Report Code: 052_GBP_IIT_SEC_ANL_14_Ver 1_Dec 2013

Status of Urbanization and Industrialization in Lower Ganga Basin

GRBMP: Ganga River Basin Management Plan

by

Indian Institutes of Technology

IIT Bombay | IIT Delhi | IIT Guwahati | IIT Kanpur | IIT Kharagpur | IIT Madras | IIT Roorkee

Preface

In exercise of the powers conferred by sub-sections (1) and (3) of Section 3 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government has constituted National Ganga River Basin Authority (NGRBA) as a planning, financing, monitoring and coordinating authority for strengthening the collective efforts of the Central and State Government for effective abatement of pollution and conservation of the river Ganga. One of the important functions of the NGRBA is to prepare and implement a Ganga River Basin Management Plan (GRBMP).

A Consortium of 7 Indian Institute of Technology (IIT) has been given the responsibility of preparing Ganga River Basin Management Plan (GRBMP) by the Ministry of Environment and Forests (MoEF), GOI, New Delhi. Memorandum of Agreement (MoA) has been signed between 7 IITs (Bombay, Delhi, Guwahati, Kanpur, Kharagpur, Madras and Roorkee) and MoEF for this purpose on July 6, 2010.

This report is one of the many reports prepared by IITs to describe the strategy, information, methodology, analysis and suggestions and recommendations in developing Ganga River Basin Management Plan (GRBMP). The overall Frame Work for documentation of GRBMP and Indexing of Reports is presented on the inside cover page.

There are two aspects to the development of GRBMP. Dedicated people spent hours discussing concerns, issues and potential solutions to problems. This dedication leads to the preparation of reports that hope to articulate the outcome of the dialog in a way that is useful. Many people contributed to the preparation of this report directly or indirectly. This report is therefore truly a collective effort that reflects the cooperation of many, particularly those who are members of the IIT Team. Lists of persons who have contributed directly and those who have taken lead in preparing this report is given on the reverse side.

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1. Introduction

This report presents the trends in urbanization and industrialization in the Lower Ganga River basin and analyzes their implications for the GRBMP, as most of the cities, towns and industrial units in the basin are located at the bank of Ganga, its offshoot canals and its tributaries. These urban centers and industrial units not only draw water from rivers for their various needs but also release untreated sewage and industrial effluents into them, adversely affecting both quantity as well as quality of water in the rivers. It may be further pointed out that even sewage from cities and wastewater discharges from industrial units which are located far away from the river bank also directly or indirectly go to the river through drainage system and heavily pollute it. The accelerated pace of growth of urbanization and industrialization, especially during the last two decades of economic reforms in India, has put enormous pressure on the carrying capacity of the river system.

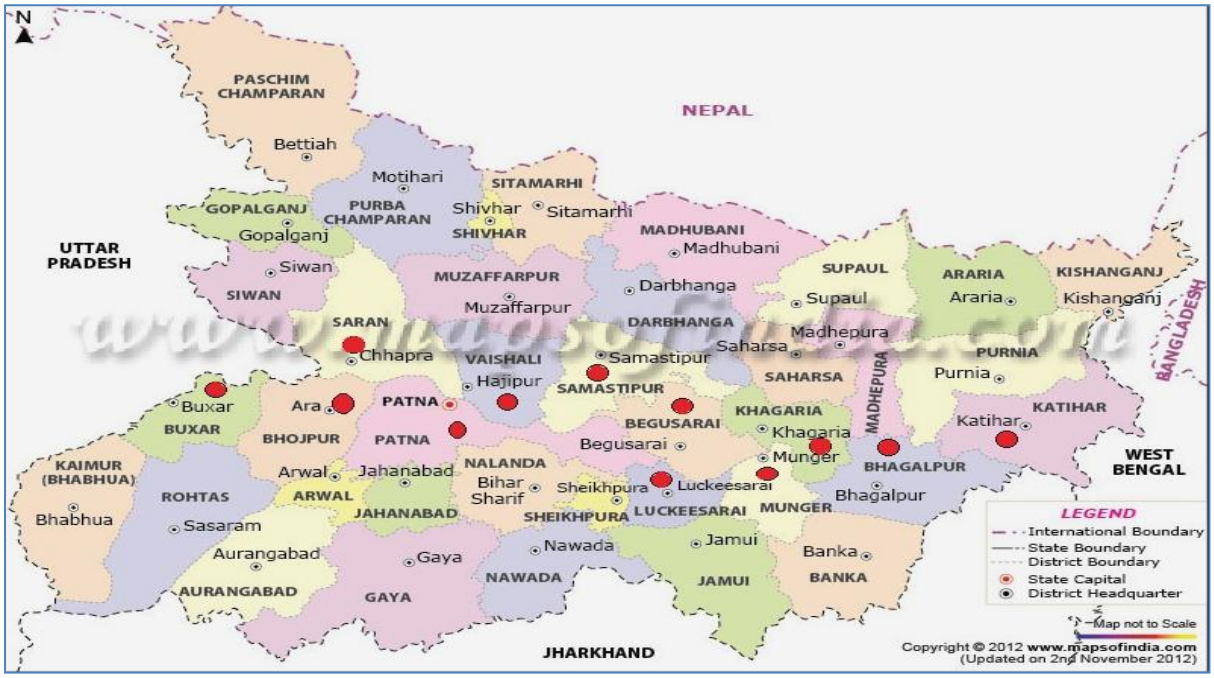
Since, urbanization, industrialization and the water pollution are inter-related issues; they are required to be addressed in an integrated manner. There are several anthropogenic and socio-economic factors associated with rapid and at times unregulated urbanization and industrialization that affect the quantity and quality of water resources. For example, growth and composition of GDP, household consumption expenditure, pattern of industrialization, production and consumption practices, occupational structure, rural-urban migration, and other socioeconomic-demographic outcomes are some of the important indicators of water demand as well as its degradation. Therefore, in order to prepare a holistic plan for the management of the Gang River Basin (GRBMP), this report investigates the trends and pattern of urbanization and industrialization along with the associated factors and their impacts. For the study purpose, the entire GRB is divided into three stretches, namely Upper Ganga Basin (Uttarakhand), Middle Ganga Basin (Uttar Pradesh) and Lower Ganga Basin (Bihar and West Bengal). This report exclusively focuses on Bihar.

2. Methodology

This report is based on secondary data drawn from various published sources, which include, among others, Census of India, NSSO reports, Bihar Statistical handbook, Economic survey of Bihar and Annual Survey of Industries (ASI). For some indicators of urbanization and industrialization data from Department of the Economics and Statistics, Ministry of Statistics and Programme Implementation (MOSPI) have been taken.

Analysis of data is done at three levels— state, district and region (bank and non-bank region). The report accounts for all the 38 districts of Bihar. In order to make the analysis more cogent, districts have been further divided into two categories viz., bank districts and non-bank districts. 12 districts are included in bank districts which are on the bank of river Ganga and the rest of the 26 districts which are far from river Ganga are categorized as non-bank districts. The map below shows all the bank and non-bank districts of Bihar.

Figure 1: Districts of Bihar



Source: Developed from the map available at www.mapsofindia.com

3. A Brief Profile of the Lower Ganga Basin (Bihar)

The state of Bihar is located in the fertile Gangetic Plains. It is the ninth largest state of India in terms of area and the second largest in terms of population. It is bounded by Nepal in the north, Orissa in the south, West Bengal in the east and Uttar Pradesh in the west. Bihar lies mid-way between the humid West Bengal in the east and the sub humid Uttar Pradesh in the west. The Bihar plain is divided into two unequal halves by the river Ganga which flows through the middle from west to east. The total area covered by the state of Bihar is 93,596 sq. km. The state is located between 21°-58'-10" N ~ 27°-31'-15" N latitude and between 82°-19'-50" E ~ 88°-17'-40" E longitude.

Bihar is mainly a vast stretch of very fertile flat land. It has several rivers namely Ganga, Son, Bagmati, Kosi, Budhi Gandak, and Falgu – many of which originating in the Himalays in Nepal. Central parts of Bihar have some small hills, for example the Rajgir hills. The Himalayan Mountains are to the north of Bihar, in Nepal and Chota Nagpur plateau lies towards the south.

4. Urbanization: Growth and Dimension

4.1 Urbanization in Bihar

Urbanization and urban population growth are pointers towards the change in the occupational pattern of the community, from agriculture and allied livelihoods to industrial and other non-agriculture occupations. However, it is easy to state at the outset that the state of Bihar is predominantly characterized by agriculture based economy and least level of urbanization in the country.

Table 1: Level of Urbanization in Bihar and India for the year 2001 and 2011 (in %)

Year	2001	2011
India	27.81	31.16
Bihar	10.46	11.84

Source: Census of India 2011, Government of India

Bihar is predominantly a rural state with almost 90% of its people residing in rural areas. As per 2011 population census, in terms of urbanization while Tamil Nadu ranks highest with 48.45% residing in urban areas, Bihar at 11.84% stands way below the national average of 31%. As urbanization has become a proxy indicator of economic development, it is also evident that Bihar lies far behind in terms of overall development. Nonetheless, during the first decade of the 21st century urbanization in the state has increased marginally from 10.47% in 2001 to 11.84% in 2011 indicating renewed impetus on economic growth.

