Comprehensive Integrated Master Plan for Chennai Bengaluru Industrial Corridor Final Report

Regional Comprehensive Plan

Executive Summary

October 2015

Japan International Cooperation Agency

PricewaterhouseCoopers Co., Ltd.

Nippon Koei Co., Ltd.

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Executive Summary

Background and Objective

Background

Both Bengaluru and Chennai are developing rapidly and accept increasing number of private companies including Japanese. On the other hand, the private sector claims that bad access to ports, bad road condition, frequent blackouts, tax system, not transparent visa procedure, incomplete policy etc, are bottlenecks of their investments in India.

Joint Statement between Government of Japan (GOJ) and Government of India (GOI) at December 2011 emphasized the importance of infrastructure at Chennai-Bengaluru area, and Japan informed to provide with financial and technical support for the preparation of the comprehensive master plan for this area.

Based on the request from GOI to formulate "Infrastructure Development Program for Chennai-Bengaluru Industrial Corridor" (the Program), GOI and JICA agreed to develop "Comprehensive Regional Perspective Plan for Chennai-Bengaluru Industrial Corridor Region," (the Perspective Plan) in May 2013. In addition to the development of the Perspective Plan, the Program consists of: (ii) feasibility studies for prioritized infrastructure projects; (iii) development of infrastructure; (iv) technical assistance for performance improvement support.

JICA hired a consortium for the preparation of the Perspective Plan and a consortiumprepared this report with consultation of related stakeholders and JICA.

Objective

The basic understanding of the study framework is the following.

Aim and Objectives of the Consulting Assignment:

- To prepare a Comprehensive Regional Perspective Plan for the Chennai-Bengaluru Industrial Corridor Region, along with developing Strategy for transforming the region into a globally competitive investment destination
- Identify suitable nodes to be taken up for industrial development within the project influence area (states of Karnataka, Andhra Pradesh and Tamil Nadu) and prepare Master Plan and Development Plan for at least two selected Industrial nodes (amongst the various nodes identified under the study)

Target Year:

- The Master Plan will cover 20 years, during 2013-2033.

Target Area:

- Target of the study would be an Influence Area spread across the States of Karnataka, Andhra Pradesh and Tamil Nadu, along the corridor between Chennai-Bengaluru (around 560 km).

Counterparts Involved

Main counterparts include Department of Industrial Policy and Promotion (DIPP) of Ministry of Commerce and Industry and three State Governments, Government of Tamil Nadu, Karnataka, and Andhra Pradesh. The study team consults with related Ministries, including Ministry of External Affairs, Finance, Shipping, Railways, Civil Aviation, Road Transport and Highways, Power, Environment and Forests, and related agencies, such as NHAI.

It was agreed between GOI and GOJ that the Monitoring Committee is established to monitor the study progress. The Monitoring Committee is chaired by Prime Minister's Office of at India and Embassy of Japan with the structure described in the chart below.

In addition, a monthly meeting is held between DIPP and JICA to update and share the progress of the study.

Table 1: Related stakeholders and supporting agencies

Monitoring Committee	India	Japan
Chair	Prime Minister's office	Embassy of Japan in India
Related stakeholders and supporting agencies	• Ministry of External Affairs • Department of Economic Affairs, Ministry of Finance • Ministry of Shipping • Ministry of Railways • Ministry of Civil Aviation • Ministry of Road Transport and Highways • Government of Tamil Nadu • Government of Karnataka • Government of Andhra Pradesh • DMICDC • Ministry of Urban Development • Ministry of Environment & Forests • Ministry of Power	• Ministry of Foreign Affairs • Ministry of Economy, Trade and Industries • Ministry of Land, Infrastructure, Transport and Tourism • Japan External Trade Organization • Japan Chamber of Commerce and Industry India
Implementing agency	Department of Industrial Policy & Promotion (DIPP)	Japan International Cooperation Agency (JICA)

Scope of Work

GOJ and GOI agreed with the detail scope of the work and structure is summarized below. The scope of work is divided to two parts which correlates to the study objectives. Part A aims to prepare comprehensive regional perspective plan for CBIC region, which is assumed to be conducted in about 6-8 months, during October 2013-March 2014. The main steps include (i) defining the delineation of the Corridor; (ii) reviewing industry and infrastructure; (iii) short listing of nodes; and (iv) developing a comprehensive regional plan. After the completion of Part A, GOJ and GOI agreed on the selection of three nodes for the further study under Part B. Part B aims to prepare a concept master plan and development plan for three nodes in about 10-12 months. The detail work plan will be developed by the study team .

Table 2: Scope of work of the study

Part A: Preparation of Comprehensive Regional Perspective Plan for CBIC Region (6-8 months)	Part B: Preparation of Concept Master Plan and Development Plan for two Industrial Nodes (10-12 months)
1. Define delineation of the Corridor and its influence area 2. Identify the macro level development vision and target for the corridor 3. Evolve the industrial development plan in the CBIC region 4. Identify potential nodes for future development 5. Recommend development of the regional infrastructure 6. Develop phasing plan and comprehensive regional perspective plan	1. Conduct market potential and critical gap assessment study of industries and infrastructure 2. Evolve concept master plan by sector with block cost estimates 3. Prepare development plan for the industrial node

Regional Profiling of the Corridor

Socio Economic profiling of the corridor

The CBIC region is composed of parts of 3 states, Tamil Nadu, Karnataka and Andhra Pradesh. Delineation of the region is basically along district administrative boundary; however, in Anantapur and Nellore districts in Andhra Pradesh state, they are under discussion how large the parts of these districts will be components of the region. At the stage of 1st Interim report issued on December 6 2013, the south part of Nellore and south west of Anantapur would be regarded as potential CBIC region so that at this section, we reviewed socio-economic parameters of 7 districts of Tami Nadu state, 7 district of Karnataka state, 1 district and also 2 parts of district of Andhra Pradesh state.

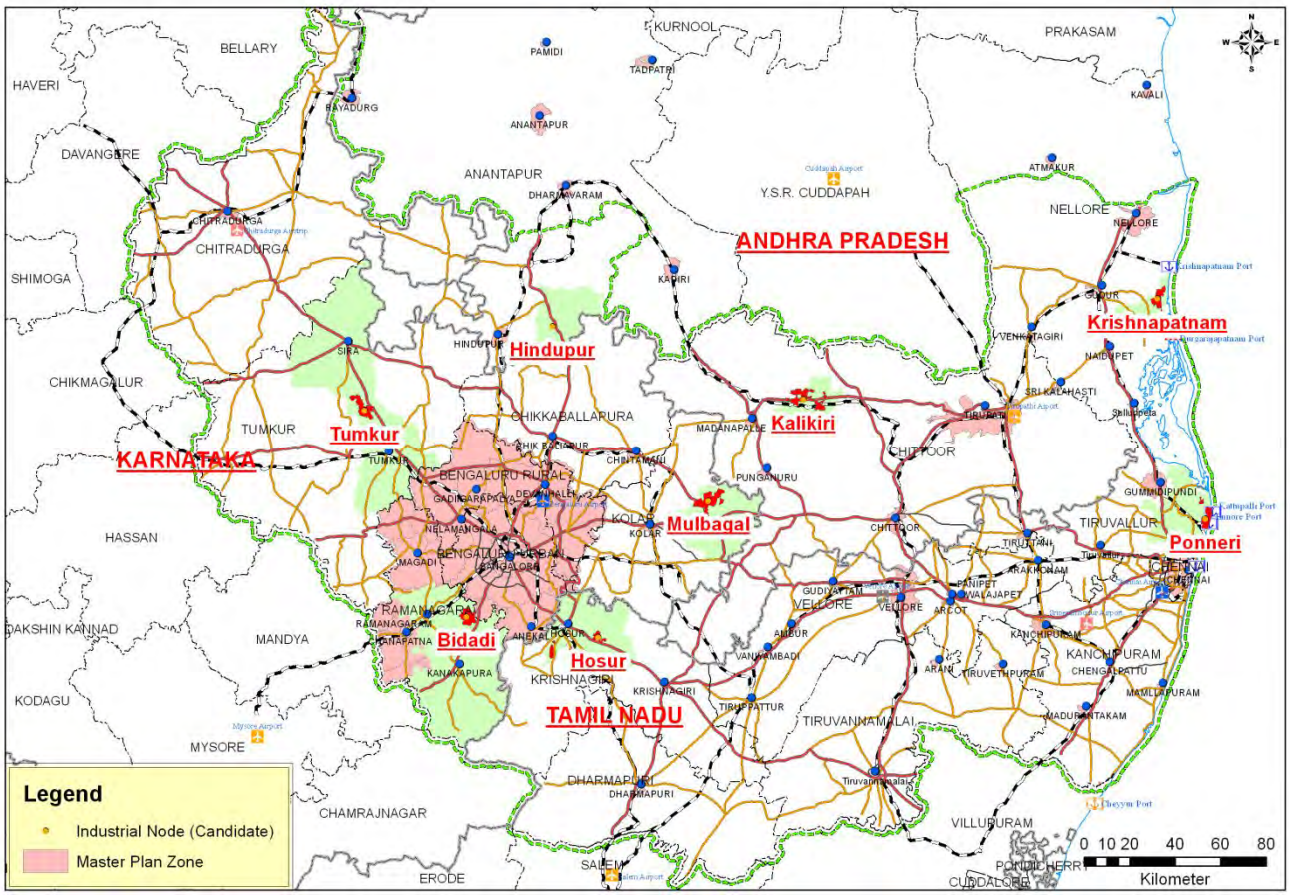


Figure 1: Overview of Corridor influence zone

Table 3: Districts under the corridor influence

Districts covered		
Tamil Nadu	***Karnataka***	***Andhra Pradesh***
1. Chennai	8. Bengaluru (urban and rural)	14. Chittoor Potential area
2. Tiruvallur	9. Ramnagara	15. South part of Nellore
3. Kancheepuram	10. Kolar	16. South west part of Anantapur
4. Tiruvannamalai	11. Chikkaballapura	
5. Vellore	12. Tumkur	
6. Dharmapuri	13. Chitradurga	
7. Krishnagiri		

Table 4: Area of the CBIC region

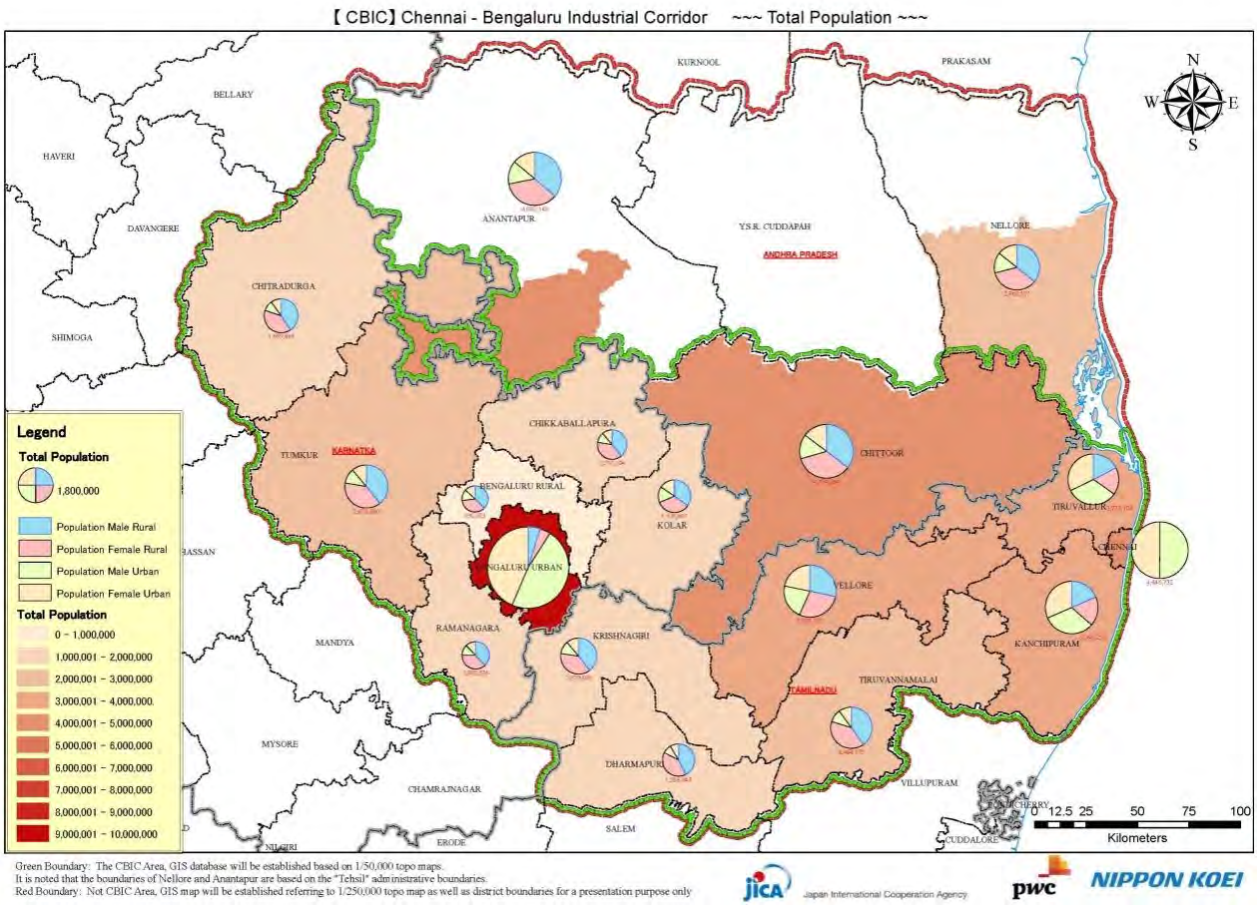
State	CBIC districts	Area covered (Sq. Km)
Tamil Nadu	Chennai	175
	Thiruvallur	3,394
	Kancheepuram	4,483
	Tiruvannamalai	6,188
	Vellore	6,075
	Dharmapuri	4,497
	Krishnagiri	5,129
Karnataka	Bengaluru	2,196
	Bengaluru rural	2,298
	Ramanagara	3,516
	Kolar	3,979
	Chikkaballapura	4,244
	Tumkur	10,597
	Chitradurga	8,436
Andhra Pradesh	Chittoor	15,152
	Nellore	6,400
	Anantapur	4,300
Total CBIC		**91,059**
All India		**3,166,414**
CBIC as a % of India		**2.9%**

Source: Census 2011

Population and related parameters

Total population

According to Census 2011, the total population of India is 1,210.57million, while that of the CBIC region is 47.53million. Compared with 2001, the total population of India has increased by 17.69% from 1,028.61 to 1,210.57million while that of the CBIC region was 26.60% from 37.54 to 47.53million. It clearly indicates the population growth speed of CBIC region for the last decade has been greater than that of all India.



Source: PwC, NK Analysis, data from respective state governments

Figure 2: Breakup of population along corridor region

The most populated district is Bengaluru which has 9.62 million (20.24% of the CBIC region) in 2011. Chittoor n Andhra Pradesh state and Chennai in Tamil Nadu state, the 2nd populated districts in the region, have respectively over 4 million. Also the 3 eastern districts in Tamil Nadu, Tiruvallur, Kancheepuram, and Vellore, have a population of over 3.5 million respectively despite their relatively smaller areas. It could be suggested that east coast districts closer to the Bay of Bengal are populous area rather than inland area except Bengaluru district.

Density, gender balance and urbanization ratio

Average density of the CBIC region is 464 persons per Sq. km as per census 2011. The density map above typically suggests that the density of Chennai in Tamil Nadu state and Bengaluru in Karnataka state are enormously higher dense than the other district.

Also it can be suggested that in the eastern side of the CBIC region, Tiruvallur, Vellore and Kanchipuram districts in Tamil Nadu states nearer the Bay of Bengal are populous and dense which is higher than the average of the CBIC region.

Between Chennai and Bengaluru districts, the ones along NH-4 (one of the alignments in CBIC) tend to be denser than the other districts. Especially the inland or north districts of CBIC region are less dense than NH-4 between Chennai and Bengaluru.

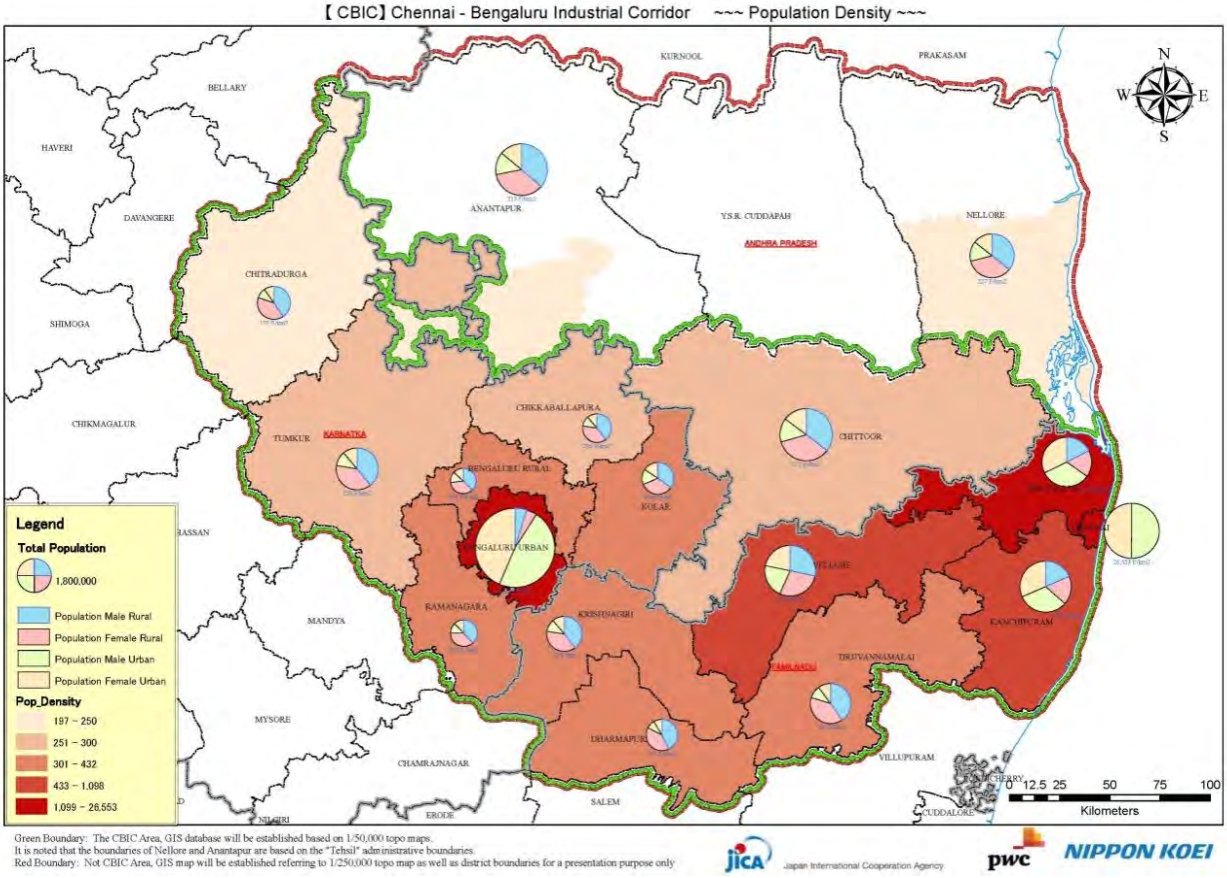
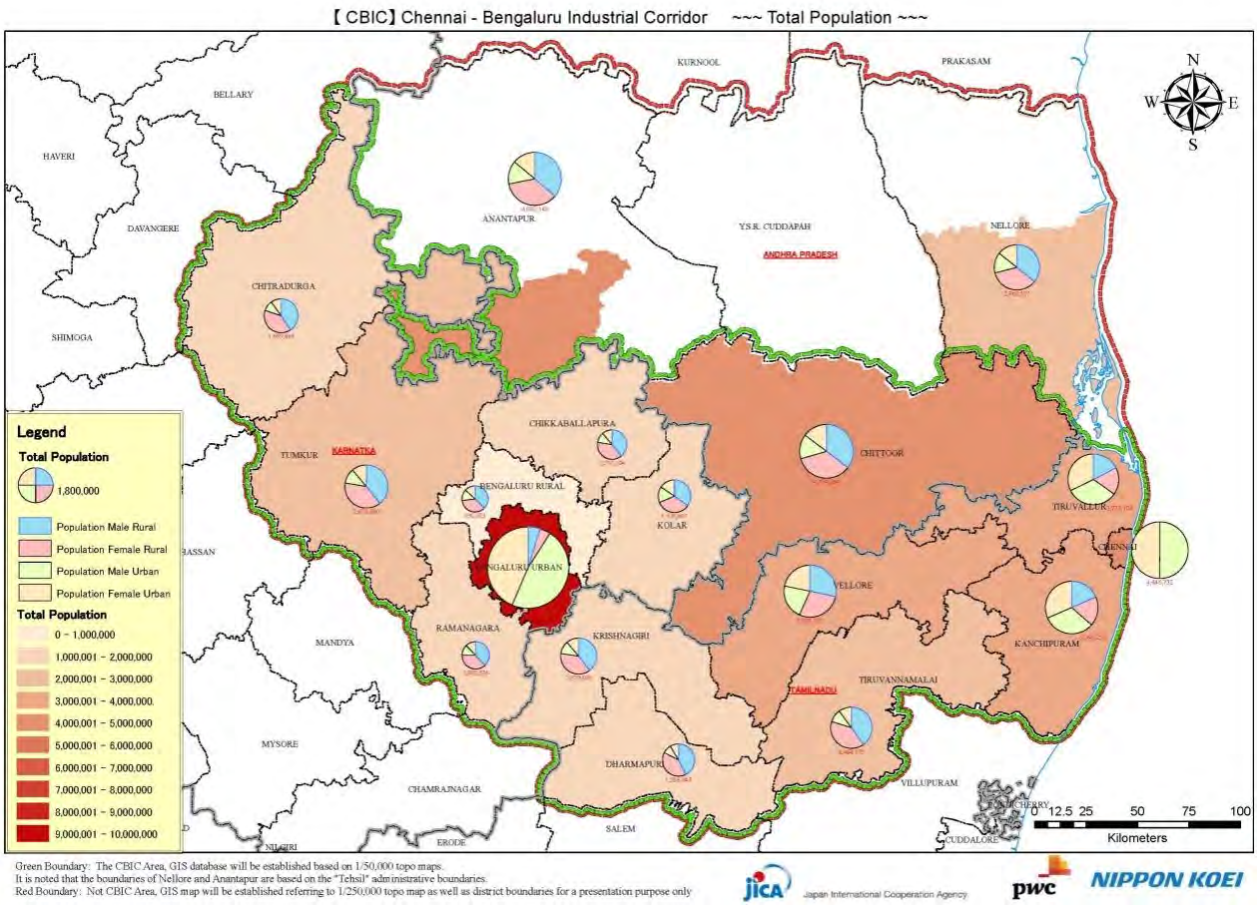


