DETERMINANTS OF AGRICULTURAL PRODUCTIVITY IN WEST BENGAL AND SYNERGY BETWEEN AGRICULTURE AND ECONOMY: AN ECONOMETRIC ANALYSIS

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Abstract: In West Bengal a major upsurge in agricultural production and productivity took place during late-eighties and the spell continued till late-nineties. However, since, nineties the trend got reversed. The paper made an attempt to find the impact of tenancy reforms, commonly known as operation *barga*, role of *pachayat*, Green Revolution, labour use per hectare, farm size, institutional credit at rural level, and economic reform on agricultural productivity. The econometric results prove the cumulative impact of tenancy reforms and green revolution to augment agricultural productivity in West Bengal and her districts. The inverse relationship between farm size and productivity do not hold. The positive impact of agricultural growth also helped indirectly towards the growth of unorganised small- scale industries. However, with the fall in agricultural productivity since late-nineties, marginalisation of rural workforce is being increasingly felt. As average size of landholdings is small, growing population makes it smaller, and there is a possibility that with rising cost of production many of these holdings may prove to be uneconomical for the farmers. With inelastic land area and with an adverse land/man ratio, it becomes imperative to transfer excess agrarian population to non-farm activities. Otherwise, absolute number of persons and households dependent on agriculture is bound to rise. Notwithstanding all the negative aspects, West Bengal though continued to achieve high growth in production and productivity of rice and foodgrain compared to agriculturally advanced states like Punjab, Haryana, and Western Uttar Pradesh. However, continuous decline in foodgrain and rice productivity since late-nineties shall not only create agrarian crisis in Bengal but it bound to affect the national agrarian scenario too.

Keywords: Agricultural Productivity, Tenancy Reform, Green Revolution, Panchayat, Economic Reform, Average Holdings, Agrarian Crisis.

Introduction: Among the agriculturally progressive states in India, West Bengal, during 1980s, emerged successfully as one of the leading states in terms of growth of agricultural production and productivity in foodgrain. In 2008-09, West Bengal contributed 7.6 percent of the total foodgrain production of the country and more than 15 percent of the rice was produced by West Bengal alone. The net sown area is 61 percent of the total geographical area of the state against the national average of 46 percent. The gross cropped area reached to 97.5 lakh hectares with cropping intensity of 184 percent. Small and marginal farmers account for over 95 percent of total farm population and they own about 80 percent of cultivated land. From 1980-81 to 2000-01, foodgrain production grew at a rate more than 3 percent per annum while growth of productivity of foodgrain during the same period remained close to 3 percent. Among the non-foodgrains, like potato, Rapeseeds & mustard and sesamum registered long term annual compound growth rate in production above 4 percent. Foodgrain production was primarily dominated by rice. The contribution of agriculture to Gross State Domestic Product at current prices declined from 42 percent in 1970-71 to 23. 5 percent 2009-10 but it remained much higher than the all-India figure of 17 percent. Importantly, the contribution of industry to Gross State Domestic Product at current prices in 2009-10 is 18.4 percent, which is much lower than the contribution of agriculture. This exhibits the dominance of agriculture in the economy of West Bengal. To substantiate further, around 72 percent of the population live in rural areas with over 95 percent as small and marginal farmers and till date agriculture continues to be the main source of sustenance for more than 50 percent of the rural populace.

However, growth of agricultural output remained stagnant upto 1980. An in-depth study was carried out by James Boyce (1987) to explore the nature and causes of agricultural stagnation in West Bengal and Bangladesh. He estimated that between 1949 and 1980, the agricultural output grew at a rate of 1.74 percent per annum and rural population and total population of West Bengal grew at 2.31 percent and 2.42 percent per annum during the same period. This created an impasse in agricultural production and had unfavourable distributive impact

on the rural population. According to Boyce (*ibid.*), between 1949 and 1980, the productivity of aman grew at a nominal rate of 0.24 percent per annum and annual growth of area under aman rice was also found to be very low (0.57 percent per annum). The abysmal growth of aman rice was identified as the root cause of agricultural stagnation in West Bengal by Boyce. The turn around in agricultural growth occurred in eastern region, precisely in West Bengal since the 1980s. A considerable number of scholarly works has extensively highlighted the trends in agricultural production and productivity in West Bengal. For example, West Bengal in general and majority of the districts achieved vey high growth rates of production and productivity in agriculture since the 1980s (Saggar,*et al.*, 1989; Harris, 1993; Saha and Swaminathan, 1994; Sen and Sengupta, 1995; Rogaly *et al.*,1995; Raychaudhuri and Sen, 1996; Gazdar and Sengupta, 1996; Banerjee and Ghatak, 1996; Sanyal, Biswas and Bardhan, 1998; Rawal and Swaminathan, 1998; Chakraborty, 2002, Banerjee *et al.*, 2002, Bardhan and Mookherjee 2004, Raychaudhuri, 2004; Chattopadhyay, 2005) after a long spate of stagnation in agriculture (Shah, 1975; Islam, 1978; RBI, 1984; Planning Commission, 1985: GoI,1985; Vaidyanathan, 1987; Boyce, 1987). Growth in production and productivity of foodgrain was primarily driven by rice and increase in yield contributed most to the growth in productivity and production. It is noticed, however, the overwhelming growth in production and productivity in foodgrain achieved by West Bengal and her districts during eighties, was arrested in the nineties and since 2000-01 the decline became sharp.

