Development of Basic Infrastructure:
An Analysis of South 24 Parganas District in West Bengal, India

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Abstract. Infrastructure provides the fundamental basis for socio-economic development of any country. It acts as the backbone of an economy. Regional disparities in infrastructural development naturally result in uneven development. Infrastructural development has greater significance in less developed areas due to their various inherent deficiencies and imbalances. With regard to this, status of the basic sectors of the infrastructure of South 24 Parganas district of West Bengal, India has been discussed in this article. This is a less developed area. Comparative analysis on infrastructural achievements at sub-district level has also been made. The study not only points towards the lack of uniform infrastructural development over the entire region, but also towards a tendency for concentration of such growth process in those areas of the district which lie in close proximity to the metropolis of Kolkata.

Contents:

1. Introduction

The role of infrastructure is of great importance in development process of any kind, as its shortage often becomes the major limiting factor for economic progress. This has become even more significant under the globalised market regime, where increased productivity, wider connectivity, greater efficiency and competitiveness, to a large extent, determine the viability of any economy. Infrastructural development assumes greater importance in large developing countries, like India, struggling with illiteracy, mass poverty, unemployment, underemployment, poor health condition and lower level of living. Large developing countries have embarked upon ambitious development programmes, which have raised their demand for infrastructure. Moreover, numerous studies conducted in these countries point out that, regional disparities in socio-economic development, to a large extent, result from uneven development of infrastructure. Several economists attempted to theorise the nature of linkage between infrastructure and development (e.g. Rosenstein-Rodan, 1943; Nurkse, 1953; Hirschman, 1958; Rostow, 1960 and others).

Infrastructure as a term means something that lies below or comes before the 'structure'. It is the base upon which the superstructure is built. Thus, in economic discussion all those activities and services which contribute to the economy not only by generating income within the sector itself, but also by providing sustenance and support to income generation in the rest of the economy can be considered as 'infrastructure' (Majumdar 2008). The first reference to the concept of infrastructure was made by Hirschman (1958). Social Overhead Capital (SOC), according to him, comprises 'those basic services without which primary, secondary and tertiary productive activities cannot function' (Hirschman, 1958). SOC can thus be identified as infrastructure. In his famous theory on 'The Stag-

es of Economic Growth', Rostow (1960) considered SOC as a precondition for take-off into self-sustained growth. Later Aschauer (1990) defined infrastructure as a region's 'public stock of social and economic overhead capital'. The World Bank (1994), in the World Development Report of 1994, included the following as infrastructural services:

1. Public Utilities: Power, telecommunications, piped water supply, sanitation and sewerage, solid waste collection and disposal, piped gas,
2. Public Works: Roads, major dams, canal works for irrigation and drainage,
3. Other Transport Sector: Urban and inter-urban roadways, urban transport, ports, waterways and airports,
4. Social Infrastructure: Basic education, primary health and banking services.

Evidence from many countries of the Third World shows that in case of the provisioning of infrastructure explicit dispersal policies that were meant to support a smaller urban centre were often undermined by spatial biases in macro-economic and sectoral policies, including trade, industrial and agricultural policies. Discussing the economic growth and urbanisation of Sub-Saharan Africa, Tiffen (2007) considered that public investment in basic infrastructure, like electricity, piped water, telecommunications, to a greater number of towns may become more effective than direct state investment in manufacture. Studies on spatial planning strategies in Indonesia show that access to regional and national urban networks increases the market potential of a village. Such linkage development also provides rural households with alternative income generating opportunities (Douglas, 2007). In overpopulated, labour-surplus countries like India, the creation of infrastructural facilities increases the scope of gainful employment on the one hand and these facilities open up avenues for economic growth and development on the other (Majumdar, 2008).

In this context, an attempt has been made to trace the nature of infrastructural development of South 24 Parganas district of the state of West Bengal in India. It is the southernmost district of the state occupying the southern part of the Bengal Delta (Fig. 1). The district lies between 21°29'0" north and 22°33'45" north latitudes and between 88°3'45" east and 89°4'50" east longitudes. In spite of being an adjoining district of the Kolkata Metropolis, it is one of the backward districts of the state. Thus, development of basic infrastructure deserves special attention to raise the level of overall socio-economic development. The status of seven broad sectors of infrastructure has been discussed. These are agricultural infrastructure, educational infrastructure, healthcare system, transport infrastructure, financial services, electrification and household amenities including drinking water and sanitation facility.
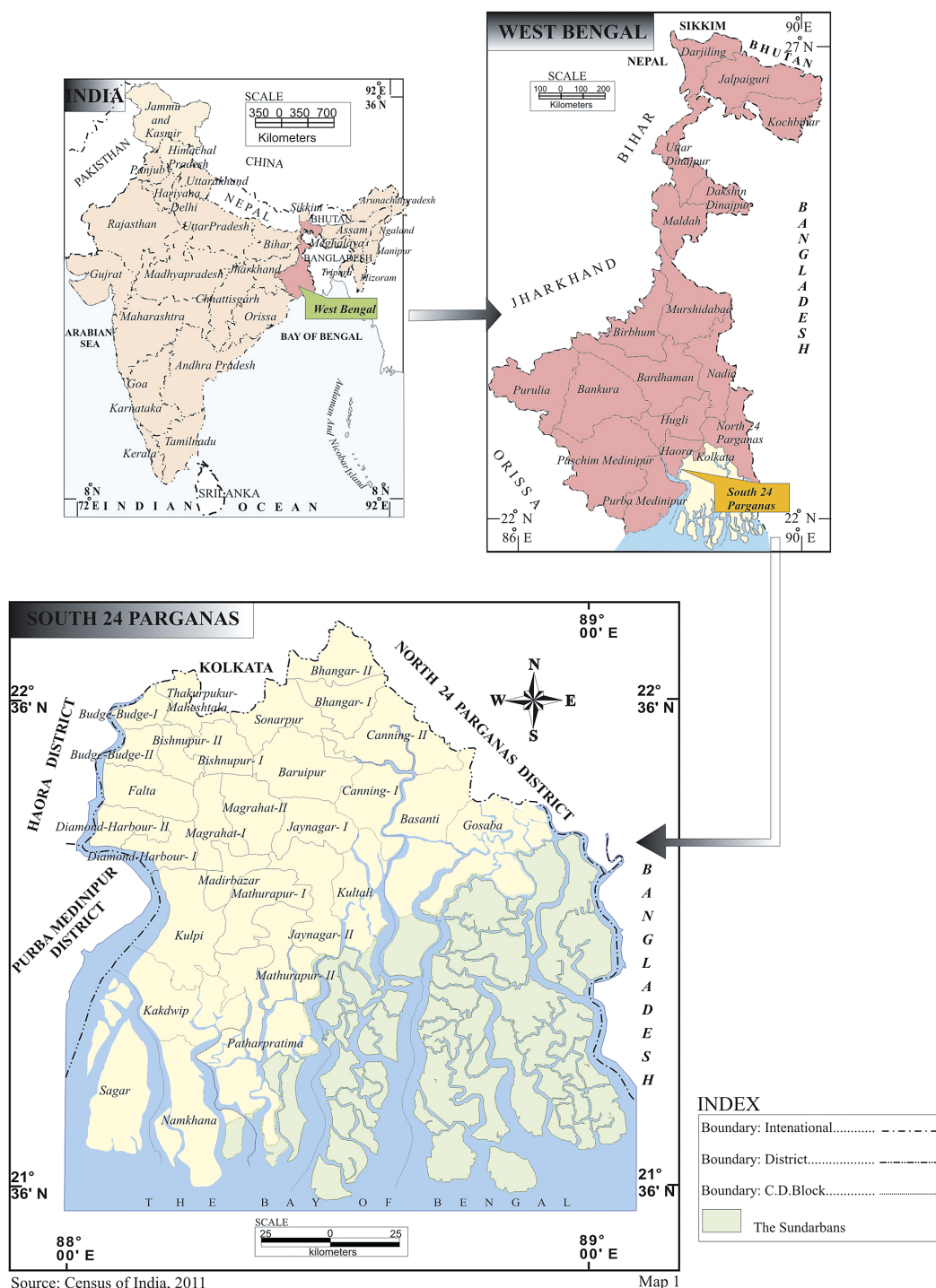
Fig. 1. Location map of South 24 Parganas District in West Bengal, India

Source: Census of India, 2011

Objectives of the study - The article focuses on three basic objectives as outlined below.
1. To discuss the achievement of the district in selected sectors of infrastructure and to analyse the major disadvantages and problems of the concerned sector.
2. To emphasise the study of the performances of the C. D. Blocks and to construct index of infrastructural development for each C. D. Block in order to make an intra-district comparative analysis.
3. To compare the performance of the district with that of the state as a whole.

2. Research materials and methods

The present analysis has been carried out in two parts. Firstly, the nature of the achievement in different sectors of basic infrastructure has been discussed both at district and sub-district levels. The district presently has twenty nine Community Development Blocks (C. D. Block). These blocks have been treated as micro level units for this study. Data have been collected from various sources, like the Census of India; the Bureau of Applied Economics and Statistics, Government of West Bengal; the Eastern Railways, Indian Railways; the Lead Bank Office, Baruipur Subdivision, South 24 Parganas, etc. Secondly, certain basic parameters from each broad sector of the infrastructure have been selected and the index of infrastructural development has been constructed for each C. D. Block with the help of Principal Component Analysis. For this purpose the software of Statistical Package for Social Sciences (SPSS, version 20) has been used. The intention is to make a more comprehensive comparative study across the C. D. Blocks of the district in terms of infrastructural development.The methodology of this calculation has been discussed in detail later in the related section. A socio-economic regional classification of the C. D. Blocks of this district has been used in this study for convenience of discussion (Table 1).

Table 1. Socio-economic regionalisation in South 24 Parganas

Region	Location	Character	Name of C. D. Blocks
Region I	North-western Region	Semi-transformed/ Semi-urban Region	Thakurpukur-Maheshtala, Budge Budge I, Budge Budge II, Bishnupur I, Bishnupur II, Sonarpur
Region II	North-east and Mid-western Region	Transforming Region	Baruipur, Bhangar I, Bhangar II, Falta, Diamond Harbour I, Diamond Harbour II, Kulpi, Magrahat I, Magrahat II, Mandirbazar
Region III	The Sundarban Region	Predominantly Rural and Backward Region	Canning I, Canning II, Basanti, Gosaba, Joynagar I, Joynagar II, Mathurapur I, Mathurapur II, Kultali, Patharpratima, Kakdwip, Namkhana, Sagar

Source: Human Development Report, 24 Parganas (South), 2009, pp. i, 50-56

3. Research results

3.1. Agriculture

Agriculture traditionally acts as a major source of income and employment for South 24 Parganas, though recently there has occurred a large scale decline in the share of agricultural workforce. Its contribution to income generation has also been falling. Agriculture in this district has remained largely traditional in nature. South 24 Parganas concentrates on cultivation of food crops mainly. The area under food crop was more than three-fourth of total cultivated area in 2010-11. Till now there has been an overwhelming preponderance of paddy cultivation, especially the monsoonal variety. The area under rice was more than 70 per cent of total cultivated area in 2010-11. Other food-crops include pulses, wheat, barley and maize mainly. Major non-food crops are oilseeds, potato, chilies (dry), ginger, jute and sugarcane. The yield of most of these principal crops was lower in South 24 Parganas than in West Bengal in 2010-11 (Table 2). Both fruit and vegetable production increased in this district during the last decade. Fruit production grew by 67.49 per cent and vegetable production by 34.92 per cent.

Between 1983-84 and 2010-11 all the blocks in Region I, except Bishnupur II, and six blocks in Region II registered an increase in agricultural productivity. However, such increase was marginal in most of the cases. Falta, Kulpi and Mandirbazar in Region II demand special mention. In Region III productivity increased only in five out of thirteen blocks. These were Gosaba, Jaynagar I, Mathurapur I, Kultali and Namkhana. However, there was a decline in the average agricultural performances of C. D. Blocks between 2001 and 2011, especially in Mandirbazar, Mathurapur II Canning II, Gosaba, Patharpratima, Kakdwip and Namkhana. The cyclone 'Aila' in 2010 badly affected the productive capacity of the area. This should be treated as an area of concern, as these are the rural and largely agricultural parts of the district. The status of availability of two basic inputs has been discussed in this context.