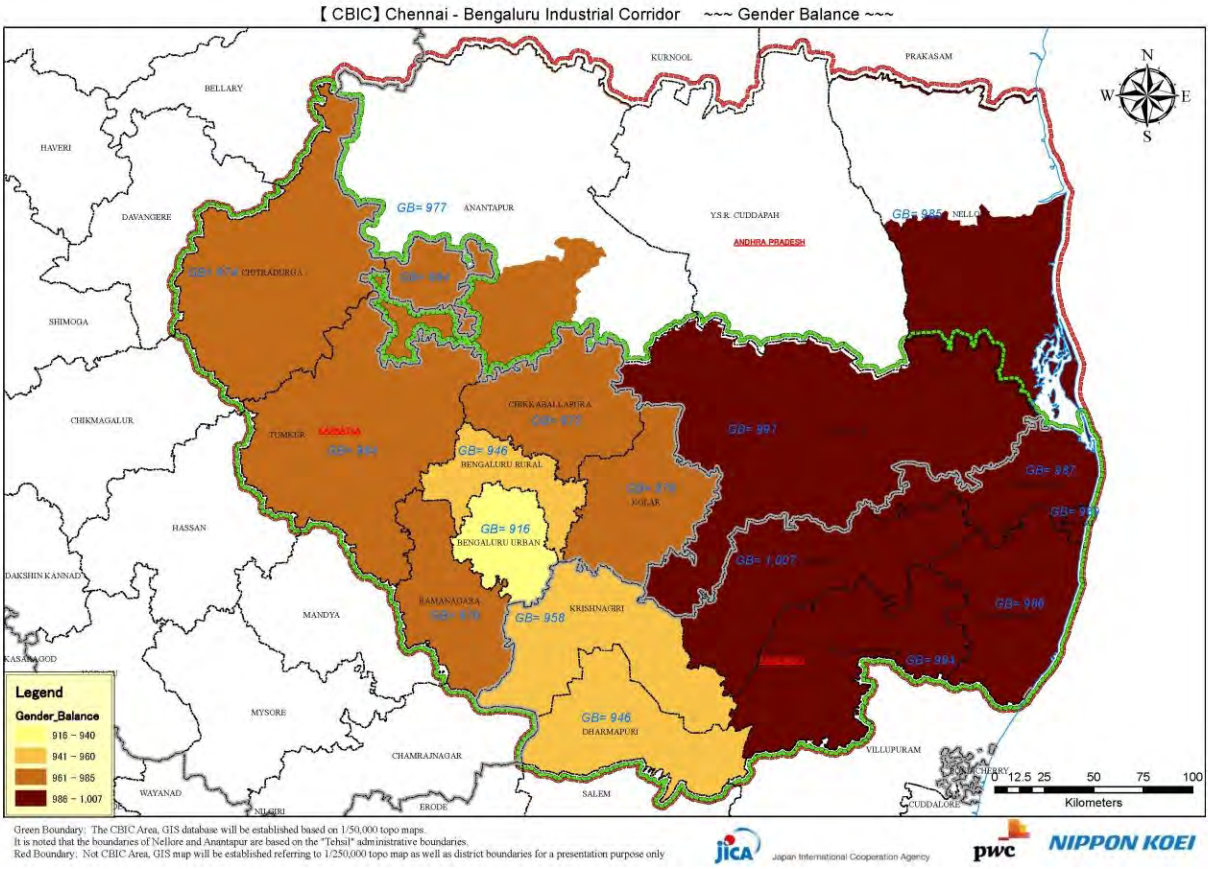
Figure 3: Density in the CBIC region



Source: PwC, NK Analysis, data from respective state governments

Figure 4: Breakup of population along corridor region

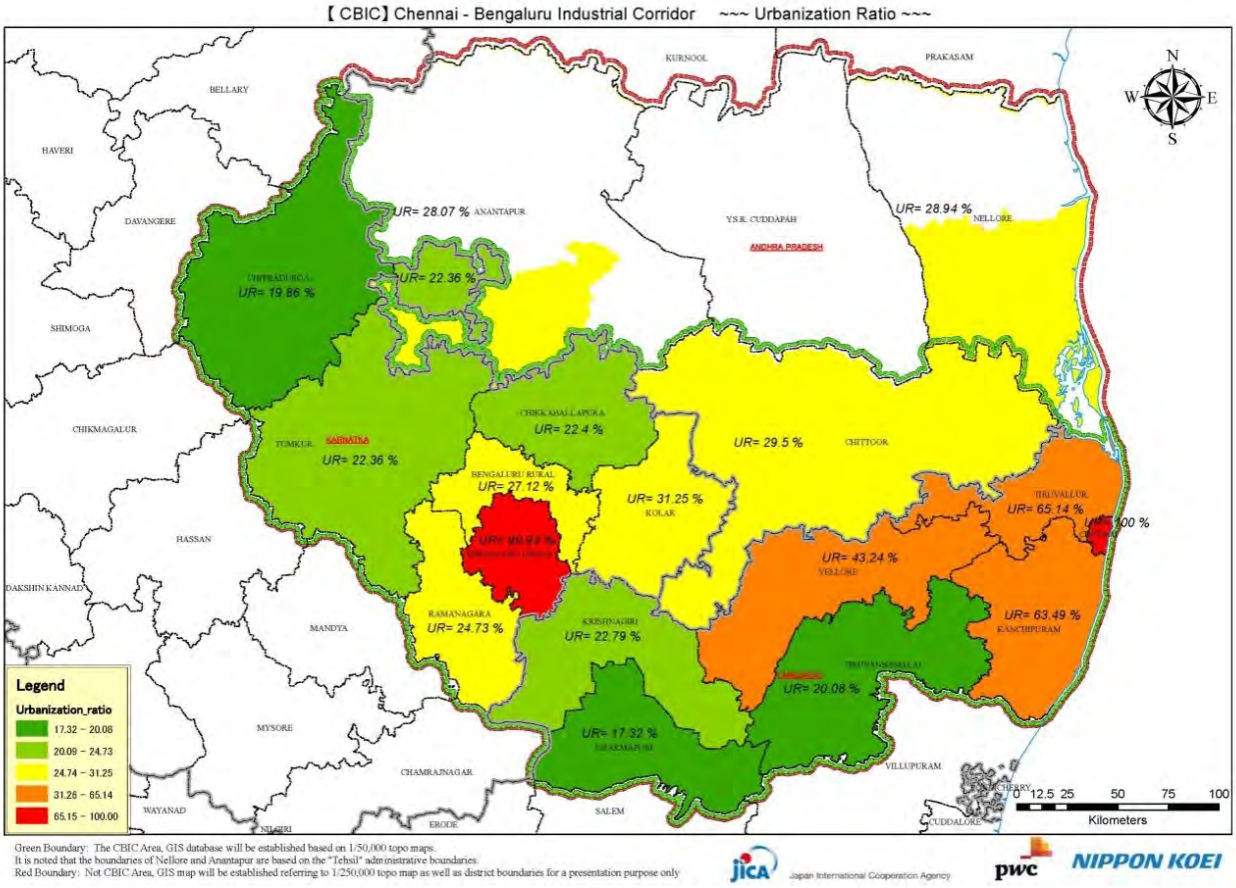
The gender balance indicates as district-wise number of females per thousand males. Average gender balance in the CBIC region is 971. This figure shows better balance than all India which is 943 as per Census 2011. Bengaluru is the only district which has a lower gender balance of 916 which is below the national threshold. Bengaluru Rural and Dharmapuri districts have relatively lower gender balance in the CBIC region, both of them indicate 946. The other districts account for a gender balance of over 970.



Source: PwC, NK Analysis; data from respective state governments

Figure 5: Gender balance in the CBIC region

Urbanization ratio is percentage of urban population to total population. The terms urban or rural is defined with respect to minimum administrative unit of village or town. The all India urbanization ratio is 31.15%, while that of the CBIC region is 51.17%. Chennai and Bengaluru, which are two most populous districts in Karnataka state and Tamil Nadu state respectively, are the most urbanized districts in the CBIC region. Additionally, in eastern area, the districts of Tiruvallur and Kanchipuram have an urbanization ratio over 60%. The other inland districts such as Dharmapuri in Tamil Nadu and Chitradurga in Karnataka are under the average urbanization ratio of the CBIC region.



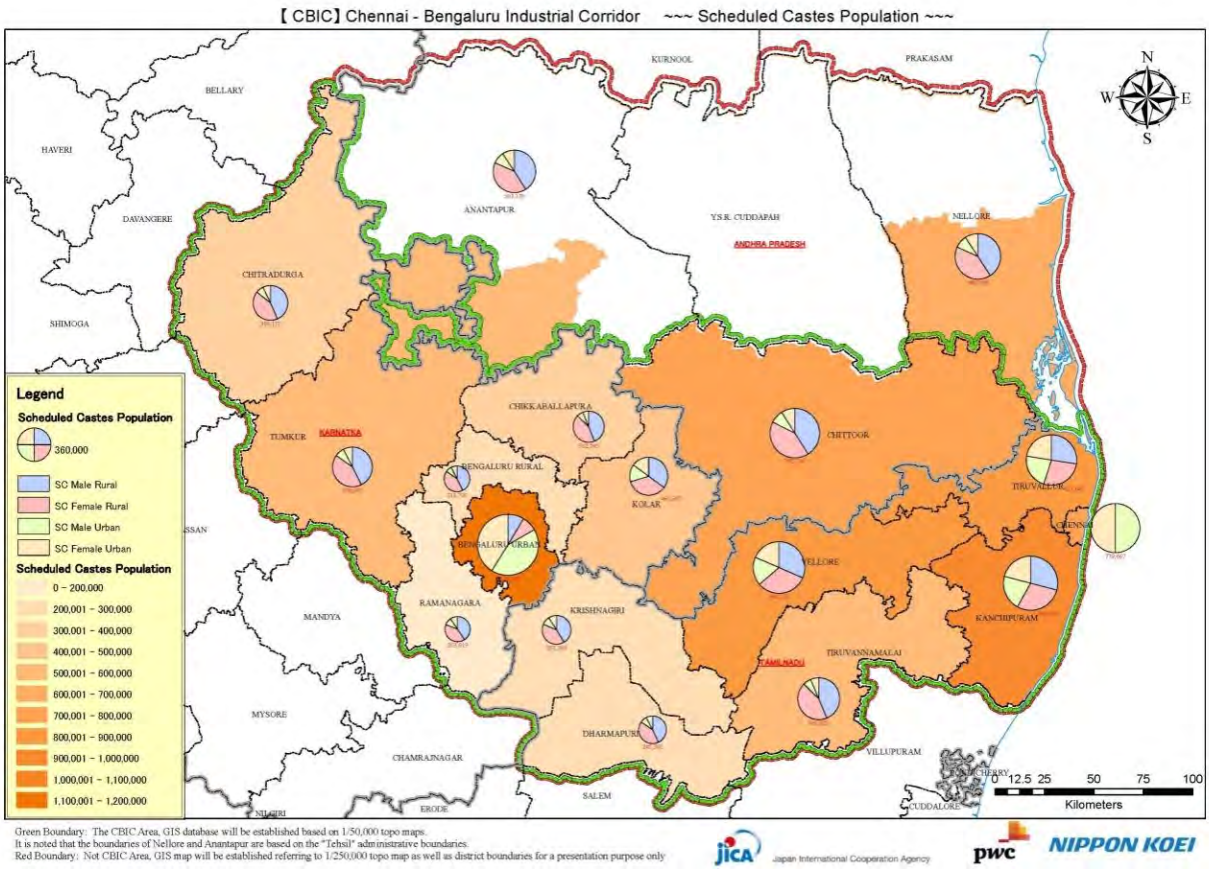
Source: PwC, NK Analysis; data from respective state governments

Figure 6: Urbanization ratio in the CBIC region

Scheduled Caste & Scheduled Tribe

It is important to study demographic distribution of Scheduled Caste (SC) and Scheduled Tribe (ST) in this region from the perspective of achieving inclusive growth in the CBIC region.

The SC and ST ratio of all India are 16.63% and 8.61% respectively, while average SC and ST ratio of the CBIC region is 18.80% and 3.76%. The SC ratio in Kolar district is the highest at 30.32%, while Bengaluru accounts for the lowest of 12.46%. The ST ratio of Chitradurga district, 18.23% is the highest in this region, and that of Chennai, 0.22%, is the lowest. Districts with high or low SC ratio are randomly spread in the region, and there is no suggestion for the trend of SC ratio from the map. On the other hand, ST ratio in south eastern areas of the CBIC region is relatively low compared with other areas such as the north western areas where the ratio is relatively high.



Source: PwC, NK Analysis; data from respective state governments

Figure 7: Scheduled Caste in the CBIC Region

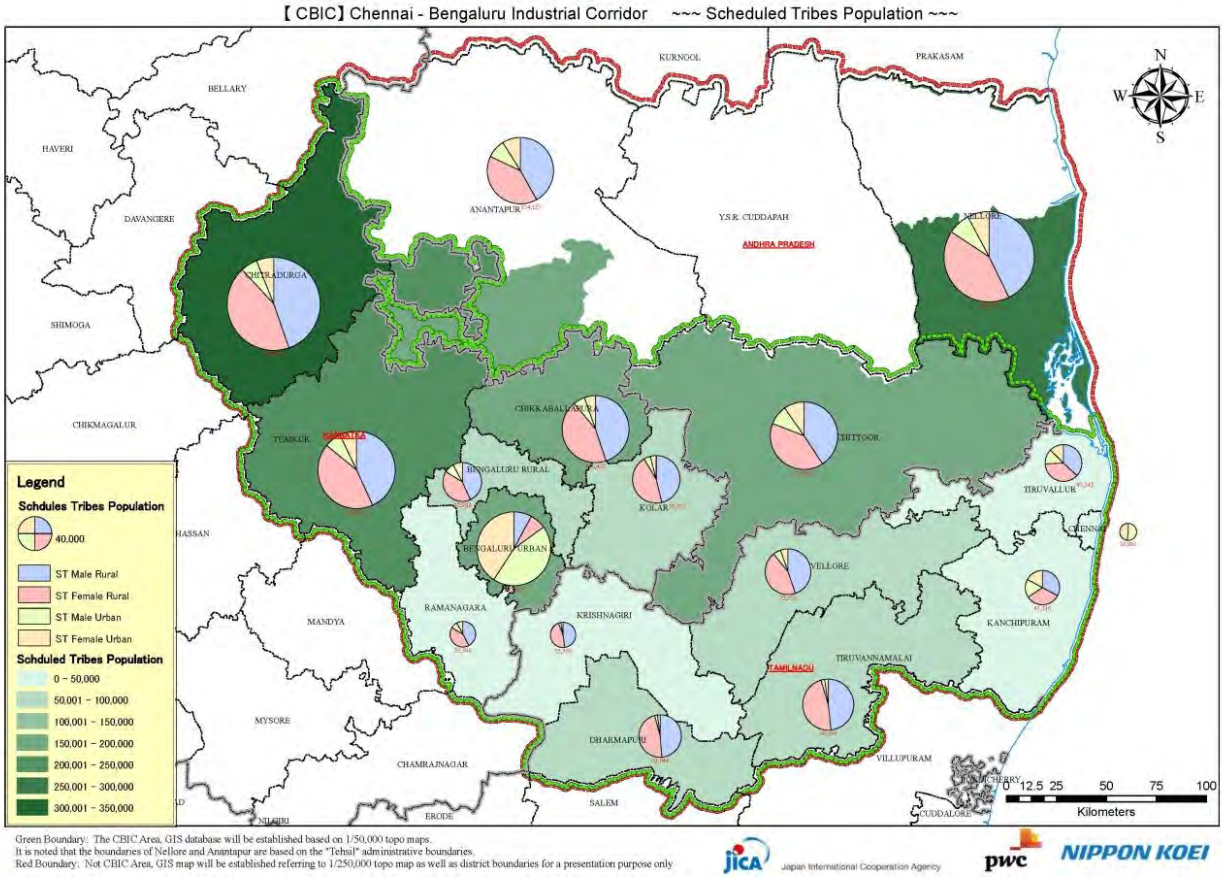
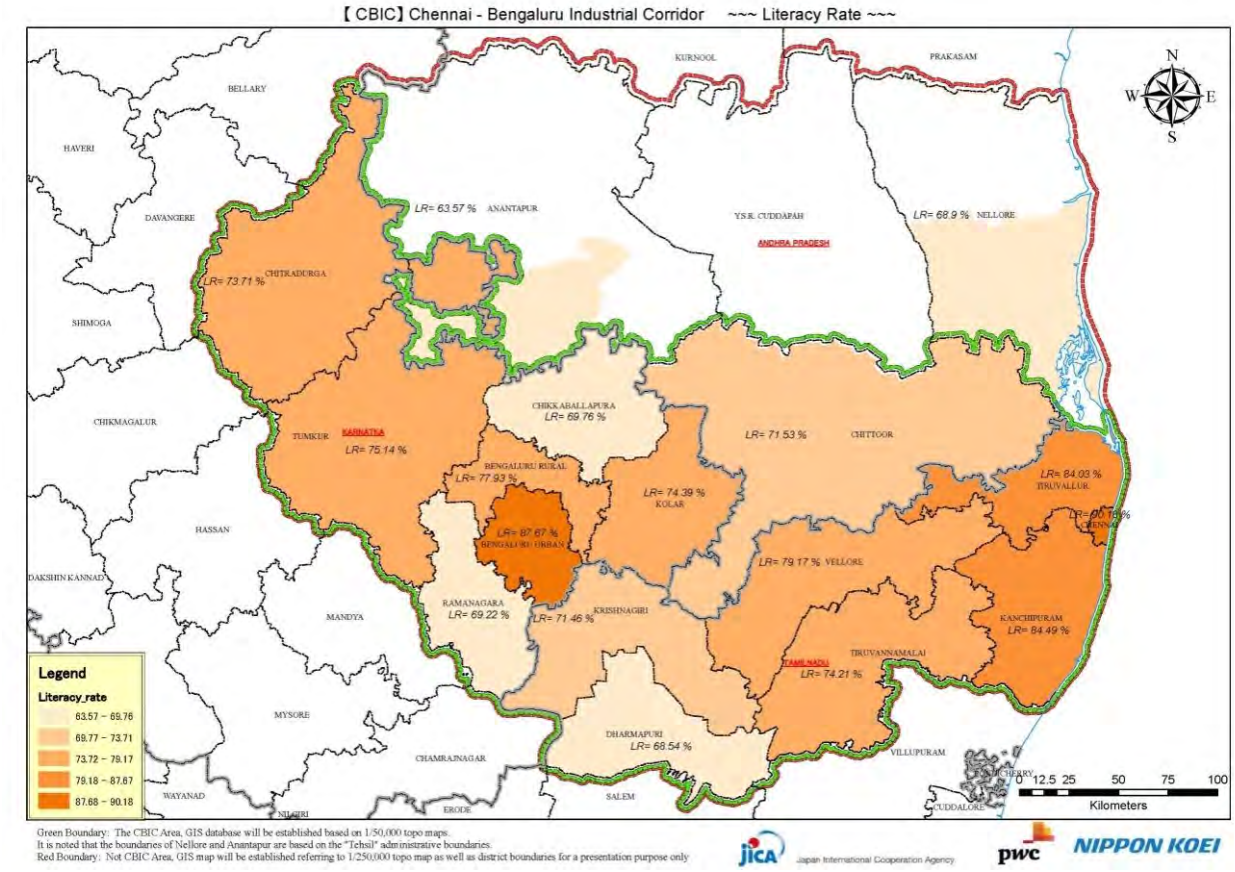


Figure 8: Scheduled Tribes in the CBIC region

Source: PwC, NK Analysis; data from respective state governments

Literacy rate

The following map shows literacy rate which is the ratio of literate persons to total population except the age group of 0-6 years. It could be suggested that industries generally would tend to be aggregated in and around areas with relatively high literacy rates. The average literacy rate of all India is 72.99%, and that of the CBIC region is 78.27%. The places where many foreign enterprises have been invested, especially Chennai and Bengaluru, have high literacy rates of over 85%. The high average of literacy rate of the CBIC region, compared to that of all India, suggests that the region has high potential to incubate industries from foreign countries. Also these districts have a large number of educational and skill development institutions. The Corridor is home to about 2,500 graduate and higher education institutions, which constitute about 47% of such institutions in Tamil Nadu and Karnataka states in total. Particularly, Bengaluru district is an educational institution hub in India with presence of leading educational institutions such as the Indian Institute of Science (IISc.), Indian Institute of Management and many other leading educational institutions.



Source: PwC, NK Analysis; data from respective state governments

Figure 9: Literacy rate in corridor region

Workers ratio

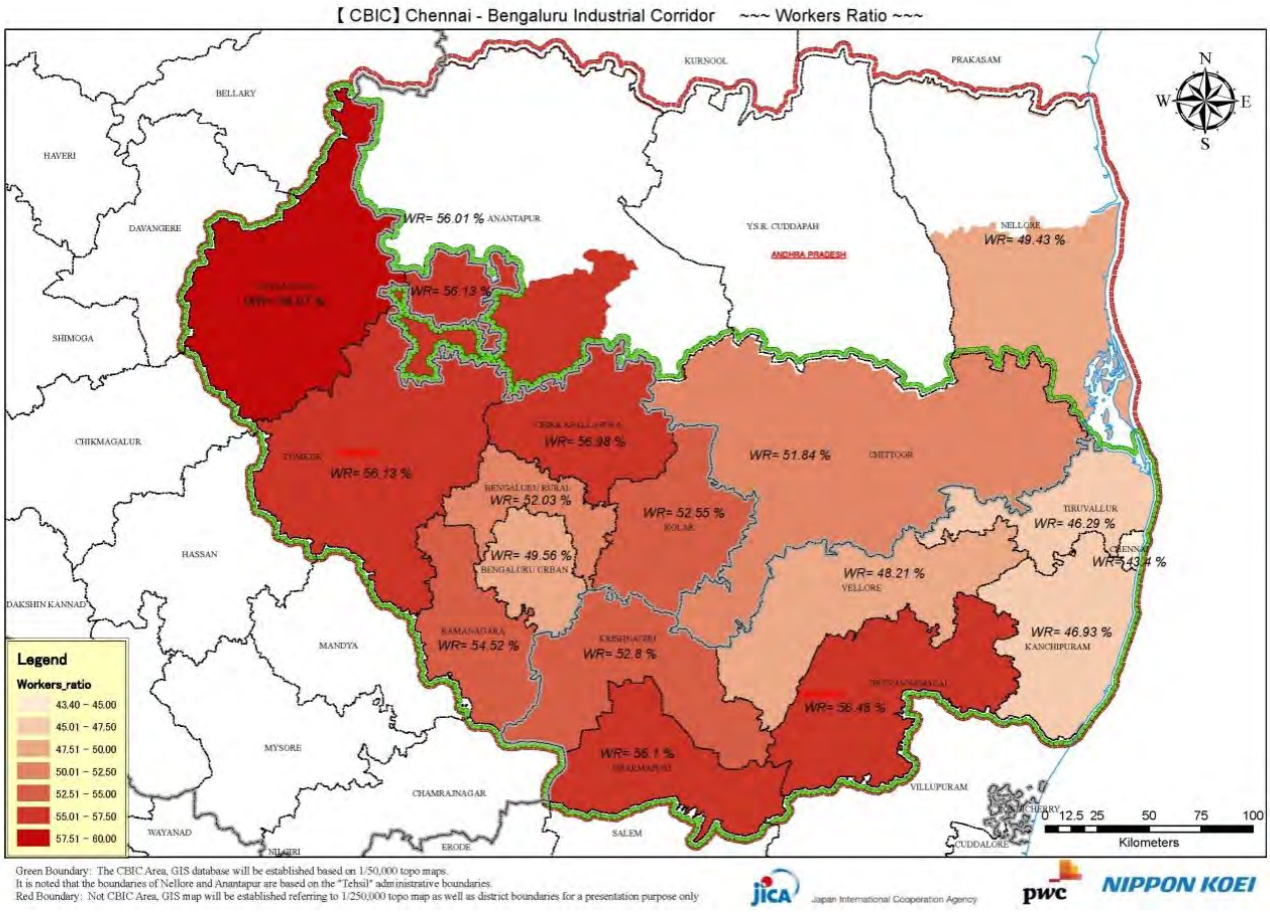
The workers[1] ratio is caluculated as percentage of workers to total population except age 0-6 group[2].

The average workers ratio in India is 46.05% as per census 2011, and that of the CBIC region is 50.81%. The workers ratio in the districts of Tiruvallur and Kanchipuram (46.29% and 46.93% respectively) is slightly over the average of the CBIC region. The inland districts of the CBIC region appear to have high workers ratio compared to the eastern area of the CBIC region.

[1]As per the Census of India, "Main workers" are defined as "those workers who had worked for the major part of the reference period (i.e. 6 months or more)", and "Marginal workers" are defined as "those workers who had not worked for the major part of the reference period (i.e. less than 6 months)". Only difference of these workers are the working period in the referencing dates for census, so that Main and Marginal workers are both regarded as workforce.

[2] Further classification of population by age is not available through Census 2011

Map xx: Workers Ratio in CBIC region



Source: PwC, NK Analysis; data from respective state governments

Figure 10: Worker ratio in corridor region

GDP growth

Future population Growth

The objective of this chapter is to explore future population of each district within CBIC area until 2033. This projected future population is utilized to estimate required capacity of infrastructure, such as road, railway, port, airport, logistics, water, solid waste management and so on.

In 2006, the population growth of India by State from 2001 to 2026 was forecasted by The Office of The Register General & Census Commissioner India based on fertility, mortality and migration rates of India along with universally accepted way[3]. The working group made assumptions on fertility rate, mortality rate, and various factors and then projected future population.

The above mentioned projection is used as the basis of the future population projection up to 2033 under this study with the adjustment based on actual demographic data of the latest census, which was conducted in 2011. In addition,

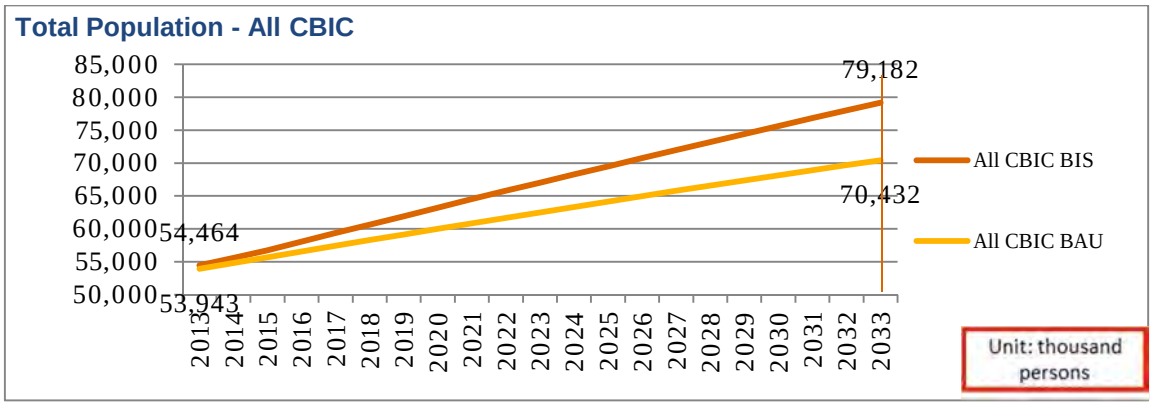
[3] http://gujhealth.gov.in/pdf/projection_report.pdf

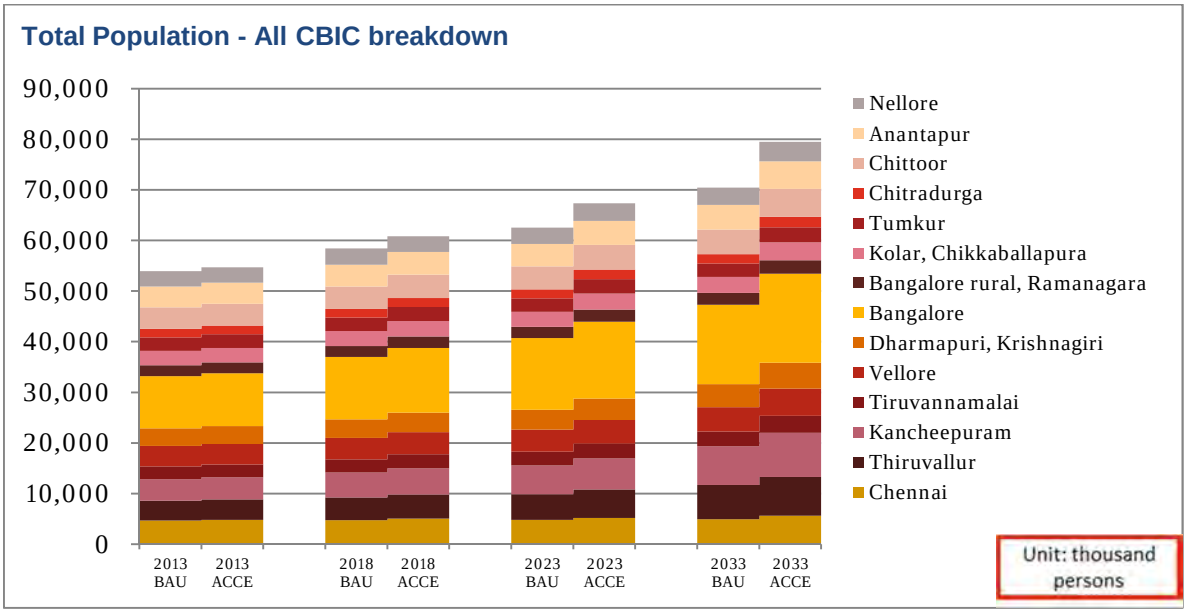
Future population was calculated by sub-district from 2013 to 2033 for 20 years under Business As Usual scenario (BAU) and Business in Induced Scenario (BIS) according to the GDP growth scenario defined under Section *2.2.1*.