There has been a wide range of economic and non economic factors that may influence growth in production and productivity of agriculture. To be specific, agro-climatic condition including rainfall, institutional reforms especially, land and tenancy reforms, introduction of local level governance or *panchayati raj*, expansion and diffusion of Green Revolution technology combining high-yielding varieties, irrigation, fertiliser etc., size of holdings, agrarian structure, land distribution pattern, cropping intensity, farm mechanisation, rural infrastructure, credit and cooperatives, population density, area under non agricultural use and urbanisation, relative prices, wages, sense of security of tenants, smooth communications of bureaucrats and technocrats to farmers etc., have considerable impact on agricultural productivity.

As the knowledge on interaction between economic and non economic factors is limited and therefore, to keep the analysis within manageable proportions, non-economic factors are generally treated as exogenous. Inputs are also classified as essential and non-essential inputs. Land, seed, minimum labour for sowing and harvesting are treated as essential inputs because output becomes zero if any one of the inputs assumes zero value. Fertilisers, pesticides, tractor services are considered as non-essential inputs (Sankar, 1997:2, 4). In addition, to estimate the impact of these factors on productivity create statistical impediments because more often than not, these explanatory variables become collinear with each other. Estimation of the impact of various components of agrarian reforms on productivity also suffers from various computational barriers because a long time series contains a number of effects simultaneously and segregation of them often become difficult. Statistical obstacles more often deter 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. It needs to be reiterated again, the studies conducted so far to identify the underlying factors for major turn around in growth of agricultural production and productivity in West Bengal either explicitly or implicitly exemplifies the role of institutional reforms or more directly, distribution of ceiling surplus land among the land-less and conferring quasi-land rights or limited transfer of property rights to the share croppers or operation *barga* and introduction of local level self governance or *panchayati raj*.

The tenancy reforms in West Bengal received impetus after the Left Front Government led by the Communist Party of India assumed power in 1977. The Land reforms Act of 1955 and its further amendments in 1966, 1970 and 1971 were further amended in 1977 by the left Front Government that conceived a pro-tenant policy and in 1978, tenancy reforms or operation *barga* was aggressively pushed to break the shackle of forces who were earlier acting as major stumbling blocks against recording of names of sharecroppers or *bargadars*. The process of granting quasi-heritable land rights to the share croppers also received the desired fillip. This was supported by the fact that by1993, the number of recorded *bargadar*s reached at 2.3 million or 65 percent as cumulative percentage of the total (Banerjee *etal*., :242).

At the same time, introduction of local self-government, i.e., three-tier elected bodies known as '*panchayat*' allowed governance to reach the grassroot level. Delegation of financial and planning responsibilities to elected local bodies created congenial environment for implementing centrally funded schemes, especially in irrigation and infrastructure. It also helped to settle the water and wage related disputes at village level. Election to

three-tier *panchayats* also took place in 1978. The administrative structure of three-tier *panchayat* introduced at the apex the *Zilla Parishad* which worked at the district level, *Panchyat Samiti* which worked at the block level (consisting of large number of villages) and finally at the grass root level of *anchal* (consisting of 12 to 15 villages) it is the *Gram Panchayat* that takes care of grass root level governance.

Various studies on West Bengal reaffirm the fact that operation *barga* and the introduction of the three-tier *panchayat* played a major role in the spectacular turn around in foodgrain production and productivity in West Bengal and it also caused an economic upswing in the rural economy of Bengal (Banerjee. *et al*.,: 267-270, Bardhan and Mookherjee, 2006:2, Bandyopadhyay, 2003; Hanstad and Brown, 2001).

Both theoretically and empirically, it has been well established that institutional reforms coupled with devolution of power at the grass root level have contributed towards the increase in the use of high yielding variety of seeds, access to more institutional credit, increase in investment in private irrigation, right incentive to produce more, improvement in the general functioning of market, especially land and credit market, increase in efficiency in small sized farm, expansion of rural infrastructure, increase in rural wage, decrease in inequality and reduction of poverty. All these contributed towards the rise in agricultural production and productivity in West Bengal (Chadha and Bhaumik, 1992; Lieten, 1992; Bhaumik, 1993; Saha and Swaminathan, *op.cit.*; Sen and Sengupta, 1995; Banerjee and Ghatak 1996; Sengupta and Gazdar, 1996; Mukherjee and Mukhopadhyay,1996; Rawal Swaminatan, *op.cit.*; Ghosh, 1998; Sanyal, Biswas and Bardhan, 1998; Williams, 1999; Banerjee *et al.*, 2002, Ghatak and Ghatak, 2002; Chakraborty, 2002; Raychaudhuri, 2004; Bardhan and Mookherjee 2004; Bhattachayya 2005; Bhattacharyya and Bhattacharyya 2007).