Table 2. Yield rate of principal crops in South 24 Parganas and West Bengal (1980-2011)

| Crops | Production, kilogram/hectare | | | | | | | |
| | 1980-81 | | 1990-91 | | 2000-01 | | 2010-11 | |
	South 24 Parganas	West Bengal	South 24 Parganas	West Bengal	South 24 Parganas	West Bengal	South 24 Parganas	West Bengal
Rice	1,280	1,442	1,220	1,795	2,036	2,287	2,302	2,576
Wheat	2,224	1,672	1,860	1,970	1,746	2,485	2,557	2,760
Pulses	495	454	262	616	791	800	921	1,031
Oilseeds	462	1,133	1,133	884	704	953	1,309	962
Jute	1,487	1,310	2,264	1,978	1,863	2,182	2,088	2,576
Sugarcane	NA	6,057	5,953	7,069	64,315	67,821	81,190	75,518
Potato	12,500	17,057	13,474	23,046	20,521	25,606	25,558	32,831
Chillies (Dry)	618	702	736	764	524	894	2,259	1,512
Ginger	1,236	300	300	1,696	400	2,026	1,504	2,157

Source: Statistical Abstract, West Bengal, 2005; District Statistical Handbook, South 24 Parganas, 2010-2011 (Combined); Statistical Handbook, West Bengal, 2011, Bureau of Applied Economics and Statistics

Agricultural area per agricultural worker- In South 24 Parganas, area under cultivation has been declining gradually while the acreage of land used for non-agricultural purposes has been increasing continuously (Table 3). Bardhan (2011) rightly pointed out in the case of India as a whole that the average size of agricultural land has been declining steadily under demographic pressure. This is indeed a common trend all over the world, in large developing countries especially: with continuous urban and economic development agricultural land has been shrinking very fast. The gravity of the situation becomes clearer if net sown area is considered exclusively. On the one hand, due to the growing unreliability of monsoon and heavy downpour in late-monsoon, land cannot be prepared for cultivation in many parts of the district. This is typically detrimental for raising winter vegetables. On the other hand, in the absence of the extension of irrigation facilities at a desired level, cultivation during winter seasons becomes difficult. The problem is acute in regions producing rice mainly, i.e. the southern blocks in particular.

Table 3. Broad pattern of land utilisation in South 24 Parganas and West Bengal

| Year | Proportion of Area, % | | | | | |
| | Cultivable Land | | Area Not Available for Cultivation | | Forest Land | |
	South 24 Parganas	West Bengal	South 24 Parganas	West Bengal	South 24 Parganas	West Bengal
1995-96	42.36	67.53	13.52	18.89	44.12	13.58
2000-01	41.61	67.95	14.27	18.35	44.12	13.70
2005-06	40.73	66.28	14.31	20.19	44.96	13.53
2010-11	39.95	65.30	15.11	21.20	44.94	13.50

Source: Statistical Abstract, West Bengal, 2005; District Statistical Handbook, South 24 Parganas, 2010-2011 (Combined), Bureau of Applied Economics and Statistics

However, while gross cropped area increased, share of net cropped area as percentage share of gross cropped area declined from 91.83 per cent in 1980-81 to 69.65 per cent in 2010-11 (Fig. 2). This suggests that there has been a growing tendency towards cultivating agricultural land more than once in a year. But cropping intensity was still 34 points lower than the state average in 2010-11. Another disappointing fact is that, marginal holdings (less than one hectare in size) have been increasing in proportion covering more than 80 per cent land holdings by number and more than 60 per cent by area in 2011. On the one hand, there is an expanding agricultural workforce (in terms of absolute number). On the other hand, there is a steadily declining area available for cultivation along with the severe problem of land fragmentation due to the law of inheritance. If cultivated area per agricultural worker is taken into account, one would find a fall in average size in 2010-11 below the 1990-81 level. Two out of six blocks in Region I, eight out of ten blocks in Region II and all the blocks in Region III experienced such a fall. The biggest decline, i.e. more or less 0.30 hectare/agricultural worker, was registered in Mathurapur I and II, Kultali, Patharpratima, Kakdwip, Namkhana and Sagar. In fact, the average cultivated area per agricultural worker increased in many of these blocks during the 1990s, but dropped again during the following decade. The cyclone 'Aila' devastated vast areas of West Bengal and Bangladesh in May 2010. The district as a whole and the southern blocks in Region III in particular experienced loss of agricultural land due to increasing levels of soil salinity, waterlogging, etc. Bishnupur II and Magrahat I and II also experienced shrinkage in cultivated area available per agricultural worker between 2000-01 and 2010-11. Only Bishnupur I recorded continuous increase since 1980-81.
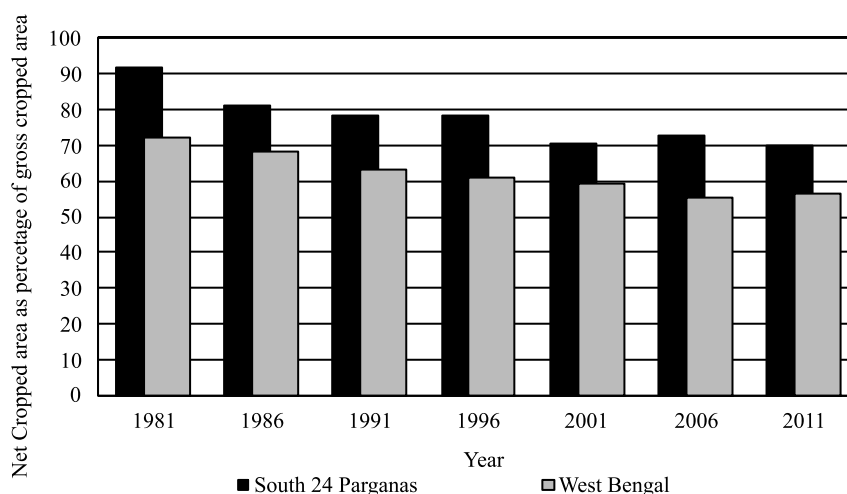
Fig. 2. Net cropped area as part of gross cropped area in South 24 Parganas and West Bengal

Source: Developed by the author based on data available at Bureau of Applied Economics and Statistics

Table 4. Agricultural area under irrigation in South 24 Parganas (1990-2011)

Year	1990-91	1995-96	2000-01	2005-06	2010-11
Irrigated area (in thousand hectares)	53.327	83.91	71.036	109.54	106.39
Irrigated area (as percentage of net sown area)	13.35	21.08	18.78	29.58	29.68

Source: District Statistical Handbook, South 24 Parganas, 1994, 1998, 2001, 2005, 2007, 2010-2011 (Combined), Bureau of Applied Economics and Statistics

Fig. 3. Correlation between Net Irrigated Area and Average Productivity in South 24 Parganas, 2010-11

Source: Calculated by the author based on data available at Bureau of Applied Economics and Statistics

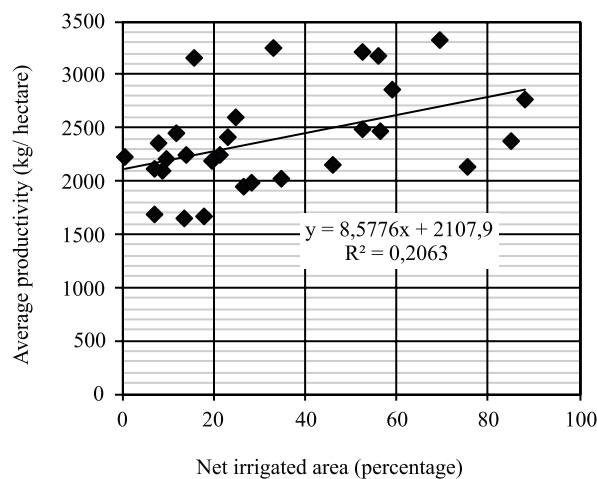**Irrigation system** – Irrigation system is of tremendous importance to the agricultural sector in countries with monsoonal climate, like India. Though the share of total cultivated area with irrigation facility increased during last two decades, less than one-third of net sown area was irrigated even in 2010-11 (Table 4). Government canals remained by far the most dominant source of irrigation in this district in terms of area covered. C. D. Blocks within Region I and Region II had a much better status in terms of the availability of irrigation facility than the blocks of Region III in 2010--11. Falta, Bishnupur I had more than 80 per cent of net sown area under irrigation, while Bhangar I and Diamond Harbour II had more than 60 per cent area under this facility. In Region III achievement was very poor in Gosaba, Basanti, Jaynagar I and II, Kultali and Patharpratima having less than one-tenth of net sown area under irrigation. This is a paradox indeed, as the spread of irrigation facility was lowest in the region depending most heavily upon agriculture. Bi-variate linear regression analysis between share of irrigated area and average productivity at block level shows that, the relation was positive and of medium magnitude [correlation coefficient (r) =0.454] in 2010-11 (Fig. 3). It was statistically significant at 2 per cent level [using test of significance (t) of correlation coefficient (r), it is found that the calculated value of t (2.65)

is greater than the tabulated value of t (2.47) at 27 (29-2) degrees of freedom for 2 per cent level of significance]. Lack of adequate irrigation facility is a major constraint resulting in low cropping intensity, less crop diversification and limited agricultural commercialisation. The mono-cropping pattern of cultivation is followed largely because of poor irrigation facilities and high soil salinity. The main causes for the slowdown in the expansion of irrigation are: a) deceleration in capital formation in public and private sector after 1996-97, b) decline in availability of electric power to agriculture and c) stress on water resources (Chand et al., 2011).

3.2. Literacy and education

Literacy status is generally considered as one of the most influential elements of human development. Literacy rate positively influences the rate of participation in gainful work, quality of workers and level of productivity. South 24 Parganas improved continuously in terms of literacy status (Table 5). In 2011, with a total literacy rate of 67.77 per cent, it ranked ninth among the districts of West Bengal. Rural literacy increased more rapidly, by 43.44 per cent points, than urban literacy (21.67 per cent points) during the last six decades.

Table 5. Crude literacy rates in South 24 Parganas (1951--2011)

Year	Crude literacy rate, %		
	Total literacy rate	Rural literacy rate	Urban literacy rate
1951	23.58	22.20	52.32
1961	28.64	27.30	46.40
1971	30.46	28.58	49.83
1981	37.00	34.56	54.90
1991	44.63	41.93	62.26
2001	58.89	56.62	71.07
2011	67.77	65.64	73.99

Source: District Census Handbook, Twenty Four Parganas, 1951, 1961, 1971 and 1981; District Census Handbook, South 24 Parganas 1991, 2001; Primary Census Abstract, West Bengal, 2011

Out of twenty nine C. D. Blocks, the literacy rate was over 70 per cent in nine blocks and more than 60 per cent in seventeen blocks as per the latest census of 2011. All C. D. Blocks in the north-western part nearing Kolkata, except Bishnupur I, had literacy rate over 70 per cent. In C. D. Blocks in the central and southern part of the district was it more than 60 per cent. There were some exceptions. Four most remote blocks within or around the Sundarbans, namely Namkhana, Sagar, Patharpratima and Gosaba, performed better than many others. These blocks had literacy rate over 70 per cent. On the other hand, in Canning II, Basanti and Kultali the literacy rate was between 50 per cent and 60 per cent. However, the highest literacy was always found in areas closer to Kolkata, while the lowest literacy rate in the distant parts. For instance, in 2011 Sonarpur had the highest literacy rate (78.80 per cent) and the lowest rate was in Canning II (55.07 per cent). One more good observation is that literacy differential between rural and urban areas has been lowering with time. Urban literacy rate remained higher than rural rate in most of the blocks. There has been a continuous rise in both male and female literacy rates in this district with a simultaneous decline in gender disparity since 1951. Male and female literacy rates were 72.91 per cent and 62.39 per cent respectively in 2011.