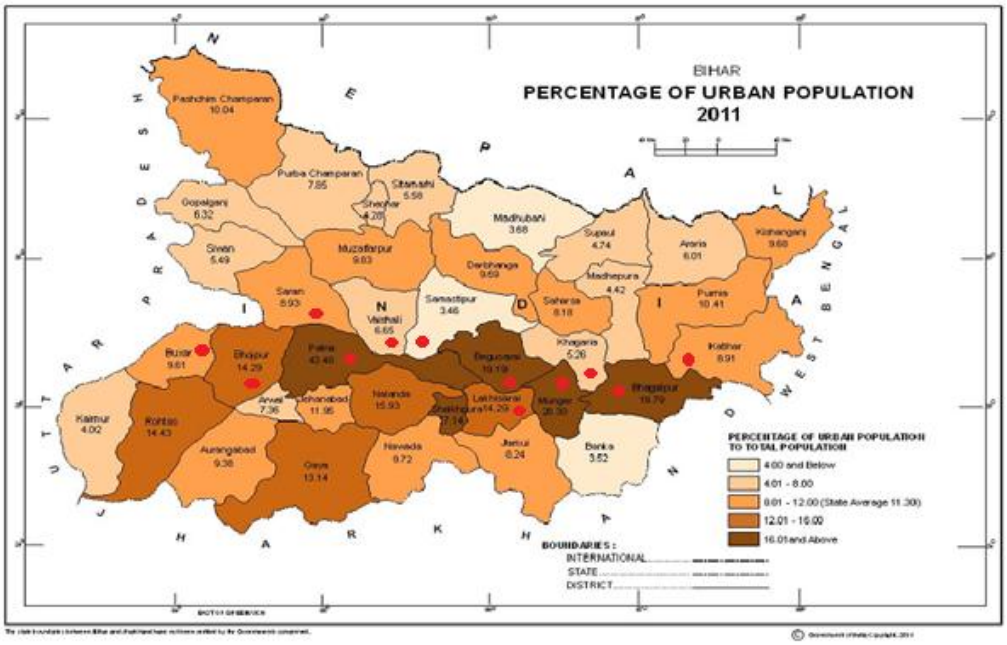
Level of urban population across all the districts of Bihar as per Census 2011 is presented in Figure 2 below. As per this the districts can be classified under 5 categories:

- There are 4 districts with urbanization below 4%. Only one out of the four viz., Samastipur (3.46%) is situated near Ganga River.
- In 11 districts urbanization is between 4 to 8.%. Similarly, despite being close to River Ganga, the two districts in this category, viz., Khagaria (5.26%) and Vaishali (6.65%) are characterized by rather low level of urbanisation.
- There are 13 districts which have slightly higher level of urbanization – close to the state average in the range of 8 to 12% . Among these, only 3 districts viz., Buxar, Saran, Katihar are located near River Ganga and the rest are located away.
- The next category corresponds to 12-16% urbanization and comprises only 5 districts, out of which only Bhojpur (14.29%) is situated near River Ganga while the rest are located away from the main stream.
- In the remaining 5 districts urbanization is recorded to be over 16%. In this category, 4 of the 5 districts are situated near River Ganga and only one district is located away.

Evidently Patna - the state capital, which also happens to be on the bank of River Ganga represents the highest urbanized district with 43.48% while Samastipur at 3.46% is having lowest level of urbanization. District-wise urbanisation data and classification in bank and non bank districts is presented in Annex/Table A1.

It is noted that only in the highest category (> 16%) most number of districts are found to be located close to the river while in the lower categories there is no such distinct pattern or correlation. It is also noted that only 4 of the 12 bank districts have comparatively higher urbanisation while the rest are around or way below the state average. Thus the hypotheses that proximity to the river is the key factor for economic growth does not seem to emerge clearly in this case. Not questioning the universality of this premise, it indicates significant cumulative investment deficit towards development works across the state in general and industrialisation in particular.

Figure 2: District-wise percentage of Urban Population of Bihar (2011)



Source: Census of India, 2011, Government of India

4.2 Trends and Pace of Urbanization in Bihar

The trend of urbanization in terms of 'statutory' and 'census' towns in Bihar and India over the last decade is presented in Table 2 and depicted in Figure 3. While a 'statutory town' is one which has a notified municipal body, on the other hand a 'census town' is one which has acquired urban characteristics (population > 5000; over 75% of which is involved in non-agriculture occupations; and population density of 400 per sq.km.) but as yet has not been designated as an urban area by the state government and therefore does not have a notified municipal body. It is interesting to note that Bihar has recorded a phenomenal increase of 1100% in the number of so called 'census towns' while the overall number of

towns has grown by only 53% (and number of statutory towns increased by 11%). On the national level the corresponding values are 186% and 96% (and 6%) respectively. This indicates that on one hand a fair degree of urbanization is taking place in the smaller or marginal areas of the state and on the other hand there is a major lack of recognition on the part of the state government.

Table 2: Trends of Urbanization in Bihar and India

Census Year	Bihar			India		
	Total Towns	Statutory Towns	Census Towns	Total Towns	Statutory Towns	Census Towns
2001	130	125	5	4041	3799	1362
2011	199	139	60	7935	4041	3894
Increase	53%	11%	1100%	96%	6%	186%

Source: Census of India 2011, Government of India

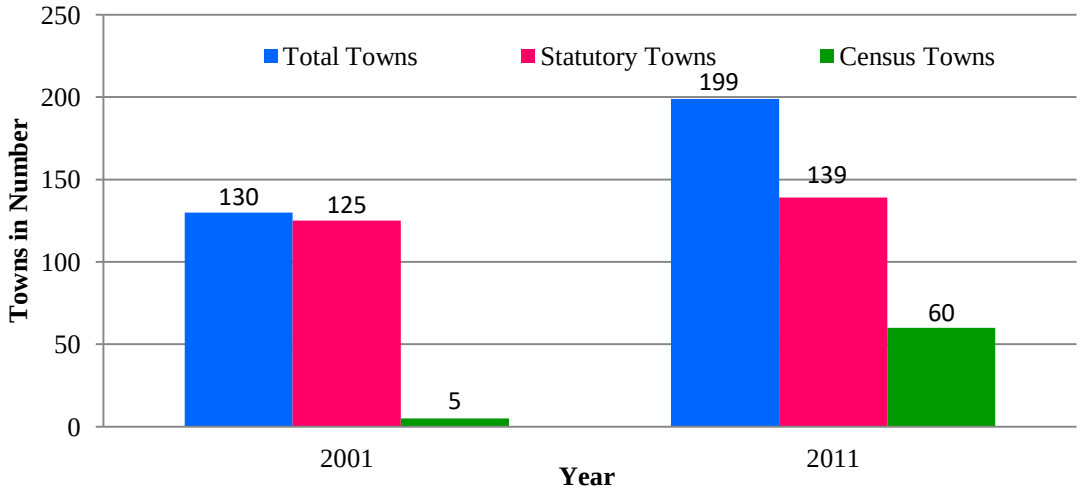


Figure 3: Trends of Urbanization in Bihar for 2001 and 2011

Evidently this trend of rapidly transforming villages into towns without the concurrent recognition and availability of corresponding institutions represents a huge challenge towards provision of urban infrastructure and services. The institutional, infrastructure and services deficit results in poor urban environment, poor quality of life and consequently higher pressure of pollution on, among others, the receiving water bodies in general and River Ganga in particular.

As shown in Table 3 over the last decade from 2001 to 2011 urban population of Bihar has increased by 35% and the number of urban agglomerations has increased from 9 to 12. In a way this appears to be a positive indication for the overall growth of the state as the state recorded GDP growth rate of 18% during 2006-07 and a stunning 11.03% over a 5 year period from 2004 to 2009, making it the second fastest growing state in the country. However, historically the state economy has performed poorly and as a result it came to be

recognized with the lowest GDP per capita and which explains the generally low level of urbanisation across the state as compared to other parts of the country[1]. It is also noted that the overall decadal growth rates for Bihar as well as India have shown declining trends.

Table 3: Urban Population and the Number of Urban Agglomeration (UAs) in Bihar

	Bihar		India	
Year	**2001**	**2011**	**2001**	**2011**
Urban Population (in lakh)	86.79	117.29	2860	3770
Overall decadal growth rate (in %)	28.6	25.1	21.5	17.6
Number of UA	9	12	384	475

Source: Census of India 2001, 2011, Government of India

4.3 Pattern of Urbanization in Bank and Non-bank districts

The pattern of urbanization in the state can be best understood in relation to the proximity of a district to River Ganga (i.e, 'bank' and 'non-bank' districts). Accordingly Figure 4 presents a comparison of the proportion of urban population in the 'bank' and 'non-bank' districts alongside that of the entire state (refer Annex/Table A1 attached to this report for district wise pattern). It is noted that the average percentage of urban population in 'bank' districts is almost double of that in the 'non-bank' districts and it is also consistently higher compared to the state average. From this it appears that proximity to River Ganga is a driver towards growth of the local economy of a district. However, as shown in an earlier section, due to cumulative investment deficit over last several decades, this does not emerge as a strong hypothesis. In this respect it also needs to be recognised that Bihar has been characterised by agrarian economy[2], and therefore it was never primed for urbanization as an harbinger or indicator of growth of its economy.

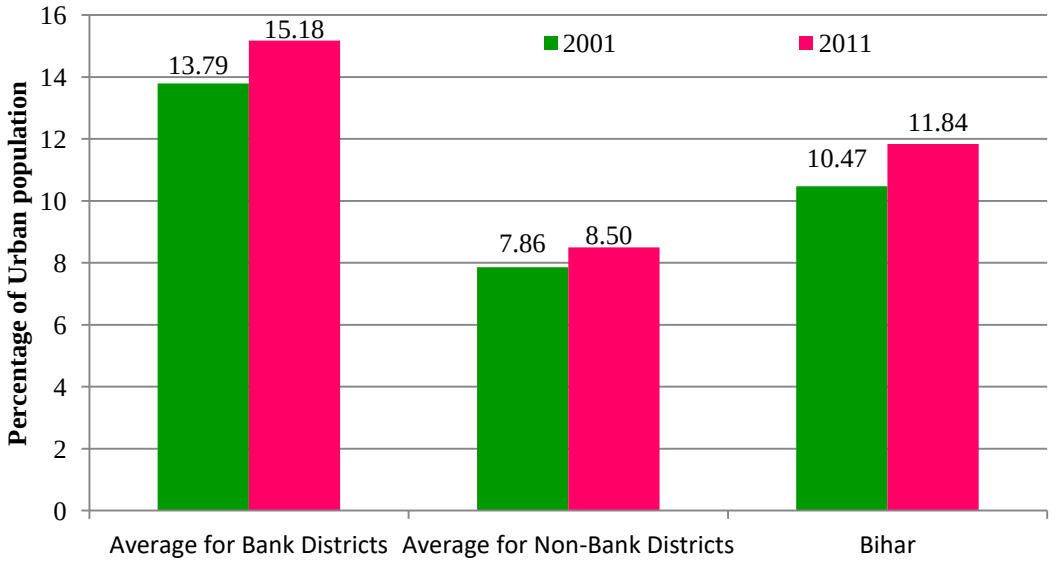


Figure 4: Percentage of Urban Population in Bank and Non-bank districts of Bihar

[1] For instance during 2002-2006 manufacturing sector recorded a growth of only 0.38% and during 1999 to 2008 the state GDP growth was 5.1% as compared to the national average of 7.3%.