Harris (1993) on the other hand, have preferred to ignore the role of institutional reform for enhancing production and productivity growth in agriculture in West Bengal during eighties, rather he emphasised that growth in production of boro and simultaneous expansion of private shallow tube-wells have propelled the growth of agriculture. Seemingly these opposite view points has been synthesised best by Sengupta and Gazdar (*op.cit*.: 168). While they argue that ' the amount of cropped land distributed under ceiling laws represents around 6.5 per cent of total cropped area in the state, less than a third of which was distributed after 1977. Precise estimates of the total area registered under operation *barga* are not available, but this is unlikely to exceeded 15 per cent of the total cropped area. For land redistribution and operation *barga* to be the driving forces behind accelerated growth, these relatively small areas of land would have had to achieve extraordinarily high rates of productivity growth. This, clearly, has not been the case. Instead, there has been wide adoption of HYVs for aman and an extensive increase in (irrigated) boro cultivation. The dichotomization of the explanations of recent agricultural growth in West Bengal between market versus non-market innovations and reforms versus private incentives is problematic from both conceptual as well as empirical viewpoints'.

Banerjee. *et al.*, (*op.cit*.:275& 276) covered the period between 1979 and 1993 and they chose 1979 because it marked the beginning of operation *barga* programme and measured the magnitude of the effect of operation *barga* on productivity by multiplying the coefficient on the registration rate with change in registration over the period. Their estimation ascertained that operation *barga* raised average productivity of rice in West Bengal by 20 per cent.

This paper intends to accomplish two specific objectives: first, to measure the impact of various economic and non-economic factors that influenced the growth in productivity in West Bengal in general and her districts in particular and second is to examine how changes in growth of agricultural productivity has influenced the economy and employment of the state vis-à-vis districts by taking aforementioned statistical impediments into consideration.

Methodology to Measure the Impact of Various Factors on Foodgrain Productivity: Against this backdrop, initially, the effects of operation *barga*, role of *pachayat*, Green Revolution, labour use per hectare, farm size, institutional credit at rural level, and economic reform on agricultural productivity, have been measured by using standard pooled regression over districts and time. Ordinary least squares (OLS) method was applied to estimate the coefficients. Data on 15 districts and for the time period of 1980-81 to 2008-09 were pooled together for the analysis. As dependent variable, log value of yield rate (kg/ha) of foodgrain (FDGRN-PDVTY) has been considered. Among the independent or explanatory variables, *barga* households as percentage to total number households operating (BARGA %) has been incorporated as proxy for operation

barga. To measure the impact of the activities of *panchayat* on productivity, rural road constructed by the *Zilla Parishad* in terms of kilometre road per thousand square kilometres area (ZILLA ROAD) has been considered. Logarithmic value of districtwise fertiliser use (LNFERT) has been pooled for the period of 1980-81 to 2008-09 and incorporated as an independent variable to capture the impact of Green Revolution technology on agricultural productivity. If fertiliser is considered as a non-essential input, labour is considered as an essential input for production. Therefore, labour engaged on per-unit of land (AGRI LAB-NCA) has been obtained (total number of agricultural labourers divided by Net Cropped Area or NCA) for districts over time and included as one of the independent variables in the model. Average land holding (AV TL HLDN) has been calculated by as dividing total landholdings by total number of operational holdings (in hectare) and this has been incorporated to verify the farm size-productivity relationship. A dummy has been used to measure the impact of economic reform (RF D1) so that from 1990-91 to 2008-09, assuming value '1' and for rest of the period '0'. While applying the OLS method, VIF statistic and Durbin-Watson statistic (DW) have been considered to check the problems of multi-collinearity and autocorrelation in the model.

The model to be estimated thus takes the following form:

$$\text{FDGRN-PDVTY} = \beta_1 + \beta_2 \text{ BARGA \%} + \beta_3 \text{ ZILLA ROAD} + \beta_4 \text{ LNFERT} + \beta_5 \text{ AGRI LAB-NCA} + \beta_6 \text{ AV TL HLDN} + \beta_7 \text{ RF D1} + \mu \quad \text{---------- (1)}$$

Where,

FDGRN-PDVTY = Log Value of foodgrain productivity (kg/ha)

BARGA % = *Barga* households as percentage to total number households operating.

ZILLA ROAD = Rural road constructed by the *Zilla Parishad* in terms of kilometre road per - thousand square kilometres area.

LNFERT = Log value of fertiliser use (kg)

AGRI LAB-NCA = Labour engaged on per-unit of Net Cropped Area (NCA).

AV TL HLDN = Ratio of total landholdings and total number operational holdings.

μ = Random Term.

Results of the estimated parameters of Equation 1 are presented in Table 7.1.