Status of major educational parameters – In South 24 Parganas educational institutes, students and teachers have increased in number in the course of time. In 2010-11, there were 3699 primary schools, 55 middle schools, 408 high schools, 345 higher secondary schools and 38 degree colleges. Moreover, there were 6 technical schools, 16 technical colleges and special and 11172 special and non-formal educational institutes. During last two decades, the total number of school-students increased, but the number of students in primary schools decreased by almost 21 per cent. However, the number of students increased manifold in high and higher secondary schools, and also in colleges. The number of teachers increased at both school and college levels (Table 6).

Table 6. Selected educational parameters of South 24 Parganas (1991-2011)

Year	Educational institutes/100000 population						
	Primary schools	High schools	Higher secondary schools	Total schools	Degree colleges	Technical schools	Technical colleges
1991	56	8	1	71	0.30	0.09	0.02
2001	50	6	2	61	0.29	0.28	0.01
2011	45	5	4	55	0.47	0.07	0.20
Year	Teachers in educational institutes/1000 students						
	Primary schools	High schools	Higher secondary schools	Total schools	Degree colleges	Technical schools	Technical colleges
1991	16	86	64	19	38	226	24
2001	14	25	24	18	15	98	45
2011	22	17	16	19	18	47	104

Source: Computed by the author from District Statistical Handbook, South 24 Parganas, 1995, 1998, 1999 & 2000 (Combined), 2005, 2007 and 2010-2011 (Combined), Bureau of Applied Economics and Statistics

The number of primary, middle and high schools per lakh population declined here during the last two decades. In 2011, the number of primary schools per lakh population was the highest in Kulpi block (73) in the west and the lowest in Thakurpukur-Maheshtala (24), which was preceded by Sonarpur (25). In this regard some of the central and southern blocks achieved higher ratios than the blocks surrounding Kolkata. This ratio was very high (60 and above) in Patharpratima, Gosaba, Mandirbazar, Diamond Harbour II and Mathurapur I; high (50 and above) in Bishnupur II, Diamond Harbour I, Falta, Mathurapur II, Kakdwip, Namkhana and Sagar. In the rest of the blocks the ratio was between 30 and 50. Bi-variate linear regression analysis has shown a positive, but very weak (as r has a very low value of 0.03 only) and statistically insignificant relation between availability of primary schools per lakh population and literacy rate in 2011 (Fig. 4).
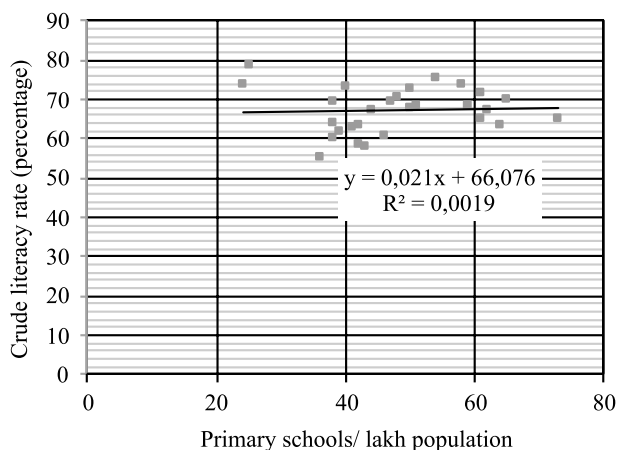

Fig. 4. Correlation between number of primary schools and literacy rate in South 24 Parganas, 2010-11

Source: Calculated by the author based on data available at Bureau of Applied Economics and Statistics

This is a matter of concern, as the spread of literacy depends primarily on it. C. D. Blocks in the southern region especially have been suffering from a decline in the number of primary schools per lakh population since 1991. However, the number of higher secondary schools and colleges per lakh population grew during the last two decades and the situation improved in the southern blocks in this regard. In 2011, the maximum ratio was in Mathurapur II (18) and the minimum in Canning II

(4). This ratio was also high (more than 10) in Bishnupur II, Budge Budge II, Gosaba, Mandirbazar, Kulpi, Falta Diamond Harbour I and II, Mathurapuri, Kakdwip, Namkhana, Sagar and Patharpratim. New colleges were established in C. D. Blocks which had no college before, but the number is still very small in proportion to future demand.

If the teacher-student ratio is taken as a parameter, the condition became slightly better in primary schools. At this level the growing teacher- student ratio was more influential in spreading literacy at C. D. Block level (as the value of r, in bi-variate linear regression analysis, is 0.78 in 2010-11). The relation was also statistically significant at 1 per cent level [as the calculated value of t (6.42) is greater than the tabulated value of t (2.77) at 27 (29-2) degrees of freedom] (Fig. 5). But a fall in this ratio was observed in high and higher secondary schools and in colleges since 1991. At college level, the situation improved in few blocks during 2001-11. Technical schools also suffer from a falling teacher-pupil ratio, but technical colleges recorded a rise.
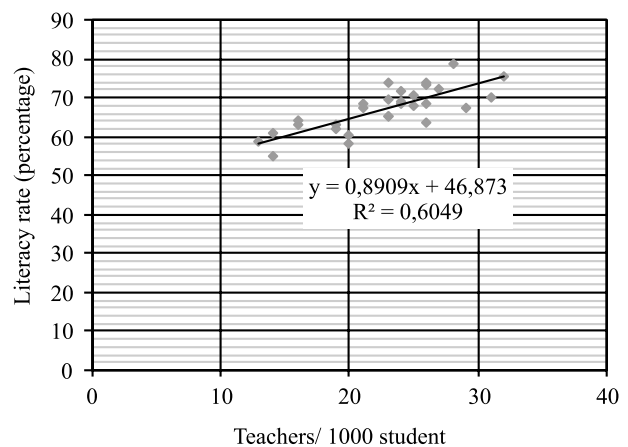
Fig. 5. Correlation between teacher-student ratio in primary schools and literacy rate in South 24 Parganas, 2010-11

Source: Calculated by the author based on data available at Bureau of Applied Economics and Statistics

3.3. Healthcare system

Health condition has significant bearing upon the general wellbeing of any community and can be related with aggregate economic growth. A good health condition is important as it influences the functionality of a person and it creates an enabling

environment for individuals to access or utilise the facilities and services available. Provision of equitable access to healthcare system was recognised in the 'Health for All' initiative undertaken by the World Health Organization (2003) in 1978. Thus, availability of cost-effective health services, for the poor and rural areas specially, should be given priority in the development agenda of any region, more so in developing economies. In the analysis of health infrastructure three basic components, such as the number of medical institutions, doctors and beds, have been considered.

In South 24 Parganas, the number of medical institutions of different categories increased over time with a phase of decrease between 2003 and 2005. In 2010-11, the district had 100 public healthcare systems, 188 private healthcare systems, 1 central government undertaking institute and 1 institute run by local bodies. Detailed data on medical infrastructure, available since 2003, shows that there has been a relative decline in the availability of public healthcare system since 2006 along with a spurt in private healthcare facilities. As in other parts of India, the public healthcare system in the districts of West Bengal has also been undermined by recent global economic changes and the subsequent macroeconomic reforms at national level. These reduced state government's ability to provide people with safe and effective healthcare. The resultant fiscal constraint lessened the rate of capital investment and also created a massive shortage in funds needed for current expenditure.

Table 7. Status of selected medical parameters in South 24 Parganas and West Bengal (1991-2011)

Year	Hospitals/ /100000 population		Total medical institutions/ /100000 population		Beds/ /100000 population		Doctors/ /100000 population	
	South 24 Parganas*	West engal#	South 24 Parganas*	West Bengal#	South 24 Parganas*	West Bengal#	South 24 Parganas*	West Bengal#
1991	0.31	0.58	2	5	32	98	NA	72
2001	0.26	0.54	3	12	23	89	3	56
2011	0.22	+2.53	4	+15	61	+118	10	NA

Explanation: NA= data not available

Source: * District Statistical Handbook, South 24 Parganas, 1995, 2002 and 2010-2011 (Combined), Bureau of Applied Economics and Statistics; # Statistical Abstract, West Bengal, 2002-03, Bureau of Applied Economics and Statistics; + Economic Review, Statistical Appendix, West Bengal, 2011-12, Bureau of Applied Economics and Statistics

In South 24 Parganas there is not even one hospital per lakh population and the ratio declined during last two decades (Table 7). But the total number of medical institutions per lakh population increased, because of the rise in the number of nursing homes and private clinics all over the district, even in the distant and rural C. D. Blocks of Region III. The blocks which developed in terms of total medical institutions per lakh population between 1991 and 2011 were Diamond Harbour I, Falta, Bishnupur I and II, Baruipur, Bhangar I and Magrahat I. But both these parameters remained much smaller than the state figure (Table 7). Still, there exist a large number of villages without medical facilities not only in the Sundarban Region but also in the north-eastern part of the district and even on the periphery of Kolkata.

The number of beds in all medical institutions increased 2.69 times during the last two decades. The number of available beds per lakh population also increased (Table 7). But it remained lower than the state level ratio and remained much below the level of adequacy with respect to the vast and growing population of this district. Only 61 beds were available per lakh persons in 2011. The highset increase in the number of beds per lakh population was in Diamond Harbour I between 1991 and 2011. The ratio rose in most of the blocks, especially in Patharpratima, Kakdwip, Mathurapur II, Basanti, Jaynagar II, Magrahat I and Baruipur. Budge Budge I also had a high ratio between 1991 and 2011. Though the number of doctors in medical institutions increased by 4.72 times during the last fifteen years, the ratio between the number of avail-

able doctors and population was really very poor (Table 7). The district stands in sharp contrast with West Bengal in this regard. Only ten doctors were available in South 24 Parganas for caring over one lakh persons in 2011. However, the ratio improved in Kakdwip, Mathurapur II, Budge Budge I, Baruipur and Diamond Harbour I in particular.

In fact, in South 24 Parganas the availability of different medical facilities at the regional level presents a mixed picture, in the sense that some C. D. Blocks in Region III were better performers than some C. D. Blocks in Region II and were at par with some C. D. Blocks in Region I. Basically, Diamond Harbour I and Budge Budge I can be distinguished from others in terms of their greater achievements with respect to almost all selected medical parameters during the last two decades.

3.4. Transport facilities

The extent of economic development and the opportunity for employment for common people in an area significantly depend on the development of basic transport infrastructure. Rostow (1960) was of the opinion that investment in SOC, in fields of transport especially, should be considered as one of the major preconditions for take-off in stages of growth. Satterthwaite and Tacoli (2007), analysing the role of small and intermediate towns in regional and rural development, highlighted the impact of transport and communication facilities. These urban centres may become the market place for agricultural products from the surrounding rural areas with an available and affordable good transport network connecting them to the producing villages as well as to other larger and potential markets. Better transport facilities have been considered as a key element of livelihood strategies based on occupational diversification and reliance on both rural and urban resources. The following section discusses the availability and development of two principal components of transport infrastructure, namely roadways and railways, in South 24 Parganas.

Roadways - In this sector, the performance of West Bengal has remained reasonably good. In South 24 Parganas roadways are the most important component of transport infrastructure. Total road length increased by almost nine times from 3,927.77

kilometers in 1993-94 to 35,028.38 kilometers in 2010-11. There was a sharp increase in the length of roads at the end of the 1990s. Metalled roads increased almost continuously from 2,702.71 kilometers in 1993-94 to 14,175.15 kilometers in 2010-11, registering an increase of little more than five times. In contrast, un-metalled roads recorded an increase of almost seventeen times during this period, i.e. from 1,225.06 kilometers to 20,853.23 kilometers. These roads comprise almost three-fifth of total roads in 2010-11. Since the late 1990s, the joint operation of Zilla Parishad, Gram Panchayats and Panchayat Samities has been undoubtedly successful in increasing the connectivity and accessibility of rural areas in the last decade, though the achievement has remained far from adequate. The construction of rural roads of metalled type has gained further momentum in this district since 2006-07 with the initiation of the 'Pradhan Mantri Gram Sadak Yojona' (2000), a centrally sponsored scheme for rural road development. The Public Works Department (P.W.D.) constructed the first National Highway in 2004-05. It forms a part of the National Highway 117 (NH 117), with its north-western terminal at Kona, in Haora district and its southern terminal in the coastal town of Bakkhali in South 24 Parganas district.

