-periods, viz., 1970-71 to 1979-80, 1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-2001 to 2008-09?
6. Has West Bengal and her districts undergone any change in production of crop-mix and if so what factors have contributed towards diversification of crops?

7. Do farm size, operation *barga*, role of *panchayat*, introduction of Green Revolution technology, economic reforms have any simultaneous impact on foodgrain productivity in West Bengal over time and districts?

8. Do the changes in agricultural productivity, if any, have impact on agricultural employment and economy?

1.6 Hypotheses of the Study

1. Colonial rule in Bengal withheld the process of sub-infeudation in agrarian sector of Bengal and helped to bring positive changes in agricultural production and productivity.

2. India through institutional reforms, techno-biological changes and economic reforms have sustained high growth agricultural production and productivity and also reduced regional growth disparity in agricultural production and productivity across the states.

3. A positive trend break in foodgrain production and productivity was observed in West Bengal and her districts in the eighties and it has been sustained in subsequent decades with further acceleration and reduction in instability of growth.

4. Crop diversification has increased over time in the state of West Bengal as well as among the districts over time.

5. Growth in foodgrain production and productivity in West Bengal has been driven and sustained by small farm size, tenancy reform, namely operation *barga*, techno-biological revolution and economic reforms.

6. Growth in foodgrain productivity has increased income and employment in the farm sector and also helped in the growth of non farm sector of the economy over time and across the districts.

1.7 Methodology

The proposed study intends to explore the changes in agricultural production, productivity and area under cultivation of various foodgrains and non-foodgrains in West Bengal as a whole and also disaggregated at district level covering time span of 39 years, that is, from 1970-71 to 2008-09. The whole period was divided into four sub-periods, viz. 1970-71 to 1979-80, 1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-2001 to 2008-09. Sub-periods have been created keeping the broad policy interventions in mind. If the 1970 to

1980 was identified as a decade of 'agricultural impasse', then decade of 1980s to 1990s has been indentified as end of 'agricultural impasse'. Here, distributive measures were like land reforms and tenancy reforms, commonly known as operation *barga*, introduction of *panchayat* as a means of grass root level governance and resource mobilisation and generation at village level and introduction of Green Revolution technology in Bengal's agricultural practices. Finally, the period between introduction of economic reforms in 1991 and its onward journey till date, was divided in two sub-periods, 1990-91 to 1999-2000 and 2000-2001 to 2008-09. This has been done to unearth the initial euphoria or pessimism that the introduction of economic reforms created in India and to capture the impact of second generation reforms where in agriculture also got more closely linked with economic reforms.

1.7.1 Measuring Growth of Crop Output, Productivity and Area

To measure the growth of agricultural output, area and productivity most frequently used tool is compound annual rate of growth or CAGR. Compound annual growth rate (CAGR) is the rate at which available (e.g. output, population, investment etc.) grows over a period of time, taking into account the effect of annual compounding[11].

Changes in the agricultural output may occur because of the interplay of various variables including technological, institutional change, relative prices and the weather. To begin with, the exponential (log-linear) form has been chosen to measure the growth.

In our study, to measure the long term growth (1970-71 to 2008-09) of agricultural output, area and productivity, CAGR and exponential growth are frequently used. The T-Statistics is also reported to indicate the probability levels at which the coefficients are statistically significant or not.

1.7.2 Acceleration and Deceleration of Growth

Since, the exponential form of growth curve assumes a constant growth rate, therefore, to examine, statistically, the acceleration or deceleration (or constants) of growth and/or growth rates, log-quadratic form has proved to be convenient. It can be written in the following form:

$\ln Y_t = a + bt + ct^2 + u_t$

If estimated value of c assumes significantly (T-ratio is used as test statistics) positive value then it shall suggest acceleration in growth rate and in case of significantly negative

value of c, it will indicate deceleration (Boyce, *op.cit.*: 262; Reddy, 1978:807; Srinivasan, 1979: 1283; Saha and Swaminathan, *op.cit.* :A2-A3).