[2] As per 2008 data, the economy of the state is characterized by dominance of services sector at 55%, followed by agriculture at 35% while the industrial sector accounts for only 10%.

4.4 Growth Trend in Urban Agglomerations (UAs)

In Census 2001 one of the criteria for UA was minimum population of 20,000; however in Census 2011 this was increased to 100,000. Accordingly as shown in Table 4 and Figure 5, as per Census 2001 there were only 9 UAs in Bihar and the number increased to 12 by 2011. However it is noteworthy that while 6 additional UAs were recognised, the 3 existing UAs of Begusarai, Samastipur and Motihari despite having comparatively fairly large population were derecognised, . Interestingly, it is noted that as per the Census 2011 the number of UAs in the 'non-bank' has gone up from 4 to 7 while it remained unchanged in 'bank' districts which indicates somewhat renewed growth impetus in the case of the former.

Table 4: Urban Agglomerations in Bihar for 2001 and 2011

Sr. No.	Name of the UA	Population (in Number)		Remarks
		2001	**2011**	
A.	**Bank Districts**			
1	Patna	16,97,976	20,46,652	
2	Katihar	1,90,873	2,40,565	
3	Begusarai	1,07,623	2,954,367	Derecognised in 2011
4	Samastipur	61,998	4,254,782	Derecognised in 2011
5	Buxar	83,168	1,10,608	Recognised in 2011
6	Bhagalpur	3,50,133	4,10,210	
7	Saran (Chapra)	179,190	2,12,955	Recognised in 2011
B.	**Non Bank Districts**			
1	Gaya	3,94,945	4,70,839	
2	Purnia	1,97,211	3,10,817	
3	Motihari (East Champaran)	1,08,428	6,43,851	Derecognised in 2011
4	Sitamarhi	87,279	1,05,924	
5	Muzarffarpur	3,05,525	3,93,724	Recognised in 2011
6	Darbhanga	2,67,348	3,06,089	Recognised in 2011
7	Bettiah (West Champaran)	1,16,670	1,56,200	Recognised in 2011
8	Nawada	81,891	1,18,820	Recognised in 2011

Notes:

1. Source: Report on Final Population of Urban Agglomerations and Towns – 2001, Ministry of Urban Development; Census of India 2011, Government of India.

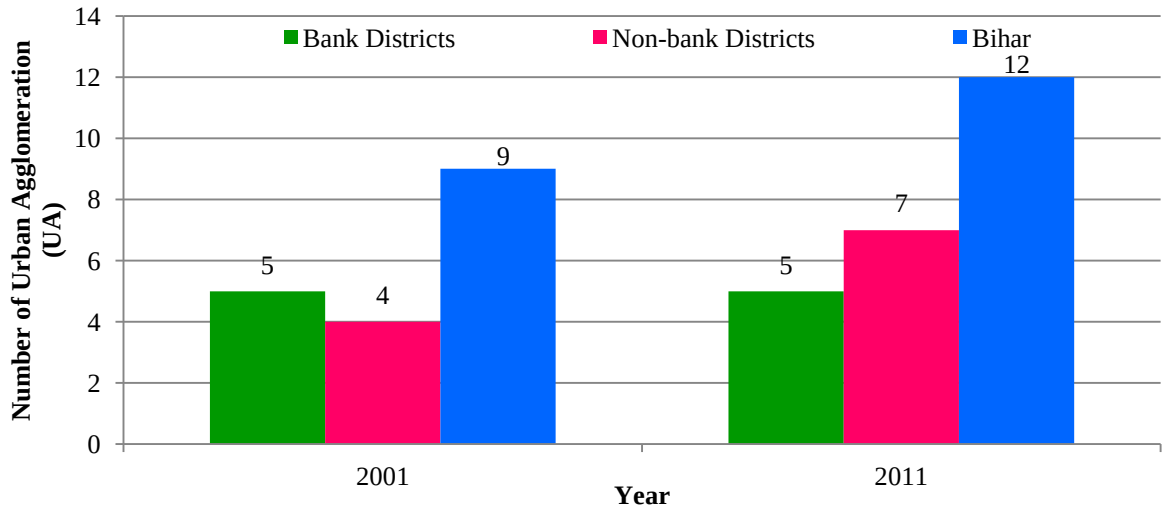


Figure 5: Number of Urban Agglomerations in Bank and Non-bank districts of Bihar for2001 and 2011

4.5 Category-wise Growth of Cities and Towns

The distribution of the number of towns of the state in different population categories is presented in Table 5. As per this, in 2001 almost 85% of the towns were with population below one lakh and slightly over 50% were in the 20-50,000 category. Patna was the only city with a population in excess of 1 million (~ 1.4 million) while the second highest was way below under half million. Census 2011 has identified around 60 hitherto villages which have acquired urban characteristics and where the population is more than 5000.

Table 5: Number of Towns under Population Categories

Category	Population Range	Number of towns (Census 2001)	Number of towns (Census 2001)
I	> 1 Lakh	20	27
II	50,000-100,000	17	NA
III	20,000-50,000	68	NA
IV	10,000-20,000	19	NA
V	5,000-10,000	6	69
VI	< 5,000	None	NA
	Total	130	199

Source: Census of India 2001 and 2011, Government of India

The districts having class I cities are Patna, Vaishali, Saran, Munger, Katihar, Bhagalpur, Bhojpur, West Champaran, East Champaran, Sitamarhi, Purnia, Saharsha, Darbhanga, Muzaffarpur, Siwan, Nalanda, Rohtas and Gaya. The district wise number of towns under different population categories for the year 2001 is given in Annex/Table A2.

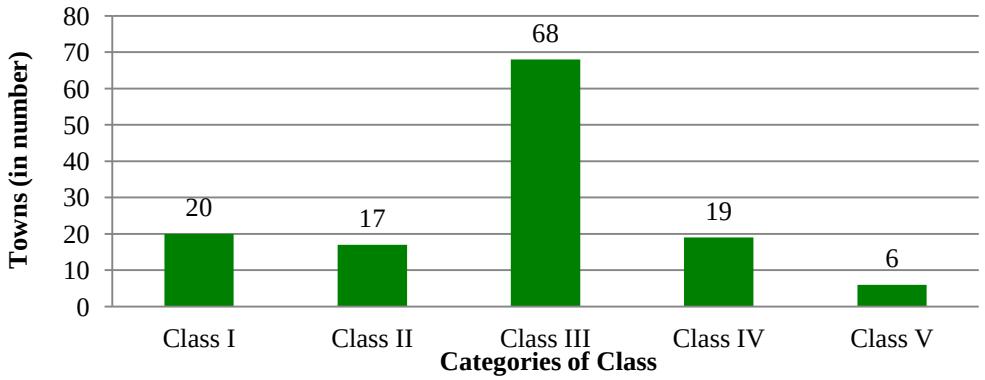


Figure 6: Number of Towns in different Classes of Bihar (2001)

From Figure 7 it is noted that as per Census 2001 there are more numbers of towns in non-bank districts (80) as compared to bank districts (50) and among all population categories the former scored consistently higher. From this it is rather evident that proximity to the River Ganga has not necessarily contributed in inducing urbanisation in the state.

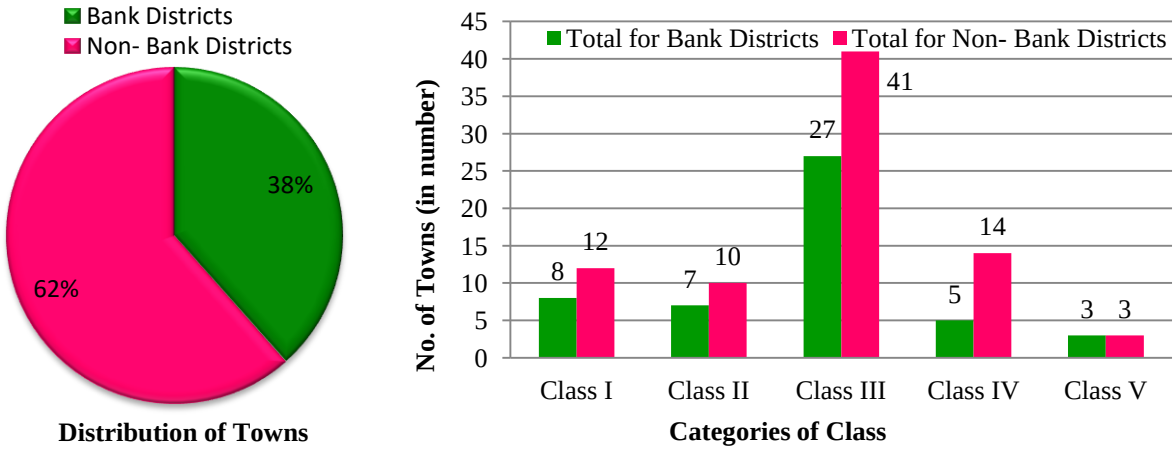


Figure 7: Number of Towns under different Classes for Bank and Non-Bank Districts (2001)

7.0 Urban Occupational Structure

Household occupational patterns for the years 2004-05 and 2009-10 based on the 61st and 66th round of NSSO are presented in Figure 8. It is noted that while there is not much change in the wage/ salary earners and casual labours, the 'self employed' category has registered a significant increase from 47% to 61.4%. This rise in 'self-employed' could be attributed to, among others, creation of livelihood opportunities in the informal or unorganised sector as a result of the state GDP recording a stunning growth of 11% during 2004-09 period as mentioned earlier. However, this could also be interpreted as job losses in the organised sector on account of other factors.