A more specific idea on the accessibility of roads in any region may be obtained from the measurement of road density, i.e. length of road per unit of land area. West Bengal's road density has been much higher than the national average and South 24 Paraganas' achievement was better than the state level in the last two decades (Fig. 6). It must be mentioned in this context that the availability of metalled roads is more important for better functioning of economy. It is an essential pre-condition for the development of heavy industries, as these roads are motorable. In this regard, South 24 Parganas is definitely a lagging region. Metalled road density has remained much below un-metalled road density since 1998-99 (Fig. 7).

Profound disparities at regional level can be observed in South 24 Parganas in the last two decades. Two indicators, namely metalled road density and total road density, have been considered here. In 2010-11, the highest density of metalled roads was in Budge Budge I (17.66 km/sq km), followed by Thakurpukur-Maheshtala (7.72 km/sq km) and

Budge Budge II (7.56 km/sq km). Other blocks with better achievements were Sonarpur, Bishnupur II and Baruipur. Gosaba, on the other hand, had the lowest metalled road density (0.48 km/sq km), and was preceded by Patharpratima, Kultali, Basanti and Sagar successively, each having road density less than 1 km/ sq km. The improvement of Baruipur, Bhangar I, Diamond Harbour II and Magrahat I deserves special mention. Total road density was the highest in Jaynagar I (25.29 km/sq km), followed by

Budge Budge I (22.02 km/sq km) and Budge Budge II (17.52 km/sq km). The lowest density was in Basanti (2.41 km/sq km), preceded by Kultali (2.82 km/sq km). None of the remaining blocks had road density less than 3 km/sq km. However, total road density was relatively lower in Falta, Gosaba, Namkhana and Patharpratima. It may be generalised that the distant blocks within and adjoining the Sundarbans traditionally remained poor performers in terms of road development.
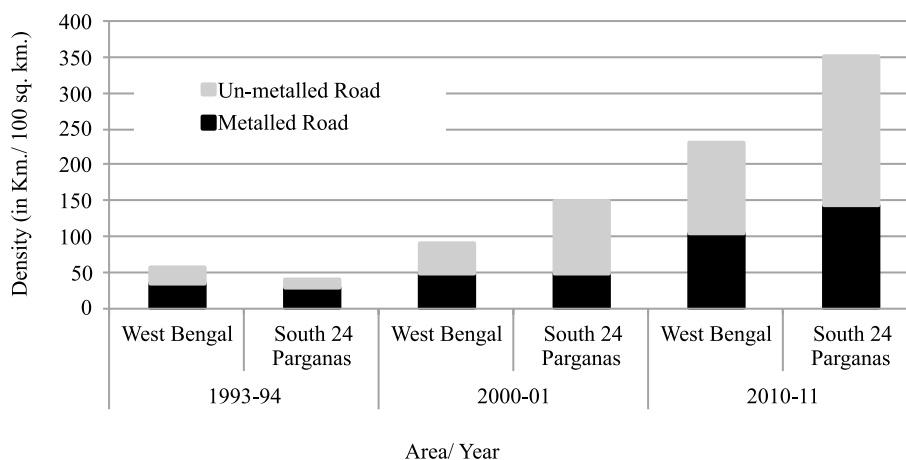

Fig. 6. Road density in South 24 Parganas and West Bengal

Source: Developed by the author based on data available at Bureau of Applied Economics and Statistics
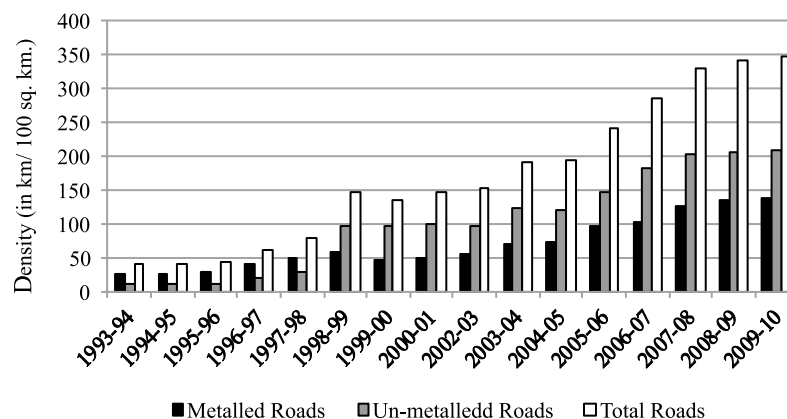

Fig. 7. Density of roads of various categories in South 24 Parganas (1993-94 to 2009-10)

Source: Developed by the author based on data available at Bureau of Applied Economics and Statistics

Railways - The development of railways in South 24 Parganas has been limited in extension. Thus, a vast part of it is devoid of any rail service and therefore entirely dependent upon road transport. The district is served by four railway routes connecting different parts of the district with the nodal station at Sealdah of the Sealdah Subdivision of the Eastern Railways of India. These include the Sealdah-Budge Budge route, the Sealdah-Diamond Harbour route, the Seldah-Namkhana route and the Sealdah-Canning route. At present only fifteen C. D. Blocks of the district have railway routes. Railway density is higher in Budge Budge I, Baruipur and Diamond Harbour I (Table 8). Sonarpur and Baruipur are served by more than one route which adds positively to their degree of accessibility. Very low densities are found in Jaynagar II, Namkhana, Mathurapur I and Canning I. Keeping in mind the necessity of increasing the rail services in South 24 Parganas, a bunch of proposals for extending these railway routes and opening new railway routes has been sanctioned by the railways authority of India.

Table 8. Length and density of railways in South 24 Parganas, 2011-12

C. D. Blocks	Railway length, km*	Railway density, km/100 sq km
Canning I	8	4.26
Baruipur	36	15.30
Sonarpur	11	6.25
Magrahat II	12	8.76
Magrahat I	9	7.56
Diamond Harbour I	8	10.15
Jaynagar I	13	9.92
Mathurapur I	8	5.43
Mandirbazar	6	5.08
Kulpi	16	7.59
Kakdwip	17	6.73
Namkhana	8	2.16
Budge Budge I	8	18.14
Maheshtala	9	8.39
Jaynagar II	2	1.05

Explanation: * – Approximate lengths.

Source: Eastern Railways, Sealdah Sub-division

3.5. Electrification

Power infrastructure has a different connotation for the economic development of present days. Levels of productivity, whether in agriculture or in manufacturing, depend to a large extent on the rate of consumption of electricity. On the one hand, it plays a labour-saving role in various economic productions; on the other hand, adequate availability of electricity creates an enabling environment for human resource development that would again control the quantity and quality of future workforce. Hirschman (1958, pp.83-84), in his discussion on the relationship between infrastructure and economic development, pointed out that 'enlarged availability of electric power and of transportation facilities are essential preconditions for economic development practically everywhere'.

Consumption pattern of electricity - Total consumption of electricity increased manifold in South 24 Parganas in the last two decades, from 59,721 KWH in 1990-91 to 6,73,700 KWH in 2010-11. Consumption grew by 257.58 per cent during the 1990s and 215.48 per cent during the last decade. The sectoral pattern of consumption of electricity shows that the domestic sector has been progressively becoming the larger consumer (Fig. 8). Its share in total consumption increased from 43.80 per cent in 1990-91 to 61.24 per cent in 2010-11. However, it remained the largest consumer. This is an impressive trend, in terms of the standards of living of the district's population, resulting from the continuous effort by the state government to enhance the availability of electricity at household level. The industrial sector comes next followed by the commercial sector.

Proportion of Electrified Villages – Rural electrification has become a major part of government initiatives in the power sector. Some significant projects in this regard include Rajib Gandhi Gramin Vidyutikaran Yojona-XI Plan, West Bengal Rural Household Electricity Programme, Sundarban Island Electrification Works, Sagar Island Electrification, etc. Work under the West Bengal State Electricity Development Corporation Limited (WB-SEDCL) has been in progress in such remote islands as Sagar, Gosaba and Patharpratima. As a result, electrified villages multiplied in number during the

last two decades. Only 15.62 per cent villages were electrified in 1981. The district has been moving towards 100 per cent coverage with 96.63 per cent villages having electric connection in 2011. All villages in Thakurpukur-Maheshtala, Budge Budge II, Jaynagar II, Canning I and II, Mathurapur II and Kakdwip have become electrified by 2011. The remaining C. D. Blocks, except Sagar (89.36 per cent) and Patharpratima (77.18 per cent), had more than 90 per cent of their villages electrified.
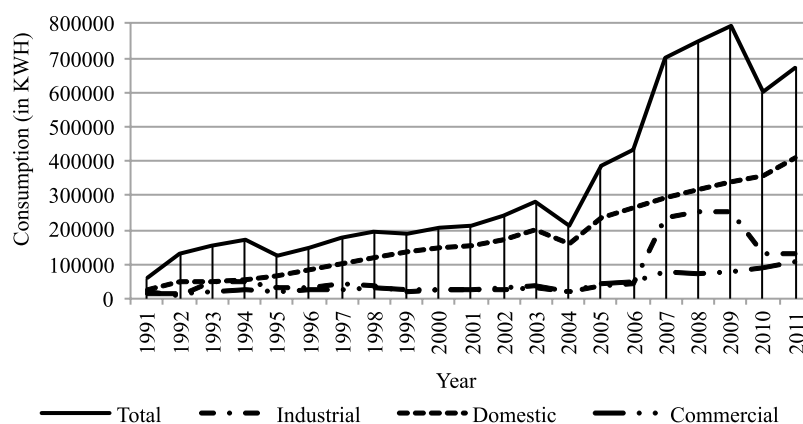

Fig. 8. Volume of consumption of electricity by major economic sectors in South 24 Parganaas (1990-2011)

Source: Developed by the author based on data available at Bureau of Applied Economics and Statistics

Availability of electricity at household level – An analysis of electrified households in South 24 Parganas yields rather less impressive results. The district's performance remains below the state average, though the difference has been reduced with time. Moreover, there remains a huge rural-urban disparity also. In 1981, 4.35 per cent households in rural areas and 42.23 per cent households in urban areas were electrified. In 2011, the urban proportion reached up to 80.68 per cent, while in rural areas only 40.31 per cent households had an electric connection (Fig. 9). A profound disparity can be found at the regional level also. In 2011, the largest share of households were electrified in Thakupukur-Maheshtala (93.50 per cent), followed by Sonarpur (87.54 per cent) and Budge Budge I (83.64 per cent). In Region II, Baruipur ranked first (65.30 per cent) followed by Falta (55.28 per cent) and Bhangar II (54.67 per cent). Region III, on the other hand, contained two worst performers, namely Sagar (1.10 per cent) and Patharpratima (7.04 per cent). However, rural-urban disparity in the level of electrification was also lower in 2011 than before. It was low (around 7 per cent points) in most of the better performing blocks, like Thakupukur-Maheshtala, Bishnupur II, Budge Budge I and II, and was exceptionally high (around 30 per cent points) in blocks with a lower level of household electrification, like Jaynagar II, Baruipur, Canning I, Basanti, Diamond Harbour I and II.
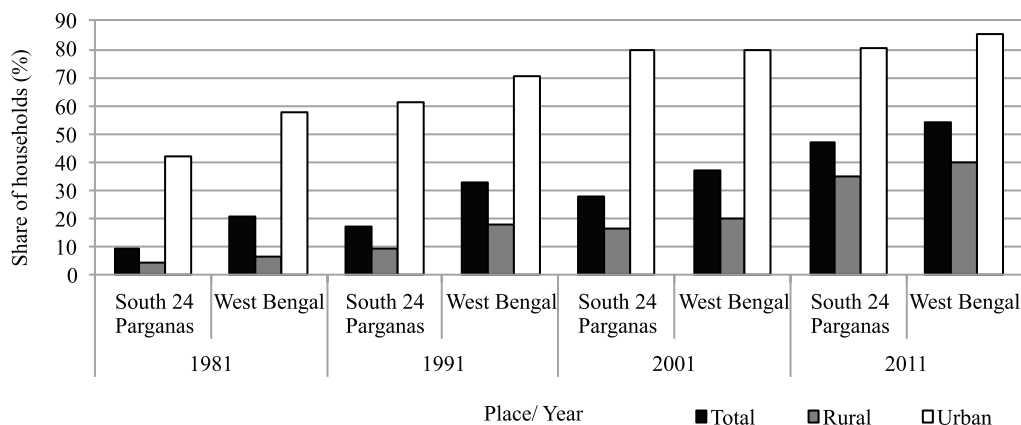

Fig. 9. Availability of electricity at household level in South 24 Parganas and West Bengal

Source: Developed by the author based on data available at Bureau of Applied Economics and Statistics

3.6. Financial services

A well-knitted and efficiently functioning financial system, having a wide network in rural and urban areas as well, helps in the formation, mobilisation and more effective utilisation of capital resources. Most of the developing economies, still having low rate of capital formation and its accumulation, generally suffer from lack of investment potentiality. South 24 Parganas district of West Bengal also belongs to this category. Performances of two essential components of the financial infrastructure of the district have been discussed in this context.