Followings are the result of future population projection in CBIC area.

- All CBIC

Table 5: Total Population-All CBIC



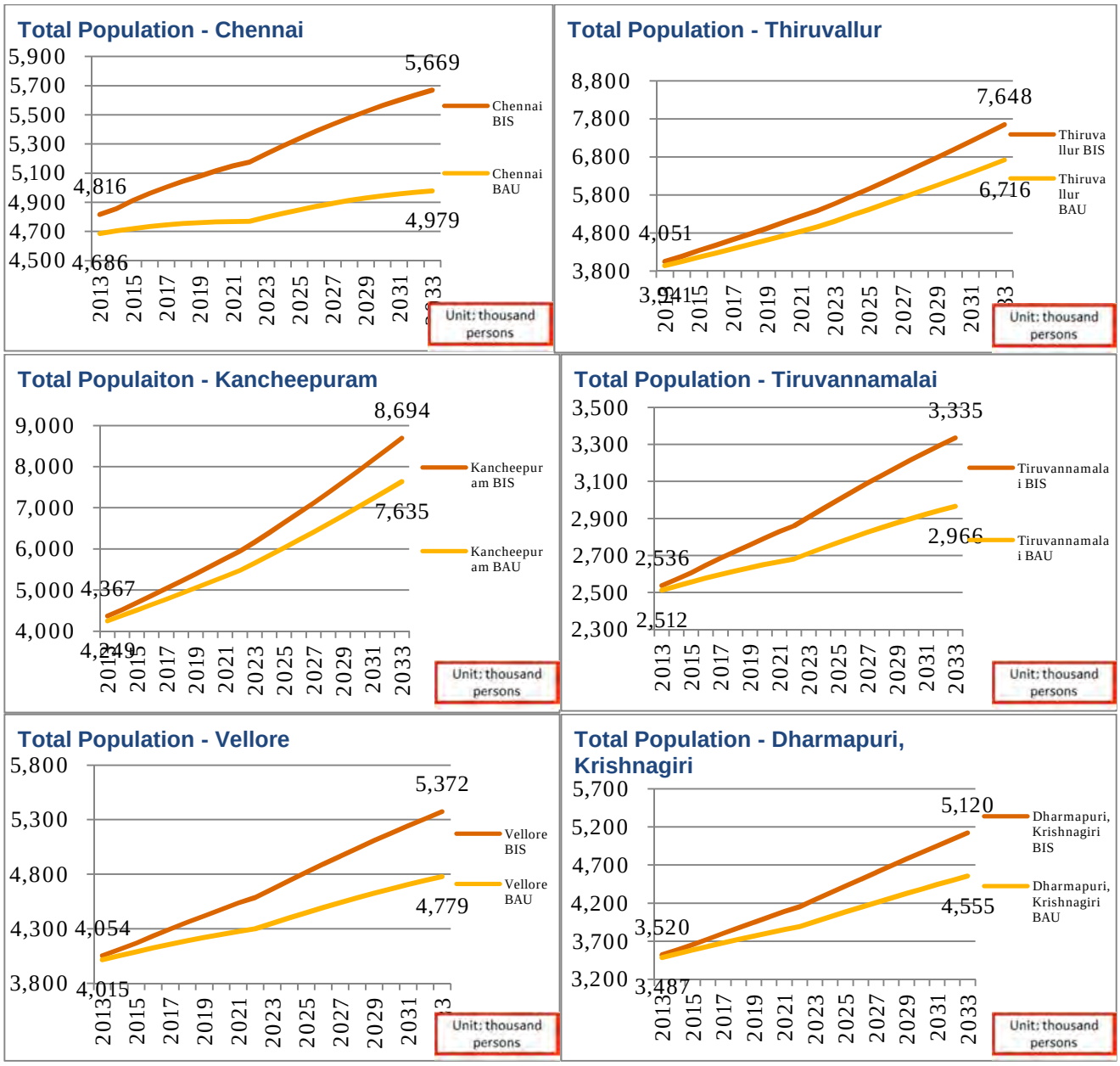


- Regarding to future population of all CBIC area until 2033 under BIS, the population will increase by 47% from 54,464 thousand in 2013 to 79,182 thousand in 2033. The compound average population growth rate from 2013 to 2033 is estimated as 1.89%, which is slightly higher than actual growth rate from 2001 to 2011 of 1.82%.
- On the other hand, the average growth rate from 2013 to 2033 under BAU scenario is estimated as 1.37%. In 2033, population will reach at 70,432 thousand, the level which will be achieved in 2026 under BIS.

The followings are population projection for each district;

- Tamil Nadu State

Table 6 : Population of each district in Tamil Nadu state



- Total population of these 7 districts are estimated to increase from 23,345 thousand in 2013 to 30,718 thousand in 2033by 32%. According to the actual data on Census 2011, the population of these 7 districts account for 42% of CBIC area. In 2033, the share of the population in CBIC area is assumed to increase to 45%.The average population growth rate from 2013 to 2033 is estimated at 2.17%, which is higher than actual State average growth rate from 2001 to 2011 of 1.82%.
- Kancheepuram district and Tiruvallur district are estimated to show the highest population growth rate until 2033 based on the actual data during 2001-2011. In Kancheepuram District, population is estimated to increase in almost double from 4,367 thousand in 2013 to 8,694 thousand in 2033 and in Tiruvallur district, population is estimated to increase by 89% from 4,051 thousand in 2013 to 7,648 thousand in 2033.

– Chennai District, where is the most populated area among these 7 districts in Census 2011, is estimated to have less population increase than the above two districts due to the high density. As per census 2011, the density of Chennai District in 2011 was 26,553 people per square km, which was prominently high in the CBIC region. The density of the district of second highest density, Bangalore in Karnataka state, was 4,381 people per square km.

- Karnataka State

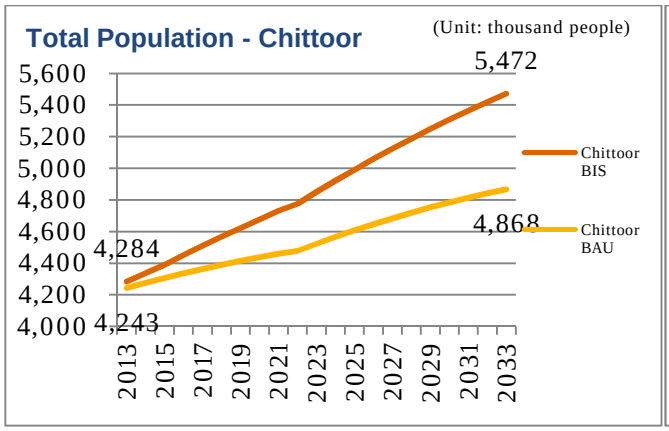
Table 7 : Population of each district in Karnataka state

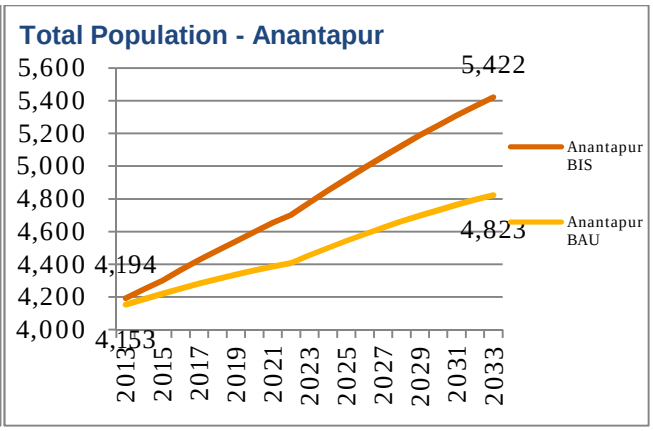
– In 2023, Bangalore urban area is estimated to reach urbanization of 100%. Population inflow into Bangalore urban would be forecasted to slow down and the population would tend to spread out to districts around Bangalore urban.
– Total population of these 7 districts will increase by 46% and is estimated to reach at 28,873 thousand in 2033, of which 60% will be in Bangalore.
– According to the Census 2011, the population of these 7 districts account for 36% of that of CBIC area. In 2033, the share of population in CBIC region will be about 36% as well. The average

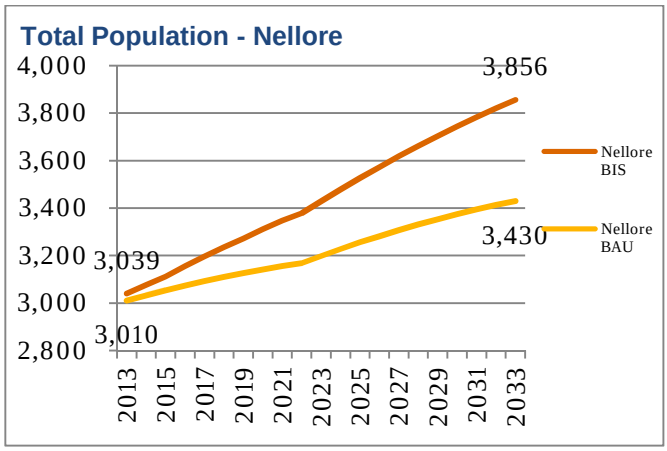
population growth rate from 2013 to 2033 is estimated as 1.89%, which is lower than actual State average growth rate from 2001 to 2011 of 2.26%.

- Andhra Pradesh state

Table 8 : Population of each district in Andhra Pradesh state







- Total population of these 3 districts is estimated to increase by 23% from 11,517 thousand in 2013 to 14,751 thousand in 2033. According to the Census 2011, the population of these 3 districts account for 20% of that of CBIC area and expected to slightly decrease to 19% in 2033. The average population growth rate from 2013 to 2033 is estimated at 1.25%, which is higher than actual State growth rate from 2001 to 2011 of 1.10%.
- As for the districts of Chittoor and Anantapur, the population is estimated to increase over 1,000 thousand people during 20 years by 2033. Population in Chittoor and Anantapur Districts are expected to increase by 28% from 4,284 thousand in 2013 to 5,472 thousand in 2033, and by 29% from 4,194 thousand to 5,422 thousand, respectively. The relatively low density of population at the area expected to allow some room for future population increase.

The table below shows the summary of population projection of each district in 2013, 2018, 2023 and 2033. The population of 2011 was actual data from Census 2011.

Table 9 : District wise population projection

(in 000)			Actual	Projected	Projected	Projected	Projected
State	**District**	**Level**	**2011**	**2013**	**2018**	**2023**	**2033**
TN	Chennai	District	4,647	4,816	4,946	5,144	5,597
	Thiruvallur	District	3,728	4,051	4,680	5,477	7,550
	Kancheepuram	District	3,998	4,367	5,113	6,063	8,583
	Tiruvannamalai	District	2,465	2,536	2,722	2,907	3,335
	Vellore	District	3,936	4,054	4,359	4,664	5,372
	Dharmapuri, Krishnagiri	District	3,387	3,520	3,874	4,243	5,120
KA	Bangalore	District	9,622	10,445	12,808	15,185	17,593
	Bangalore Rural, Ramanagara	District	2,074	2,124	2,253	2,373	2,650
	Kolar, Chikkaballapura	District	2,792	2,859	3,031	3,190	3,558
	Tumkur	District	2,679	2,711	2,788	2,847	2,989
	Chitradurga	District	1,659	1,697	1,793	1,881	2,083
AP	Chittoor	District	4,174	4,284	4,567	4,849	5,472
	Nellore	District	2,964	3,039	3,235	3,429	3,856
	Anantapur	District	4,081	4,194	4,485	4,776	5,422

CBIC's Regional Potentials and Challenges

India is the second most preferred country by Japanese investors based on the survey conducted by JBIC in 2013. The top five main advantages from investors'' perspectives are the potential of local market, low cost of labour, the existing local market, potential for supply hub and the hub for export to the third country. On the other hand, lack of infrastructure, competitive environment, unclear legal/regulatory framework, labour issues, complicated tax system are considered to be the main bottlenecks.

Similar to the above evaluation, based on the interviews with investors at the region, the following points are considered to be the potentials of CBIC:

- Strong existing industrial base with effective industrial clusters
- Connectivity to the domestic consumption market and regional gateways
- High population density, greater urbanization & increasing migration

Lack of infrastructure is the key bottleneck of the region and unclear legal/regulatory framework, labour and tax issues are also key concerns as in other cities in India.

Comprehensive Regional Perspective Plan for 20 years is aiming to transform the region into a globally competitive investment destination and suitable nodes to be taken up for industrial development within the project influence area are identified.

Vision and Target

The context

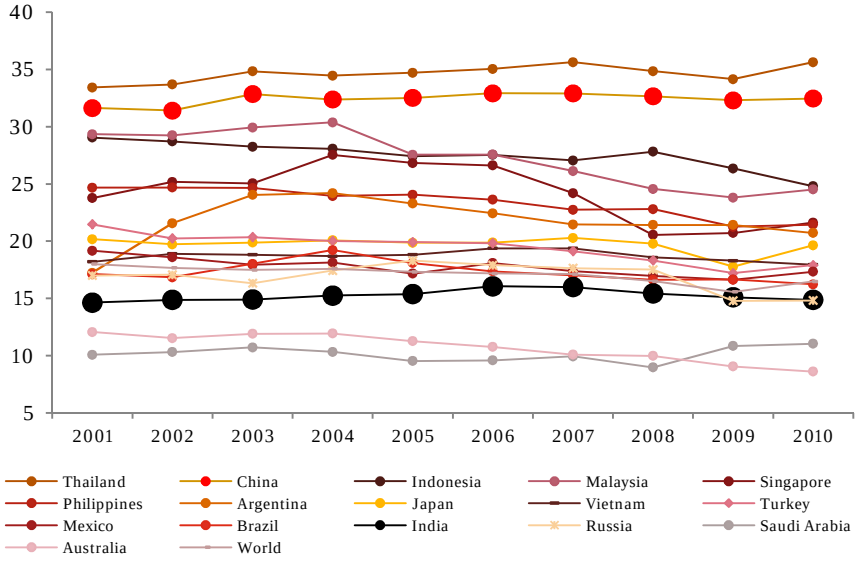


Figure 11: Trend in manufacturing GDP contribution in past 10 years

Post liberalisation, Indian manufacturing sector has been able to shift to a steeper trajectory from 5.37% CAGR to 6.73% CAGR[4]. In the past 10 years, Indian manufacturing has grown at a robust rate of 8.4%, putting itself on the map of some of the best performing manufacturing economies. However, when contribution of manufacturing sector to overall GDP is compared to fast developing economies in the region like Thailand, China, Indonesia and Malaysia, there appears to be further scope for improvement.

Recognising the opportunity, National Manufacturing Policy 2011 puts forward a vision for the manufacturing sector with following 6 objectives:

- Increase manufacturing growth to 12-14% and improve manufacturing contribution to 25% by 2022
- Creating 100 million additional jobs by 2022
- Creation of appropriate skill set among rural migrant and urban poor to enable inclusive growth
- Increase domestic value addition and technological depth in manufacturing
- Enhancing global competitiveness of global manufacturing through appropriate policy support
- Ensuring environmental sustainability

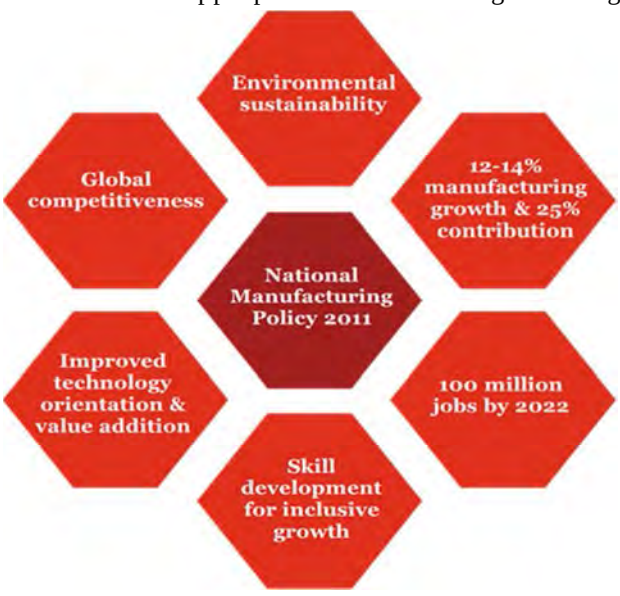


Figure 12: National Manufacturing Policy 2011

Chennai Bangalore Industrial Corridor (CBIC) constitutes a key step towards achieving the above objectives. CBIC's vision and strategies are aligned to national vision and shall aim at maximising contribution to achieving the national objectives.

[4] *Planning Commission Data Tables*

CBIC vision and strategy

The long term vision of the corridor is to develop itself as ***"a globally competitive manufacturing hub that promotes sustainable development".*** The vision is articulated across five principle themes and strategies:

Table 10: Five Principle Themes

Theme	Strategy	Target outcome
Thrust to manufacturing in the region	While, tertiary sector has given substantial thrust to corridor economy in the past; going forward manufacturing will further add to this thrust.	• Manufacturing contribution in the corridor - Increase from 17% to 25% of corridor GDP by 2033-34. • Corridor's GDP growth in 20 years – Increase from 8-9% as seen during past decade to an average of 12-13%
Enabling global acceptance	The manufacturing industries in the corridor will be driven by high standards that gain preference in international markets.	• Drive export from the region by focus on sectors like Electronics, Automobile, Textiles, Food Processing
Activating higher value addition in key industries	The manufacturing industries will integrate further into hi-tech and down-stream products that will create higher value add per unit produced and shall drive up GDP. This will also include special intervention packages for boosting MSMEs.	• Promote higher value addition in sectors like Automobile, Electronics, Food Processing, and Textiles
Employment creation	The economic progression will focus on making a sustainable impact on local communities by creating and engaging an employable workforce with high skill levels.	• Create 22 million additional jobs in next 20 years • Drive growth of both large industries and SMEs within the corridor
Prioritising sustainable development	The corridor will take into account environmental responsibility with focus on green technologies for environment and promote development of green products	• Focus on environment sustainability - Textiles, Chemical & Petrochemicals, Metallurgy, Pharmaceuticals • Focus on green products - Automobile, Machinery and Electrical Machinery

Figure 13: Strategic framework for CBIC

Creating the right levers - the balancing act

It is important to recognise the fact that all industries are not equal in terms of contribution to the target outcomes. While the corridor has a large set of industries contributing to the manufacturing output a set of 10

short listed sectors that currently contribute to over 75% of the manufacturing output will drive the growth of the corridor.

Also, amongst the set of short listed sectors each one of them will have their own unique strengths. For example, while Food Processing may not be a substantial driver in terms of GDP growth (due to relatively lower potential of high value add even at higher levels of value chain), it may be a significant driver for employment. On the contrary, while pharmaceuticals can create the required value add it may not contribute to employment as much. Under such circumstances, a strategic mix of focus industries are required that can create a balance in terms of contribution to all 5 outcomes. Accordingly, as representative sample of 10 focus sectors have been identified based on individual characteristics and significance from the target outcome perspective.

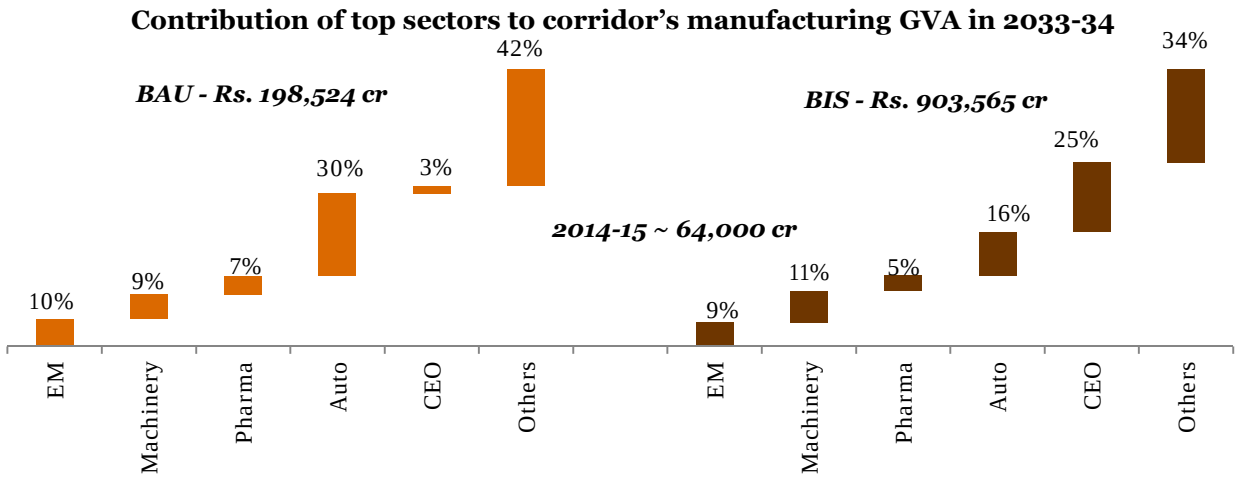
Table 11 Focus sectors across corridor's objectives

Sectors	*Thrust to manufacturing in the region*	*Employment creation*	Thrust to MSME	*Activating higher value addition in key industries*	*Prioritising environment*	*Enabling global acceptance*
Food Processing		√	√		√	√
Textiles & Apparels		√	√	√		√
Machinery & Electrical Machinery	√	√	√	√		
Chemical & Petrochemical			√		√	
Pharmaceuticals	√		√	√	√	√
Automobiles	√	√	√	√		√
Computer, Electronics & Optical (CEO)	√	√				√
Others				√	√	

Achieving the targets

Thrust to manufacturing GDP

To ensure improved contribution of the manufacturing GDP of the corridor it would be essential to focus on sectors that are large in size. Machinery, Electrical Machinery, Pharmaceuticals, Automobiles and Computer, Electronics and Optical products would be key in driving GDP. These sectors together contribute to over 50% of the corridor's GVA. In addition to these sectors, amongst the services sector Information Technology and Financial Services sector would also play a key role in driving the industrial output from the corridor.

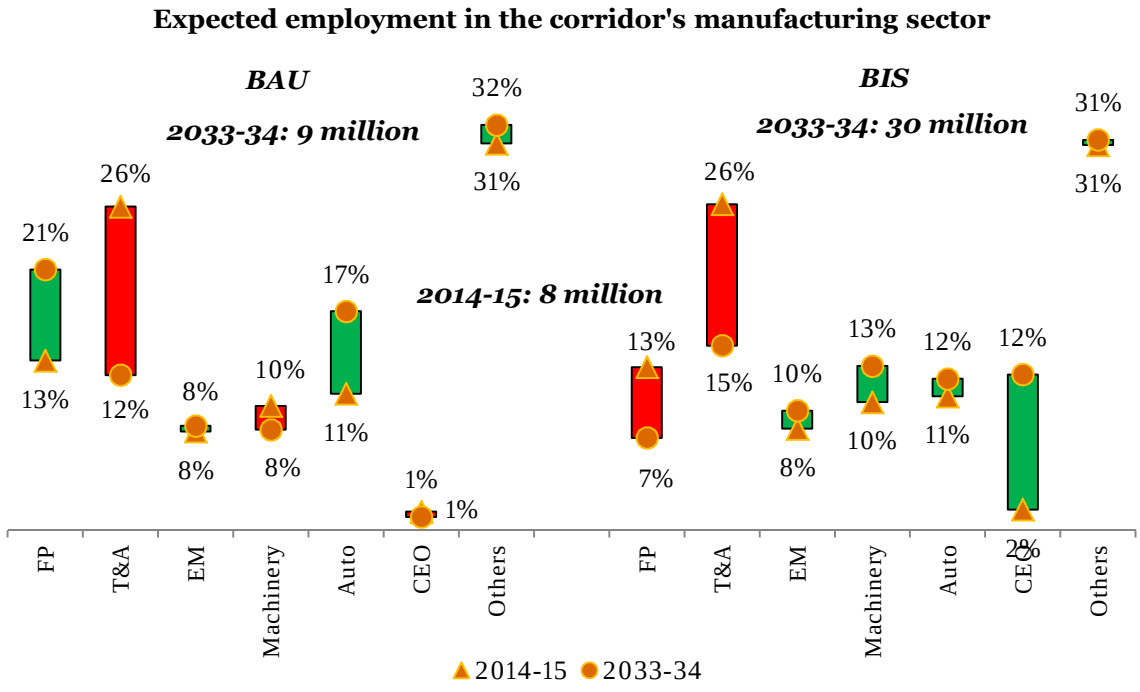


Source: ASI, PwC analysis

Figure 14: Contribution of top Sector's to corridor's Gross Value Added

Employment Creation

In terms of employment, Food processing, Textiles and Apparels, Electrical Machinery, Machinery, Automobiles and CEO sector are expected to generate around 70% of the employment. Proposed interventions in these sectors will help in increasing job creation by 1 million under business as usual to 22 million under the BIS scenario. In addition to this, IT sector is expected to generate an additional employment of around 10 million by 2033-34 in the corridor districts.