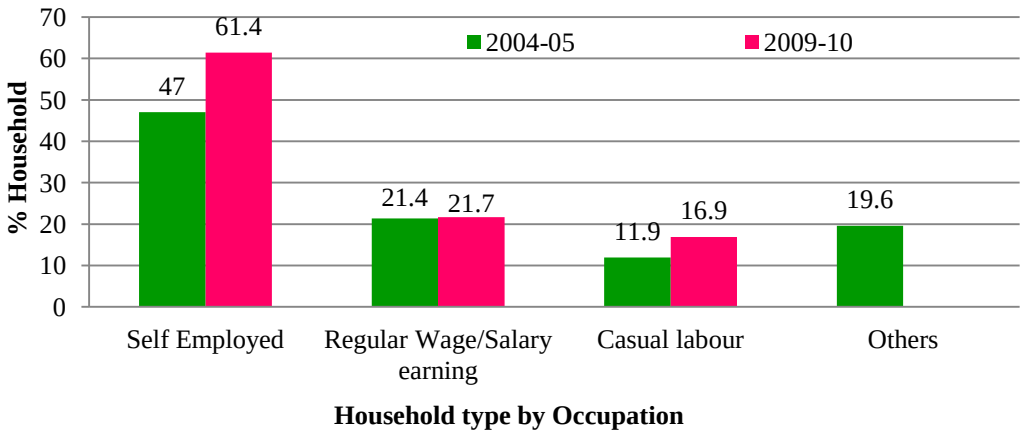


Figure 8: Percentage Distribution of Household by Type of Occupation in Bihar

8.0 Trends in Migration

As a consequence of changes in the state economy, overtime the nature and pattern of migration has also been changing. Migration may involve either daily commuting from nearby places or permanent shift of residence. Besides this, since the rural migrants are not a homogenous group, the nature and pattern of migration also varies from one social group to another. Among the latter there can be four different streams, viz., rural to rural, rural to urban, urban to urban and urban to rural. In the context of this report, two streams, viz., 'rural to urban' and 'urban to urban' are important which contribute towards urbanisation.

As per the 64th round of NSS Bihar has reported one of the highest rates of out-migration to other states which is 4.4% of urban male and 9.2% of rural male. As shown in Figure 9, in 2001 more than 28 lakh persons migrated out of Bihar to other places whereas about 10 lakh persons came into the state. Large out migration can be attributed to very high level of poverty (urban poverty ratio 43.7%), lack of employment opportunities in the services sector, lack of investment in industrial and infrastructure sectors and the fact that labour from the state has been in demand in distant centres of economic growth e.g., Delhi, Mumbai, Punjab, and Kolkata, etc. In recent decades Bihar labour has also been found to be in demand even in South India as far as Tamilnadu and Kerala.

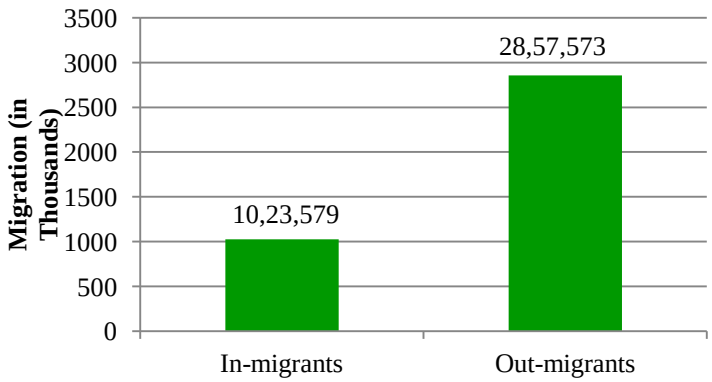


Figure 9: Migration Profile of Bihar for the year 2001

Figure 10 presents percentage share of different migration streams in total rural migration for the year 2001. In the case of male migrants, male migration from rural to urban areas out of total rural migration was 42.64%. In contrast, female rural to urban migration from total rural migration was very low (6.11%). In general while the male migration is attributed to livelihood/ employment opportunities, exclusive female migration is mainly related to marriage.

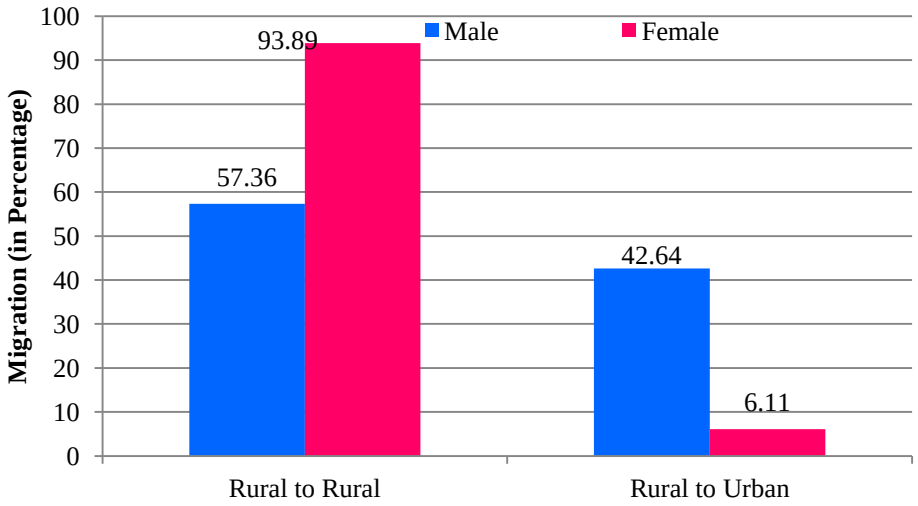


Figure 10: Percentage Share of different Migration Streams in Total Rural Migration for the year 2001

The total urban migration in terms of urban to urban areas was higher than urban to rural areas. Likewise male migration from urban to urban areas was higher than urban to rural areas. Similar pattern is observed in the case of female migration (Figure 11).

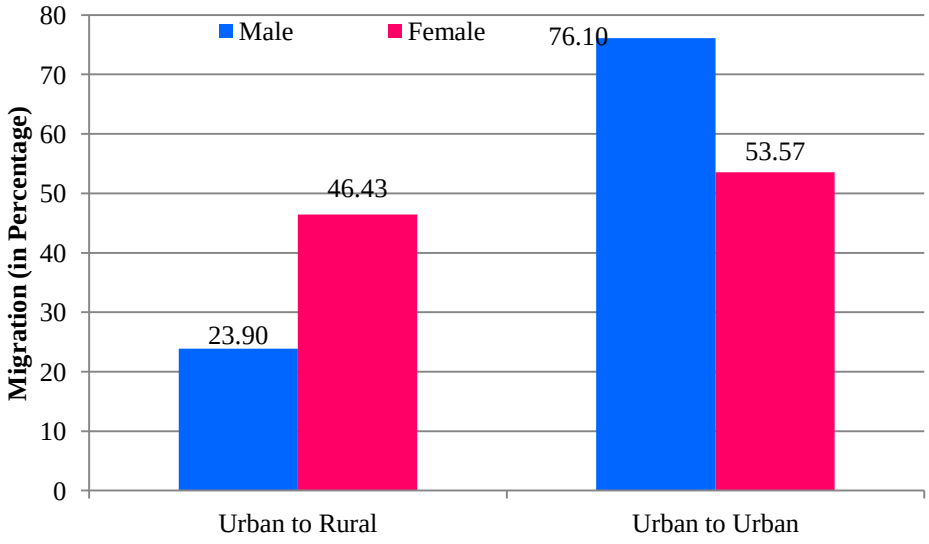


Figure 11: Percentage Share of different Migration Streams in Total Urban Migration for the year 2001

Details of total migrants in the state according to the migration stream is presented in Table 6. The total migration for Bihar in the year 2001 was 1,84,68,036 which is a very large number and represents a significant aspect as regards state demography, socio-economic profile and income.

Table 6: Migration pattern in Bihar for the Year 2001

Migration Stream	Total (In Number)
Total Migrants	1,84,68,036
Total Rural Migrants	1,63,83,192
Rural to Rural	1,59,72,631
Rural to Urban	4,10,561
Total Urban Migrants	20,84,844
Urban to Rural	14,71,701
Urban to Urban	6,13,143

Source: Adapted from Census of India 2001, Government of India

8.1 Regional pattern of Rural-Urban Migration in Bihar

8.1.1 Region-wise and Gender-wise Distribution of Rural and Urban Migration Rates

Rural and urban migration in case of male and female for both bank and non-bank districts are discussed here for the year 2001 (Figure 12). For bank districts, urban male migration (52.67%) was higher than rural male migration (41.82%) and also urban female migration (47.98%) was more than rural female migration (33.15%). On the whole urban migration was more than rural migration in bank districts. But a different trend is observed in the case of non-bank districts where rural male and female migration rates were higher than the corresponding urban rates.

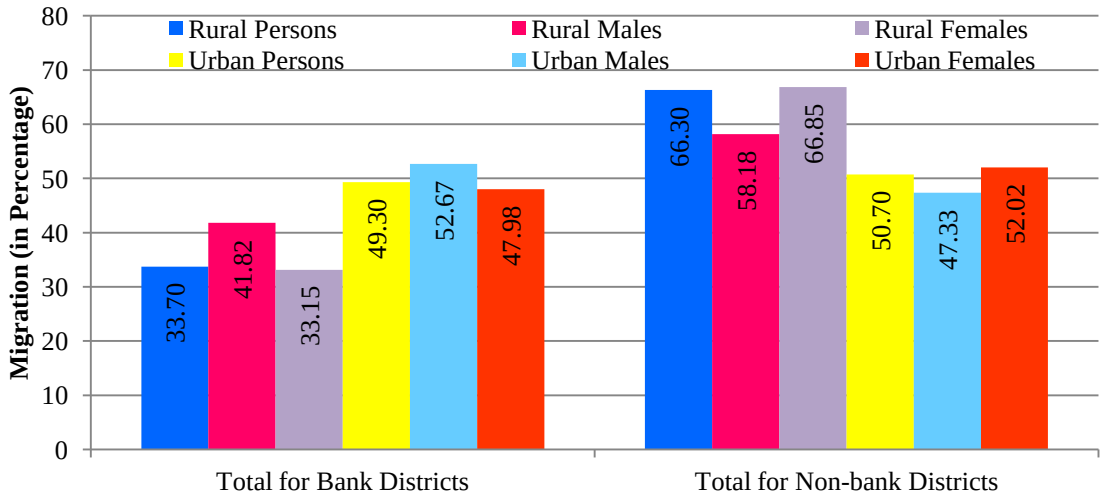


Figure 12: Rural and Urban Migration rates in Bihar for the year 2001 (Last Residence Elsewhere in India)

On the whole it is observed that rural migration was more than urban migration in non-bank districts of Bihar for the year 2001 (refer Annex/Table A8). Moreover, migration in non-bank districts is comparatively higher than that of bank districts of Bihar. Search of work opportunities is the main reason among male population. As Bihar is an agrarian economy, people from rural areas migrate in search of short-term labour work to bank districts.