Banking facility - Commercial banking system has remained by far the most significant part of financial services in India, as it covers a wide range of people and reaches diversified business areas. Like in other districts of West Bengal, banking activities have progressed in South 24 Parganas also. The district is served by different commercial banks,

and also by one Gramin Bank, one unit of West Bengal State Co-operative Bank and one Primary Co-operative Agriculture and Rural Development Bank. West Bengal Financial Corporation also has a branch office here. The number of banks has increased by 101 during the last two decades. In this district semi-urban banks registered the highest increase in number during the last two decades. This growth undoubtedly reflects the changing and expanding demand of the semi-urban areas in tune with the ongoing socio-economic transformation, which influences this region mostly. Since the early 1990s the highest increase in the number of banks has taken place in Baruipur followed by Sonarpur C. D. Blocks. In 2010-11, Baruipur and Sonarpur had 28 and 25 banks respectively. Other blocks having good achievements were Budge Budge I, Jaynagar I and II, Canning II, Basanti, Magrahat II, Mandirbazar, Kulpi, Falta, Diamond Harbour I, Mathurapur I, Kakdwip and Sagar. Thus, there have been efforts to bring a progressively wider portion of the district under banking network.
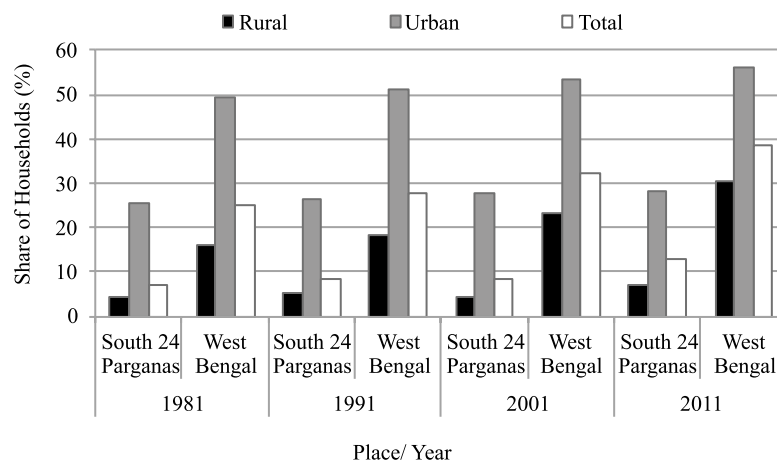
Fig. 10. Selected financial parameters of South 24 Parganas and West Bengal (1991-2011)

Source: Developed by the author based on data available at Bureau of Applied Economics and Statistics

In spite of the rising number of banks in South 24 Parganas, a bank office has to serve a huge mass of people. One bank office served 25348 persons in 2010-11 (Fig. 10). These estimates were more than 1.5 times larger than that of the state. At the sub-district level, each bank office in C. D. Blocks of Region II and Region III generally serves a larger size of population than a bank office in C. D. Blocks of Re-

gion I. The situation improved in Region I, except in Budge Budge II, and in most of the C. D. Blocks in Region II by 2010-11. Population pressure increased upon bank offices of the three most distant blocks, namely Namkhana, Patharpratima and Sagar, and also in Kultali, Canning I and Gosaba. The population served by each bank office in Region III was nearly double of that in Region I in 2010-11.The Fi-

nancial Inclusion Campaign (2011) by the Government of India, to bring all villages with more than 2000 population under banking network, is definitely a welcoming move to improve rural financial conditions. Deposits in banks of all types in South 24 Parganas increased manifold during the last twenty years. Total bank deposit was ` 27,278 lakh in 1990 and in 2011 it reached an amount of 9,17,300 lakh, recording a staggering increase of 3262.78 per cent. Per capita bank deposit also increased during this period, but it was much lower than the state average. In 2010-11, per capita bank deposit of this district was less than one-third of that of West Bengal. Advances or credits disbursed by banks increased largely during this period, but the credit-deposit ratio shows a fluctuating trend (Fig. 10). The ratio declined continuously during the 1990s, followed by an upward trend in the last decade. South 24 Parganas lagged far beyond the state average in terms of credit disbursement in the last two decades.

Annual Credit Plans are prepared for each district by the concerned Lead Bank Office in accordance with the Potential Linked Credit Plan (PLP) drafted each year by the National Bank for Agriculture and Rural Development (NABARD). NABARD (2005) basically identified potential sectors for exploitation through credit intervention and estimation of credit requirement for such exploitation. An analysis of credit planning for South 24 Parganas since 1997-98 shows that the service sector was targeted to achieve the largest share of credit followed by the agriculture and allied sector during the late 1990s. Achievement in credit disbursement was also highest in the service sector. Later, the agriculture and allied sector has become the most prioritised sector followed by the industry and service sector since the middle of the past decade. NABARD has identified South 24 Parganas as an agriculturally potential district, where farming may become more intensive and market oriented with proper infrastructural support. Thus, greater credit provision has been made for minor irrigation, land development, farm mechanisation and crop loan. The allied sectors with good potential are plantation, horticulture, fisheries, animal husbandry, bio-gas and others. The industrial sector included mainly the small scale industries in this district. Entrepreneurship development and skill building are two major objectives of credit facilitation in industry and service

sectors. The amount of per capita bank credit increased in these three broad sectors in the last two decades. However, the target-achievement ratio has declined heavily in each sector since the 1990s.

Co-operative societies - The second component of financial system are co-operative societies of two types, credit and non-credit societies. In South 24 Parganas with growing marginalisation of labourforce, the share of workers engaged in part-time, irregular, and less secure jobs with low return has been increasing rapidly. Co-operative societies are of great help for the economic wellbeing of these people. However, special emphasis has been given to agricultural and non-agricultural credit societies. The number of agricultural credit societies and their members declined during the last two decades, though the working capital of these societies increased. The availability of per capita agricultural credit increased in an irregular fashion during the 1990s. From ` 10.65 only in 1990-91 it reached up to a value of ` 2,612.60 in 2002-03 and then declined rapidly. The number of non-agricultural credit societies increased continuously from 189 in 1990-91 to 347 in 2010-11. The number of members became double, from 74,000 in 1990-91 to 140958 in 2010-11. The trend is significant in the context of the growing non-agriculturisation of the district's economy. But the volume of working capital declined drastically in 2006-07 with an increase in the following years. Per capita credit availability of these societies was higher than that of the agricultural credit societies during the 1990s, but the situation became the reverse during the last decade. In 2010-11, the number of members and the volume of working capital of non-agricultural credit societies were little more than one-third and almost one-fourth respectively of those of agricultural credit societies. The largest number of societies and members along with the biggest share of capital were owned by C. D. Blocks in Region III followed by Region II. Kakdwip, Sagar, Patharpratima, Namkhana, Baruipur, Kulpi, Diamond Harbour I and Sonarpur deserve special mention. However, the manner in which these societies are organised and function is not always conducive to an efficient use of the huge volume of resources at their disposal. In most of the cases throughout India, their finances are in a stage of chronic sickness and prone to recurrent crisis (Vaidyanathan, 2013).

3.7. Household amenities

Two basic household amenities, drinking water and sanitation facility, have been taken into account here. Availability of these two amenities of good quality is a basic criterion for achieving good health and a decent standard of living. This in turn influences the productive capacity of any community.

Drinking water - During the last three decades there has been some development in the field of drinking water supply in West Bengal. But conditions are precarious with regard to two vital aspects. Firstly, the number of households having a source of drinking water within their premises is very low. Secondly, still a lower number of households have been served by piped supply of drinking water. Thus, a large number of households have to depend upon common external sources of water, irrespective of the quality of water. In South 24 Parganas, the availability of drinking water at household level is far from the desired level. In 1981, only 7.07 per cent of total households had drink-

ing water facility within household premises and in 2011 the proportion was just 12.93 per cent of total (Fig. 11). The district always remained much below the state average in this regard and the difference increased largely by end of the last decade. The conditions differ largely between rural and urban areas. In 2011, households with drinking water facilities within their own premises were 7.25 per cent of total in rural areas and 28.25 per cent of total in urban areas. Coverage under piped supply of water by administrative authorities remained still very low. It was only 6.25 per cent in 2011. Piped water supply increased mainly in urban areas with 15.27 per cent of urban households having this facility in 2011. The proportion was only 2.91 per cent in rural areas. During the last decade, this source became particularly important in C. D. Blocks bordering Kolkata and having a larger urban population, like Thakurpukur-Maheshtala, Budge Budge I and II, Bishnupur I and II, Sonarpur and Baruipur. In 2011, the next major sources were hand pump and tube well, which were primary sources up to 2001.

Fig. 11. Households with Connection of Drinking Water in South 24 Parganas and West Bengal

Source: Developed by the author based on data available at Bureau of Applied Economics and Statistics

The achievements of C. D. Blocks differ considerably in terms of having sources of drinking water within their own household premises. In 2011, the highest achievement was found in Bhangar II (39.78 per cent) followed by Sonarpur (39.23 per cent). Thakurpukur-Maheshtala, Bishnupur II, Budge Budge I and II had more than 20 per cent

households with such facility, while the share was more than 10 per cent of total households in Baruipur, Bhangar I, Bishnupur I and Canning I. In the rest of the C. D. Blocks, the coverage was of a range of 1-4 per cent only, with Canning II and Magrahat I having a slightly better achievement. The situation in urban areas was better than in the rural counter-

part. In 2011, the disparity between rural and urban areas was very high in Sonarpur, Budge Budge I and Canning II (within a range of 21 to 29 per cent points). Thakurpukur-Maheshtala, Bishnupur I, Baruipur and Canning I had high disparity within a range of 10 to 16 per cent points. Disparity was small, around 3-4 per cent points, in Bishnupur II, Bhangar I and Budge Budge II. Other urbanised C. D. Blocks also suffered from such disparity, but at a lower level, as coverage in both rural and urban areas was very low in these blocks.