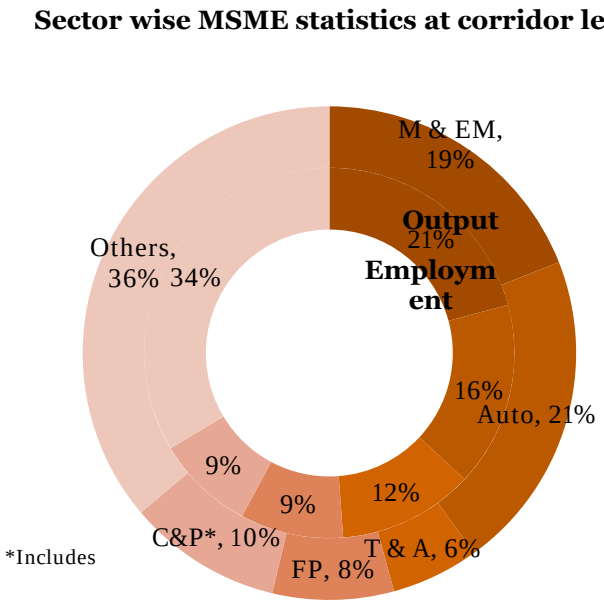
Source: NMCC, PwC analysis

Bars in green represent increase in % contribution to corridor's employment - 2013-14 vs. 2033-34
Bars in red represent decrease in % contribution to corridor's employment - 2013-14 vs. 2033-34

Figure 15: Expected employment in corridor's manufacturing sector in 2033-24

Thrust to MSME

Machinery, Electrical Machinery, Automobiles, Textiles and Apparels, Food Processing, Chemical & Petrochemical and Pharmaceuticals are likely to play a key role in developing the MSME output. These sectors together contribute to around 65% of the employment in the corridor in the MSME sector. For MSMEs to flourish in the corridor it would be essential to focus on these sectors and take steps to overcome the challenges faced by enterprises across all sectors.



Source: Final Report, Fourth All Inida Census of Micro, Small and Medium Enterprises, Ministry of MSMEs, GoI, PwC analysis

Figure 16: Contribution of major sectors to employment in the MSME sector

Achieving higher value addition in key industries

Automobiles, Pharmaceuticals, Machinery, Electrical Machinery, Textiles and Apparels and Medical Equipment are among the highest value addition sectors. Amongst these, Pharmaceuticals and Electrical Machinery are expected to be the key drivers of value addition. Technical textiles and apparels segment are expected to have a higher value addition when compared to other segments in Textiles and Apparels sector. In addition to these sectors, Medical Equipment which is a sunrise sector in India is expected to be high on value addition and will be majorly driven by product innovation in India.

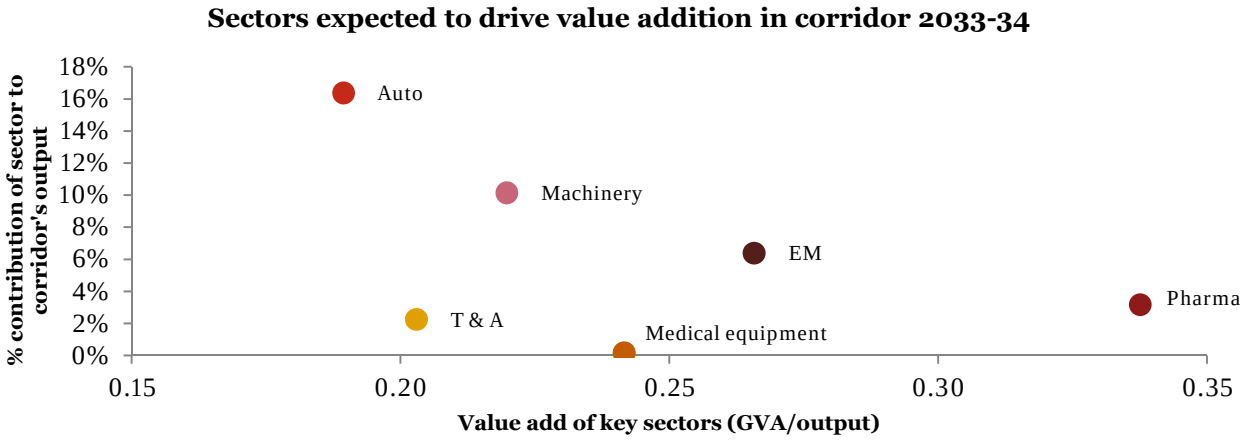


Figure 17: Focus sectors to increase corridor's value addition in the manufacturing sector

Prioritising sustainable development

The corridor will focus on promoting sustainable industrial development by focussing on efficient use of resources like Power, Water, and Land. Also, the corridor will promote green mobility through auto sector investments in electric vehicles and green energy through renewable energy sector investments. The food processing, pharmaceuticals, chemical & petrochemical, metallurgy are identified as highly polluting sectors. These sectors are also going to drive investmens within the corridor. Secondly, while MSMEs contribute to over 40% to industrial production, they account for substantial pollution i.e. 70% of the total industrial pollution load of India. Regulatory mechanisms to ensure compliance are ill-suited towards MSMEs, as they are tailored more towards larger industries, creating a scenario where MSMEs are unable to comply with regulations. Such approach will have to be avoided. The key strategies identified to ensure sustainability are:

- Incentivising scrap consolidation and recycling to reduce natural resource exploitation
- Incentivise products that are energy efficient and low on emissions
- Incentivise use of energy efficient machinery through subsidies
- Identify ways to prevent pollution at source through setting up of treatment plants. etc
- Improve efficient utilization of resources through productivity optimization projects, etc

Exports

Automobiles, Textiles & Apparels, Computer, electronic and Optical products (CEO), Pharmaceuticals and Food processing sectors are likely to drive exports in the corridor. Automobiles and CEO sector has the potential to drive over 50% of the exports from the corridor followed by Textiles & apparels, Pharmaceuticals and Food Processing.

Growth Scenario of CBIC at a glance

Two scenarios Business As Usual (BAU) which assumes Corridor's GDP to grow at the same rate based on past performance and Business Induced Scenario (BIS) which assumes GDP growth of around 12% with aggregation of vision and ambitions of different sectors were prepared for the analyses.

CBIC region can grow at 8-12% per annum, taking share of manufacturing to 17-25% and generate between 4-22 million employments in manufacturing, over the next 20 years.

By 2033-34, at an accelerated average growth rate of 12-13%, CBIC corridor GDP is expected to growth to more than twice the size it would have grown under business as usual case. Manufacturing contribution shall increase from around 17-18% currently to 24-25% in 2033-34. In addition CBIC will create 22 million new jobs instead of 4 million additional jobs that corridor would have created in business as usual scenario.

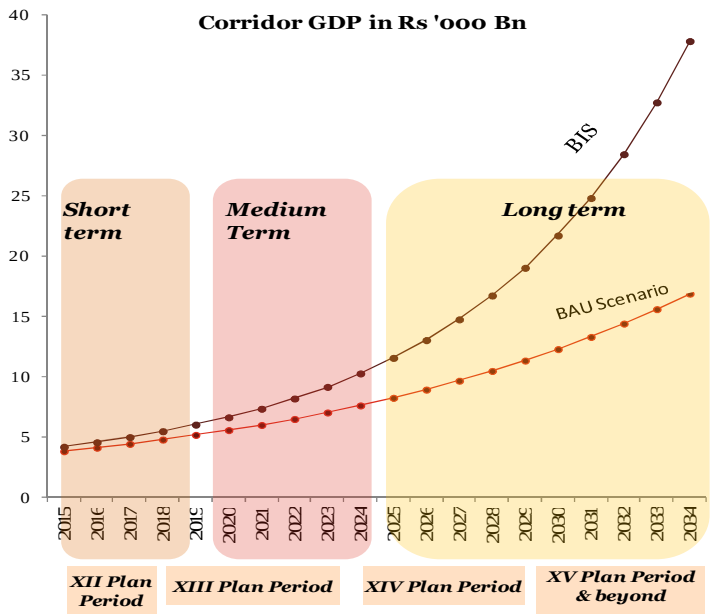


Figure 18: Corridor GDP

Overall, with efficient implementation of the proposed strategy and interventions, the corridor shall successfully deliver its vision of being a globally competitive manufacturing hub that can make sustainable economic and environmental impact locally.

Business As Usual (BAU)

- Corridor GDP grew at ~8.7% between 2006-13
- Corridor's GDP assumed to grow at the same rate based on past performance

Business Induced Scenario (BIS)

Activating the levers

Having identified the strategy to achieve the desired objectives of the vision, it is now important to understand what intervention shall be necessary to enable the sectors to move to a higher trajectory. In this context, a development framework comprising three elements – Economic enhancers, administrative enhancers and value enhancer has been created that attempts at improving the corridor competitiveness across individual sectors.

Economic enhancers refer to the interventions required in terms of industrial and support infrastructure to industries to operate efficiently.

Corridor competitiveness		
Economic enhancers	***Administrative enhancers***	***Value enhancers***
• Development of quality integrated industrial infrastructure • Promotion of local factor cost advantages • Easy of access to consumption markets and gateways to markets • Reliable availability of FoPs	• Institutional reforms • Regulatory & policy support (economic, trade, financial and tax systems) • Ease in doing business	• Productivity enhancement • Efficiency in resource use • Technological readiness and upgradation • Skill development • Effective supply chain • Research and development • Value addition

Administrative enhancers refer to the soft policy interventions that can enhance competitiveness and ease of operation of industries

Value enhancers refer to interventions that can directly or indirectly impact the operation of the industries to higher efficiency and improved value delivery.

Table 12: Enhancers by Industry

Sector	Economic enhancers	Administrative enhancers	Value enhancers
Auto	• Government needs to focus on developing the entire value chain by focusing on cost competitiveness, promote quality in the automobile sector and dissuade OEMs from bringing supplier network • Connectivity infrastructure for industrial parks with key ports within the corridor • Port capacity addition required • Ensure stable supply of water and power	• One of the key issues faced by foreign investors in India is the complicated and inconsistent tax system. There is a frequent change in the tax laws. Additionally, CST also acts as a hindrance for interstate transactions. • Currently, majority of the investments in the sector are in the OEM and Tier I sector. Majority of the foreign players are importing Tier I and Tier II parts from their base location. Hence, Specific plans need to be made to promote investment of Tier-2/Tier-3 industry members in India.	• 10-30% of the total production workers are employed on contract basis. Reducing the number of contract labours by giving flexibility in regulations to hire employees. • The Government needs to significantly strengthen non-proprietary R&D and design capacity that has strong connections with research institutes like IITs • Facilitate additional courses to cater to upcoming demand for skilled workforce in the corridor
CEO	• Availability of industrial land and improved availability of power • Improved logistics infrastructure and integration with global supply chain network	• Tax structure needs to be improved. India's current tax structure makes the final product less competitive and encourages low cost imports • Preferential market access for local companies needs to be improved. • Flexibility in labour laws is essential to cater to rapid seasonal variation in demand.	• Reliance on imports for raw materials needs to be reduced • China and Taiwan are key competitors that have invested heavily in research and development. Economies of scale create global competitiveness. The focus area should be adding more value to the existing products and creating new products through investment in R&D. • Availability of quality manpower
Pharmaceuticals	• High quality of utility infrastructure required – water availability and treatment, power availability and quality • Establishing clinical research facilities with private partnerships	• Incentivize R&D in product innovation and Good Laboratory Practices (GLP) • Improve regulatory mechanism for approval of clinical trials • Introduce reforms in health care insurance sector	• Facilitate assistance in technology transfer through collaborations with MNCs • Upgrade and design new courses in the institutes which cater to the industry requirements • Create dedicated R&D institute for promoting product innovation and facilitate creation of product promotion centers for SME players
Food Processing	• Development of support infrastructure in the form of warehousing/ cold storage infrastructure and customized transportation network required • Reduction in raw material costs and losses by bringing in efficient logistics network. Last mile connectivity should be improved in order to strengthen the linkage between raw material supplier and processing units	• Government should promote reliable and strong supply chain network between raw material suppliers and processing units on PPP basis • There is a need to introduce uniform tax rates in all states avoiding multiplicity of taxes at different stages. • Systems and procedures may be simplified. The need for documentation/ paperwork at multiple checks posts and in different states, customs formalities, needs to be reduced.	• Awareness on quality standards could be created through seminars, newsletters and training programmes • The linkage between government agencies, universities, industry and other stakeholders like cooperatives, farmer organisations etc needs to be strengthened • Government should provide support to clusters in form of credit, inputs, expertise and marketing links • Focus on improving the quality of products

Sector	Economic enhancers	Administrative enhancers	Value enhancers
			Specific incentives to be given to encourage product diversification and increase production of value added products
Machinery and Electrical Machinery	• Ensure availability of raw material (CGRO/CNGRO* electrical steel) – clear certification mechanism for importers in the short run and setting up indigenous facilities for electrical steel production in the long run • Strengthening rail network (specially Bengaluru rural, Krishnagiri, Thiruvallur) as necessary requirement to transport over dimensional consignments • Set up indigenous testing and calibrating facilities for equipment testing	• Promote technologies upgradation, new technology introduction and accordingly modify the existing procurement policies by PSUs/utilities to facilitate technology absorption by electrical machinery and machinery manufacturers. • Quality control mechanisms and certification systems in the sector to ensure product quality control (supplies from vendors and end-products) • Transition from import dependent to export oriented sectors: in the short run - support indigenous manufacturers, by putting restrictions on second hand equipment, mandating foreign partners to foster technology transfers along with setting up manufacturing facilities; in the long run – export promotion polities; preference to joint ventures, not 100% foreign owned companies	• Establishment of linkages between industry and academia – active involvement of public and private participation to bridge growing skill erosion • Support/incentives to the manufacturing units in setting of R&D facilities (especially MSMEs) • Enhancement of value addition – incentives to the foreign players to increase value addition in India under technology transfer, roadmap for setting up facilities for manufacturing of automation equipment indigenously
Metallurgy	• Rail connectivity from mines and industrial units of Bellary to Chitradurga, Anantapur and Chittoor districts to Krishnapatnam, Managlore and Chennai Ports • Railway connectivity from Nellore to West Godavari, East Godavari mines • Expanded power generation and transmission initiatives adding sufficient capacity and covering identified nodes	• Policies to provide power tariff subsidies for first 5-10 years of operation • Further allocation of mines to companies planning to set up smelter units in the corridor • Creation of state owned enterprises focused on scrap consolidation and recycling. This would address raw material bottlenecks as well as make the industry greener.	• Technological linkages with countries like Japan who have been top exporters in spite of scarcity of raw materials • Knowledge Transfer Partnerships to create larger institute-industry interface and focus on employable workforce • Improved R&D on mineral exploration and environmental friendly linkages
Medical instruments	• Infrastructure for uninterrupted power supply • Mixed cluster approach with electronics and electrical industry to enable synergies	• Quality standard norms to discourage low quality imports and give boost to domestic industry • State level healthcare initiatives in segments like telemedicine/portable clinics that can provide boost to portable device segment • Enhance branding of the industry in the corridor through initiatives like medical technology parks	• Incentives for R&D in hi-tech medical equipment segment e.g. pooled fund to support R&D within SMEs • Better grants in biomedical instrument or like subjects to attract brighter research talent • Focus on creating employable workforce
Textiles and Apparels	• Subsidizing unit rates of power or encourage usage of non conventional energy sources. Develop dedicated/captive power generating	• Regulations need to be focused on controlling raw material exports to ensure stable prices in the country and to make the sector more	• Technological upgradation, modernization of units and Automation needs to resolve the problems of shortage of labour, poor quality of

Sector	Economic enhancers	Administrative enhancers	Value enhancers
	sources specifically for the major textile clusters. • Concerned Ministries, Departments, State government need to be focus on reducing the transit time and cost at the international check points to make Indian textile products more competitive.	competitive and productive • Reimbursement schemes such as duty drawback, market development assistance etc to reduce the impact of exchange rate fluctuations • Labour laws need to be made more flexible to permit longer hours of overtime with due compensation, and to allow flexi-hiring of labour	product and will lead to higher productivity • Vocational training through ITIs, Textile Design & Management Institutions specially in the area of Apparel Manufacturing, Quality Control and Designing needs to be encouraged so that skilled work force is available • Amendment to Labour Laws is needed, to permit longer hours of overtime with due compensation, and to allow flexi-hiring of labour, especially to support apparels sector
Chemical and Petrochemical	• Develop freight corridor between Bengaluru rural and Chennai seaport, to promote exports of chemicals and petrochemicals • Improve rail connectivity between Bengaluru rural and Chennai seaport • Ensure feedstock availability of natural gas and naphtha	• Consolidate acts into an Integrated Chemical Legislation, simplify regulatory structure and strengthen regulations and ensure stricter enforcement of regulations and promoting green manufacturing practices • Rationalize taxes and duties to promote domestic manufacturing • Incentivize the MSME players to increase the sectors' presence in the MSME segment along the corridor districts	• Set up a dedicated R&D centre and Centre of Excellence for Specialty Chemicals • Incentivize industry players to follow best practices of manufacturing like higher efficiency, latest technologies; promote “zero discharge” technologies • Establish a CBIC Chemical Innovation Fund to encourage commercialization efforts for innovations generating inclusive growth

Below the past growth trends and possible investment districts for key sectors are summarized.

Table 13: Summary of key sectors – historical growth rates and key districts for investment

Sector	Output growth India (CAGR)	Key districts for investment in the corridor
Computer, electronics and optical products	15% (2006-11)	Chennai, Kancheepuram, Bengaluru urban, Bengaluru rural
Metallurgy	14% (2004-12)	Chitradurga, Anantapur, Chittoor, Nellore, Tiruvallur, Thiruvannamala, Kancheepuram, Tumkur, Bengaluru rural
Textiles and Apparel	17% (2006-11)	Tiruvallur, Dharmapuri, Kancheepuram, Bengaluru Rural, Bengaluru Urban, Chitradurga
Food processing	20% (2009-11)	Nellore, Chittoor, Tiruvannamalai, Dharmapuri
Pharmaceuticals	14% (2008-12)	Bengaluru Urban, Bengaluru Rural, Chennai, Kancheepuram, Nellore
Chemical and petrochemicals	11% (2009-13)	Bengaluru Urban, Bengaluru Rural, Ramnagara, Chennai , Tiruvallur
Electrical machinery	23% (2009-11)	Kancheepuram, Chittoor, Chennai, Bengaluru urban, Bengaluru Rural, Krishnagiri, Tiruvallur
Machinery	14% (2009-11)	
IT and financial	8% (2008-12)	Bengaluru Urban, Bengaluru Rural, Chennai

Regional industrial agglomeration creates the advantages of districts including cost competitiveness, availability of skilled manpower and robust MSME base.

Cluster advantage

- Automobiles- clustered around **Chennai;** Corridor accounts for about 60% of India's automotive export
- IT/ITeS - about400 of the Fortune Global 500 companies outsource their IT/ITeS/other services to firms in **Bengaluru & Chennai**
- 30% of Japanese companies in the region

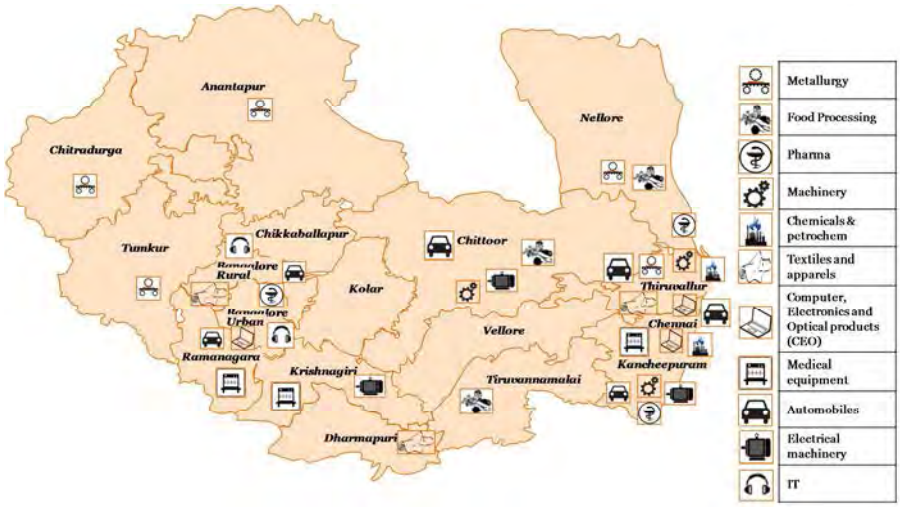


Figure 19: Key Potential Sectors

Factor cost advantage

- Textiles - **Kancheepuram** hub of silk weaving and handloom industries of India
- Food Processing – strong availability of raw materials in **Nellore**
- Leather – **Vellore** accounts for about 37% of the country's export of leather products

Skilled manpower availability

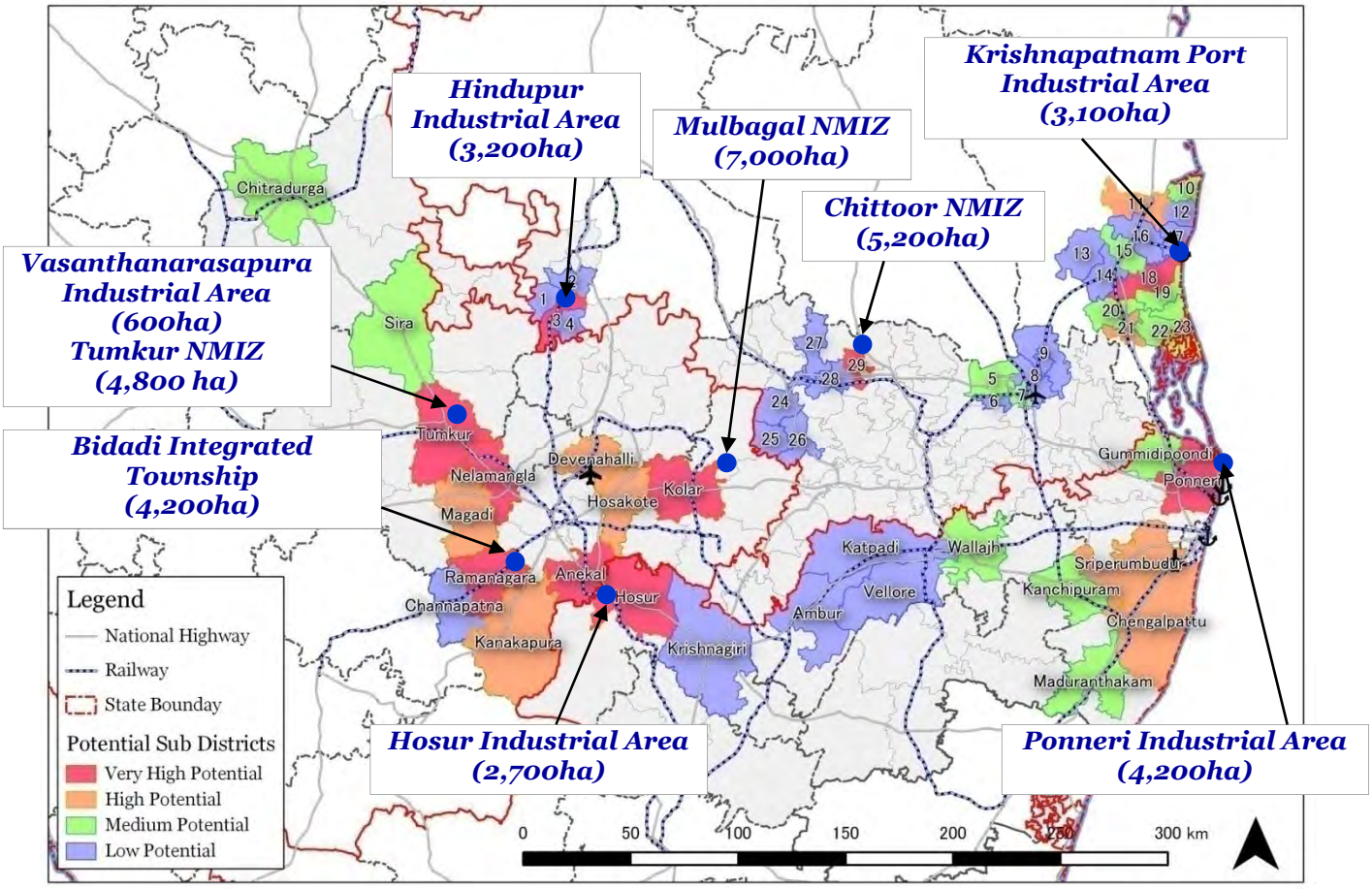
- **Bengaluru** is the 4th largest technological cluster in the world after Silicon Valley, Boston and London.
- About 50% of MNC R&D centres in India are based in Bengaluru

Robust MSME base – vibrant base of MSMEs accounting for about 15% of India's MSME units

Development Plan
Node Development

One of the objectives of the JICA CBIC study is to identify suitable nodes for industrial development within the CBIC area. In this regard, the JICA study team undertook i) an analysis of node development potential including the potential zones at a broad level, ii) an assessment of potential areas at a sub-district level for development of industrial nodes, iii) a confirmation of the ground situation and potential of shortlisted nodes including prospects of investment from Japanese Companies, and iv) proposition of industrial nodes for the master plan.