1.7.3 Measuring Growth in Sub-Periods: Kinked Exponential Model

To calculate exponential growth rate simultaneously for the whole period (1970-71 to 2008-09) and for four sub-periods (1970-71 to 1979-80, 1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-2001 to 2008-09), kinked exponential model has been used. Three kinks (k_1, k_2 and k_3) were introduced to measure the four pre-specified sub-periods.

The kinked exponential model can also be specified by re-normalizing time such that t = 0 at the break point k_1, t =10 at the second break point k_2 and t =20 at the third break point k_3, then equation can take the following form and which can be used to estimate the growth rates for four sub-periods with a joint intercept:

$\ln Y_t = a_1 + b_1 D_1 t + b_2 D_2 t + b_3 D_3 t + b_4 D_4 t + u_t$

Where, D_1 = 1 for 1970-1971 to 1979-1980,

= 0 elsewhere.

D_2 = 1 for 1980-1981 to 1989-1990,

= 0 elsewhere.

D_3 = 1 for 1990-1991 to 1999-2000,

= 0 elsewhere.

D_4 = 1 for 2000-2001 to 2008-2009,

= 0 elsewhere.

1.7.4 Weather or Rainfall Adjusted Growth Rate

Weather especially rainfall plays a crucial role in Indian agriculture. However, most of the studies while discerning growth of agricultural production have ignored the weather factor (Mahendradev, 1987: A82-83). Rainfall index is defined as actual rainfall as percentage of normal rainfall. The rainfall index is incorporated in exponential growth equation to estimate the weather adjusted growth rate or rainfall adjusted growth rate.

1.7.5 Measuring Instability of Growth Rate

In the present study the method followed by Boyce (*op.cit.*), Saha and Swaminathan (*op.cit.*) and Mahendradev (*op.cit.*) has been used to measure the instability in production.

Based on actual value of production for the period 1970-71 to 2008-09, an exponential trend line has been fitted and exponential growth rate calculated. Predicted values have been calculated for the all the successive periods from 1970-71 to 2008-09.

The difference between the actual values and predicted values of crop output are calculated and the differences are expressed as the percentage of the predicted value. The square of these percentage deviations are calculated and regressed against time. The estimated coefficient of time is considered as instability coefficient. If the estimated coefficient on time is positive, it can be concluded that the instability has increased and if the coefficients assume negative values then it can be said that instability has decreased. The T-statistics of the coefficient indicates the strength of the trend.

1.7.6 Measuring Crop Diversification

To understand the nature of changes in cropping pattern in West Bengal as well as in the districts, the rate of growth of acreage under different crops in time perspective has been considered. The annual exponential rates of growth of the area under crops were estimated. After obtaining the respective exponential growth rates of output area and productivity, the area effect and yield effect were calculated. After estimating the rate of growth and change in the rates of growth of acreage of different crops, substitution effect and expansion effect have been calculated. To ensure, whether the area under any crop has undergone change because of inter-crop shift of area or due to substitution effect or due to change in the total area under cultivation or expansion effect, the cropped area-gross cropped area elasticity (E) was measured.

While studying the crop diversification, Herfindahl Index and Simpson Index have been used to measure the extent of crop concentration/diversification both at aggregate level i.e., for the state of West of Bengal as well as at disaggregated level or at district level. It is to be mentioned that the Herfindahl index is the index of concentration and higher value of it indicates crop specialisation. Therefore, to obtain the index of diversification, it is subtracted from one, which is a simplified form of Simpson index of diversification.

To understand the spatial pattern of diversification, the computed values of indices were ranked for the districts of West Bengal. To test the consistency of the ranking patterns of the districts based on the values of Herfindahl indices and Simpson indices, Spearman's rank correlations of district wise indices between any two years along with level of significance, are also considered.

Correlation between Simpson indices and various factors that may affect crop diversification has also been considered.

1.7.7 Standard Pooled Regression

To validate (or invalidate) farm size and productivity relationship and to capture the impact of operation *barga*, introduction of *panchayat* for local level governance and to shape the development agenda at rural grass root level, impact of Green Revolution, economic reforms and simultaneous impact of Green Revolution and operation *barga*, on agricultural productivity, standard pooled regressions over districts and time have been used.