Sanitation facilities – At all-India level West Bengal is in a relatively lower position among mediocre performers with regard to sanitation. Till now most of the rural households do not use latrine for defecation and many of them even do not have any drainage facility. Though sanitation facilities in urban areas are better than in rural areas, the situation is far from ideal even in urban areas. The performance of South 24 Parganas is also not satisfactory in this regard. The availability of sanitation facility in households of South 24 Parganas has improved over time. In 2011, 62.59 per cent households had this facility. In urban areas 83.10 per cent households had their own sanitation facility and this figure was slightly below the state average. Though the proportion of rural households with sanitation facilities increased manifold in this district, the overall achievement remained still poor with an achievement of 54.99 per cent in 2011 (Fig. 12). However, in the case of rural areas the district's performance remained above the state level average.
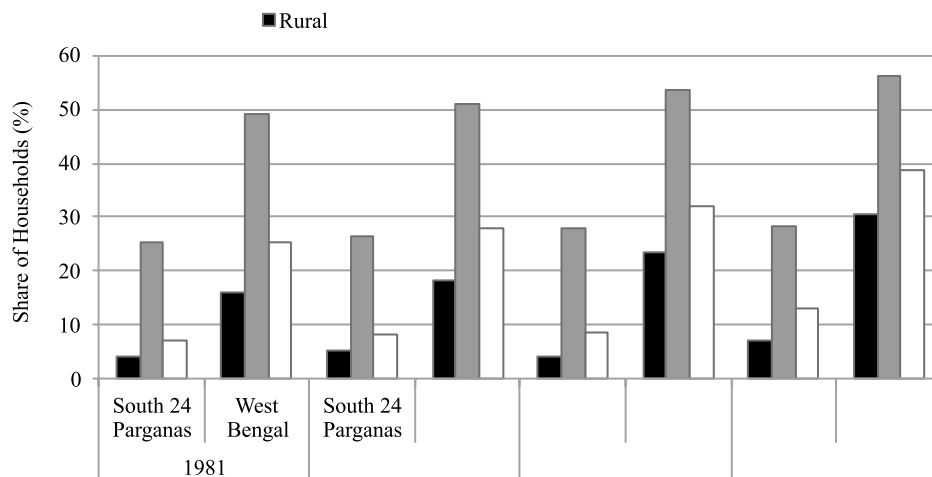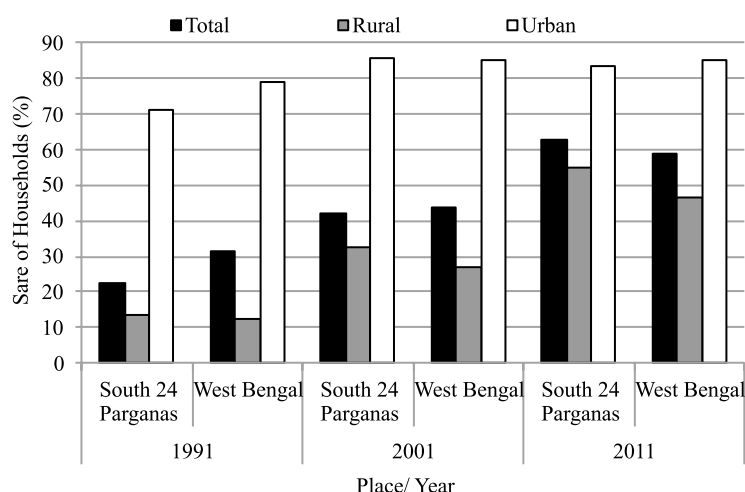

Fig. 12. Households with Toilet Facilities in South 24 Parganas and West Bengal

Source: Developed by the author based on data available at Bureau of Applied Economics and Statistics

Household availability of sanitation facility at C. D. Block level remained full of disparities. Unlike the progress of household electrification, differences in achievement with regard to sanitation facility got reduced only slightly. In 2011, Sonarpur was the highest achiever (93.33 per cent) followed by Thakurpukur-Maheshtala (90.42 per cent). C. D. Blocks with more than 60 per cent households with sanitation facility were Sagar, Bhangar II, Gosaba, Budge Budge I, Namkhana and Baruipur. C. D. Blocks with more than half of their households having sanitation facility were Bhangar I, Diamond Harbour I and II, Falta, Bishnupur I and II, Budge Budge II, Mathurapur II, Kakdwip, Patharpratima, Canning I and II. The worst achievements were noticed in Kultali (32.25 per cent) followed by Kulpi (37.57 per cent). However, some less developed blocks, like Sagar (86.88 per cent), Gosaba (75.28 per cent), Namkhana (72.79 per cent) and Bhangar II (77.66 per cent), came up with very good achievements.

Rural-urban disparity has declined in the last two decades mainly due to improvements in rural areas. In 2011, the minimum disparity was found in Budge Budge II (0.15 per cent point) and the maximum in Jaynagar II (51.63 per cent points).

Other C. D. Blocks having relatively low difference between rural-urban achievements were Thakurpukur-Maheshtala, Budge Budge I, Bishnupur II, Magrahat I and II, Mandirbazar, Kulpi, Diamond Harbour II and Mathurapur I. C. D. Blocks having relatively high disparity were Bishnupur I, Sonarpur, Jaynagar I, Baruipur, Bhangar I, Canning II, Basanti, Falta and Diamond Harbour I.

4.   Discussion

The above analysis makes it clear that C. D. Blocks in South 24 Parganas differ considerably in terms of various infrastructural achievements. Thus, forming an idea on the overall status of the basic components of infrastructure seems quite sig-

nificant in estimating the development potentials at sub-district level. Therefore, an attempt has been made to construct an index of infrastructural development for each C. D. Block of the district and to make a comparative analysis. For this purpose seventeen variables representing the above mentioned seven basic sectors of infrastructure have been selected (Table 9). With these variables Principal Component Analysis has been done. It must be mentioned here that the choice of indicators is dependent upon the relevance of a particular indicator in revealing the condition of infrastructure of the district under consideration on the one hand, and also upon the availability of data at district level on the other. Naturally, selection of indicators for PCA has definitely some bearing upon the indices obtained and relative positions of the C. D. Blocks.

Table 9. Economic variables for factor analysis of infrastructural development in South 24 Parganas, 2011

Category	Variable no.	Nature of variable	Variable code
I Agriculture	X1	Net irrigated area (per cent)	Net Irri.
	X2	Cultivated area/ agricultural worker (hactare)	Culti. Area/ Agri. Wor.
II Literacy and Education	X3	Total literacy rate (per cent)	Lit. Rt.
	X4	Number of primary schools/ lakh population	Pri. Sch./ Lakh Pop.
	X5	Number of secondary and higher secondary schools/ /lakh population	Sec. & H.S./ Lakh Pop.
III Healthcare System	X6	Number of medical institutes/ lakh population	Medi. Insti./ Lakh Pop.
	X7	Number of beds/ lakh population	Beds/ Lakh Pop.
	X8	Number of doctors/ lakh population	Doctors/ Lakh Pop.
IV Financial Services	X9	Number of banks/ lakh population	Bank/ Lakh Pop.
	X10	Number of co-operative societies/ lakh population	Co-op. Soc./ Lakh Pop.
V Transport Facilities	X11	Length of metalled road/ sq. km.	Sur. Rd. Den.
	X12	Length of total road/ sq. km.	Total Rd. Den.
	X13	Length of railways/ sq. km.	Railway Den.
VI Electrification	X14	Electrified villages (per cent)	Elec. Vill.
	X15	Households with electric connection (per cent)	Elec._HH
VII Household Amenities	X16	Households with own sources of drinking water (per cent)	Water_HH
	X17	Households with toilet facilities (per cent)	Toi._HH

Source: Author's suggestion

4.1. Methodology for computation of the infrastructural development index

The computation of economic development index for the C. D. Blocks has been done in four steps.

As variables with different measurement units and disproportionate range fail to provide the accurate results, 'Z-scores' have been calculated for each variable at the C. D. Block level in order to get the standardised values of variables. The next step is to assign factor loadings and weights

with the help of Principal Component Analysis (PCA). This has been done by using the Statistical Package for Social Sciences (SPSS) software, version 20.

Several statistical tests are used to assess the appropriateness of using the PCA for a particular dataset. In the present study, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (MSA) test has been used. It compares the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients (Krishnan, 2010). If the variables, in fact, have common factors, the partial correlation coefficients should be small relative to the total correlation coefficient. The KMO statistic varies between 0 and 1. A value of 0 indicates that the sum of partial correlations is large relative to the sum of correlations, indicating diffusion in the pattern of correlations (hence, factor analysis is likely to be inappropriate). A value close to 1 indicates that patterns of correlations are relatively compact and so factor analysis should yield distinct and reliable factors. Values greater than 0.5 are considered as barely acceptable, values between 0.5 and 0.7 as mediocre, values between 0.7 and 0.8 as good, values between 0.8 and 0.9 as great and values above 0.9 as superb (Field, 2009). However, there are other references where values less than 0.50 have been considered as 'miserable' (Beaumont, 2012) and therefore unacceptable. For the variables of 2011, the KMO value is 0.635, signaling that a factor analysis of the variables can proceed (Table 10). Another test of the strength of the relationship among variables has been done using the Bartlett's Test of Sphericity (1954). It tests the null hypothesis that the variables in the population correlation matrix are uncorrelated. The results of the analysis of socio-economic indicators of South 24 Parganas show a significance level of 0.00 (Table 10), a value that is small enough to reject the hypothesis, as the probability should be less than 0.05 to reject the null. These diagnostic procedures indicate that factor analysis is appropriate for the data.

Table 10. KMO and Bartlett's test for factor analysis of infrastructural variables, South 24 Parganas, 2011

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.635
Bartlett's Test of Sphericity	Approx. Chi-Square	438.055
	df	136
	Sig.	.000

Source: Author's calculation

The next table task is to determine Total Variance Explained by different components and thereby to capture the principal components as extracted by the PCA. One of the most commonly used techniques is Kaiser's criterion, or the Eigen Value Rule. Under this rule, only those factors with an eigen value (the variances extracted by the factors) of 1.0 or more are retained (Krishnan, 2010). Using this criterion, the result shows that the first five components have initial eigen values greater than one and these five together explain 82.507 per cent of total variance explained (Table 11). Now weights for variables have to be calculated with the help of the Extracted Component Matrix (Table 12) and the Initial Eigen Values for the first five components. First Eigen Value (e.g. 5.551) has been multiplied with first the Extracted Component Column (e.g. 0.369, 0.424, 0.484 etc.), the second Eigen Value (e.g. 3.766) has been multiplied with the second Extracted Component Column (e.g. 0.204, 0.473, 0.318 etc.) and so on. Only absolute values have been considered here, in other words values have been taken irrespective of their signs and negative values have been treated as positive. Then the values obtained for each variable have been added up horizontally, e.g. in the case of the first variable, the sum obtained is 4.085343. This value is treated as the weight for the first variable. Similarly, weights for other variables are obtained. All weights have been summed up to obtain the Grand Total of all weights. It is 94.62883 in this case (Table 12).

Table 11. Total variance explained by components of factor analysis of infrastructural development, South 24 Parganas, 2011

Component	Initial eigen values			Extraction sums of squared loadings		
	Total	Variance %	Cumulative values %	Total	Variance, %	Cumulative values %
1	5.551	32.653	32.653	5.551	32.653	32.653
2	3.766	22.150	54.803	3.766	22.150	54.803
3	2.039	11.996	66.799	2.039	11.996	66.799
4	1.452	8.541	75.340	1.452	8.541	75.340
5	1.218	7.166	82.507	1.218	7.166	82.507
6	.809	4.757	87.264			
7	.645	3.794	91.058			
8	.472	2.775	93.833			
9	.278	1.635	95.468			
10	.246	1.446	96.914			
11	.152	.893	97.807			
12	.141	.827	98.635			
13	.088	.520	99.155			
14	.063	.373	99.528			
15	.047	.279	99.807			
16	.025	.147	99.954			
17	.008	.046	100.000			

Extraction method: Principal component analysis

Source: Author's calculation

Table 12. Component matrix and weights of selected infrastructural variables for factor analysis, South 24 Parganas, 2011

Standardised variables	Components					Calculated weights
	1	2	3	4	5	
Zscore: Net Irri.	.369	.204	.063	.760	.030	4.085343
Zscore: Culti. Area/ Agri. Wor.	.424	.473	.129	.323	.093	4.981653
Zscore: Lit. Rt.	.484	.318	.754	.087	.057	5.614816
Zscore: Pri Sch./ lakh Pop.	.569	.562	.178	.192	.403	6.410761
Zscore: Sec & HS School/ lakh Pop.	.170	.637	.431	.218	.408	5.033244
Zscore: Medical Institutes/ lakh Pop.	.335	.712	.325	.225	.324	5.92237
Zscore: Beds/ lakh Pop.	.529	.714	.315	.080	.203	6.630854
Zscore: Doctors/ lakh Pop.	.478	.745	.340	.035	.259	6.519377
Zscore: Banks/ lakh Pop.	.865	.176	.130	.070	.137	5.999449
Zscore: Co-operative Societies/ lakh Pop.	.050	.853	.273	.146	.054	4.324193
Zscore: Metalled Road Den (km./ sq. km.)	.884	.090	.044	.101	.282	5.826338
Zscore: Total Road Den (km./ sq. km.)	.637	.054	.166	.313	.532	5.182565
Zscore: Railways Den (km./ 100 sq. km.)	.653	.221	.226	.388	.209	5.732628
Zscore: Elec. Vill.	.362	.191	.499	.415	.167	4.551914
Zscore: Elec_HH	.875	.170	.021	.361	.092	6.178612
Zscore: Water_HH	.698	.471	.262	.142	.197	6.628721
Zscore: Toilet_HH	.527	.028	.650	.111	.400	5.005994
Grand total						94.62883

Extraction method: Principal component analysis

Source: Author's calculation

Now the standardised values of each broad category have been multiplied by their corresponding weights and weighted values have been summed up in order to get the Composite Weighted Values for each C. D. Block (Appendix I). In the last step

Composite Weighted Values of each C. D. Block have been divided by the Grand Total of Weights and the results would finally give the indices of the infrastructural development of the C. D. Blocks (Table 13).