The detailed assessment at sub-district level was done considering: i) accessibility to regional trunk roads, ii) existence of protected/restricted areas, iii) government land availability and availability of proposed industrial development areas, iv) water availability, v) assessment of urban planning strategy, vi) existing and planned industrial areas, vii) accessibility to major transport facilities (port and airport), and viii) accessibility to electricity network. Subsequent to the detailed assessment, sub-districts that had very high potential for industrial nodes were identified through discussion with the state governments and 8 nodes were shortlised as shown in the follwing map.



Source: JICA Study Team Analysis

Figure 20: Location of Shortlist Nodes

Additional land development of the industry area of 20,000 ha will be required for the CBIC region to achieve BAU (Business as Usual Scenario) and the development of all 8 nodes, amounting to about 35,000 ha, are considered to be necessary and high priority. The total estimated industrial land demand is estimated to be 79,000 ha under BIS case.

Infrastructure Development

Importance of Infrastructure Development

Availability of adequate infrastructure is critical for attaining the vision and industry potential for the corridor. The criticality of infrastructure for development and sustenance of various key focus sectors is shown as under. The strengthening of various infrastructure components such as transport (covering railways, road, ports and airports), water and power would be required for achieving the vision for the corridor.

Table 14: Criticality of Infrastructure by Industry

Industries	Water	Power	Road connectivity	Rail connectivity	Ports	Airports
Metallurgy	◔	●	●	●	◑	◔
Medical equipment	◔	●	◔	◔	◔	◔
Food processing	◔	◑	◔	◔	◑	◔
Textiles	●	◔	◔	◔	●	◔
Electrical machinery	◑	◔	◔	◔	◔	◔
Machinery	◑	◔	◔	◔	◔	◔
Chemicals	●	●	●	◑	◔	◔
Pharma	●	●	●	◑	◔	◔
Auto	◔	●	◔	●	◔	◔
Computer, electronics	◔	●	◔	◔	◑	◑

Importance: ● Critical ◔ High ◑ Medium ◔ Low

The table above summarizes findings with regard to importance of each infrastructure component based on sector analysis and stakeholder interactions.

The development strategy of critical infrastructure elements such as transport (covering ports, roads, railways, urban transport, logistics and airports), water, energy and solid waste management are summarized below.

Transport

Availability and affordability of adequate transport infrastructure is a necessary element to enable development of industrial sector. The Global Competitiveness Report 2013-14 by the World Economic Forum assesses quality of infrastructure (including roads, railroads, ports and air transport infrastructure) as one of many different components measuring different aspects of competitiveness. On a scale of 1-7, following is India's score against competing countries for manufacturing sector investment.

Table 15: Global Competitiveness Index

Global competitiveness index	India	China	Thailand	Korea
Quality of **roads**	3.6	4.5	5.0	5.8
Quality of **railroad** infrastructure	4.8	4.4	2.6	5.6
Quality of **port** infrastructure	4.2	4.5	4.6	5.5
Quality of **air transport** infrastructure	4.8	4.5	5.7	5.2

India's score against competing countries is relatively low for road and port infrastructure. India's railroad and air transport infrastructure are relatively close to competing countries standards.

Transportation via road is significant as compared to rail in the CBIC region. The modal split of cargo, mainly containers, moving for imports and exports from Chennai port is 95% and the rail is 5%. The current rail work is heavily dominated by passenger services and less orientated towards freight traffic. Further, critical portions of the rail network in the CBIC region stands utilized at over 100% causing congestion and limited bandwidth to increase the frequency of freight trains. While this has been a cause for concern, bottlenecks in the cities of Bangalore and Chennai and poor last mile connectivity to ports have contributed to slow movement of cargo in the region. The time taken for transportation of goods from the Bangalore region to Chennai and vice versa is almost 6-7 days, rendering loss of competitiveness according to industry stakeholders.

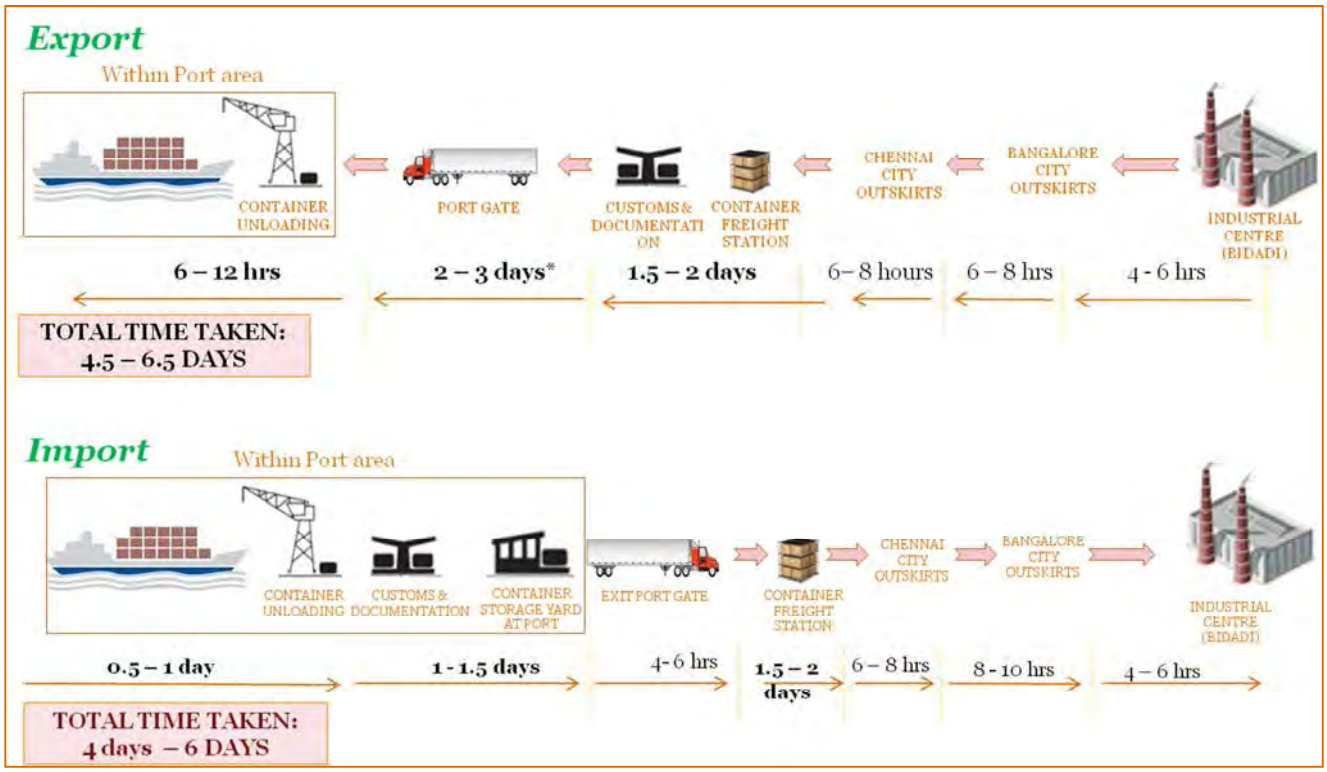


Figure 21: Time taken in movement of Export and Import containers between Chennai Port and Bidadi Industrial Area

The delays in transit of goods are caused due to inadequate infrastructure at the cities for smooth movement of cargo, poor last mile connectivity at ports causing trucks to heavily queue at the port and lengthy customs procedures at ports. These issues arguably add to loss of competitiveness of the region.

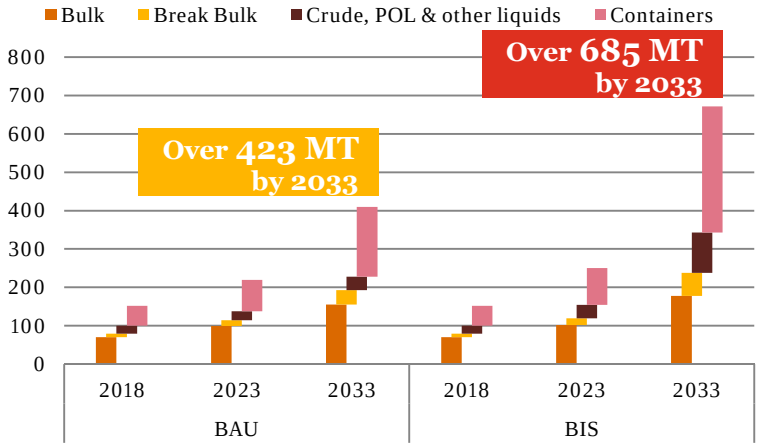
The focus of the transport sector strategy is aimed at addressing the critical bottlenecks over the short term. Over the medium to long term, the need for additional projects have been analyzed for various transport sub-sectors (covering ports, roads, railways, urban transport, logistics and airports) in order to meet future growth needs of the corridor in consideration of the future industry potential.

Ports

Manufacturing led growth expected to drive port traffic in the CBIC region to over 685 MT

The ports serving the CBIC region include Chennai Port, Ennore Port, Kattupalli Port and Krishnapatnam port. These ports jointly handled traffic of 92 MT in the year 2012-13. The manufacturing-led growth in the CBIC region is expected to be the major driver for increased traffic at ports in the CBIC region. The traffic at the ports is expected to reach 423 MT in the BAU scenario and to over 685 MT in the BIS case by the year 2033. This increased cargo traffic at the ports in the CBIC region are likely be comprised of the major commodity segments such as bulk and containers collectively accounting for over 75% of the total traffic at the ports in 2033 in the

BIS case. Other segments such as POL and break-bulk are expected to account for 16% and 9% respectively in 2033 in the base case. The ports of Chennai, Ennore, Kattupalli and Krishnapatnam are to jointly account for a traffic handling capacity of close to 600 MT in 2033.



Source: JICA Study Team analysis

Figure 22: Port Traffic in the CBIC Region

The port sector strategy puts the spotlight on improving the existing infrastructure and connectivity at the ports in the CBIC region in order to maximize the use and effective use of these ports. The effective use of ports is impacted by critical parameters such as efficient road and rail connectivity to the ports that enable faster & efficient evacuation of cargo at the ports. A host of connectivity improvement projects have been committed for implementation at Chennai and Ennore ports. Timely & successful implementation of these projects is critical and central to effectively utilizing the ports. The projection of traffic and criticality of these connectivity improvements are discussed over the short and medium to long term.

The overall port capacity in the region is expected to be sufficient over the short term (up to 2018) and over the medium term (up to 2023) subject to timely commissioning of planned berth side and connectivity improvement projects at Chennai & Ennore Ports and the berth side capacity expansion / new capacity creation projects at Kattupalli and Krishnapatnam ports as well.

However, as visible from the following graph, port capacity is expected to fall short of the capacity requirement over the long term (in 2023). The capacity deficit is expected to be around 134 MT for container traffic, 140 MT for dry bulk and around 105 MT for all other commodities combined.

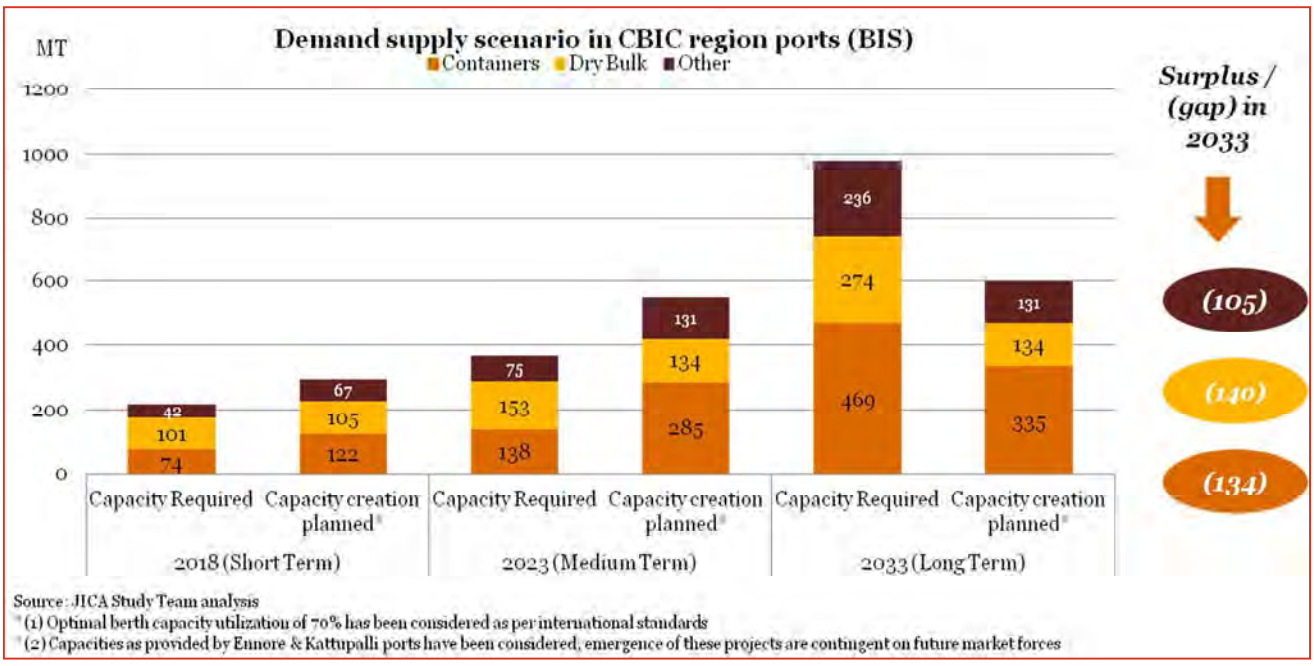


Figure 23: Demand Supply Scenario in CBIC Region Ports (BIS)

Container Traffic & Capacity in CBIC region:

Short-term scenario:

Over the short term, the major bottleneck in the transportation of containers is expected to be the limited road capacity available at the roads connecting the ports. However, there is significant capacity addition planned in enhancing road connectivity to the ports in the CBIC region. Some of these proposed projects are the ongoing elevated road corridor from Maduravoyal to Chennai Port, the Ennore – Manali Road Improvement Project, the proposed Northern Port Access Road etc. Thus the enhancement in the road-based evacuation capacity over the short term is expected to resolve the current congestion issue at the ports for the movement of road-based cargo including container cargo. The ports in the region shall also need to undertake port-gate capacity enhancement projects to meet the traffic flow requirements.

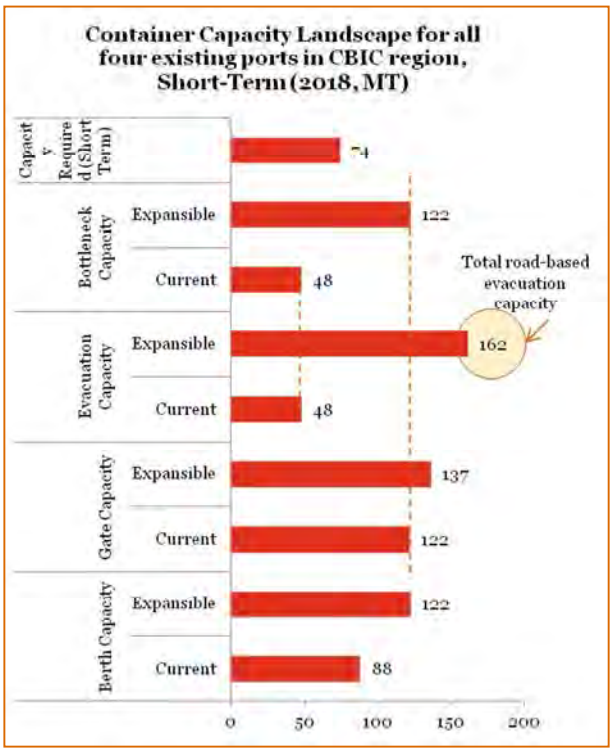


Figure 24: Container Cpacity Landscape for Four Ports in CBIC Region (Short-Term)

Medium-term scenario:

Over the medium term, the major capacity additions expected for containers in the region include the proposed Container Terminal – 2 project at Ennore Port and the conversion of the JD Dock into the Container Terminal at Chennai Port. The restructured MEGA Container Terminal Project in the form of the Project Outer Harbour is also expected to add around 0.74 MnTEUs container capacity in 2019 and a total container capacity of 1.48 Mn TEUs upto 2026 to the ports in the CBIC region.

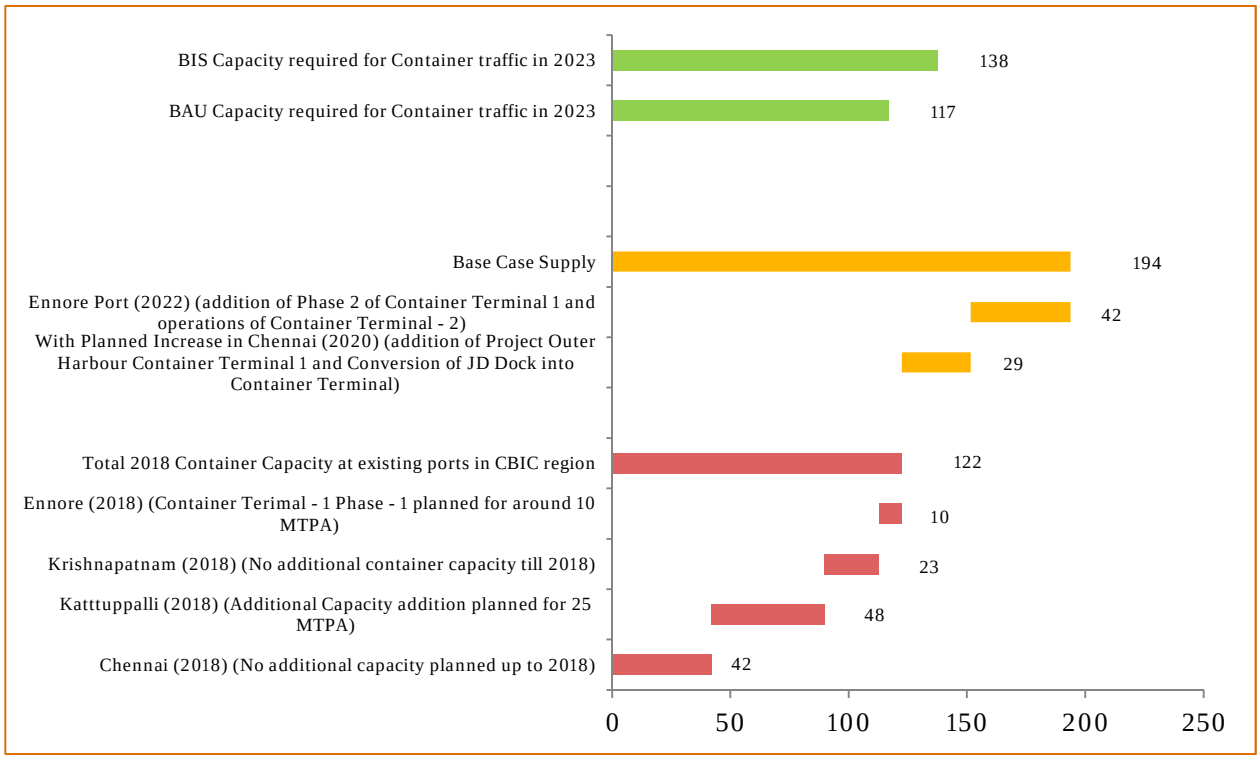


Figure 25: Major Capacity Additions for Containers in CBIC Region

As the graph above suggests, the planned additions in container capacity at the ports (Chennai, Ennore & Kattupalli) in the CBIC region are likely to be sufficient to meet the capacity requirements in the BAU and BIS scenario over the medium term. However, the container berth capacity expansion projects planned over medium term also face some risks and overcoming / mitigating these risks is essential to ensure sufficient capacity at the ports in the region. These risks pertain mainly to risk of materialization of the proposed investments in the planned infrastructure development, planned capital infusion not being targeted to handle the changing shipping trends across the world and the availability of deeper draft berths and better land-side evacuation at neighbouring ports. The materialization of these risks may have the potential to draw traffic away from the established ports of Chennai and Ennore.

Long-term scenario:

In the long run, while the ports at Chennai, Ennore, Kattupalli and Krishnapatnam shall be able to cater to the container traffic in the BAU scenario, the requirement for 1-2 additional deep sea ports for handling the container traffic in the BIS case shall arise.

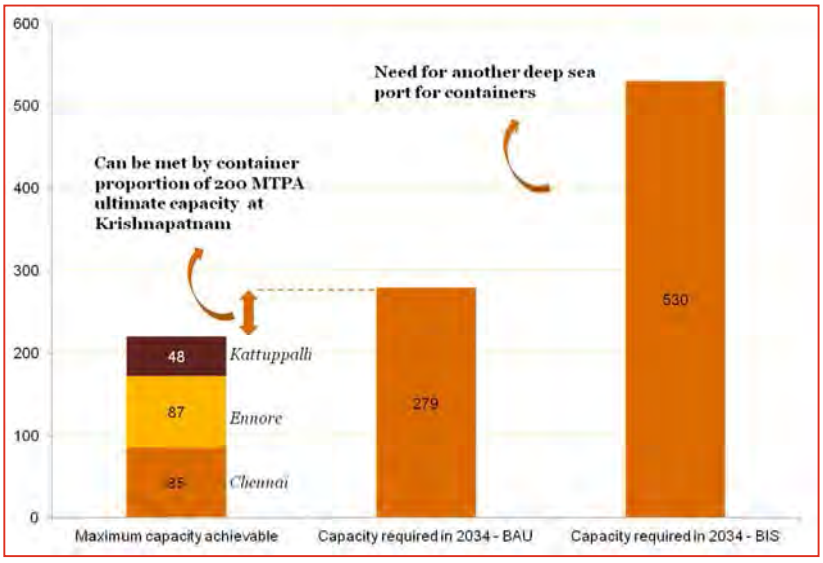


Figure 26: Container Cpacity Required in CBIC Region

Coal Traffic & Capacity in CBIC region:

Coal is the second major commodity which is expected to form a substantial portion of the port traffic inthe CBIC region. The Chennai Port has recently stopped handling thermal, coking and other coal as well as other dusty cargo due to its emphasis on handling clean cargo. Due to this, the coal traffic is likely to shift to Ennore Port which also caters to a substantial coal requirement of TNEB power plants in the region. Krishnapatnam is also likely to emerge as the port of choice for coal traffic in the CBIC region and is expected to cater to the UMPP as well as other thermal power stations in the vicinity. Cheyyur, which is planned to be developed as a captive coal handling port, is likely to cater to the requirement of the Cheyyur UMPP.

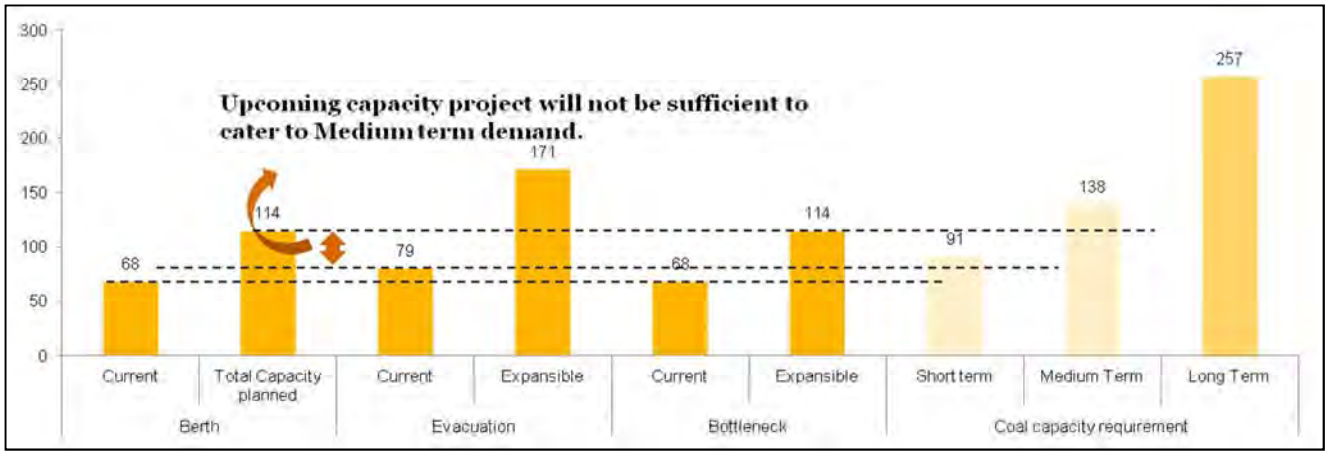


Figure 27: Coal Handling Capacity at the Ports in CBIC Region

As the figure above suggests, while the short term requirements can be met by the proposed capacity additions planned in the short term at the ports in the CBIC region, a medium-to-long term coal strategy shall be important to meet the coal handling capacity requirements in the region.