Table 1: Results of Estimated Parameters of Equation 1
Dependent Variable: Log Value of Foodgrain Productivity

Explanatory Variables	Coefficients	Std. Error	T-statistic	Sig.	VIF
Constant	-565.816	139.41	(-4.06)	0.000	
BARGA %	0.079	1.89	(2.66)*	0.008	1.36
ZILLA ROAD	0.115	0.04	(3.55)*	0.000	1.16
LNFERT	0.392	30.349	(9.36)*	0.000	2.71
AGRI LAB-NCA	0.560	44.918	(13.43)*	0.000	2.68
AVG TL HLDN	0.315	65.077	(7.48)*	0.000	2.74
RF D1	0.175	40.556	(4.88)*	0.000	2.00
R Square	Adjusted R Square	Std. Error of the Estimate		Durbin-Watson	
0.723	0.719	290.20		0.689	

Significant at 1% level, ** Significant at 5% level, * Significant at 10% level*

Source: *Calculation based on data collected from various volumes of West Bengal Economic Review And District Statistical Handbook, Government of West Bengal*

Interpretation of the Regression Result: The results of estimated parameters of equation 1 are been shown in Table 7.1. The value of adjusted R^2 indicates that 72 per cent of the total variation has been explained by the explanatory variables. The value of Durbin-Watson statistic is greater than 0 but less than 4, therefore, the absence of first-order auto-correlation is pronounced. The Variance Inflation Factor or VIF of all the explanatory variables are found to be much less than 10, hence, presence of multi-collinearity among the explanatory variables is negligible. Among the estimated explanatory parameters, all the explanatory variables the variables have considerable impact on foodgrain productivity. Coefficients of BARGA %, ZILLA ROAD, LN FERT, AGRI LAB-NCA, AV TL HLDN and RF D1 are all positive and prove to be significant factors in influencing the foodgrain productivity at 1 per cent level.

Opeartion Barga: *Barga* households as percentage of total number of households operating (BARGA %) or operation *barga* has significant impact on agricultural productivity. In other words, rise in *barga* registration by 1 per cent, would raise the foodgrain productivity by 0.079. This result validates the empirical studies of

Banerjee *et.al.*, (*op.cit.*), Raychaudhuri (*op.cit.*). It has also been observed that the districts which are having higher average productivity, the number of *bargadars* registered as percentage of total number of operating households (BARGA %) remained relatively high (Table 7.7). Districts of Birbhum, Bankura, Burdwan, Hoogly, Malda and Midnapore bear the testimony. Commensurate increase in fertiliser use will further make the case stronger in the sense that operation *barga,* coupled with increased use of fertiliser, will be having a stronger impact in raising foodgrain productivity in the districts as well as for the state. Among the districts of West Bengal, Burdwan, Midnapore, 24 Parganas, Hoogly, Murshidabad, West Dinajpur, Nadia and Birbhum achieved high average productivity of foodgrain and average use of fertiliser (kg/ha) also remained relatively higher (Table 2) in comparison to the other districts of West Bengal.

Table 2: Districtwise Average Foodgrain Productivity (kg/ha), percentage of *Barga* and Average Fertiliser Use (kg/ha) from 1980-81 to 2008-09

District	Average Foodgrain Productivity (kg/ha)	District	Barga %	District	Average Fertiliser Use (kg/ha)
Burdwan	2549	**Birbhum**	37.6	**Midnapore**	111.5
Hoogly	2347	**Hoogly**	31.4	**Burdwan**	98.0
Birbhum	2307	**Bankura**	30.1	**24 Parganas**	93.0
Bankura	2196	**Burdwan**	28.4	**Hoogly**	84.6
Nadia	2079	**Cooch Behar**	27.1	**Murshidabad**	59.4
Murshidabad	2048	**Midnapore**	24.8	**West Dinajpur**	54.1
Malda	1945	**Jalpaiguri**	23.3	**Nadia**	53.2
Midnapore	1944	**West Dinajpur**	22.0	**Birbhum**	52.9
Howrah	1885	**Malda**	21.8	**Malda**	44.6
24 Parganas	1882	**24 Parganas**	17.4	**Bankura**	40.7
West Dinajpur	1757	**Howrah**	17.3	**Howrah**	39.1
Darjeeling	1696	**Nadia**	15.4	**Cooch Behar**	37.6
Purulia	1620	**Darjeeling**	14.6	**Jalpaiguri**	33.9
Cooch Behar	1385	**Murshidabad**	13.7	**Purulia**	27.4
Jalpaiguri	1282	**Purulia**	2.5	**Darjeeling**	20.8

Source: *Calculation Based on Data Collected from Various Volumes of West Bengal Economic Review, Government of West Bengal*

Expansion of Zilla Parishad Road: Expansion of roads constructed by Z*illa Parishad* (ZILLA ROAD) also has had a yield-raising effect. The *panchayats* execute many rural development schemes sponsored by the Central government; most of the schemes have been designed to create rural infrastructure, especially roads and in some cases, excavation of tanks and ponds. It is thus evident that this effort of improving the rural infrastructure has a positive impact on productivity. Precisely, rural roads and connectivity to urban centres reduces transportation cost and transaction cost, and also allows farmers to realise better prices of their farm products.