Table 13: Infrastructural development index of C. D. Blocks in South 24 Parganas, 2011

C. D. Block	Infrastructural development index	C. D. Block	Infrastructural development index
Thakurpukur – Maheshtala	0.260398	Mandirbazar	-0.10928
Bishnupur I	0.256731	Canning I	-0.26222
Bishnupur II	0.309672	Canning II	-0.77894
Budge Budge I	1.221448	Basanti	-0.83297
Budge Budge II	0.220018	Gosaba	-0.29625
Sonarpur	0.64945	Jaynagar I	-0.07436
Baruipur	0.349781	Jaynagar II	-0.36532
Bhangar I	-0.30386	Mathurapur I	0.044474
Bhangar II	-0.18974	Mathurapur II	0.109143
Falta	0.063201	Kultali	-0.79776
Diamond Harbour I	1.230563	Patharpratima	-0.47651
Diamond Harbour II	0.149501	Kakdwip	0.125754
Magrahat I	-0.08071	Namkhana	0.001488
Magrahat II	-0.24582	Sagar	-0.14427
Kulpi	-0.03362		

Source: As in Appendix I

4.2. Profile of infrastructural development at sub-district level

The computation of infrastructural development index at sub-district level in South 24 Parganas for the year 2011, brings out some interesting results. Diamond Harbour I (1.231) tops among the C. D. Blocks, closely followed by Budge Budge I (1.221).

Sonarpur (0.649) comes next, but with a much lower index than the first two. The lowest rank is obtained by Basanti (-0.833), preceded by Kultali (-0.798) and Canning II (-0.779) respectively (Fig. 13). C. D. Blocks have been classified according to their infrastructural development indices into five groups (Table 14). Certain basic features have been highlighted below.

Table 14. Classification of C. D. Blocks according level of infrastructural development, South 24 Parganas, 2011

Category	Range of infrastructural development index value	Name of the C. D. Blocks
Very High	above 1.00	Diamond Harbour I, Budge Budge I
High	0.50 to 1.00	Sonarpur
Medium	0 to 0.50	Baruipur, Bishnupur II, Thakurpukur- Maheshtala, Bishnupur I, Budge Budge II, Diamond Harbour II, Kakdwip, Mathurapur II, Falta, Mathurapur I, Namkhana
Low	-0.50 to 0	Kulpi, Jaynagar I, Magrahat I, Mandirbazar, Sagar, Bhangar II, Magrahat II, Canning I, Gosaba, Bhangar I, Jaynagar II, Patharpratima
Very Low	below -0.50	Canning II, Kultali, Basanti

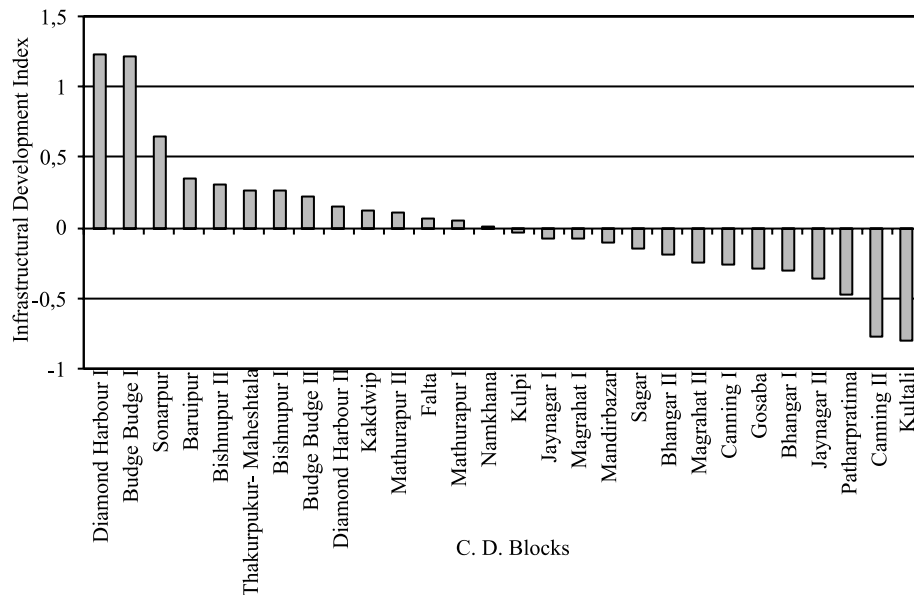*Source*: Prepared by the author from Table 13

Fig. 13. C. D. Blocks of South 24 Parganas arranged according to the infrastructural development index, 2011

Source: Developed by the author based on data available in Table 13

1. C. D. Blocks closer to Kolkata are distributed among first three developmental classes. Budge Budge I and Sonarpur occupy very high and high categories respectively. Greater achievements in transport sector in Budge Budge I and in financial services along with household amenities in case of Sonarpur are the major factors behind such higher order ranking. The remaining four blocks from Region I, namely Thakurpukur- Maheshtala, Budge Budge II, Bishnupur I and II, fall in the medium developmental class.

2. Diamond Harbour I is an exception, as it is the only block of Region II occupying the very high developmental class. Much higher achievements in health infrastructure can be identified as the key factor behind such high scoring. Baruipur, Diamond Harbour II and Falta of Region II belong to the medium category. Other blocks in this class are from Region III. These include Kakdwip, Namkhana, Mathurapur I and II. Baruipur has the highest index value (0.350) among the blocks of the medium developmental class. The above mentioned blocks of Region III along with Diamond Harbour II and Falta have much lower infrastructural developmental indices than Baruipur and the blocks of Region I.

3. The low developmental category has six blocks from Region II and Region III each. Within the lowest class there are three blocks from Region III, namely Canning II, Kultali and Basanti.

4. Distribution of C. D. Blocks across quartile ranges shows an almost uniform pattern (Table 15). The first, second and fourth quartiles contain 24.14 per cent C. D. Blocks each. Only the third quartile has the remaining 25.78 per cent blocks. The lowest quartile contains blocks mostly from Region III except Bhangar I. These blocks are Canning II, Kultali, Basanti Gosaba, Jaynagar II and Patharpratima. The third and second quartiles contain blocks from both Region II and Region III. Budge Budge II is an exception. This is the only block from Region I which belongs to the second quartile. The highest quartile is full of five blocks from Region I along with Diamond Habour I from Region II.

Table 15. Classification of C. D. Blocks according to quartile values of infrastructural development, South 24 Parganas, 2011

First Quartile		Second Quartile		Third Quartile		Fourth Quartile	
C. D. Blocks	Infra-structural development index	C. D. Blocks	Infra-structural development index	C. D. Blocks	Infra-structural development index	C. D. Blocks	Infra-structural development index
Basanti	-.83	Canning I	-.26	Namkhana	.00	Bishnupur I	.26
Kultali	-.80	Magrahat II	-.25	Mathurapur I	.04	Thakurpukur-Maheshtala	.26
Canning II	-.78	Bhangar II	-.19	Falta	.06	Bishnupur II	.31
Patharpratima	-.48	Sagar	-.14	Mathurapur II	.11	Baruipur	.35
Jaynagar II	-.37	Mandirbazar	-.11	Kakdwip	.13	Sonarpur	.65
Bhangar I	-.30	Magrahat I	-.08	Diamond Harbour II	.15	Budge Budge I	1.22
Gosaba	-.30	Jaynagar I	-.07	Budge Budge II	.22	Diamond Harbour I	1.23
-	-	Kulpi	-.03	-	-	-	-
Quartile value	-.2792	-	-.0336	-	.2384	-	-

Source: Author's calculation

5. The analysis of average distances of C. D. Blocks from the Kolkata Metropolis and their level of infrastructural development in 2011 shows a negative correlation. The correlation coefficient (r) of this linear correlation is -0.51. This is also statistically significant at 1 per cent level [as the calculated value of t (3.08) is greater than the tabulated value (2.77) at 27 (29-2) degrees of freedom for 1 per cent level of significance]. Thus, indices are much lower in the case of the distant blocks, namely Basanti (88 km.), Patharpratima (112 km.), Kultali (72 km.) and Canning II (65 km.), while indices are higher in the case of Sonarpur (25 km.), Budge I (38 km.) and Diamond Harbour I (45 km.). However, some exceptions are there. For instance, Namkhana at a distance of 100 kilometers from Kolkata has a higher index value than less distant blocks like Jaynagar I (50 km.) and Jayngar II (55 km.). Similarly, Thakurpukur-Maheshtala at an average distance of only 8 kilometers from the metropolis has a lower index value than either Sonarpur or Baruipur which are respectively 25 kilometers and 28 kilometers away from Kolkata.

5. Conclusion

The overall performance of South 24 Parganas is of mediocre nature in terms of the availability of basic socio-economic infrastructure. In most of the cases, the status of urban areas was found to be better than their rural counterparts. Besides, the existence of a distance-decay effect with respect to Kolkata can be traced in the level of infrastructural development achieved at sub-district level. Thus, blocks of Region I are better performers than most of the blocks of Region II. However, limited accessibility and connectivity of a vast stretch of land, inadequate availability of primary educational services and also technically skilled and highly educated persons, disparities in availability of electricity and drinking water at household level, and insufficiency of health and financial services can be identified as more crucial areas in terms of development. Since the structure of economy rests upon the existing infrastructure, regional imbalance in their availability creates differences in economic opportunities and overall development also. Thus, a more balanced infrastructural development assumes paramount sig-

nificance with respect to the holistic development of this less developed district of West Bengal.