Enhancement of ports' internal efficiency is equally important:

With the expected completion of last mile road connectivity projects such as Ennore Manali Road Improvement Project (EMRIP) and Elevated corridor to Maduravoyal and the existing rail evacuation capacity, the road based evacuation capacity of the port (coupled with rail) is expected to reach 83 MT. This evacuation capacity is expected to be sufficient for evacuation of land based cargo handling capacity of 68 MT, but could create constraints during peak times. Considering growing urbanization and rigid land use patterns, no further connectivity improvements would be practically possible around the Chennai region benefitting Chennai Port. The port target implementing the efficiency improvement measures recommended by OCDI as part of the JICA sponsored study (concluded in February 2014) which involve the below key immediate measures:

Efficiency improvement measures recommended by OCDI
Termination of export containers having insufficient documentation at CFSs and CWC
Shift trailer inspections to the off-dock parking area instead of at the port gate
Relocation of customs gate from the terminal gate to the port gate
Regulation of idling trailers in the port
Establishment of a common portal web system
Authentication of trailer's port pass by introducing information technology systems

Over the long term, the capacity of the region's ports turn insufficient triggering need for additional port handling capacities

Over the long term (2033), the port traffic in the region is expected to be in the range of ~430 MT to ~685 MT (BAU and BIS cases respectively) by 2033. This is expected to be largely contributed by the segments of bulk (32%), POL (12%) and containers (47%). While the short term and the medium term scenario present sufficient capacity for most commodities (except bulk in medium term), there is likely to be capacity shortfall

Table 16: Deficiencies in Port Handling Capacities

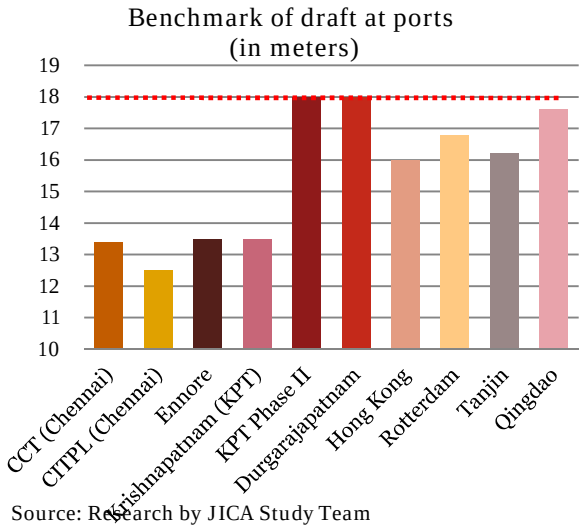
Deficiencies for segments (BIS)	2018	2023	2033
Bulk	-	18	140
Break Bulk	-	-	33
Crude, POL & other liquids	-	-	72
Containers	-	-	134

Krishnapatnam and Durgarajapatnam have significant potential to cater to the region's growing demand and emerge as next generation ports

The ports of Chennai & Ennore are expected to have a joint container handling capacity of ~122 tonnes by 2023. Further, the draft in these ports are around 13.5 meters limiting their abilities to handle large sized vessels (DWT 250,000 & above).

Ports in India such as Mundra are designed to handle ships of the size of ~250,000 DWT, owing to presence of a draft of over 18 meters that considerably reduce the costs of shipping by around 30%-40% thus making sea transportation costs competitive.

The CBIC region exhibits critical competitive advantages for creation of large "next generation" ports having the ability to attract large vessels contributing to significant reduction in costs of transportation of cargo. Some of the key factors that are critical for creation of world class ports are presence of a deeper draft, presence of Greenfield locations to exercise freedom of planning of port



Source: Research by JICA Study Team

Figure 28: Benchmark of Draft at Ports

infrastructure and associated storage & connectivity infrastructure, and presence of a strong economic hinterland capable of generating large volumes of cargo.

Presence of deeper draft to accommodate larger vessels

Presence of a large economic hinterland for generaing large cargo volumes

Greenfield locations to exercise freedom of planning & development of ports and connectivity infrastructure

Krishnapatnam port (phase II) and the planned Durgarajapatnam port have a draft of 18 meters, which could be one the deepest in the world and higher compared to Qingdao in China which has the deepest operating draft of 17.6 meters.

Large volumes of containers are required to attract large sized vessels. The port of Yangshan off the coast of Shanghai, which attracts large sized vessels, is preparing for a capacity expansion to 13 million TEUs by 2020. Khalifa Port in UAE, which also attracts large sized vessels, has planned a capacity expansion to 12 million TEUs by 2030. The container traffic in the CBIC region is expected to reach 10 million TEUs and 19 million TEUs in the BAU and BIS cases respectively in 2033. Almost 50% of these volumes are expected to be handed in the Krishnapatnam belt. Though the CBIC region accounts for significant volumes, the abilities of the ports of Krishnapatnam and Durgarajapatnam to adequately expand their capacities to global levels would need to be examined.

The areas around Krishnapatnam port and proposed Durgarajapatnam port are relatively less urbanized and greenfield thereby providing the advantage to develop world class port infrastructure in a phased manner with enhanced scope for evacuation at the ports. It is necessary that the development plan for these ports consider regulating the development around these ports in a manner that the efficiency of these ports is retained over a longer time horizon of 30-50 years.

Considering the above factors, Krishnapatnam and Durgarajapatnam have the potential to emerge as next generation ports potentially emulating the standards of ports such as Mundra that have the capacities to handle large sized vessels. This requires further examination from technical perspectives and it is suggested that the above competitive advantages be sufficiently considered in the expansion of Krishnapatnam port[5] and development of Durgarajapatnam port.

The Government of Karnataka plans to develop the ports on the western coast of the state with an eye on the strategic and economic benefits of these ports. Mangalore port is an important port on the western coast of the State of Karnataka. However, additional detailed studies are required to determine the issues related to seamless road and rail connectivity of the port at Mangalore to the proposed CBIC region.

Roads

Chennai and Bengaluru, the 2 major urban centres in the CBIC area, are linked by national and state highways, which also pass through many major towns. Approximately 2,942 km of national highways and 5,343 km of state highways have been identified in the CBIC area, with those lengths set to increase due to rapid urbanisation. Major road projects in the CBIC area that have been identified include: 8 ongoing projects, 5

[5] It is anticipated that the expansion plans of Krishnapatnam port shall be guided through a formal regulatory & approval process involving the State Government of Andhra Pradesh

announced projects, and 6 projects under study in Tamil Nadu, 5 ongoing projects, 7 announced projects, and 3 projects under study in Karnataka and 1 ongoing project, 2 announced projects, and 5 projects under study in Andhra Pradesh. These projects include the development of new urban ring roads and capacity improvements of major intercity roads.

Freight traffic volume in CBIC area has been increased as represent 13% average growth rate of container handling volume of Chennai port, and share of road transport in container transport is about 95% against about 5% by rail. Reliability of transit time is another major issue on road infrastructure. A lack of high grade road network connecting major logistical node and facilities and bottlenecks on road network are obstables.

Demand supply gap analysis under condition of no road development and traffic growth of BAU development scenario is carried out for year 2018, 2023, 2028, and 2033. As a result of above analysis, the share of over 1.0 vehicle congestion ratio of national highway network will reach almost 50% in Karnataka state in year 2018, in Tamil Nadu state in year 2023, respectively, while Andhra Pradesh state will maintain less than 50% of vehicle congestion ratio even in year 2033. The share of vehicle congestion ratio will rapidly grow in Karnataka state and it will exceed 90% in year 2033. The share of state highway network in Tamil Nadu and Karnataka will continuously increase as well as the national highway network of Tamil Nadu and Karnataka to reach at almost 50% in year 2028 and year 2023, respectively. It is obvious that immdediate supply of road capacity in an efficient manner is essential for the sustainable industrial development in CBIC area and comprehensive regional development.

Strategic policy measures of road sector is examined based on identified road sector issues, demand supply gap analysis result and the planning principle as follows:

- Strengthening of logistic road network

  - Formulation of major logistic network (primary logistic road network)

  - Formulation of network between primary logistic road network and major industrial node, sub centre, and logistic node / formulation of network between primary & secondary logistic road network and industrial park (secondary logistic road network / tertiary logistic road network)

  - Development of access-controlled expressway network

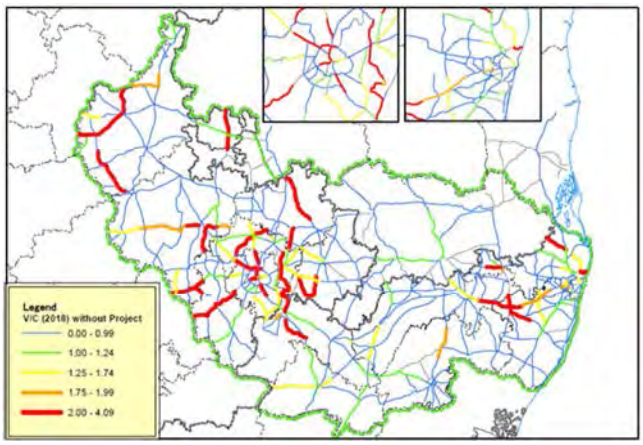
  - Congestion mitigation at metropolitan areas and major cities

- Enhancement of logistic road network capacity and level of service

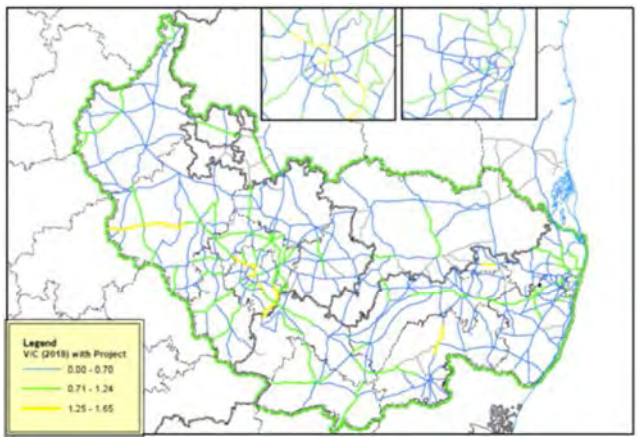
  - Widening of existing roads to respond future traffic demand

Based on examination of the strategic policy measures on road network in CBIC area, logistic road network in CBIC area is formulated. Capacity provision by widening is also examined on the logistic road network and in total, fifty four projects (including committed projects) for a length 2,975km have been proposed as strategic road infrastructure project. Seven projects are new project and forty seven projects are widening projects and total project cost of the logistic road network project is 5,871 million USD. Project costs of each term are 1,942 million USD in short-term, 2,087 million USD in medium-term, and 1,842 million USD in long-term.

In the short term, it is essential to develop urban ring roads at Metropolitan Areas. The lengths of committed and proposed road projects by implanting agencies and comparison of V/C ratio with and without projects are summarized below.



V/C rate in the short term
"Without Projects- BAU"



V/C rate in the short term –
"With Committed and Proposed Projects" - BAU

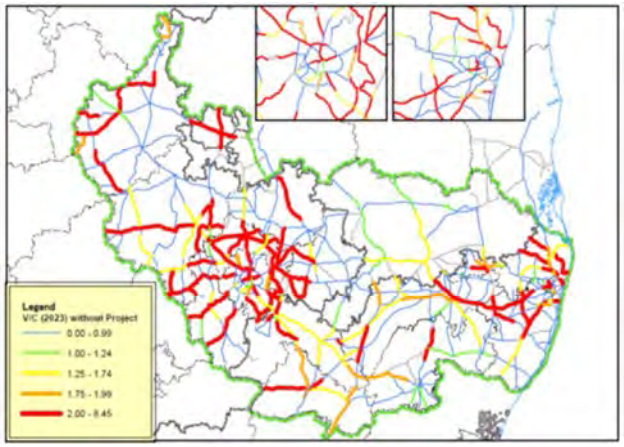
Source: JICA Study Team

Figure 29: Comparison of V/C rate in the Short Term

Table 17: Length of Committed and Proposed Projects in the Short Term

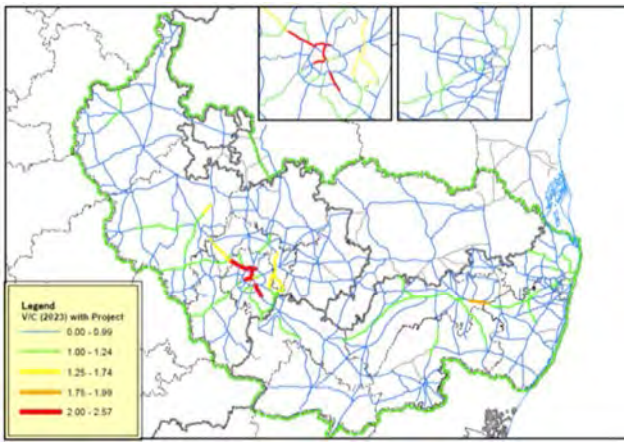
Ownership	Committed (km)	Proposed (km)
Tamil Nadu (SH)	104	39
Karnataka (SH)	65	170
Andhra Pradesh (SH)	-	33
NHAI	429	69

In the medium term, Chennai Bengaluru expressway will be needed by 2023, and Chennai peripheral ring road would also be required by 2023 to ease congestion.



V/C rate in the medium term

"Without Projects- BAU"



V/C rate in the medium term –

"With Committed and Proposed Projects" - BAU

Source: JICA Study Team

Figure 30: Comparison of V/C rate in the Medium Term

Table 18: Length of Committed and Proposed Projects in the Medium Term

Ownership	Committed (km)	Proposed (km)
Tamil Nadu (SH)	139	-
Karnataka (SH)	-	152
Andhra Pradesh (SH)	-	-
NHAI	328	416

Railways

The railway network in the CBIC area is 2,806 Km long covering three zones of the Indian Railways – Southern Railway, South Western Railway and South Central Railway. The network contains 22 routes and 66 line sections, linking Chennai and Bengaluru and providing through routes to other cities like Mumbai and Hyderabad. The network is mostly electrified within the Southern and South Central jurisdictions; however much of South Western Railway consists of single line, non electrified track (though some doubling and electrification is in progress). There are links to major industrial areas and ports at Chennai, Ennore, and Krishnapatnam.

Capacity saturation occurs when the number of trains each way per day exceeds 90% of the estimated daily train capacity. Nearly 37% of this network in terms of route km has either already reached or is fast approaching capacity saturation.

The Chennai – Bengaluru route currently carries 10.5m tonnes of through-freight. The freight includes bulk cargo (mainly coal, limestone and dolomite), break bulk (foodgrains and fertilizers) and containers. It is forecasted that in the BIS case, by year 2033, the Chennai – Bengaluru route will carry 65.2m tonnes of freight in total in both directions. It is expected that rail will also start carrying cars for export via Ennore. Coal from Ennore and Krishnapatnam is also expected to be a major driver of rail freight growth. Also, based on available data, it was estimated that 3.3m passengers (all reserved classes) travelled in 2013 in both directions on the Chennai – Bengaluru route. It is further estimated that this will grow to 29.7m by 2033. With regard to capacity saturation in the BIS case, of the 22 routes, 10 are already exceeding their capacity; another 1 will be capacity saturated by 2019/20, while another 1 will exceed their capacity before 2020/21, 1 more route by 2023/24, 2 more routes by 2024/25 and 1 more by 2027/28.

Six strategies are proposed for the development of railway infrastructure within CBIC and those are to:

- expand railway route capacity to satisfy increased freight and passenger demand;
- connect the railway to industrial nodes being proposed for accelerated development;
- improve railway connectivity of major east coast ports;
- apply rolling stock and commercial strategies to attract high potential freight customers to rail;
- consider construction of a Dedicated Freight Corridor (DFC) between Chennai/Ennore/Krishnapatnam and Bengaluru (with provision for future extension to Goa); and
- consider construction of a High Speed Passenger Railway (HSR) between Chennai and Bengaluru.

For expansion of railway route capacity, 2,133 km of additional running lines will need to be constructed over the 20 year forecast period (2013-2033) to satisfy freight and passenger demand which would be generated under the BIS case. This will include 686 km of new running lines on the Chennai – Bengaluru route and 1,447 km of new lines on all other routes. 1,653 km of additional running lines would be required even under the BAU case, with 486 km for the Chennai – Bengaluru route and 1167 km of new running lines for all other routes.

A number of short term measures may be taken to optimise the utilisation of route capacity, including: i) increasing train lengths up until the available length in crossing/passing loops and sidings; ii) providing freight rate incentives to encourage the back-loading of general purpose wagons; and iii) combining rakes of empty wagons in order to reduce train numbers. It is understood that the Railways has proactively applied these measures, although it is likely that there is scope for further action.

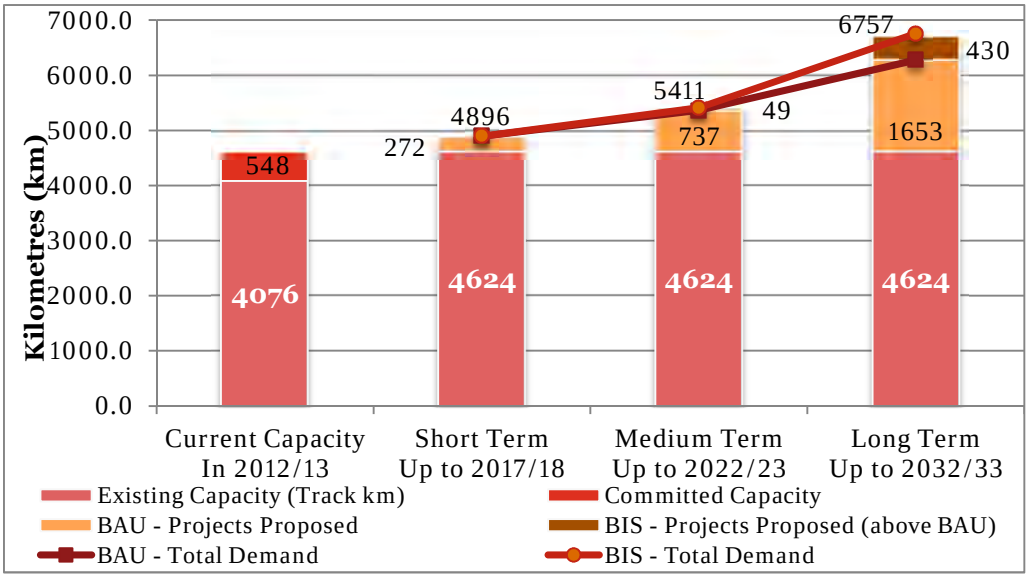


Figure 31: Suppy and Demnd of Rialway Track km

One very important measure for increasing railway capacity is the upgrading of absolute block signalling to automatic signalling. Other longer term measures can be applied to expand railway route capacity, including: increasing the number of running tracks, addition of train passing/crossing loops on single line sections, electrification, lengthening of crossing/passing loops and sidings, increasing axle loads of rolling stock and track, increasing motive power, etc. As a conclusion, other than signalling improvements, there may be few practical alternatives to increasing the number of running tracks to increase line capacity. The study estimates that over 20 years in the BAU case, 10 of the 66 line sections (15%) will need expansion beyond 4 running lines; in the BIS case, 12 out of 66 sections (18%) will need to be similarly expanded.

The railways are also constructing or planning several new lines with the CBIC area. These projects will improve connections to 5 of the 8 candidate nodes when completed. Additionally, the new line projects also include a new line to Ennore Port and improved connectivity from Krishnapatnam Port to its hinterland.

The cost of the proposed capacity expansion in the BIS case is 1,835 million USD (not counting committed investment, which is estimated to be 407 million USD). New line projects that will improve port connectivity will cost 216 million USD while new lines to nodes will cost 665 million USD. The total cost will be 3,123 million USD, which works out to 1,457 million USD in the short term, 498 million USD in the medium term and 1,168 million USD in the long term.

Table 19 Cost for Railway Development Project

(Unit: Million USD)

Category	Short (2013/14 – 2017/18)	Mid (2018/19 – 2022/23)	Long (2023/24 – 2032/33)	Total
Study on Comprehensive Demand Analysis	To be done in the short term	-	-	-
Route Capacity Expansion (548 km Committed)	407	-	-	407

Category	Short	Mid	Long	Total
(Estimated Cost)				
Route Capacity Expansion (BIS Case)	227	440	1,168	1,835
New Line Construction – node connections	607	58	0	665
New Line Construction – port connections	216	0	0	216
Total	1,457	498	1,168	3,123

Source: JICA Study Team (All costs in Million USD)

It is uncertain whether a Year 20 traffic volume of 65 million tonnes will be sufficient to justify the likely level of investment in a Chennai-Bengaluru DFC project. Although the required level of investment has not yet been established with any confidence, information provided to the consultants by the MoR suggests that a higher level of traffic might be needed to justify investment in the project. For this reason, it is essential that a comprehensive forecast, which is inclusive of potential freight volume from all sources of demand for a DFC is undertaken. As is also the case with the DFC project, consideration of the High Speed Railway should include a comprehensive demand analysis.

Urban / Public Transport

Chennai Metropolitan Area (CMA)

Chennai has four major National Highways which form a radial network, two ring roads with two more planned and several other key main roads that serve the city. There is a well established public transport system in Chennai, which consists of bus services run by the Metropolitan Transport Corporation and a suburban railway network consisting of three major lines and an elevated MRTS line run by Southern Railway with a 2-line Metro system under construction.

Due to the steady growth of Chennai's vehicle population, however, it is reported that the car volume is in excess of capacity on urban main roads. In addition, the current public transportation services lack ssufficient coverage of suburban areas, especially in the southern area where industrial investment has been promoted. Furthermore it is estimated that the 2008 figure for the total number of trips in CMA will be doubled by 2026, suggesting traffic demand will further increase significantly.

Chennai has an existing urban transport master plan, Chennai Comprehensive Transportation Study (prepared by Chennai Metropolitan Development Authority, 2010), and it proposed a strategy and projects for land use for transport, road network, and public transport. In addition to the existing strategies, there is a need for further strategies focusing on enhancement of connectivity to regions which will generate large freight traffic demand to/from ports and logistic facilities in CMA, where key gateways for CBIC are located. Based on the above condition, 14 projects in CMA have been selected, including both existing plans and new proposals. The projects include Outer Ring Road, Peripheral Road, and Northern Port Access Road to improve road network, and new route of BRT and suburban train to provide an access measure for passengers to/from industrial parks .The total project cost is 3,023 million USD under the BAU case broken up into 1,197 million USD in the short term, 1,725 million USD in the medium term, and 101 million USD in the long term.

Bengaluru Metropolitan Area (BMA)

Three National Highways pass through the centre of Bengaluru and an 62 km-long Outer Ring Road (ORR) is in place around the area. A Peripheral Ring Road is being planned outside the ORR to deal with the increased demand from further suburbanisation. Public transportation is provided mainly by a bus service at present,

although a metro system, initially consisting of two lines, is under construction with a small section opened in 2011. There is also a proposal for a Commuter Railway system to be established.

Although urban roads in BMA are being developed, it is reported that due to rapid vehicle growth, traffic on some main roads already exceed the capacity. The Commuter railway is proposed to cover areas about 15 km from the urban centre; however, satellite towns have been proposed at around 30-50km from the city centre, suggesting the proposed rail network will not cover the satellite towns.

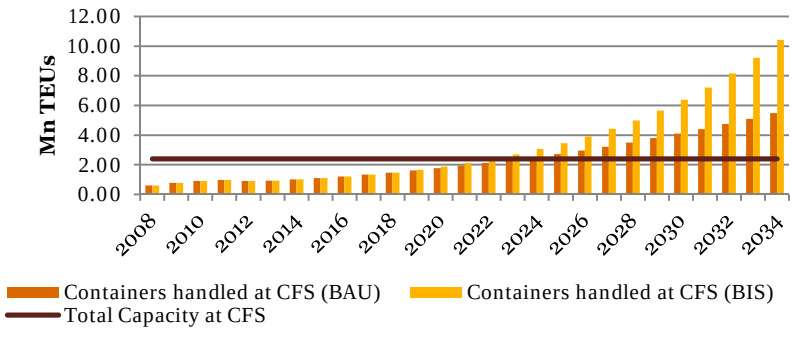
Bengaluru also formulated a transport master plan, Comprehensive Traffic and Transport Plan in Bengaluru (Karnataka Urban Infrastructure Development and Finance Corporation, 2010) and it proposed a strategy and projects including improving radial and ring roads and widening coverage of the public transport network. When considering industrial development in the CBIC area, it is also necessary to connect potential industrial areas and satellite towns around Bengaluru which contribute to economic development. Based on these strategies, 11 projects have been chosen and proposed, including both existing plans and new proposals. The projects include Peripheral Ring Road, Satellite Town Ring Road, and Expansion of NH207 to improve road network, and BRT and suburban trains to cover suburban industrial areas and satellite towns. The total project cost is 2,916 million USD under the BAU case broken down into 1,412 million USD in the short term, 1,392 million USD in the medium term, and 112 million USD in the long term.

Logistics

The major logistics infrastructure in the corridor region comprises of Container Freight Stations and the Inland Container Depots (located in and around Chennai) and one Inland Container Depot at Whitefield, Bengaluru. The modal split of the container traffic to and from Chennai Port comprises of 95% of container movement by road and only 5% by rail. At present, most of the 26 Container Freight Stations located in and around Chennai handle only around 36% of the total export container traffic movement by road to Chennai Port while the remaining container traffic comprises of factory stuffed containers.

While the present CFSs are operating at around only 45% - 50% capacity utilization the major bottleneck is present in the poor last mile connectivity to the ports. The high percentage of factory stuffed containers which do not pass through CFSs and hence take considerable time for customs clearance and documentation activities at the Port gate also add to the congestion at the Chennai port. This hinders efficient transportation of containers from the CFSs to the port. As compared to international ports where railways also have a substantial share in the transportation of containers from hinterland to the port and vice versa, the absence of last mile connectivity from the ICD to industrial centers as well as the priority accorded to passenger traffic vis-à-vis freight hampers the use of rail as a popular mode of transportation.