Fertilizer: The productivity enhancing capacity of fertiliser (LN FERT) have also been validated with strong positive value of its coefficient. Logically wide spread application and success of Green Revolution technology depend on use of HYV seeds, irrigation and fertiliser. In all above regression results, role of fertiliser to enhance agricultural productivity has doubly been confirmed. Therefore, implicitly, it can be said that the spread of HYV seeds and irrigation must have taken place. In 2008-09, more than 55 percent area of Gross Cropped Area (GCA) is under HYV rice (West Bengal Economic Review, 2008-09).However, presence of high multi-collinearity among fertiliser uses, area under HYV and irrigation and unavailability of comparable time series data at district level act as deterrent to incorporate them together as explanatory variables.

Agricultural Labour, Average Land Holding and Productivity: The result also reaffirms the logic that the increase in labour (AGRI LAB-NCA) and average total holding (AV TL HLDN) shall increase the agricultural productivity as general input-output relationship, as neo-classical economics presupposes. Similarly, 1 per cent rise in agricultural labour per hectare net cropped area should enhance the productivity by 0.560. In this model, the estimated coefficient of average land holding (AV TL HLDN) reveals that 1 per cent increase in land

holding size will raise the productivity of foodgrain by 0.315 and thus inverse relationship between farm size and productivity does not hold. Here average total holding has been considered and in West Bengal, the difference between average total holding and average marginal holding is quite narrow. The average size of total holding stands at 0.77 ha and average marginal holding at 0.49 ha (Calculated from the data available from Agricultural Census 2005-06). Evidently, the possible inverse relationship between farm size and productivity provided a logical basis and favoured a redistribution of land to the landless, and brought substantial improvement in production and productivity. The present study also corroborates the fact that the then prevailing agricultural practices were mostly dependent on inputs procured out of the resources owned by the households. Free resources from nature also contributed substantially. Land was the only resource that such farmers did not have secured access to. Providing access to land, either through redistribution or through a secured tenancy contract, would have been effective in increasing the productivity of agricultural practices. The situation has, however, changed significantly with the Green Revolution that altogether altered the basis of the input supply system faced by the farmer. The inputs are no longer to be procured from out of family resources or from nature. They are to be purchased from market, be it seeds, fertilisers, water and even labour. The poor tenants, small and marginal farmers face a difficult situation not only in procuring the complementary inputs at affordable prices but also realizing the optimum value for the output produced. Our study also corroborates the observations made by Ghosh (1979) and Lipton (1993). According to Ghosh, with the advancement of technology, inverse relationship disappears. Lipton observed 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. Ashok Rudra (1968) is thus perhaps right while he observed that, 'there is no scope for propounding a general law regarding farm size and productivity relationship.'

Economic Reforms: It has also been observed that economic reform whose effect has been captured by reform dummy (RF D1) has a positive impact on agricultural productivity. During the reform era, cost of production has increased firstly, because of the withdrawal of subsidy on fertiliser and price being determined by the market, and secondly, public investment in agriculture has declined. There has been continuous hike in diesel prices which is one of the propelling factors behind the sharp expansion of tube-well irrigation in the state. Even other inputs also got dearer to the farmers. Various studies have shown that economic reform laid emphasis price factors and infrastructure while the institutional aspects of agriculture did not receive adequate attention. (Chadha, 2002; Majumdar, 2002; Bhalla, 2002; Kumar, 2002).

Role of Irrigation in Augmenting Agricultural Productivity: The present study while explaining the role of various factors in influencing the agricultural productivity, has failed to incorporate irrigation as one of the explanatory variables in the above econometric model due to the presence of high multicollinearity among fertiliser uses, area under HYV and irrigation and unavailability of comparable time series data on irrigation at district level. However, an attempt has been made to fill this gap by using various research documents on irrigation in West Bengal.

Till 1970, there was slow progress in irrigation, especially the growth of tube-well irrigation was very slow (Rawal, 2001:4017). During 1982 only 16 per cent of the groundwater potential of the state was used (Boyce, *op.cit*). Within the period till 1970, three major river valley projects were commissioned; Damodor Valley Corporation (DVC) Project was commissioned in 1933 which became the major source of irrigation for Burdwan, Hoogly, Howrah and Bankura. In 1954, the Mayurakshi Project started operating and it provided irrigation to major parts of Birbhum, and certain parts of Burdwan and Murshidabad. The Kangsabati Project became operational in 1968 and irrigated agricultural land in Bankura, Midnapore and Hoogly. During late - seventies and eighties, 11 medium canal irrigation projects and several minor surface irrigation projects were initiated to cater to the irrigation needs of western part of the state and Purulia was largely benefited by these projects. From the Teesta project (awaiting completion), irrigation of agricultural lands of Jalpaiguri, plains of Darjeeling District, Cooch Behar, West Dinajpur and Malda districts are partly accomplished.
However, major turn around in irrigation system as well as increase in net irrigated area took place between eighties and nineties with the massive growth of tube-well irrigation in West Bengal. According to the study made by Rawal (*op.cit*.:4018), one notices that from 1975-76 to 1992, net irrigated area had increased by 115 per cent and tube-well irrigation had increased by more than 460 per cent and irrigated 636 thousand hectares of land. Density of tube-well per 100 sq-km was found to be high in 24 Parganas, Nadia and Murshidabad. High percentage increase in numbers of tube-wells (both driven by electric and diesel) was observed in Jalpaiguri, Cooch Behar, West Dinajpur, Bankura, and Malda, although the density remained much lower in comparison to the eastern districts of West Bengal (Rawal, *op.cit*., 4018-4023). It has been observed that there is a close