8.1.2 Region-wise and Gender-wise Rural and Urban Migration rates of Workers

Rural and urban migration of both male and female workers for bank and non-bank districts of Bihar is shown in Figure 13. In bank districts, migration of workers in urban areas (45.21%) was more than that in rural areas (28.49%). Similar pattern is observed for male and female workers of rural and urban areas for bank districts.

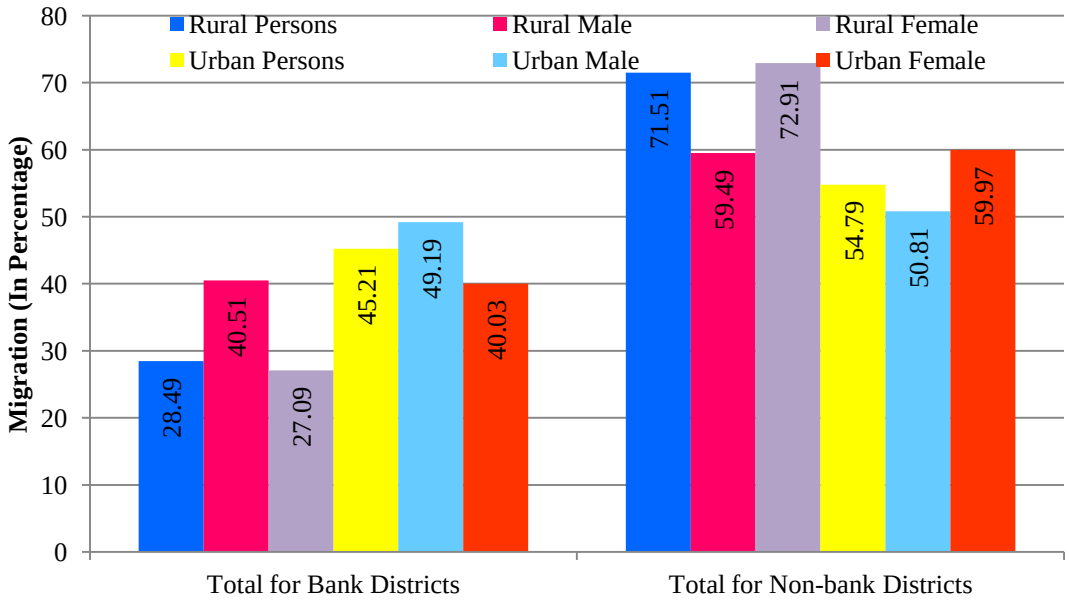


Figure 13: Region-wise Rural and Urban Migration rate of Workers in Bihar for the year 2001 (Last Residence Elsewhere in India)

For non-bank districts, the overall rural workers migration (71.51%) was much higher than the overall urban workers migration (54.79%). It is noticed that while in the case of bank districts rural male migrants are higher than rural female - which is normal; however in the case of non-bank districts a reverse trend is found and which is rather difficult to explain. (Annex/ Table A9). Nevertheless, it can be concluded that rural workers migrate more in non-bank districts in search of work related to primary sector, whereas urban workers migrate more in bank districts in search of work related to secondary and tertiary sector.

8.1.3: Occupational Distribution of Rural-Urban Migrant Workers

Based on the available data for the year 2001 as shown in Figure 14 in all 13 occupational categories have been identified. It is noticed that migration of workers engaged in 'other services' including public services comprises a major proportion at 29%. 'Agricultural

labourers' and 'wholesale and retail trade worker' each constitute about 15% of total migrant workers from rural to urban area.

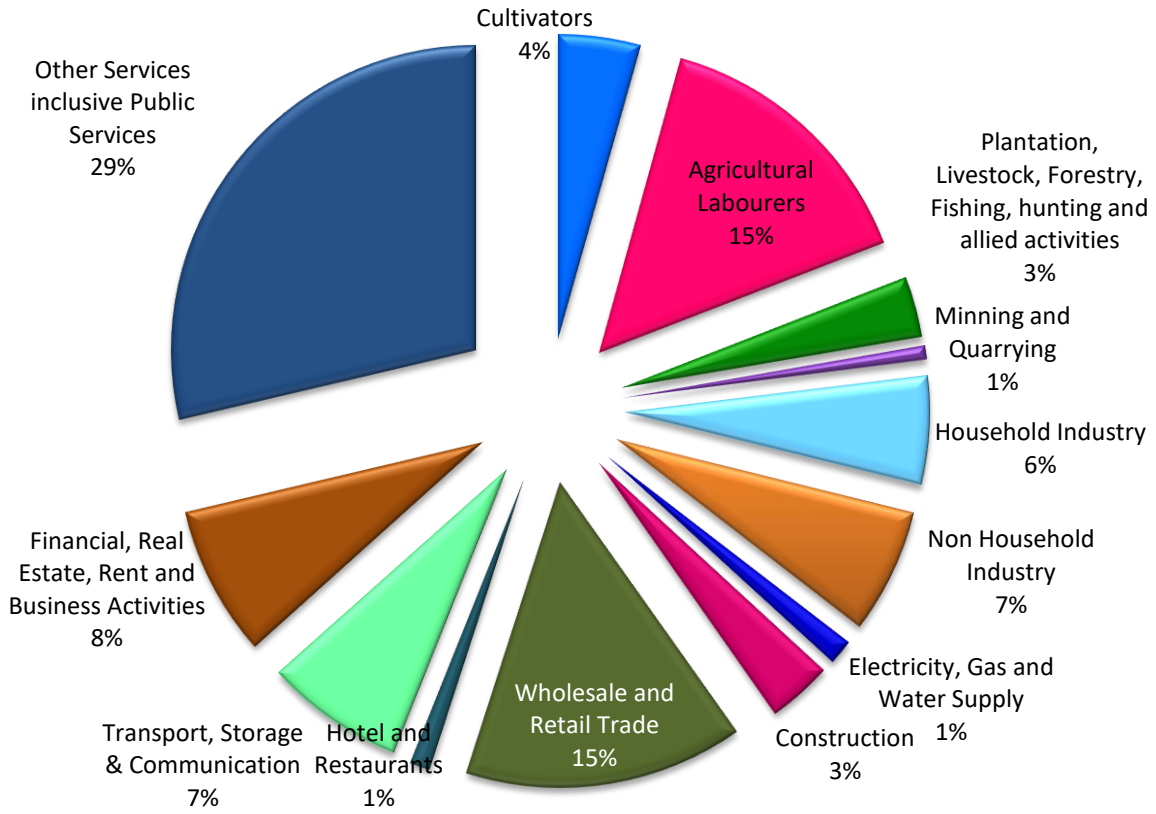


Figure 14: Occupational Classification of Rural to Urban Migrant Workers in Bihar for the year 2001

The percentage share of cultivators, agricultural labourers, mining & quarrying and the household industries workers has occupied one fourth of total migrant workers. 8% of the total migrant workers are engaged in financial, real estate, rent and business activities in Bihar. Very negligible portions (only 1%) of workers are engaged in hotel & restaurants and in electricity-gas and water supply related services (Annex/ Table A10).

9.0 Condition of Slums

A typical slum is a high density settlement with a collection of poorly built dwellings (with or without tenancy rights), mostly of temporary nature and crowded together. Slums are characterised by significant deficit in terms of infrastructure – especially for water, sanitation, roads, electricity, drainage, etc. Invariably slum population is characterised by low level of education and income and high unemployment; poor health conditions, poor nutrition, etc. As per 2001 census out of the total urban population of about 150 Lakh across the entire state of Bihar close to 25% is residing in slum or slum like settlements. Likewise for the 37 Class-I and Class-II cities in the state (20 and 17 respectively out of a total of 130 cities) where the combined urban population was estimated to be 105.6 lakh the slum population constitutes 25- 31%. Table 7 summarises the data for the state and the country

and Figure 15 presents a graphical comparison. It is noted that compared to the national pattern, proportion of slum population across Bihar is higher.