While cargo flow is expected to improve with anticipated last mile port connectivity, improvements to customs procedures are necessary for faster transit of cargo



Source: JICA Study Team Analysis

Figure 32: Demand and Supply of Containers Handled at CFS in CBIC Region

The last mile connectivity to Chennai, Ennore & Kattupalli ports are being improved through critical road projects (expected completion years in brackets) such as EMRIP (2015), Elevated Corridor from Maduravoyil (2018), Northern Port Access Road (2017) and NCTPS Road (2018). This, along with the expected completion of the ring roads in Chennai as noticed earlier, the last mile connectivity to Chennai, Ennore & Kattupally ports are expected to improve over the short to medium term. As per the study conducted by OCDI, the time taken for customs clearance is more than 12 hours for exports and over 38 hours for imports. Improving the efficiency of customs procedures at the ports are

necessary for faster transit of cargo. It is proposed that a separate study be initiated for efficiency improvement in the customs procedures at the ports covering use of information technology solutions to enable faster movement of cargo.

Demand for container handling at logistics facilities expected to erode their capacities 2022-23

The total capacity of the infrastructure (CFSs & ICDs) in the region is 2.4 million TEUs. It is observed that the capacity is expected to be sufficient till 2022-23. Gaps in supply compared to demand are expected in 2023 under the BIS scenario and in 2024 under BAU scenario. As per the projections, the capacity required at 2034 would be 5.48 million TEUs in BAU scenario and 10.42 million TEUs in BIS scenario. Capacity augmentation should be planned for the required additional logistics facilities.

Additional logistics infrastructure are required to improve competitiveness of the region

Additional logistics infrastructure such as node-level logistics parks and large multi-modal logistics are required to improve competitiveness of the region. However, these are dependent on a variety of factors.

Firstly, the existing CFSs in around the Chennai & Ennore region are operating below their capacities by over 50% owing to connectivity issues. The efficiency and operations of the CFSs are determined by not only the infrastructure within the CFS facility, but also the connectivity within the facility and the connectivity to gateways and industrial centres. Rapid urbanization is being witnessed in most of the locations of CFSs and ICDs in the region thereby causing access and evacuation issues. In order to help improve the efficiency of the existing CFSs/ ICDs, it is recommended that a detailed analysis be undertaken to study the critical dependences and facilities at these CFSs and chalk out a plan for modernization of these facilities and improvement of last mile connectivity.

Secondly, the lead time to set up logistics infrastructure is shorter and planning for such facilities could be taken up based on the need, changing traffic patterns and the pace of shift of traffic from the Chennai / Ennore belt to Krishnapatnam belt. Development of logistics parks attached to the port in Krishnapatnam would be critical to support for faster movement of cargo from the CBIC hinterland. It is anticipated that the private sector would be able to respond to market demand and set up the required logistical infrastructure based on changing traffic patterns and need for logistics infrastructure.

Thirdly, the nodes proposed for the CBIC region should house state of the art logistics facilities to improve their competitiveness. Timely requirement of raw materials and the delivery of the finished goods is utmost important. The inclusion of the below typical facilities could be further evaluated during preparation of the master plan for the nodes.

Table 20: Typical Logistic Facilities

Facility	Description
Transport facilities	Availability of internal roads, connectivity roads and rail facilities, with inter-modal transit facilities
Information Centre	Essential for cost reduction and decision making as they provide timely and accurate information
Centres for storage, consolidation, and segregation of cargo	Availability of warehouses, cold chains & storage infrastructure and value added services like packaging, consolidation, labelling storing, etc.
Customs processing centre	Essential for processing and procuring customs clearance at the node level for direct shipment to ports / gateways
Support and Social infrastructure	Administration facility, communication facilities for the personnel, water and electricity provisions.

Lastly, large sized government planned logistics hubs may be needed, particularly with multi-modal facilities which are difficult to be developed by the private sector alone. However, a more specific Origin Destination (OD) study is necessary for development of such infrastructure which has not been undertaken at this stage. Also, such OD study should be undertaken after important projects such as the Dedicated Freight Corridor and the Bangalore Chennai Expressway are decided as these marquee projects could significantly change traffic patterns in the corridor. At this stage, three regions have broadly been identified for development of such logistics parks which include the Bengaluru outskirts, Chennai outskirts (near Sriperumbudur) and Krishnapatnam region. Development of such facilities should be undertaken outside the city limits to enable smooth last mile connectivity to the said facilities. As emphasized earlier, the planning for development of these facilities could be taken up after the alignments of the DFC and Expressway have been firmed up, backed by an OD study considering the effect of changing traffic flows in the corridor.

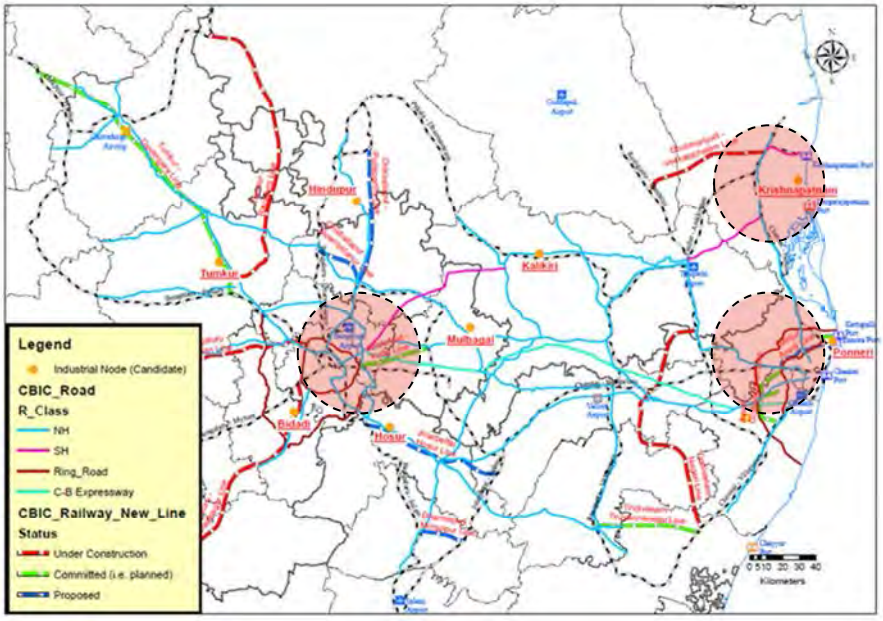


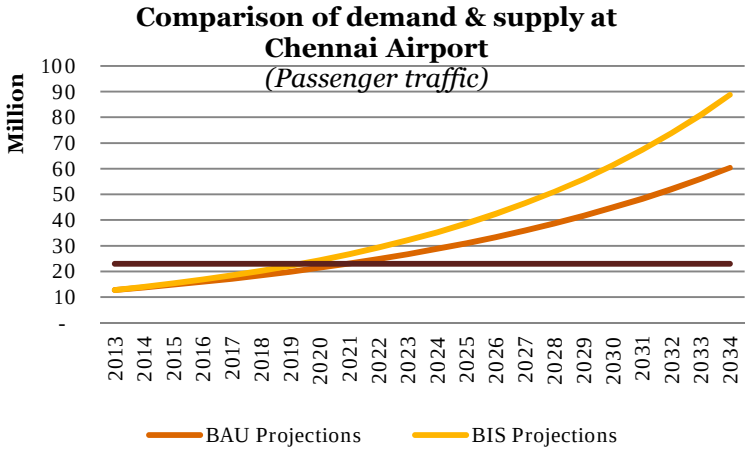
Figure 33: Three Regions for Development of Logistic Parks

Airports

Manufacturing led-growth expected to drive demand for air travel in the CBIC region

Air passenger traffic is influenced by a host of economic and social factors covering rising GDP, expanding middle-income group, increase in skilled workforce, rising urbanization, tourism and other important aviation industry related factors such as increase in low cost carriers making air travel cheaper and accessible to the rising middle & upper middle class[6]. The CBIC region is expected to increase its manufacturing output significantly; correspondingly, elements such as urbanization, migration of skilled workforce and business travel are expected to be increase significantly. The total air passenger traffic in the CBIC region (comprising of Chennai & Bangalore airports) is expected to reach 174 million passengers in the BIS case and 118 million passengers in the BAU scenario.

Additional airport in Chennai necessary as passenger demand is expected to surpass capacity in 2020-21

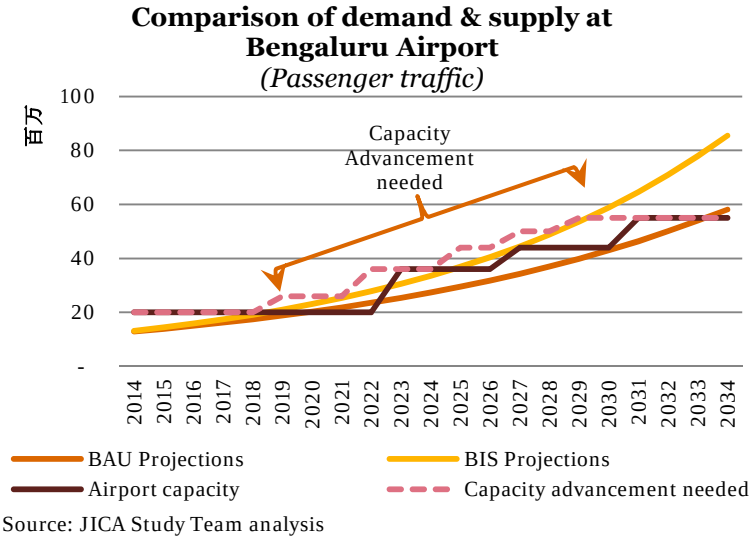


Source: JICA Study Team analysis

Figure 34: Demand and Supply at Chennai Airport

[6] Report of the Working Group on Civil Aviation Sector, Ministry of Civil Aviation, 2012

The peak capacity of 23 million passengers of Chennai airport is expected to fall short of rising demand in the years 2020-21, triggering the need for an additional airport in the region. The proposed airport in Sriperumbudur at a distance of 40 kilometres from the existing Chennai airport would need to be operational by 2020-21. ***Considering a time period of 2-3 years for land acquisition and development period of 3-4 years, the efforts for creation of this airport needs to begin immediately.*** It is recommended that a separate study be commissioned at the earliest for development of the proposed airport and also determine its passenger and freight handling capacities.



Source: JICA Study Team analysis

Figure 35: Demand and Supply at Bengaluru Airport

Bengaluru airport could sustain demand in the region up to 2029-30 provided its scheduled expansion is advanced by 2-3 years

Bangaluru airport has sufficient capacity to handle the passenger demand up to 2029-30 after which the region's traffic demand surpasses 55 million in the BIS scenario. Timing issues are observed in the pattern of rise in demand compared to the airport's expansion plans. The capacity expansion may be needed earlier by 2-3 years to cater to the region and minimize demand supply gaps. Given that Bengaluru airport is a private airport guided by formal regulatory process for planning and approving its capacity expansion, it is expected that that the process would be best placed to carry out a dynamic assessment of developments and time the expansion in accordance to growing demand.

Airport at Krishnapatnam envisaged as region remains unserved by existing airports

Krishnapatnam is at a distance of 200 kilometres from Chennai airport and 134 kilometres from Tirupati airport. According to the plans of the Ministry of Civil Aviation, the annual passenger handling capacity of the airport in Tirupati is expected to be 73,000 by the end of the XII Plan. This expansion would not be sufficient to cater to the air passenger demand expected from Krishnapatnam which is one of the nodes in the CBIC region. Therefore, it is proposed that a new Greenfield airport be developed in Krishnapatnam by 2020. It is recommended that a separate study be commissioned for development of the proposed airport and also determine its passenger and freight handling capacities.

Mulbagal suitable for development of alternative airport near Bangalore over the long term

Considering the timing differences in rise in demand compared to Bangalore airport's expansion plans, the need for an additional airport could be expected in the year 2024-25. Creation of the new airport could be delayed by a 5 year period should the capacity addition at Bangalore airport happen as per the suggestions made above. However, it would be beneficial to have an additional airport by the year 2024-25 owing to growing demand in the region and reduce over-dependence on Bangalore airport to serve the hinterland.

The potential nodes in the vicinity of Bangalore (within a reach of 150 kilometres) have been shortlisted[7]. These included Mulbagal, Hosur, Bidadi, Tumkur & Hindupur. Among these nodes, the nodes where large scale developments such as the NIMZ are planned have been further shortlisted. These include Tumkur and

[7] The prevailing regulations of the Ministry of Civil Aviation prohibit development of additional Greenfield airports within a region of 150 kilometres from an existing airport. The proposed location of Sriperumbudur where an additional airport is expected to be developed to support growing demand in the Chennai region is about 40 kilometres from the existing airport in Chennai. Accordingly, it can be inferred that the Ministry of Civil Aviation regulations would not strictly apply in cases where an existing airport's capacity faces saturation triggering the need for an alternative airport.

Mulbagal. Among these locations, the Mulbagal has been chosen as it serves the maximum number of nodes within a range of 150 kilometres covering Kalikiri, Hosur, Bidadi and Hindupur). It is recommended that a separate study be commissioned for development of the proposed airport and also determine its passenger and freight handling capacities.

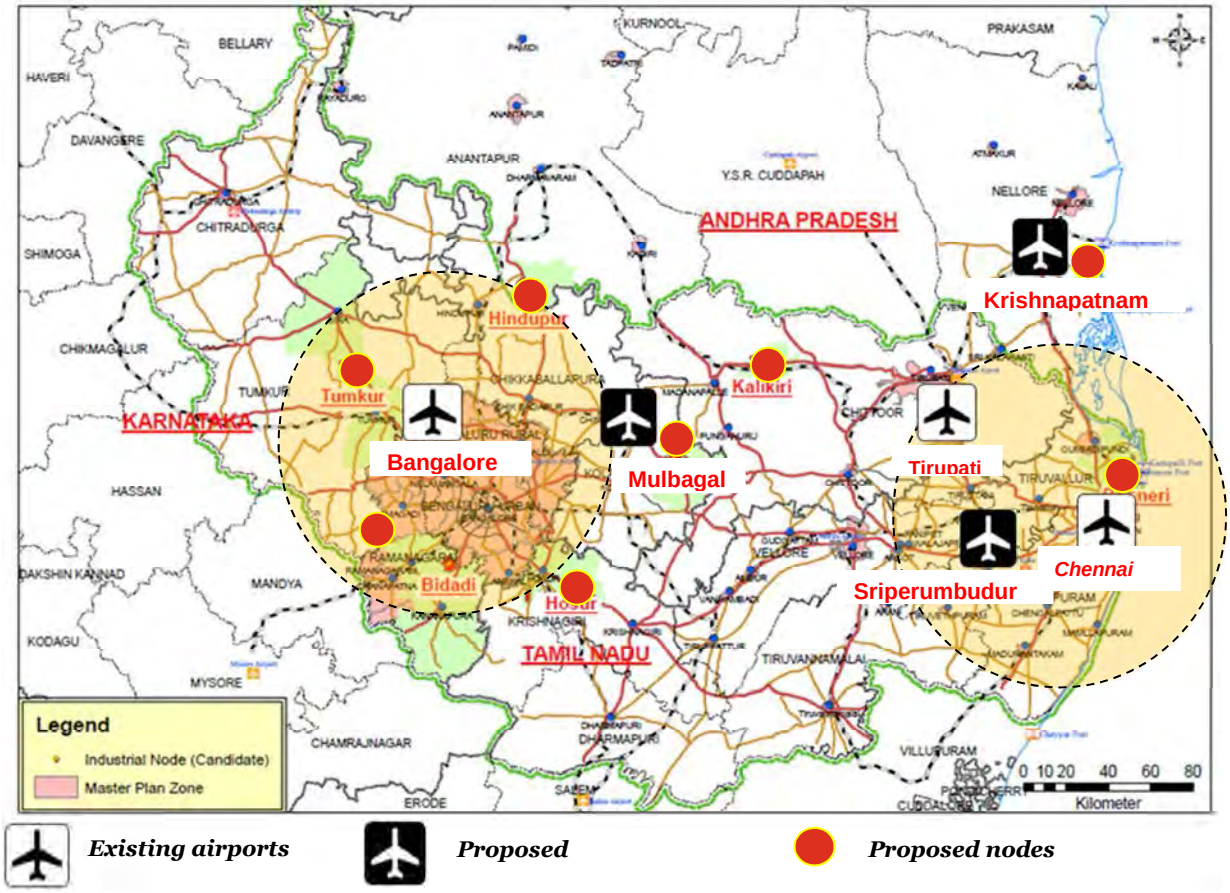
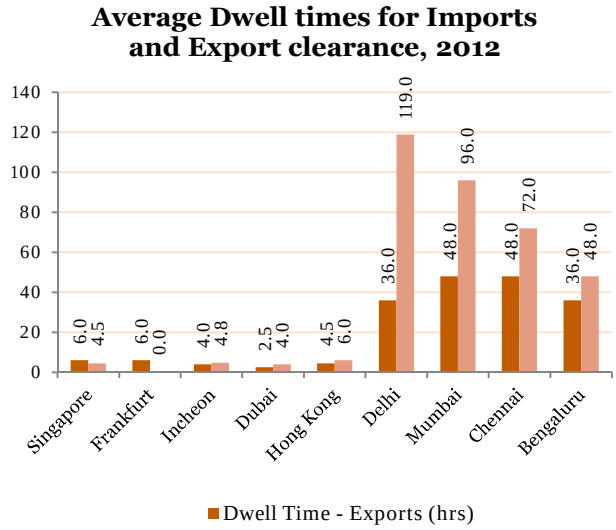


Figure 36: Existing and Proposed Airports

Airports in the corridor should target improving average handling time of cargo to international standards

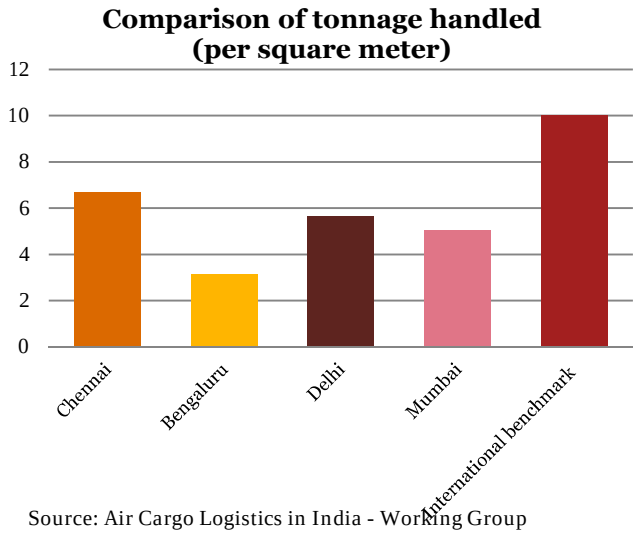
The dwell time of cargo at Chennai and Bangalore airports are significantly higher when compared to leading international airports. For instance, the dwell time of export cargo in Chennai airport is 48 hours compared to around 4.5 to 6 hours in the airports at Hong Kong, Singapore and Frankfurt. The chart below captures the dwell time of cargo at both Chennai and Bangalore airports compared to the international benchmarks.

A comparison of the average tonnage handled per square meter shows that Chennai and Bangalore handle about 6.6 and 3.14 tonnes per square meter respectively. This when compared to international benchmark of 10 tonnes per square meter is very low.



*Includes 72 hours free period both on Exports and Imports in India
(Source: *Working Group Report on Air Cargo Logistics in India*

Figure 38: Average Dwell Times for Imports and Exports Clearance



Source: Air Cargo Logistics in India - Working Group Report, Ministry of Civil Aviation, 2012

Figure 37: Comparison of Tonnage Handled

Challenges need to be overcome for developing airport infrastructure in CBIC region:

Development of airport infrastructure requires policy-level interventions at the central level in order to incentivize investments. There is a need to attract investments in the tier 2 & 3 cities where they have existing minimal demand.

1. A comprehensive planning involving all the stake holders would develop an induced demand in these regions. A hub and spoke model can be developed in the long run with airports in metro and regional nodes around forming a hub with this network.
2. New business models can be encouraged for better private participation along with mitigation of demand risk through alternate concession models like provision of subsidies, commercialization of assets, creation of industrial hubs in the region around and development of airport cities and aerotropolis etc.
3. Measures to encourage / incentivize airline operators to fly more routes to remote locations could attract the required demand for making the non-metro airports viable.
4. Standardization of the design and specifications, functional airport infrastructure and service quality could curtail investment requirement to some extent and this capping on project cost would also help in resolving the issue of cost overrun.

Thus, while specific policy-level interventions are required to facilitate the growth of the airport infrastructure in the region, the projects aimed at efficiency improvement at existing airports should target handling of increased cargo handling and target to bring down the cargo dwell time to international benchmarks of roughly 4-6 hours. This would also entail improvement of customs procedures at the airports and management of traffic and cargo within the airports. Further the port could consider modernizing the cargo handling facility to induce a high degree of automation in order to achieve a lower dwell time of cargo. Accordingly, a separate study has been recommended to evaluate options for modernization of passenger and cargo handling facilities at Chennai and Bangalore[8] airports.

[8] The Government of Karnataka and AAI jointly own 26% of the equity stake of Bangalore airport; though majority of the stake is held by the private developer, it is recommended that the need for process improvement be emphasized by the Government of Karnataka and AAI on priority.

Town Development and Industrial Development

Urbanization

Bengaluru's urban area, which includes the Bengaluru Development Authority (BDA) area and the Bengaluru Metropolitan Region Development Authority (BMRDA) area, has the 5th biggest population in India (approximately 6 million). The city area is divided into inner and outer areas by a green belt. The city centre of Bengaluru is mixed with both residential and institutional use, similar to Chennai. Bengaluru city centre has a rich green environment including several public parks; it is called the "Garden city of India".

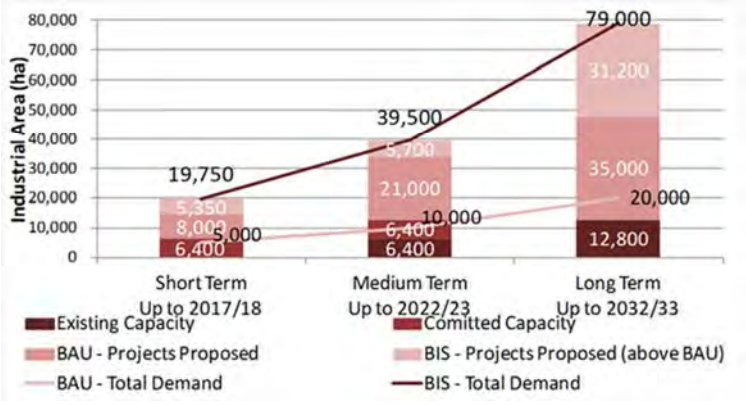
The urban areas of the CMA, the BDA and BMRDA were analysed through overlay analysis of satellite images from 2003 (based on MODIS data), 2008 (based on MODIS data) and 2013 (based on LANDSAT data). The results show that the urban area has expanded along major roads although the green belt (forests, agricultural fields and water bodies) protects some surrounding areas from the expansion.

Urbanized area as of 2013 is estimated at 1,970 sq.km. Also the increased urbanised area of CBIC was estimated at 350 sq km during the period 2003 to 2013. On the other hand, 27 million people will increase during the same term. Based on this trend, additional required urban area in 2033 will be 1,010 sq km (about 50% of current urbanized area). As total, 2,980 sq.km is required to cover the projected population. This rapid urbanization shows necessity of urban development control by urban master plans, and difficulty of finding the new lands for the development inside of metropolitan area which is already developed.

Industrial Infrastructure

The majority of the existing industrial parks in the CBIC area are situated within a 50km radius from the centres of Chennai and Bengaluru. Although some mid/small-sized industrial parks are located in other areas, there is no dense industrial zone outside of these two metropolitan cities. In the case of major industrial parks in South East Asia which have foreign capital companies as tenants, it is common to guarantee the provision of stable power supply, water supply and waste water treatment system for 24 hours a day every day. Stable infrastructure systems such as these are essential conditions for international standard industrial parks. However, infrastructure (such as water treatment plant, waste water treatment plant, power supply) at some of the existing industrial parks in CBIC area is insufficient. This creates a bottleneck for industrial development although the selling price of factory plots (Oragadam Industrial Growth Center is 32USD/sq.m and Sri City is 26 USD/sq.m, according to JETRO's data as of Sep 2013) is attractive compared to others.

According to the industry projections, the total estimated industrial land demand for the whole CBIC area is estimated to be 79,000 ha in the BIS case. And 35,000 ha will be developed by new node developments. Therefore, 44,000 ha of industrial development (2,200 ha per year) will be required in addition to node development. In BAU case, industrial land demand is projected as 20,000 ha additionally. Since the planned area of the industrial nodes is 35,000 ha, the projected land demand is covered by only the node developments. The right figure shows comparison of supply demand gap of facility's capacity in BAU and BIS cases with /without proposed projects.



Source: JICA Study Team

Figure 39:Comparison of Industrial Area Supply and Demand

It should be emphasized that currently operating foreign factories and developers for industrial parks emphasised various issues in terms of accessibility from trunk roads to industrial park, water availability, electricity availability, and accessibility to ports etc. Tamil Nadu Investment Promotion Program (TNIPP) is being carried out using JICA Yen Loan Scheme to improve such issues to promote investment. This program is mainly focusing on promotion of infrastructure developments (e.g. road development, power supply, water supply etc.). Also, a similar project for Karnataka and Andra Pradesh as well as TNIPP phase-2 should be considered and realised to create a good investment environment for foreign factories and developers.