relation between introduction of HYV summer paddy and rapid expansion of tube-well irrigation in West Bengal. As a matter of fact, until late seventies, major proportion of agricultural land in the state was mono-cropped. Paddy cultivation in large scale in many low-lying and flood prone areas commenced after the introduction of HYV summer paddy, especially boro paddy. Boro paddy is a highly water intensive crop. During the early eighties, i.e., early period of the transition to boro cultivation, canal irrigation, irrigation by using deep tube-wells or river-lift irrigation were the major sources of irrigation for boro cultivation. Gradually, diesel powered shallow tube-wells and thereafter, with the fall in water level, submersible pump tube-well systems were extensively used. Investment on shallow tube-wells and submersible pump tube-wells were mostly borne by the users from their personal savings, private borrowings from local money lenders (Moitra, 2005:128-140). This opened up the market for the supply of ground water. Therefore, from the aforementioned empirical results and discussion since the eighties, the wider penetration of seed-fertiliser-water technology got established and it certainly contributed positively to the growth in production and productivity of foodgrain in West Bengal.

Agriculture and Economy Interface: A Few Critical Issues: For West Bengal, doubts may be raised that rise in the growth of agricultural productivity in the eighties and subsequent fall in the nineties may have some negative impact on agricultural income, employment and economy at large. And, lack of alternative employment and income opportunities outside agricultural may further complicate the situation. It may lead to possible marginalisation of rural work force.

Taking sectoral share into consideration (Table 3), it is observed that from 1980-81 to 1995-1996, the share of agriculture to GSDP experienced a gradual increase and thereafter it started declining in subsequent years. The decline became sharp since 2000-01. However, contribution of the secondary sector to GSDP failed to surpass the share of primary sector from 1980-81 to 2009-2010 and decline in share became faster since 1990-91. Within the secondary sector, the secular fall in share of contribution of both registered and unregistered manufacturing sectors has also been observed. Absence of large-scale manufacturing sector is a reality in West Bengal and small-scale industries act as a backbone of industrial activities in the state. Inspite of the fact that contribution of registered and unregistered industries to GSDP (at constant prices) being 4.2 per cent and 5.1 per cent per annum respectively between 1980-81 to 2009-10, it became sluggish during the eighties and picked up during nineties and onwards. Share of registered industries started declining since 2000-01 and from 2005-06 and the share of unregistered industries was also declining sharply. This indicates that the number of units in operation must have declined or closed down during this period.

It is clearly evident from Table 4 that since 1990, barring the district of Howrah, number of small-scale units registered with Directorate of Micro and Small-Scale Enterprises of the state have declined for all the other districts. However, registration of small-scale industries does not necessarily imply the setting up of the units (Report on the West Bengal Economy, 2003: 46). On the other hand, concentration of registered factories remained high in the districts of Howrah, Hoogly and 24 Parganas. Moderate concentration was observed in Burdwan, Darjeeling and Jalpaiguri. Though the number of registered factories per thousand sq-km increased for all the districts of West Bengal, it however removed low in the districts of Cooch Behar, Purulia, Murshidabad, Malda, Nadia, West Dinajpur, Bankura and Birbhum between 1980 and 2009.

Therefore, these are the districts that are likely to be affected by the deceleration of growth in agriculture since they have low absorbing capacity of the excess workforce released from agriculture. However, situation would have been different if even unregistered small-scale units expanded in those districts. Share of construction and electricity, gas and water supply had either remained static during the period under study or marginally declined. As analysed in the previous chapters, it was observed that growth in production and productivity of foodgrain production in West Bengal had started declining since 1990-91 and deceleration became faster since 2000-01. Simultaneously, the manufacturing sector though experienced increase in growth rates but contribution to GSDP declined sharply. Hence, scope of workforce to move from agricultural to industry remained a contentious issue. The major contribution to GSDP is thus coming from the tertiary sector. Within tertiary sector, trade, hotels and restaurant, real estate and other services contributed significantly. It has been observed that tertiary sector experienced very healthy growth during nineties and in subsequent periods too. Therefore, the overall picture which comes to light from the foregoing discussion is that agriculture almost generated one-third of the state's income till 2000-01 and from 2000-01, half of the income of the state was being generated from services.