Table 7: Identified Slum Population (in Lakh) in Bihar during 2001

State	Urban Population	Identified Slum Population	Percentage of Slum Population
Bihar	149.556	35.444	23.7
India	2909.437	618.258	21.3
Class-I Towns and Cities			
State	Urban Population	Identified Slum Population	Percentage of Slum Population
Bihar	79.325	24.751	31.2
India	1900.547	424.498	22.3
Class-II Towns and Cities			
State	Urban Population	Identified Slum Population	Percentage of Slum Population
Bihar	26.264	6.566	25.0
India	316.286	63.922	20.2

Source: www.biharstat.com

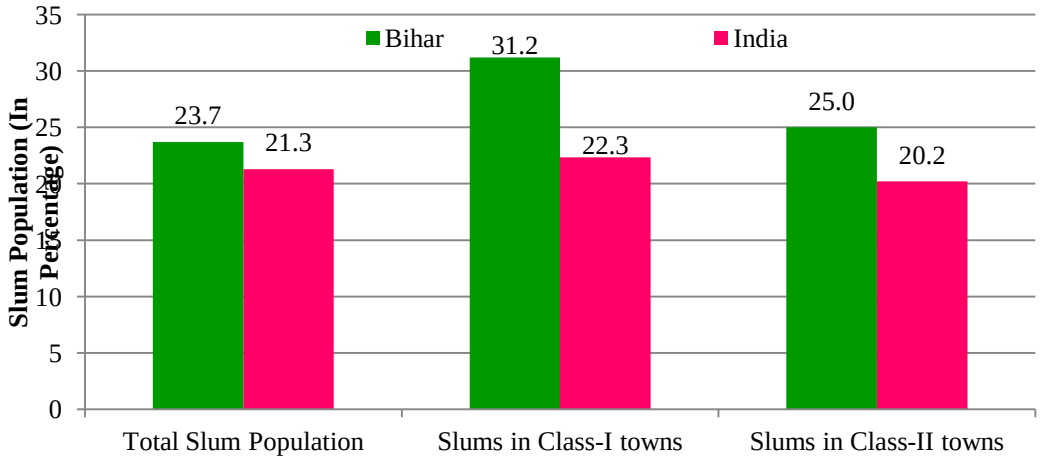


Figure 15: Percentage of Slum Population in Bihar and India for the year 2001

Areas notified as slums by the respective urban local bodies or development authorities are treated as 'notified slums' and the rest of the settlements having at least 20 household are considered as non-notified slums. From Figure 16 it is observed that in 2002 almost three quarters of the poor settlements were not notified as slums. This indicates that a large majority of poor settlements did not receive priority as regards addressing issues of infrastructure, services and livelihood, etc.

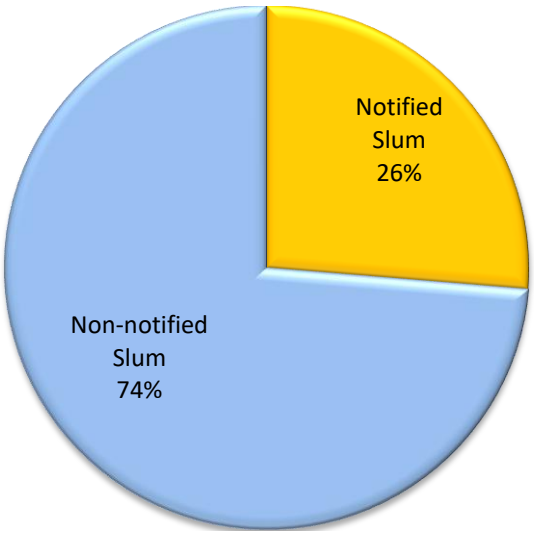


Figure 16: Percentage of Notified and Non-notified Slums in Bihar for the year 2002

Type of dwellings

House structures have been classified into three categories viz., pucca, semi-pucca and katcha houses. In notified slum areas about 66% houses are classified as semi-pucca. However in the case of non-notified slum areas semi-pucca dwellings constitute only 12% while the balance 88% comprise katcha houses (Figure 17 and Annex/Table A11).

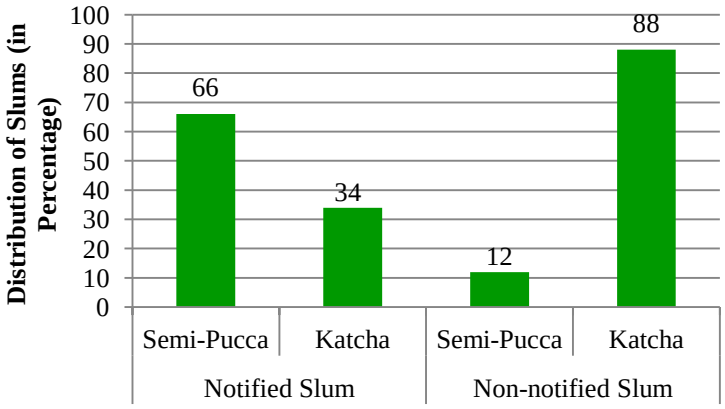


Figure 17: Percentage Distribution of Slums according to Structure of Majority of Houses in Bihar for the year 2002

Utilities and services

As per the information provided in Annex/Table A12 attached to this report, it is noted that entire population of all communities of notified and non-notified slum areas across the state does not have piped water supply and instead depends on tube wells (mostly shallow and unprotected tube wells) for drinking water supply. This puts all the communities to the risk of water borne diseases and consequent socio-economic impacts.

As regards availability of electricity in notified slum areas it is found that almost 66% of households have individual connections whereas in the case of non-notified slum areas this drops down to 37% (Figure 18 and Annex/ Table A12).

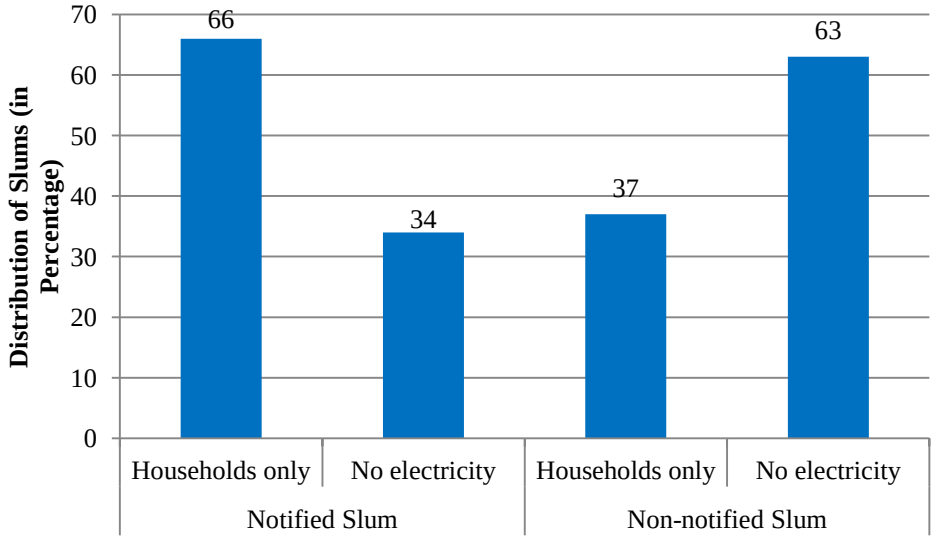


Figure 18: Percentage Distribution of Slums according to Availability of Electricity connections in Bihar for the year 2002

10.0 Level of industrialisation in Bihar

Bihar has a very small industrial base compared to the other Indian states of the country. Besides cumulative deficit in investments, this is also attributed to bifurcation of the state in year 2000 when industrialized belt has gone to the state of Jharkhand. While the state accounts for about 3% of the total land mass and 8.5% of the total population of the country, low level of industrialization is evident by presence of only 1% of the total factories and contribution of less than 1% towards the national industrial output. While on the national level contribution of the industrial sector is about 20%, in the case of Bihar it is as low as 5%. State industrial sector is dominated by small household and cottage industries. With over 80% of the state population employed or engaged in agriculture or related activities agro-based small and medium scale industries occupy a prominent place in the industrial landscape of present Bihar as they account for nearly half of the net value added (Report on "Road map for Rural Industrialization in Bihar", Govt. of India, 2008).

While Bihar is a major producer of several types of fruits and vegetables, it is characterized by almost complete lack of processing industries. The state also does not have commensurate infrastructure for irrigation, storage, transport of its produce, etc. Historically, sugar and vegetable oil extraction industries were flourishing sectors and until the mid-1950s, the state used of account for almost 25% of total sugar output in the country. Given this scenario Dalmianagar was recognized as a large agro-industrial town in the industrial landscape of the state. In the subsequent period between 1950 and 1980 there were attempts to industrialise the state (e.g., oil refinery in Barauni, a motor scooter plant at Fatuha, a power plant at Muzaffarpur, etc.) however, for a variety of local

and external factors they did not bear fruit. Nevertheless, Barauni is still one of the few old industrialised towns in the state.

Overall low level of industrialization and investment deficit is reflected in high debt of the state which was estimated at 77% of GDP by 2007. In recent years high priority has been accorded to industrialization by inviting investments from large industrial houses. A set of breweries are also proposed to be set up in the near future and further developments have taken place in the growth of small industries.

10.1:Growth trends in NSDP from Manufacturing and Tertiary Sector

The annual growth trends in NSDP from manufacturing and tertiary sector and the state income (GSDP) from 2005-06 to 2008-09 is discussed here. From the Figure 19 it is noted that in 2005-06 the growth rate in state's manufacturing sector was negative at (-)10.9%, however subsequently in 2007-08 it increased significantly to 31.7%, but again it has declined to 20.7% in 2008-09. Even tertiary sector has exhibited a fluctuating trend over the years and was recorded to be 15.8% in 2008-09.

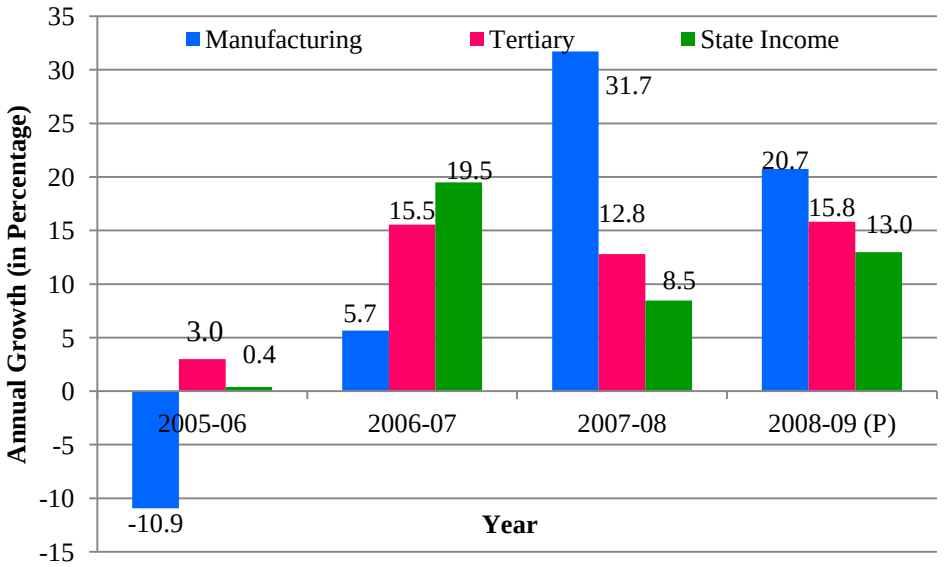


Figure 19: Annual Growth rate (NSDP) and State Income of Bihar

In 2005-06 the growth rate of Gross State Domestic Product (GSDP) (or State Income) was recorded as low as 0.4%, however subsequently in 2008-09 this has increased to an impressive 13.0%. It is a noteworthy that over the years contribution towards the annual growth rate of GSDP was more from the tertiary sector rather than the manufacturing sector.