The state is divided into 19 administrative districts viz. Darjeeling, Jalpaiguri, Cooch Behar, North Dinajpur, South Dinajpur, Malda, Murshidabad, Nadia, North 24 Parganas, South 24 Parganas, Kolkata, Howrah Hooghly, Burdwan, Birbhum, Bankura, East Midnapore, West Midnapore, and Purulia. Kolkata is excluded in this study because of its non availability of agricultural areas.

To maintain temporal continuity of data, the districts of 24 Parganas, West Dinajpur and Midnapore have been taken as an undivided unit[12] and the empirical analysis evolved around 15 districts over time.

The proposed study is based on data and information collected from various secondary sources like, West Bengal Economic Review, District Statistical Handbook, Census Report, Agricultural Census, Study of Farm Management and Cost of Production of Crops in West Bengal, Directorate of Economics and Statistics, Government of India, Ministry of Statistics and Programme Implementation, Government of India, Planning Commission, Government of India, New Delhi, Reserve Bank of India (RBI), New Delhi, National Sample Survey Organisation (NSSO) etc.

1.8 Chapterisation of the Study

The proposed study has been designed in the following chapters:

Chapter-I: This chapter has introduced the evolution of theoretical discourse on development and how contested the agricultural domain remained there in. Contextualising the theoretic on development vis-à-vis agriculture in India and the regions has been placed at background of the proposed study that moves further with specific objectives and introduction of the research problem with literature reviews. Identifying the

gaps in literature keeping the research problems at the core, research questions and hypotheses are also framed. Methodology along with statistical and econometric tools are identified to find plausible answers of the research questions and to test the hypothesis that this study has proposed.

Chapter-II: In this an over view of agriculture in Bengal during pre-colonial and colonial era were presented. Tenurial relation, agrarian structure, peasantry and economy those were prevailing during pre-colonial era have also been dealt with. Further evolution of tenancy system during colonial rule in Bengal, its impact on agrarian community as well on agriculture production and productivity in Colonial Bengal have been critically examined. And finally the agrarian reforms carried on immediately after independence has also been discussed.

Chapter-III: In this chapter the policies undertaken for the development of agriculture from independence to current period have been evaluated and how the changes in policy affected the agricultural production and productivity at national level as well as at regional level have critically been analysed.

Chapter-IV: The trends in agricultural production and productivity in West Bengal and disaggregated at district level has remained the focal point of this chapter. Changes in growth rates of production and productivity of select foodgrains in the state of West Bengal as well as in her districts from 1970-71 to 2008-09 with four pre-specified sub-periods have been analysed.

Chapter-V: This chapter tries focus on district wise acceleration and deceleration in growth of Production of select foodgrains in West Bengal from 1970-71 and 2008-2009. District wise weather adjusted growth rates and unadjusted growth rates are calculated and compared to gauge the influence of rainfall over time on agricultural production and productivity. Districtwise trends in growth instability in production and productivity of foodgrains over time have been discussed and a detailed trend analysis of production, productivity and area along with acceleration or deceleration of growth and instability of select non-foodgrains in West Bengal has also been carried over.

Chapter-VI: In this chapter whole gamut of issues related to crop diversification in West Bengal disaggregated at district level over time has been explored in length and breadth.

Chapter-VII: An econometric analysis has been carried on in this chapter to verify the farm size and productivity relationship and to capture the impact of operation *barga*,

introduction of *panchayat* for local level governance, impact of Green Revolution, economic reforms and simultaneous impact of Green Revolution and operation *barga*, on agricultural productivity from 1980-81 to 2008-09. A further attempt has been made to verify the impact of change in wage rate and agricultural income on over all employment as well as employment in the farm sector.

Chapter-VIII: Summary and Conclusions, designed to improve the agrarian sector vis-à-vis economy of West Bengal and her districts.

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[1] Alfred Marshall argued that the tenant would not have incentive to cultivate the land efficiently, since the tenant would only receive a fraction of any additional output created by putting additional work effort (Marshall 1948:644). . It needs to be reiterated that in share tenancy or share cropping contract tenant promises to pay the landlord a fraction (assuming as y*) of the total output. If it is assumed that y* is around 0.5 (empirically also proved to be so (Basu, 1994)), and the tenants who decides and bears input (e.g., water, seeds, fertiliser etc.) costs shall have no incentives to increase the output by using additional or new variants of inputs (by incurring additional costs) because under share tenancy, the tenants is not going to receive full additional output but only half of it. Therefore, the tenant will not use the new input unless the value of additional output is at least double the cost of new input. Hence, the sharecropping will be continued to be an inefficient system and there is a lesser scope of improvement in agricultural productivity and production.