Acknowledgement

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Appendix

Appendix Ia. Weighted values and infrastructural development index of C. D. Blocks in South 24 Parganas, 2011

C. D. Blocks	Agriculture			Literacy and education				Healthcare system			
	Net Irri	Culti. Area/Agri. Wor.	Total score	Lit. Rt.	Pri. Sch./Lakh Pop.	Sec. & H.S. Sch./Lakh Pop.	Total score	Medi. In-sti./Lakh Pop.	Beds/Lakh Pop.	Doctors/Lakh Pop.	Total score
Thakurpukur- Maheshtala	3.128106	-5.34143	-2.21332	6.815151	-13.0512	-2.68966	-8.92567	-4.34441	-3.19362	-4.11705	-11.6551
Bishnupur I	8.821522	5.481363	14.30288	2.124815	-0.65069	-4.10783	-2.63371	6.154586	-0.14621	-0.1105	5.897872
Bishnupur II	-1.07943	0.069992	-1.00944	5.377309	0.966743	2.983053	9.327105	0.905116	0.383794	1.49209	2.780999
Budge Budge I	2.019753	-13.4585	-11.4387	6.091289	-4.42477	-1.27145	0.39507	3.529851	17.07843	11.10765	31.71593
Budge Budge II	3.074874	-3.98856	-0.91369	3.374224	-0.11155	4.40122	7.663896	-1.71968	-2.13368	-1.7131	-5.56645
Sonarpur	-0.01785	-1.28288	-1.30073	11.61458	-12.512	-1.27145	-2.16887	-1.71968	-1.3387	-1.7131	-4.77148
Baruipur	-1.36982	-0.60647	-1.97628	2.471867	-5.50306	-4.10783	-7.13903	3.529851	1.178767	4.697276	9.405894
Bhangar I	5.819122	-8.04711	-2.22799	-5.30241	-4.96392	-4.10783	-14.3742	0.905116	-3.19362	-2.51439	-4.8029
Bhangar II	3.666963	-3.31215	0.354811	-3.12088	-5.50306	-8.36238	-16.9863	-4.34441	-3.72362	-3.31569	-11.3837
Falta	8.340759	-3.98856	4.352198	1.192699	5.819112	4.40122	11.41303	6.154586	-0.8087	0.690793	6.03668
Diamond Harbour I	-0.81482	6.157771	5.34295	0.924929	0.966743	2.983053	4.874724	24.52785	27.94321	28.73624	81.20731
Diamond Harbour II	6.780689	4.804954	11.58564	0.389444	7.436547	5.819437	13.64543	-1.71968	-2.79616	-0.1105	-4.62635
Magrahat I	4.160636	3.452086	7.612722	-3.77535	-3.34642	-2.68966	-9.81143	0.905116	-2.39865	-1.7131	-3.20663
Magrahat II	3.736332	0.746401	4.482733	0.111791	-2.26813	-4.10783	-6.26417	-6.96915	-4.25363	-5.71965	-16.9424
Kulpi	-2.47658	7.510639	5.034063	-2.07967	13.36721	1.564886	12.85242	-1.71968	-2.39865	-3.31569	-7.43401
Mandirbazar	-1.90867	5.481363	3.57269	-1.73262	6.897402	1.564886	6.729668	-4.34441	-3.3617	-3.31569	-10.9863
Canning I	-3.48165	2.099219	-1.38243	-6.57169	-5.50306	-6.94417	-19.0189	-1.71968	-0.94118	-0.1105	-2.77137
Canning II	-3.14449	-3.98856	-7.13305	-11.9165	-6.58135	-8.36238	-26.8603	-6.96915	-3.98859	-4.91835	-15.8761
Basanti	-3.96405	-3.31215	-7.2762	-8.99129	-2.80727	-5.526	-17.3246	-4.34441	-3.06113	-4.11705	-11.5226
Gosaba	-4.08342	-3.31215	-7.39557	2.957773	9.053982	8.65577	20.66753	-4.34441	-3.3617	-4.91835	-12.5889
Jaynagar I	-5.30792	-3.31215	-8.62007	-3.97366	-3.88556	-1.27145	-9.13067	-1.71968	-2.53113	-2.51439	-6.7652
Jaynagar II	-4.22539	-0.60647	-4.83185	-6.05608	-1.18984	-2.68966	-9.93559	3.529851	0.118759	1.49209	5.140699
Mathurapur I	0.214481	5.481363	5.695843	-3.68607	8.514837	4.40122	9.229986	-4.34441	-0.54366	-1.7131	-6.60117
Mathurapur II	-3.15417	6.157771	3.003601	1.361256	5.819112	11.49215	18.67252	3.529851	0.781247	2.293386	6.604485
Kultali	-4.25607	2.099219	-2.15685	-8.46568	-3.34642	-4.10783	-15.9199	-1.71968	-2.53113	-3.31569	-7.5665
Patharpratima	-3.78658	-1.28288	-5.06946	4.584048	6.897402	1.564886	13.04634	0.905116	-2.13368	-2.51439	-3.74295
Kakdwip	-2.2136	4.128495	1.914893	1.242278	1.505888	4.40122	7.149385	0.905116	3.166233	3.89598	7.967328
Namkhana	-2.86052	5.481363	2.620846	8.38191	3.123323	1.564886	13.07012	0.905116	-0.94118	-0.9118	-0.94787
Sagar	-1.61829	-3.31215	-4.93044	6.656533	5.279967	5.819437	17.75594	-4.34441	-0.94118	-1.7131	-6.99869

Appendix Ib. Weighted values and infrastructural development index of C. D. Blocks in South 24 Parganas, 2011

C. D. Blocks	Financial services			Transport facilities				Electrification		
	Bank/ Lakh Pop.	Co-op. Soc./ Lakh Pop.	Total score	Sur. Rd. Den.	Total Rd. Den.	Railways Den.	Total score	Elec. Vill.	Elec._HH	Total score
Thakurpukur- Maheshtala	4.399036	-6.60918	-2.21015	7.057676	2.051415	4.933328	14.04242	3.009999	12.48438	15.49438
Bishnupur I	4.399036	-3.12276	1.276277	0.052845	0.636782	-4.55245	-3.86283	1.870973	4.257805	6.128778
Bishnupur II	1.625731	-1.94597	-0.32024	4.149052	2.494058	-4.55245	2.090658	1.405449	7.213653	8.619102
Budge Budge I	15.49226	1.2554	16.74766	24.16538	13.58957	15.95677	53.71171	3.009999	10.09937	13.10937
Budge Budge II	-1.14757	-6.44106	-7.58863	6.782324	9.259119	-4.55245	11.48899	3.009999	6.744388	9.754386
Sonarpur	18.26556	4.193646	22.45921	5.577553	2.320856	2.513872	10.41228	-0.95185	11.04272	10.09087
Baruipur	4.399036	-1.17121	3.227828	3.426178	-1.20121	12.74581	14.97077	-0.5755	5.66313	5.087632
Bhangar I	-3.92088	-3.23238	-7.15326	-0.94544	-3.39531	-4.55245	-8.8932	1.821448	1.85105	3.672499
Bhangar II	-1.14757	-5.2497	-6.39727	-2.13296	-3.49155	-4.55245	-10.177	1.355924	3.091901	4.447825
Falta	-1.14757	-1.19313	-2.34071	-3.25168	-4.23255	-4.55245	-12.0367	2.267126	3.239446	5.506573
Diamond Harbour I	7.172341	10.08475	17.25709	-0.32581	0.213366	6.92318	6.810738	1.613426	2.603296	4.216722
Diamond Harbour II	-1.14757	1.620837	0.473263	-0.34305	-1.5188	-4.55245	-6.41431	1.930376	2.80163	4.732006
Magrahat I	-1.14757	-1.77785	-2.92542	2.393518	1.61836	3.994954	8.006831	-1.3877	2.429121	1.041425
Magrahat II	-1.14757	-3.8244	-4.97198	-0.22257	-1.62463	5.351638	3.504441	1.831326	-0.4469	1.384427
Kulpi	-1.14757	3.28003	2.132456	-3.8885	-0.58537	4.028834	-0.44504	-2.42767	-2.00947	-4.43714
Mandirbazar	-1.14757	2.169015	1.021441	-1.1003	-1.70164	1.191011	-1.61094	3.009999	-1.71679	1.29321
Canning I	-3.92088	-0.22836	-4.14924	-1.23798	1.397012	0.26393	0.422962	3.009999	-1.27415	1.735845
Canning II	-6.69419	-5.05234	-11.7465	-2.1674	-1.91335	-4.55245	-8.6332	3.009999	-4.44533	-1.43533
Basanti	-6.69419	-2.5892	-9.28338	-4.8351	-5.28145	-4.55245	-14.669	0.048478	-8.36386	-8.31539
Gosaba	-3.92088	0.977657	-2.94322	-5.40305	-4.22291	-4.55245	-14.1784	-2.5168	-9.4838	-12.0006
Jaynagar I	4.399036	-1.60246	2.796577	-0.22257	16.73632	6.663148	23.1769	0.2565	-2.16431	-1.90781
Jaynagar II	-3.92088	-3.30546	-7.22634	-1.47896	-0.26778	-3.36528	-5.11202	3.009999	-4.45978	-1.44979
Mathurapur I	4.399036	3.63816	8.037196	-1.01425	0.46358	1.586734	1.036066	-0.9915	-1.99983	-2.99133
Mathurapur II	-3.92088	2.812239	-1.10864	-2.76978	-3.38567	-4.55245	-10.7079	3.009999	-3.54306	-0.53306
Kultali	-6.69419	-3.35661	-10.0508	-5.21376	-4.8869	-4.55245	-14.6531	-3.44785	-8.57672	-12.0246
Patharpratima	-3.92088	0.809532	-3.11135	-5.05883	-3.9727	-4.55245	-13.584	-19.5924	-8.42917	-28.0216
Kakdwip	-3.92088	3.85744	-0.06344	-2.89027	-2.88529	3.056523	-2.71904	3.009999	-2.12563	0.884371
Namkhana	-3.92088	6.488711	2.567831	-4.47364	-3.81872	-2.11035	-10.4027	-2.07112	-4.61703	-6.68815
Sagar	-3.92088	9.514652	5.593772	-4.62856	-2.3945	-4.55245	-11.5755	-7.52855	-9.86601	-17.3946

Appendix Ic. Weighted values and infrastructural development index of C. D. Blocks in South 24 Parganas, 2011

C. D. Blocks	Household amenities			Composite weighted values	Infrastructural development index
	Water_HH	Toi._HH	Total score		
Thakurpukur- Maheshtala	10.30799	9.800635	20.10863	24.6412	0.260398
Bishnupur I	3.795606	-0.61073	3.184874	24.29415	0.256731
Bishnupur II	8.602887	-0.78719	7.815694	29.30388	0.309672
Budge Budge I	6.573305	4.769861	11.34317	115.5842	1.221448
Budge Budge II	8.663407	-2.68186	5.981546	20.82005	0.220018
Sonarpur	16.03388	10.70151	26.7354	61.45668	0.64945
Baruipur	5.220184	4.302402	9.522586	33.09941	0.349781
Bhangar I	3.856126	1.1694	5.025526	-28.7535	-0.30386
Bhangar II	16.33642	5.850305	22.18672	-17.9549	-0.18974
Falta	-4.31192	-2.63851	-6.95043	5.98067	0.063201
Diamond Harbour I	-4.38888	1.126048	-3.26283	116.4467	1.230563
Diamond Harbour II	-4.42739	-0.82123	-5.24862	14.14706	0.149501
Magrahat I	-4.69141	-3.66324	-8.35465	-7.63715	-0.08071
Magrahat II	-1.57823	-2.87689	-4.45513	-23.2621	-0.24582
Kulpi	-4.32292	-6.56096	-10.8839	-3.18113	-0.03362
Mandirbazar	-4.83989	-5.52076	-10.3607	-10.3409	-0.10928
Canning I	0.242412	0.107479	0.349891	-24.8133	-0.26222
Canning II	-1.59474	-0.43117	-2.0259	-73.7104	-0.77894
Basanti	-4.61989	-5.81176	-10.4316	-78.8228	-0.83297
Gosaba	-4.70792	5.113473	0.405556	-28.0337	-0.29625
Jaynagar I	-3.83339	-2.75305	-6.58644	-7.03671	-0.07436
Jaynagar II	-4.8509	-6.304	-11.1549	-34.5698	-0.36532
Mathurapur I	-4.63089	-5.56722	-10.1981	4.20848	0.044474
Mathurapur II	-4.41639	-1.18657	-5.60296	10.32805	0.109143
Kultali	-4.91142	-8.20798	-13.1194	-75.4911	-0.79776
Patharpratima	-4.81239	0.203494	-4.60889	-45.0919	-0.47651
Kakdwip	-3.46483	0.231327	-3.23351	11.89999	0.125754
Namkhana	-4.42189	4.34265	-0.07924	0.140829	0.001488
Sagar	-4.80695	8.704673	3.897723	-13.6518	-0.14427

Source: Author's calculation