10.2: Trends in Number of Industries, Fixed Capital (FC), Employment, Output and NVA of Bihar

Table 8 summarises data for the state and the country on number of industries/ factories, fixed capital, number of workers, etc. and related ratios for the years 2001-02 and 2010-11. The last column in the table presents growth in Bihar over the 10 year period.

As stated earlier Bihar accounts for around 1% of the total factories in the country which is way too low in relation to its population base. Fixed capital, gross output and 'net value added' are found to be 0.4%, 0.8% and 0.4% respectively which are significantly low. Further, in relation to the population fraction of 8% the number of workers and number of employees between 0.8-0.9% also indicate significantly low investments and low opportunities for employment. However as seen in the last column, in relation to the decadal population growth of 25% there has been a reasonably good growth on parameters.

Table 8: Trends in Capital, Employment, Output and NVA in Industries (Factory Sector) in Bihar and India

Year	2001-02			2010-11			Decennial growth, %
	Bihar	India	%	Bihar	India	%	
Population (Crore)	8.30	102.8	8.1	10.41	1210	8.6	25
No. of factories	1,478	128,549	1.1	2,805	211,660	1.3	90
Fixed Capital (FC) (in Rs. Crore)	188,919	43,196,013	0.4	526,212	160,700,652	0.3	179
No. of workers	51,375	5,957,848	0.9	90,985	9,901,970	0.9	77
No. of employees	62,618	7,750,366	0.8	106,213	12,694,853	0.8	70
Gross output (Rs. Crore)	671,339	96,245,663	0.7	3,605,131	467,621,696	0.8	437
Net Value Added (NVA) (Rs. Crore)	62,994	14,430,212	0.4	441,499	70,457,581	0.6	601
No. of workers/ factory	34.76	46.35		32.44	46.78		-7
FC/Workers (Rs. Lakh)	3.68	7.25		5.78	16.23		57
NVA/FC	0.33	0.33		0.84	0.44		155
NVA/Worker (Rs. Lakh)	1.23	2.42		4.85	7.12		294

Source: Compiled from Annual Survey of Industries 2001-02 and 2010-11, Govt. of India

It is also noted that while the ratios of 'fixed capital to number of workers', 'NVA to fixed capital' and 'NVA per worker' have recorded decennial growth varying from 57% to around 300%, there has been a decline in the ratio of 'no. of worker per factory', the latter indicating creation of less number of jobs.

11.0 Sources of Pollution in the River Ganga

Although Bihar has witnessed significantly lower levels of urbanisation and industrialisation, there are issues related to weak municipal infrastructure and services as well as inadequate implementation of regulatory measures and monitoring which contribute towards aggregation of pollution of the river system. With increasing urban population and urban centres, in general discharge of sewage from a large number of small, medium and large size urban centres across the state represents one of the major sources of water pollution. Other sources comprise discharge of trade/ industrial waste waters, leachates from open dump sites of municipal and industrial solid wastes, runoff from agriculture fields laden with pesticides and fertilizers, poorer drainage system, etc. Broadly these sources can be classified as point and non-point sources. Point sources include discharge of domestic sewage and industrial effluent; while non-point sources comprise runoff from agricultural fields, storm water drainage, etc. This section primarily deals with point sources of pollution.

11.1 Urban Sewage

In Bihar, only 12 districts are coming near River Ganga, but most of the non-bank districts are situated near the tributaries of Ganga River. Among these districts there are 199 towns and cities out of which there are 27 relatively larger towns and cities which have population in excess of 1 lakh. Among these 27 cities, one city i.e., Patana has population in excess of 20 lakh while all others fall below 5 lakh. Among the latter group, 5 cities are in the range of 3-5 lakh, 6 are in the range of 1-2 lakh and around 15 are in the range of 1-2 lakh. Rest of the 172 towns have population in the range of 5000 to 1 lakh. Total sewage generation from all the 199 towns and cities is estimated to be of the order of 1320 million litres per day (mld). (In a majority of the towns generation is estimated to be in the range of 0.5 to 10 mld while for the 27 leading towns and cities it is estimated to be from 12-64 mld and for Patna 265 mld). Evidently all of these small and large urban centres alike are generating significant quantities of sewage which is discharged into.

However as shown in Table 9 below, out of the 27 ‘one lakh plus’ cities only 5 have some form of system in place for sewage treatment while the rest of the towns and cities are discharging untreated sewage into the river system of Ganga either directly or through one of its tributaries. It is also noted that even in these cities the aggregate installed treatment capacity is way below the current requirements, let alone the projected loads 5 or 10 years down the line. Besides the aggregate installed capacity of 167 mld it is understood that for the 4 towns/cities of Patna, Chapra, Munger and Bhagalpur 7 STPs were sanctioned with a total capacity of 87.5 mld (MLD) by the Ganga Project Directorate. However it is evident that in relation to the total estimated sewage volume of around 1320 mld, this is miniscule or almost insignificant. Figure 20, 21 and 22 bring out the current scenario across the state as regards the mode of disposal and level of treatment, etc. while further details are presented in Appendix/Table A13.

Table 9: Waste Water Generation and Treatment in Bihar (Disposal in Ganga River)

City/Town	Population	Total Sewage (in MLD)	Treatment Capacity (in MLD)	Percentage Covered
Class-I				
Bhagalpur	3,81,190	61.6	11	17.9
Patna	15,42,184	249.2	109	45.0
Munger	2,09,790	34	13.5	39.7
Katihar	1,96,190	31.7	31.7	100
Class-II				
Buxar	82,975	7.6	2	26.3

Source: Central Pollution control board (2009-10), Ministry of Environment and Forests, Government of India

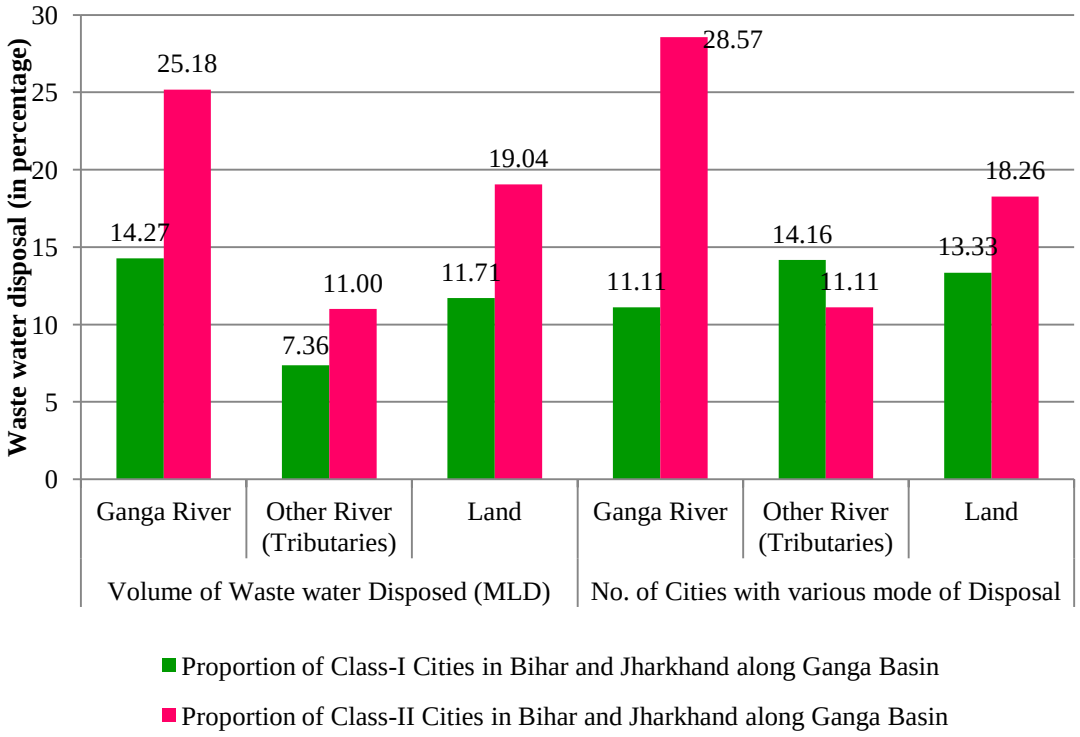


Figure 20: Percentage of Municipal Wastewater Disposal and Mode of Disposal in Ganga Basin (Bihar and Jharkhand) for the year 2010