[2] In fixed rate tenancy, tenant will be able to realise the additional output produced by him by using additional inputs. The output thus produced under fixed rent tenancy from the same amount of land is likely to be higher than that of share tenancy. The landlords were thus suggested to switchover to fixed rent contact rather relying on share tenancy.

[3] Amit Bhaduri (1973) searched the causes for stagnation in a semi-feudal agrarian economy. In his theoretical model, it is assumed that the responsibility of innovations rests on the landlord and the landlord may not be interested in innovations. In a semi feudal agriculture a landlord has two sources of earnings. He earns as rental proportion of total output. This is his property income. The landlord also earns income by charging exorbitant interest rate on the consumption loan provided to his tenants. This is his usurious income. If technological innovation takes place, the tenant's income goes up; his need for consumption loan goes down. Hence it is possible that an innovation lowers the net income of landlord. For this reason, the landlord may not be interested in innovations. As a result, stagnation continues to prevail in the backward agriculture. In Bhaduri's word 'since semi-feudal landowners as a class largely maintain their economic and political control over the *kishans*, by keeping them in bondage of perpetual indebtedness, it is quite probable that they will try to restrict the level of technological improvement in such a way as not disrupt the perpetual circle of debt in which the *kishan* is caught'. A necessary condition of Bhaduri's result is that the tenant reduces his borrowings when his income increases as a result of yield raising innovation.

[4] Barga is the local word for the share cropper.

[5] The role of successful land reform in enhancing allocative efficiency in the agricultural sector is hardly consciously considered. Allocative inefficiency results when, given the prices of inputs and outputs, a producer cannot optimally allocate her resources to minimize the cost of production and subsequently leads to non-realization of the potential productivity of the inputs used. Such inefficiencies add considerably to the lowering of the capacity of the farmers to generate marketable surplus, thus nullifying the achievement of distributive efficiency. Providing access to land, either

through redistribution or through a secure tenancy contract, would have been effective in increasing the productivity of agricultural practices.

[6] Area effect refers the increase in output in the absence of any changes in yield and cropping pattern, yield effect shows the changes in yield with constant cropping pattern and the third element potrays the effect of changes in the cropping pattern on the absence of yield changes.

[7] Price effect shows how change in crop prices contributes for the growth.

[8] Locational shift captures the effects on the shifting of crops from low yielding areas to high yielding areas or shifting of from the areas where price is low to the areas where price is high for the crop.

[9] The current land ceiling in West Bengal is 5 hectares of irrigated land and 7 hectares of unirrigated land (Bhaumick, *op.cit.*)

[10] According to West Bengal Land Reform Act (amended-1966 to1972) *bargadars* are entitled to receive 75 percent of the produced crop except in cases when the landlord was providing all non-labour inputs and such cases tenants shall receive 50 percent of the produce (Chakrabarti, 2003).

[11] The compound growth is composed of two parts: principal or the initial value of variable in consideration and the amount of change in the principal over a certain time period which is called 'growth on growth' because it measures periodic growth of a value that itself is growing periodically.
$CAGR\ (t_o, t_n) = (Y\ (t_n) / Y\ (t_o))^{1/t_n - t_o} - 1$
$Y\ (t_o)$ = Initial value of Y (may stand for output, population etc.) in the year t_o
$Y\ (t_n)$ = End value of Y (may stand for output, population etc.) in the year t_n
$t_n - t_o$ = number of years

Since while calculating CAGR for certain number of years the initial value and the end value are considered, therefore, the growth rate so calculated does not take into account the values falling in between years and any fluctuation there in does not get reflected in CAGR.

[12] The erstwhile district of 24 Parganas was split into two districts- South and North 24 Parganas in 1986, West Dianjpur was divided into North and South Dinajpur in 1992 and the district of Midnapore was divided into West and East Midnapore in 2002.