Table 3: Share of Various Sectors (in percentage) in GSDP (At Current Prices) from 1980-81 to 2009-10

Year/sectors	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2009-10
Agriculture	26.0	27.2	26.1	30.1	25.0	19.3	18.9
Forestry & logging	1.1	1.1	1.0	0.9	0.8	1.1	1.1
Fishing	3.0	3.5	3.4	3.7	3.8	3.6	3.5
Mining & quarrying	1.2	1.3	1.2	0.8	1.4	1.3	0.8
Sub Total of Primary	**31.2**	**33.1**	**31.8**	**35.5**	**30.9**	**25.3**	**24.3**
Manufacturing	21.7	17.9	18.6	15.4	12.7	10.2	9.6
Registered	12.9	9.9	10.6	8.3	4.9	5.1	4.8
Unregistered	8.8	7.9	8.0	7.1	7.7	5.1	4.8
Construction	7.3	7.6	7.0	5.4	5.1	7.5	6.1
Electricity, Gas and Water supply	1.0	1.9	1.6	2.0	1.9	2.0	1.9
Sub Total of Secondary	**30.0**	**27.3**	**27.2**	**22.8**	**19.6**	**19.8**	**17.7**
Transport, Storage & Communication	4.8	5.9	7.2	7.3	6.5	8.5	8.9
Trade, Hotels and Restaurants	11.7	12.4	11.6	13.1	10.8	16.1	15.1
Banking & Insurance	5.0	5.2	5.4	7.4	11.0	6.0	5.7
Real estate and etc.	8.1	6.7	5.1	4.1	7.6	8.0	9.3
Public administration	3.0	3.7	4.8	4.2	5.6	5.5	6.0
Other services	6.1	5.7	6.9	5.6	8.0	10.9	13.2
Sub Total of Tertiary	**38.7**	**39.6**	**41.0**	**41.6**	**49.5**	**55.0**	**58.1**
Gross State Domestic Product (GSDP)	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: *Calculation based on GSDP data collected from Ministry of Statistics And Programme Implementation, Government of India [www.mospi.nic.in] and Department of Planning, Government of West Bengal [www. wbplan.gov.in]*

Table 4: Districtwise Number of Small-Scale Industrial Units Registered with Directorate of Micro and Small Scale Enterprises and Number of Registered Factories in per '000 sq-km area

Dist/ Year	Small Scale Units				Registered Factories			
	1980	1990	2000	2009	1980	1990	2000	2009
Burdwan	236	465	106	162	53	74	108	154
Birbhum	75	96	24	65	18	22	32	37
Bankura	72	149	58	61	6	8	13	22
Midnapore	197	586	169	142	7	11	16	28
Howrah	308	601	139	486	1005	1372	1811	2199
Hoogly	74	184	45	69	103	161	250	327
24 Pargans	142	559	121	276	223	314	419	516
Nadia	76	267	67	78	29	45	53	68
Murshidabad	103	222	135	97	3	4	5	13
West Dinajpur	42	113	49	34	6	7	13	19
Malda	183	216	89	79	2	6	9	18
Jalpaiguri	47	240	46	63	41	55	70	85
Darjeeling	71	151	25	18	51	65	78	93
Cooch Behar	49	81	36	45	4	6	8	13
Purulia	98	138	38	41	8	9	11	15
West Bengal	1570	3750	1033	1537	66	92	124	157

Source: *Calculation based on data collected from Various Volumes of West Bengal Economic Review, Government of West Bengal*

Increase in incidence of land alienation of *pattadars* and eviction of *bargadars* has also been observed in various districts of West Bengal. A study conducted by the State Institute of *Panchayat* and Rural Development observed that by 2001, on an average, almost 13 per cent of the *pattadars* had lost their land and around 14 per cent of *bargadars* were evicted from their land (Table 4). The extent of dispossession widely varied across the

districts. More than 30 per cent of the *bargadars* lost possession of their land in Cooch Behar, North and South Dinajpur, and Jalpaiguri and these are also relatively agriculturally backward districts. The rate of eviction were also found to be high (around 15 to 20 per cent) in Darjeeling, Murshidabad, North 24 Parganas, Howrah and Burdwan. The percentage of dispossession, however, was low (less than 10 per cent) among districts of Malda, Purulia, Nadia and West Midnapore. It has further been observed that *pattadars* who had lost possession of land we also varied across the districts. Land alienation remained high (around or more than 20 per cent) in North Dinajpur, South 24 Parganas and South Dinajpur. Extension of tea estates in North Dinajpur and proliferation of brackish water fish cultivation and appropriation of arable land for such purposes in Sundarban regions of south 24 Parganas were identified as few possible causes, among many, for high incidence of land alienation in those districts (West Bengal Human Development Report, *op. cit.*: 41). A high percentage (14 to 16 per cent) of dispossession could also be found in Jalpaiguri, Birbhum, Murshidabad, North 24 Parganas, Purulia, Bankura and Hoogly. Among the evicted *bargadars* only 24.1 per cent reported that eviction caused the dispossession. Another important feature was highlighted in the report that around 74 per cent of *bargadars* had a feeling of tenurial security and rest were feeling insecured, inspite of the fact that their names had already been registered as share croppers or *bargardars*. However, a high proportion of *bargadars* (closer to 50 per cent) had a perceived sense of insecurity among the districts of Darjeeling, Hoogly, Jalpaiguri and North Dinajpur.