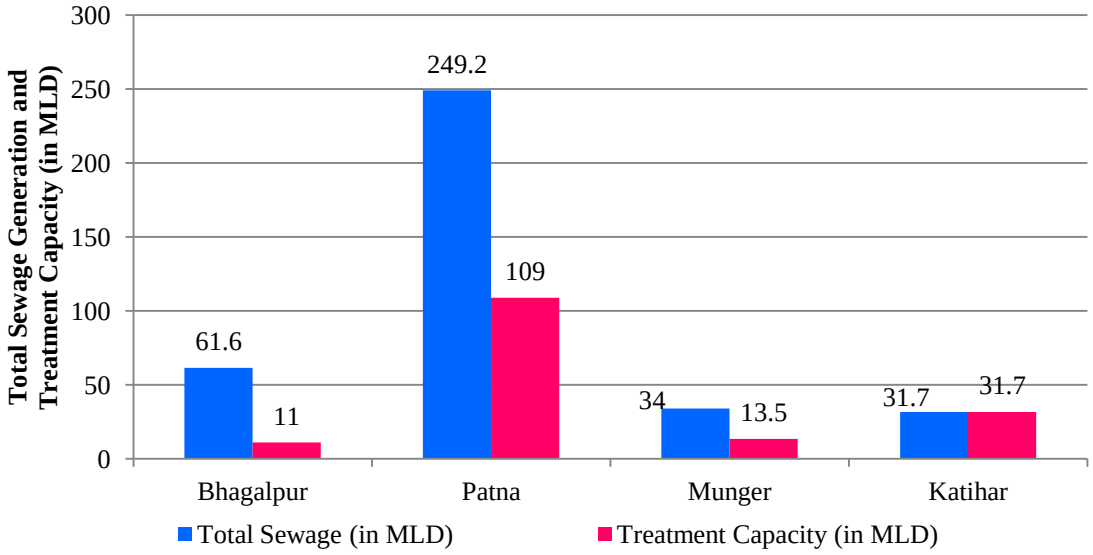


Figure 21: Wastewater Generation and Treatment Capacity for Class-I Cities Discharging Wastewater into the Ganga River

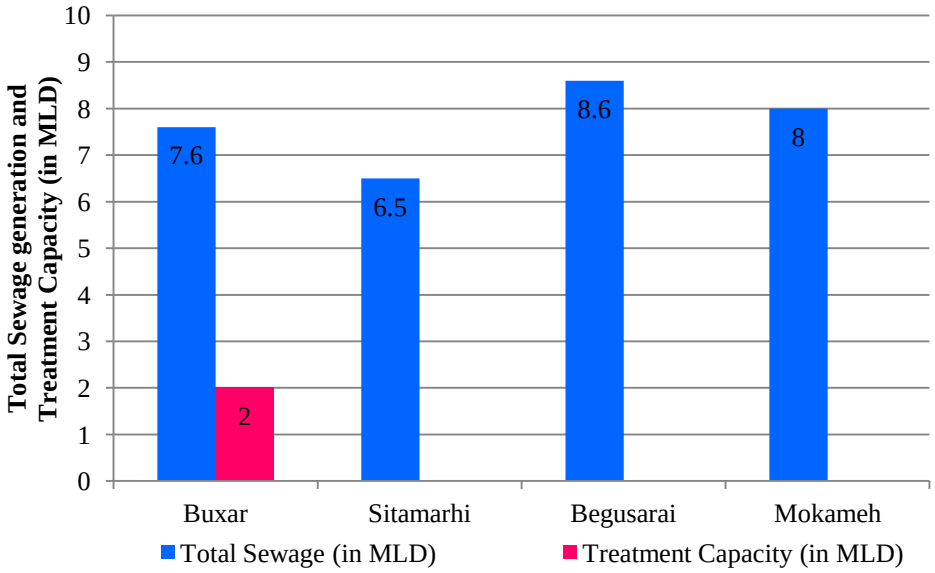


Figure 22: Wastewater Generation and Treatment Capacity for Class -II Cities Discharging Water into the Ganga River

11.2 Industrial Effluents

With a weak industrial base across the state, prima facie water pollution from industrial sources may not be as critical an issue as in the case of other states in the Ganga basin, e.g., UP and West Bengal. For instance as per the state pollution control board, there are only 34 industrial estates across the state where the registered of industries is only 5092. However, given the dominance of industries in the areas of sugar, distillery, dairy, tanneries, fertilizer, etc., and given the generally weak regulatory system, industrial pollution is of concern in

selected pockets. As shown in Table 10, in general sugar and distillery industries are contributing a large portion of industrial effluents to the River Ganga. Begusarai with presence of an oil refinery, a thermal power plant and a chemical fertiliser plant is a significant place on the industrial map of Bihar and is of special relevance from the point of view of industrial of pollution.

Table 10: POCKETS OF INDUSTRIAL POLLUTION ACROSS BIHAR

District	Type of Industries
Begusarai	Refinery, Fertilizer, Thermal
Patna	Dairy, Tannery, Distillery
Bhagalpur	Distillery, Thermal
Gopalganj	Distillery, Sugar
West Champaran	Distillery, Sugar
Sitamarhi	Distillery, Sugar
East Champaran	Sugar
Muzaffarpur	Thermal

Source: Bihar State Pollution Control Board Patna, Government of Bihar 2009-10

As regards industrial hazardous waste, the SPCB data show only 41 generators units distributed in 12 districts and the combined waste load is estimated to be about 3439 MT per annum. Out of the 12 districts there are 7 'bank districts' which together account for almost 99.5% of the hazardous waste in the state. However as seen from Table 11, among the 7, bulk of the hazardous waste is generated in only two districts of Begusarai and Patana while in the rest the quantities are insignificant. On the whole, total hazardous waste generation in Bihar is estimated be only about 0.06% of that in the country. Notwithstanding the relatively lower quantities, it is noteworthy that there are no designated or authorised facilities or sites for 'treatment, storage and disposal' of this category of waste in the state and neither are there any incinerators. Lack of commensurate infrastructure is evidently a cause of concern, particularly when the waste is characterised as hazardous.

Table 11: Pockets of Industrial Hazardous Waste Generation Across Bihar, 2009

Sr. Nr.	District	Land Disposable Waste	Incinerable Waste	Recyclable Waste	Total Waste
A.	Bank				
1	Begusarai	2790	8	-	2798
2	Munger	-	2	5	7
3	Bhagalpur	-	21	-	21
4	Patna	556	33	-	589
5	Katihar	-	2	-	2
6	Vaishali	1	0	-	1
	Sub-Total	**3347**	**66**	**5**	**3418**
B.	Non-Bank				
7	Muzaffarpur	10	6	0	16
8	Samastipur	0	1	0	1
9	Rohtas				
10	Aurangabad				
11	West-Champaran			2	2
12	Gopalganj			2	2
	Sub-Total	**10**	**7**	**4**	**21**
	Grand-Total	**3357**	**73**	**9**	**3439**

Source: National Inventory of Hazardous Waste Generating Industries, CPCB, Feb. 2009.

12.0 Conclusion and Policy Implications

Although it is not the mandate of this study, however a set of broad conclusions that are evident from the foregone analysis and discussions and a set of policy implications are presented hereunder.

12.1 Urbanization

- With only around 12% of the state population residing in urban areas, Bihar is recognised as one of the least urbanised and least developed states in the country.
- Relatively significant urbanisation is reported only in 4 of the 12 'bank districts'. As a result the hypotheses that proximity to the River Ganga is the key factor for economic growth does not seem to emerge clearly in this case. Not questioning the universality of this premise, it indicates significant cumulative investment deficit towards development works across the state in general and industrialisation in particular.
- During 2001-2011 the aggregate urban population across the state has recorded a decennial growth of 35%. The number of urban centres has jumped by over 50%, bulk of which is accounted by towns under 10,000 population. However, the state government does not appear to be prepared to handle urbanisation of smaller towns

and has not recognised them as statutory towns. As a result, these emerging urban centres are do not have appropriate institutional support system (competent urban local bodies) for planned growth and infrastructure development.

- On the whole about a quarter of the urban population is found to reside in slums or slum like settlements.
- In general urban areas in Bihar are characterised by poor municipal infrastructure. For instance dependency on hand pumps as source of drinking water across the state (comprising both urban and rural) has increased from 78% in 2001 to 88% in 2011.
- Likewise there is significant deficit of wastewater/sewage collection and treatment systems. For instance out of the 199 urban centres (27 major cities/towns) only 5 have sewage treatment plant and where the aggregate installed capacity is around 50% of the current requirements. On the whole the installed treatment capacity vis-a-vis the total sewage generation is deemed to be insignificant.
- Similarly there are no facilities for treatment and safe disposal of municipal solid waste which is leading to, among others, discharge of leachate into the water bodies, blockages of drainage channels and air pollution.
- General infrastructure deficit is known to be affecting public health, the quality of life and adversely impacting the receiving environment/ water bodies.
- State demography is also uniquely characterised by large out migration to other parts of the country, particularly in search of employment and livelihood. Relatively larger fraction of migrants comprise from rural areas which pertains to unskilled labour force, agriculture workers, etc.
- Large scale out migration represents significant deficit in employment opportunities and thereby weak industrial base in the state. However, remittances from the migrant workers are perhaps also the main source of income for a fairly large section of the rural population

12.2 Industrialisation

- Despite the advantage of early investments in some large-scale industries and base for sugar and distilleries, Bihar has lagged behind in attracting investments for industrial growth. The number of factories constitute under 1.5% of the national and there are virtually no industries or industrial belts of national significance.
- During the last decade the state has recorded impressive growth in GDP and it is expected to be sustained under the current political setup, however it faces severe challenges in terms of capital, human resources, enabling framework, supporting infrastructure, etc.
- Prima facie aggregate pollution from industrial sources is low as compared to the urban sector or other parts of the country. Nevertheless, lack of infrastructure for treatment of effluent and hazardous waste, among others, is found to be a major issue which is adversely affecting receiving water bodies and the environment.

- The state has been characterised by significant deficit in governance which is also contributing to lack of planning for the necessary infrastructure development. As regards pollution control this deficit is reflected in terms of weak implementation of the existing legal provisions and poor monitoring.

12.3 Policy Implications

- As regards development, it is evident that the state requires significant all out support and inflow of resources so as to exploit available potential.
- There is major need to promote non-farm employment opportunities in rural Bihar so that on one hand pace of migration to urban areas can be controlled and on the other hand the economic well being of the rural people in Bihar can be improved.
- There is an urgent need for growth of supporting infrastructure for the agriculture and horticulture sectors thereby facilitate exports from the state and increase income of its people.
- There is a need to recognise the emerging smaller Census Towns as ULBs which are hitherto classified as Village Panchayats and provide enabling institutional support system.
- There is an urgent need to strengthen infrastructure and services for, among others, sewage, drainage and solid waste management in all urban centres across the state.
- There is a need to adopt a paradigm shift towards urban sanitation and solid waste management so as to consider appropriate approaches and technologies.

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