Table 5: Dispossession of *Pattadars* and Eviction of *Bargadars* (in percent) from Lands between Inception of land Reforms and the Year 2000

Dist/Year	Dispossessed Pattadars (in per cent)	Evicted Bargadars (in per cent)
Burdwan	11.93	14.5
Birbhum	16.62	9.83
Bankura	15.45	11.09
West Midnapore	5.62	9.29
Howrah	9.34	15.9
Hoogly	14.63	10.48
North 24 Parganas	16.99	16.65
South 24 Parganas	22.07	10.31
Nadia	11.27	9.74
Murshidabad	15.87	19.06
North Dinajpur	22.35	31.49
South Dinajpur	19.17	30.73
Malda	10.41	5.66
Jalpaiguri	16.72	31.6
Darjeeling	14.71	16.0
Cooch Behar	12.33	30.9
Purulia	16.11	6.7
West Bengal	13.23	14.37

Source: *Chakraborti et al,. (2003): 35 and 57*

In addition Growth of unorganised small manufacturing units has also slowed down form late-nineties. It has been observed that the number of registered factories increased over the years but average daily employment per factory has substantially declined between 1990 and 2009. During the period between eighties and nineties per-factory average daily employment was quite high in Burdwan, Midnapore, Hoogly, 24 Parganas and Howrah while these districts experienced decline in average daily employment (Table 5). Large scale manufacturing units are hardly visible in the state. As a consequence, employment opportunities outside agriculture are becoming more and more inadequate. This would increase economic hardship of agrarian community of the state. Sufferings of agriculturally backward districts, therefore, would undoubtedly be on the rise.

Table 6: Per-Factory (Registered) Average Daily Employment

Dist/Year	1980	1990	2000	2009
Burdwan	267	243	111	96
Birbhum	50	42	34	39
Bankura	25	22	26	49
Midnapore	204	156	137	113
Howrah	111	80	67	54
Hoogly	469	290	187	143
24 Pargans	145	96	71	61
Nadia	95	89	80	71
Murshidabad	114	174	166	75
West Dinajpur	53	69	60	59
Malda	37	36	36	39
Jalpaiguri	79	59	61	56
Darjeeling	55	49	49	50
Cooch Behar	56	49	36	61
Purulia	97	81	72	67
West Bengal	147	106	78	67

Source: *Calculation Based on Data Collected From Various Issues of West Bengal Economic Review, Government of West Bengal*

Conclusion: In West Bengal in general, and her districts in particular, majority of the people rely primarily on agriculture, land being the primary income generating asset. In the foregoing analysis, it has already been observed that land reform and tenancy reform in terms of operation *barga* has contributed positively to the growth of foodgrain production and yield in the state as well as in the districts, during eighties and early-nineties. The positive impact of agricultural growth also helped indirectly towards the growth of unorganised small scale industries. But the scenario had started changing since the late-nineties. Marginalisation of rural workforce is being increasingly felt. In addition, distribution of ceiling surplus land and granting tenurial security to the sharecroppers indeed helped the landless section of agrarian community. But at the same time, average size of landholdings is small and growing population makes it smaller and there is a possibility that with rising cost of production many of these holdings may prove to be uneconomical for the farmers. Alienation of rural masses from their land force them to 'lose their direct control over land and operation' and finally they 'lose their capacity to fulfil their basic consumption needs on the basis of self provisioning' (Joshi, 1982:771). In addition, with in elastic land area and with an adverse land/man ratio, it becomes imperative to transfer excess agrarian population to non-farm activities. Otherwise, absolute number of persons and households dependent on agriculture is bound to rise. As a consequence, the rise in number of marginal farmers and landless agricultural labourers become inevitable which aggravates rural distress and poverty.

Notwithstanding all the negative aspects, West Bengal though continued to achieve high growth in production and productivity of rice and foodgrain compared to agriculturally advanced states like Punjab, Haryana and Western Uttar Pradesh. Couple of factors might be held responsible: firstly, agriculture in West Bengal is dominated by small and marginal farmers, since they do not have other alternatives. Under the circumstances, the farmers are compelled to produce rice on their diminishing land. Secondly, many of the small and marginal farmers apart from cultivating their own land are forced to work as agricultural wage labourers. Thirdly, the rate of growth in productivity and harvest price sometimes offsets the rate of rise in cost of production. Fourth, crop diversification, especially production of potato and rapeseeds and mustard partly compensates for the rise in cost of production. Since, mid-2000, various development programmes like interest subvention on crop loans, the National food Security Mission, National Rural Employment Guarantee Scheme (NREGS), have partly stabilised the economic condition of the small and marginal farmers and agricultural labourers. Having said so, to justify the positive impacts economic reform on foodgrain productivity, a deeper empirical probe is imperative to identify the factors that are still propelling foodgrain productivity growth in West Bengal during the post-economic reform era.

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