Water Management

Current Status & Key Bottlenecks

1) At present, the ground water resources and surface water resources are utilised for a large part of domestic and industrial purposes in CBIC, however, surplus water resources are very limited. Therefore, the development of alternative water resources such as desalinated seawater and recycled sewage & industrial wastewater are necessary for additional industrial development

2) All corporations and municipalities in CBIC have piped water services and the coverage is more than 90% of population. However, the domestic water demand of CBIC is projected to increase with the future population growth; the demand in 2018 is estimated at 119% of that in 2013, the demand in 2023 is estimated to be 133% of that in 2013 and the demand in 2033 is estimated as 160% of that in 2013.

3) In CBIC, currently only two metro cities (Chennai and Bangalore) and 13 urban municipalities have sewage treatment plants (STPs). The ratio of connected population to the existing STPs is only 27%.

4) Sea Water is one of the potential water resource in the coastal areas of CBIC, especially Andhra Pradesh and Tamil Nadu States. At present, only Chennai Metropolitan Water Supply & Sewerage Board (CMWSSB) is operating desalinization plants.

5) Re-cycling of Industrial wastewater is very minimal in CBIC, most of the industries utilise the treated water for horticulture within their premises.

6) The comparison of the unit consumption of industrial water between India and Japan shows the unit water consumption of Indian industries is 3 – 7 times (5 times on average) larger than that of Japan.

Demand/Supply Gaps

1) Domestic Water

At Present, as described in Figure 5.4 and 5.5 the northeastern area of Bangalore City, including Bangalore Rural, Kolar and Chikkaballapura Districts in Karnataka State, are the most water-stressed areas in CBIC. In addition, the surrounding areas including Thiruvallur and Kancheepuruam Districts in Tamil Nadu State are water-stressed areas, which have only 50 – 70% of water supply against the water demand for drinking purpose. The water-stressed situation will become more severe in 2033 because the domestic water demand will increase with demand forecast to 160% from 2013 to 2033 due to the rapid population growth.

Source: JICA Study Team

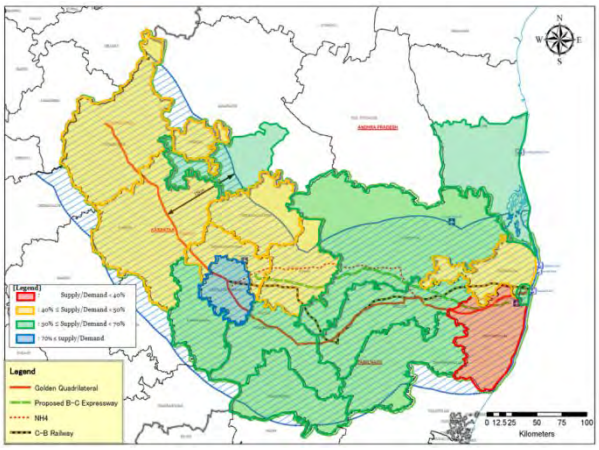
Figure 40: District-wise demand/supply gap of domestic water in CBIC in 2013

Figure 41: District-wise demand/supply gap of domestic water in CBIC in 2033

2) Industrial Water

The present demand/supply gap of industrial water in CBIC is estimated to be approximately about 1,900 MLD and it will increase in line with the industrial development projection. Considering the district-wise

industrial development trend, the demand/supply gap of industrial water will expand especially in the districts around Chennai Metro and Bangalore Metro as shown in Figure 5.6 and 5.6. The gap of Chennai District, Kancheepuram District and Bangalore Rural District will increase more than 100 MLD in 2033.



Source: JICA Study Team

Figure 42: District-wise demand/supply gap of industrial water in CBIC in 2013

Figure 43: District-wise demand/supply gap of industrial water in CBIC in 2033

3) Sewage Water

At present, only two metro cities (Chennai and Bangalore) and 13 urban municipalities have STPs in CBIC, accordingly in every district other than Chennnai District and Bangalore Urban District less than 20% of generated sewage can be treated before discharging to public water bodies.

Strategy

1) Domestic Water

In order to fill the forecast demand/supply gap and expand the water supply capacity for domestic purpose, additional water supply systems will need to be developed with on-going, planned and newly-proposed projects. This solution will contribute to meeting an approximate 80% ratio of supply/demand in 2018, 2023 and 2033. The total project cost is 2,809 million USD under BAU case. The project costs of each term are 664 million USD in short-term, 1,452 million USD in medium-term, and 693 million USD in long-term.

2) Industrial Water

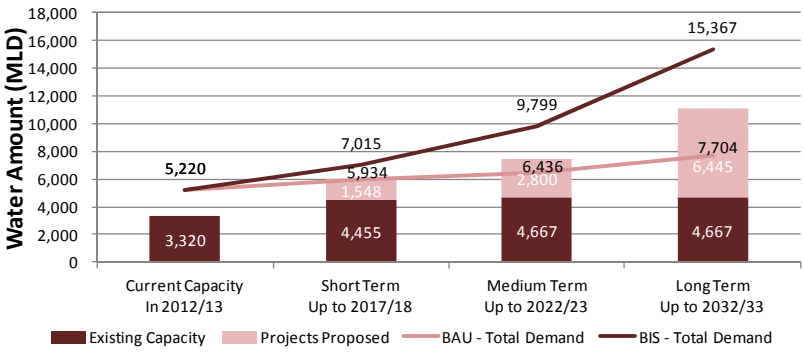
In order to fill the forecast demand/supply gap and support the expected industrial development, the following strategies are proposed.

i) Installation and expansion of sewage recycle systems with advanced treatment technologies to utilise treated sewage as alternative water resource

ii) Installation and expansion of industrial wastewater recycle systems with advanced treatment technologies to utilise treated industrial wastewater as alternative water resource

iii) Improvement of the industrial water productivity (unit consumption of industrial water) by promoting high efficient machineries and equipments in terms of water use, and capacity building of workers with Japanese technologies and investment.

These solutions will contribute to meeting a 100% ratio of



Source: JICA Study Team

Figure 44: Comparison of Industrial Water Supply and Demand

supply/demand in 2018 for the industrial development in the BAU case. The total project cost of the on-going, provisionally-planned and newly-proposed projects is 6,177 USD under BAU case. The project costs of each term are 3,244 million USD in short-term, 1,590 million USD in medium-term, and 1,343 million USD in long-term under BAU case. The right figure shows comparison of industrial water supply demand gap in BAU and BIS cases.

3) Sewage Water

In order to fill the forecast demand/supply gap and expand the sewage treatment capacity, the additional sewage treatment systems will be developed with on-going, planned and newly-proposed projects. This solution will contribute the ratio of supply/demand to meet 40% in 2018, 50% in 2023 and 65% in 2033. The total project cost is 3,829 million USD under BAU case. The project costs of each term are 593 million USD in short-term, 1,730 million USD in medium-term, and 1,506 million USD in long-term under BAU case.

Contribution of Each Solution

The expected contribution of each solution are presented as the improvement of demand/supply gap, which is summarized below.

Table 21: Improvements of Demand Supply Gap

Solution	Contribution of each solution (Effect on demand/supply gap)					
	Entire CBIC	**TN State**	**KA State**	**AP State**	**Chennai Metro. Area**	**Bangalore Metro. Area**
1) Domestic Water Expansion of domestic water supply system	56%→83%	47%→69%	63%→94%	62%→92%	43%→79%	63%→66%
2) Industrial Water Installation and expansion of sewage recycle system	19%→40%	14%→78%	20%→30%	19%→401%	14%→68%	20%→30%
Installation and expansion of industrial wastewater recycle system	40%→63%	78%→106%	30%→53%	401%→433%	68%→98%	30%→53%
Improvement of the industrial water productivity	63%→144%	106%→234%	53%→121%	433%→916%	98%→215%	53%→123%
3) Sewage Development of sewage treatment system	24%→65%	22%→79%	31%→55%	3%→55%	29%→87%	35%→55%

Source: JICA Study Team

Energy

Current power scenario

"As-is" energy scenario

In FY 2013-14, CBIC states of Andhra Pradesh, Karnataka and Tamil Nadu faced approx. 7% energy gap (18,000 MUs/annum). 71% of the total energy in the region is generated using thermal sources. In terms of equivalent coal capacity, average gap in the region was around 2.2 GW+. The scenario has improved from FY 2012-13 where the gap was more than 17% for the region*mainly due to rationalization of demand (5% decrease) *and moderate increase in supply (8% increase)* over the year. In the short term, the present gap of 7% is expected to continue for coming 1-2 years.

Impact on Industries

Due to wide energy gap, Industries in the region have been affected by unpredictable outages in grid electricity supply leading to use of costlier diesel based back up capacities. High energy gap along with pending regulatory assets of the state utilities have lead to tariff revisions of 8-10% # over the past 2-3 years in the region. This can affect the energy costs for industries and commercial organizations. In order to balance energy gap, Brown outs ("Voltage Drops") have been used for load reduction by utilities. These sudden drops in voltages can further affect the sensitive equipments at consumer end.

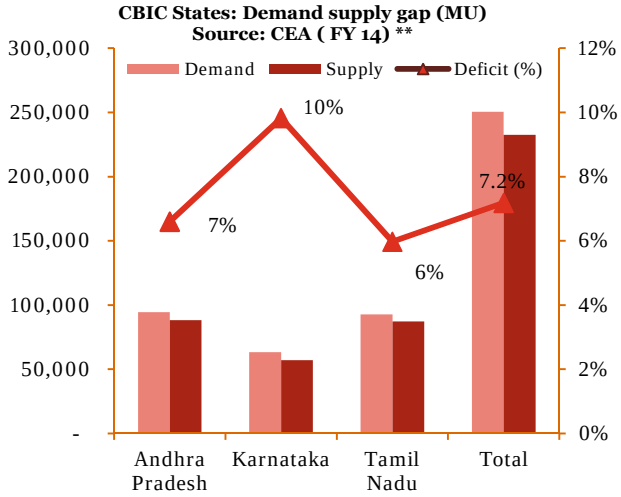


Figure 45: Generation Mix (MU), CBIC States

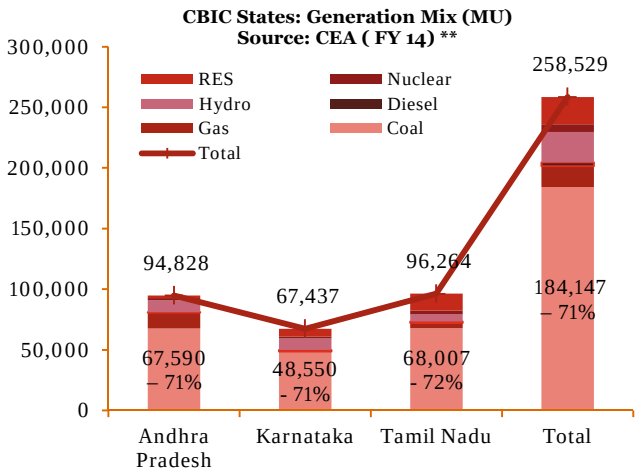


Figure 46: Demand Supply Gap (MU), CBIC States

Short term power scenario

Expected scenario by FY 18

By FY 2017-18, demand (inclusive of CBIC scenario) is expected to be met by upcoming scheduled power supply. Out of CBIC states, Karnataka is expected to remain power deficit with 5% energy gap but overall region can be expected to be more than 18% power surplus in case scheduled supply gets commissioned in time. In terms of fuel mix, thermal based capacity is expected to dominate with more than 70% share in energy generation. Hydro contributes second to the energy generation in Andhra Pradesh and Karnataka. But in Tamil Nadu, Renewable and Nuclear contribute second in energy generation after coal.

Although the region is expected to be power surplus by FY 18, but unrestricted demand is expected to contribute to usage of excess energy in the region. According to CEA (LGBR Report, 2013-14), the unrestricted demand in the southern region of the country will exceed 25% of the total requirement by FY 2018. By PwC estimates, all of the spare capacity will meet unmet latent demand in the southern region. Karnataka would need to import close to 495 MW of equivalent thermal capacity from outside sources to meet demand.

Impact on CBIC Region:

With easing demand supply gap in the region, quality of power for CBIC region is expected to improve. Also utility tariff rationalization can be expected to diminish energy cost impact on industries.

Table 22: Commissioning Status of upcoming Plants

State (FY 2018)	Demand (MW)*	Supply (MW)*	Gap (MW)*
Andhra Pradesh	15,526	20,113	+ 4,587
Karnataka	11,793	11,298	(495)
Tamil Nadu	15,198	19,268	4,070
Total	**42,518**	**50,680**	**8,162**

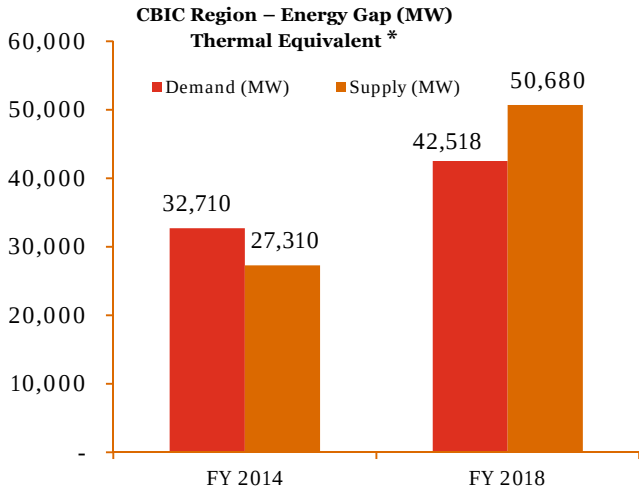


Figure 47: Expected Short Term Gap, CBIC Region

Expected plant commissioning before FY 18

Timely commissioning of upcoming projects is critical to ensure adequate supply for CBIC region in short term. In order to achieve "nil" energy gap in FY 18, supply would have to increase by 15,000 MW (Equivalent Thermal) over FY 14 base. Out of the total 21,000 MW under implementation in CBIC states, 2000 MW (Equivalent Thermal) Gas, 1000 MW Nuclear (Equivalent Thermal) and 2300 MW of Thermal Capacity would be tough to achieve before FY 17. This might create a shortfall of 5300 MW out of 21,000 MW planned by agencies. However, these supply numbers would still be 700 MW above the estimated peak demand in the region. Hence, in short term demand is expected to be met by scheduled supply.

Medium term power scenario

In medium term additional capacities of 13, 000 MW (Eq. Thermal) would be needed to fulfil CBIC's regional energy demand

Expected scenario by FY 2022

In medium term the demand in CBIC region is expected to reach close to 64,000 MW (equivalent thermal capacity). Based on present supply expectations in FY 2018, a gap of 13,000 MW (thermal equivalent) is expected in medium term (25% of present supply). As a matter of approach, supply priority has been provided to cleaner fuels in planning of generation for the region. Next priority has been provided to base load capacities like Hydro and nuclear. The remaining is expected to be filled in by thermal capacity.

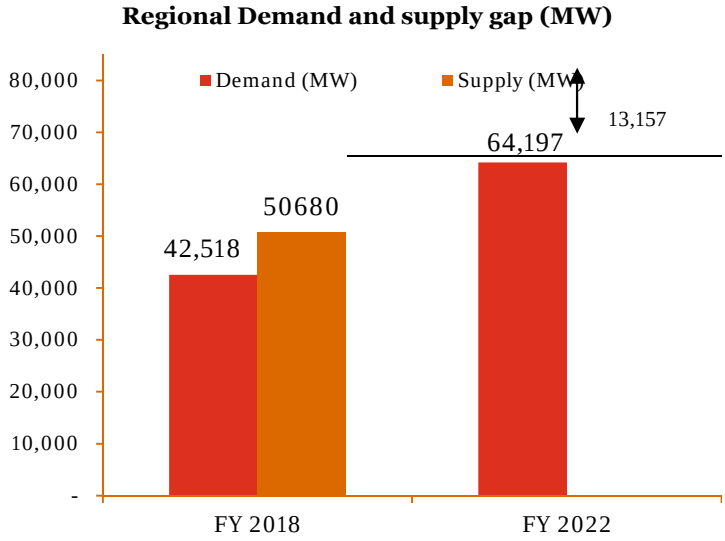


Figure 48: Expected Medium Term Gap, CBIC Region

Source wise capacity addition in medium term

In terms of equivalent coal capacity, RES is expected to meet 17% of the gap (2354 MW). Hydro and nuclear together fill 25% of the energy gap in FY 2022.Gas based capacities in addition to spinning reserves are not expected to add significantly to new capacity additions. However with Dabhol pipeline and KG 6 basin issues resolving by FY 2018, stranded assets are expected to add 1400 MW (Eq. Coal) to region. In total additional thermal based capacity needed in FY 2022 is expected to be around 6500 MW. Coal requirement for this capacity would be close to 3.41 MT/annum for the region.

In medium term, renewable (wind and solar) are expected to increase in capacity in CBIC states. Wind with expected 16,000 MW would form major contributor in meeting increased demand. Overall renewable additions would be done at state level through attractive FiTs / project incentives. Hydro is also expected to increase by almost 50% in term of commissioned capacities in coming 7-8 years. In terms of potential the states can be expected to tap almost 50% of hydro potential in the region. Hydro additions would also be done at state level through central agencies or PPP in Hydro. Nuclear energy for the region (Kudankulam nuclear plant) is expected to add 2000 MW to grid by FY 2022. This has been planned centrally through NPCIL. Gas based capacities. Presently the region has a lot of stranded gas capacities due to lack of natural gas (4000 MW). But in coming 2-3 years with Dhabol gas pipeline (3000 MW capacity gas/year) and resolution to KG-6 basin, natural gas would be available for gas capacities to develop in the region. On the other had there is issues of gas pricing which makes it a clean but expensive fuel. We therefore do not foresee significant capacity addition in gas based generation. Rest of the capacity (6650 MW) will be filled by thermal sources. TN UMPP (4000 MW) is expected to play a major role in fulfilling the gap. State (State Gencos.) as well as central (NTPC) would be needed for this addition.

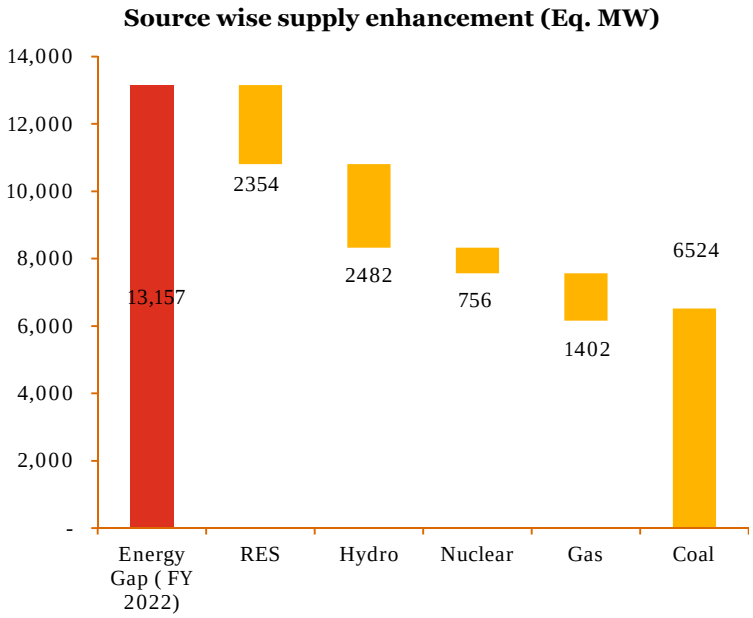


Figure 49: Source Wise Capacity Enhancement, CBIC

Table 23: Source and responsibility wise breakup of meeting demand for CBIC region in medium term, FY 2022

Fuel source (MW)	Potential	Short-term 2017	Mid-term 2022	Responsibility for additional capacity
Wind	26,029	9,880	16,387	
Solar	118,000	108	3,300	
Biomass	3,124	1,417	1,771	
Small Hydro	2,926	1,356	1,695	
Waste to Heat	425	50	250	
RES Total	150,504	12,811	23,404	STATE
% of potential		9%	16%	
Hydro	30,980	9,927	14,891	STATE
% of potential		32%	48%	
Nuclear	20,000	3,055	4,055	CENTRAL
% of potential		10%	13%	
Gas	45,000	4,396	7,200	STATE
% of potential		10%	16%	
Coal - Balance		-	6,650	MIX

Long Term power scenario

In long term, 83,000 MW of additional capacity needed for CBIC region is expected to be met majorly by thermal sources

In long term with demand expected to reach close to 147,000 MW for CBIC region, an additional capacity of 83,000 MW over FY 2022 would be needed for fulfilling demand.RES and Hydro sources are tapped first with aim of meeting the additional gap (5,226 MW Eq. Thermal Capacity). Nuclear comes next as it is a base load source and is cheaper source of generation in long term (3,400 MW Eq. Thermal Capacity). Gas based capacities would provide another 1,400 MW Eq. Thermal capacity by FY 2032. Rest of the demand will be met through thermal sources for the region. (73,000 MW – 87% of gap)

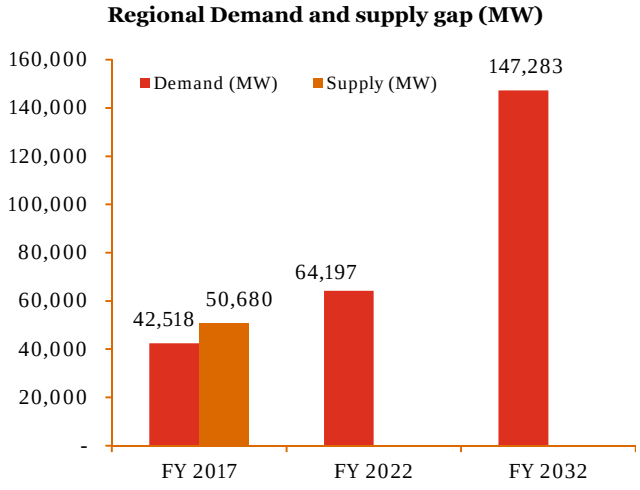


Figure 50: Expected Long Term Gap, CBIC Region

Table 24 : Source and responsibility wise breakup of meeting demand for CBIC region in long term, FY 2032

Fuel source (MW)	Potential	Mid-term 2022	Long-term 2032	Agency for capacity addition
Wind	26,029	16,387	20,484	
Solar	118,000	3,300	5,000	
Biomass	3,124	1,771	2,214	
Small Hydro	2,926	1,695	2,119	
Waste to Heat	425	250	350	
RES Total	150,504	23,404	30,167	STATE
% of potential		16%	20%	
Hydro	30,980	14,891	22,336	STATE
% of potential		48%	72%	
Nuclear	20,000	4,055	8,555	CENTRAL
% of potential		13%	28%	
Gas	45,000	7,200	10,000	STATE
% of potential		16%	22%	
Coal - Balance		**6,650**	**73,598**	**MIX**

Critical support factors: Transmission and Distribution

Transmission: Key aspects for CBIC region

Transmission plays a key role in ensuring dispatch of energy from the generation plant. A transmission line dispatching energy from a generation plant needs to be available at least 6 months before the plant is commissioned to avoid stranded capacity. Also, renewable sources need special attention due to daily variations in grid connected energy. In short term transmission projects have already been notified for upcoming generation plants in CBIC region. These projects ensure evacuation of power from the plants.

In medium term, with almost 13,000 MW of additional capacity expected to be commissioned (spread across 17% renewable and 83% conventional sources), need for strengthening of transmission network exists. Typically transmission projects can be handled both by state (Transcos.) as well as central agencies (PGCIL). In this case a mix of two would need to be utilized. Implementation of green corridor (Central scheme) would assist adequate interlinking facilities for RES. State schemes for intra state transmission would ensure last mile connectivity for generation plants. Similar would be the case for long term (83,000 MW of additional capacity - 7% renewable and 93% conventional)

In terms of investments, the ratio of generation and transmission investments for a particular project can be taken to be 1.0:0.4. Taking this measure total investments required for transmission projects would be close to 24, 068 Mn. USD over next 10-15 years in CBIC region.

Distribution: Key aspects for CBIC region

Distribution is a state specific activity and provides last mile connectivity from transmission to consumers end. The key features would be based on reliability and quality of power. Unlike generation and transmission, distribution development would not be project specific. In order to optimally and efficiently plan the development of the distribution network, the maximum generation demand for the projections period (i.e. from 2015 to 2034) has been taken

Some issues that would need handling would be high distribution losses, reliability of the system, and shortage of skilled professionals along with weak financial position of CBIC states distribution utilities. All these factors would need to be looked into before any strategy for CBIC region is finalized. Key measures like allowance of deemed distribution licensee for whole/ key parts of CBIC region can bring in new private sector participation Also technologically superior distribution systems in the form of smart cities and smart girds can also increase the quality of energy at consumers end, increase efficiency and enhance consumer satisfaction. Both these measures are state specific in nature.

In terms of investments, typically a ratio of 1:0.2 (Generation: Distribution) is used for Indian conditions. Considering the green field nature of new technologies being proposed this ratio can safely be revised to 1:0.3. Taking these measure total investments would be close to 12,000 Mn. USD over the next 10—15 years in CBIC region.

Solid Waste Management

The status of existing waste treatment and disposal facilities and planned infrastructure projects in the three states covered by the study are summarised below.

Table 25 : Exsiting and Planed Solid Waste Managment Infrastructures

States	Existing Infrastructures	Planed Infrastructures
Andhra Pradesh	• There are two TSDFs with common incinerators in Rangareddy and Visakhapatnam District.	• There are no future plans in Andhra Pradesh
Karnataka	• There is also only one TSDF and five common incinerators in Bengaluru, Tumkur and Ramanagara District.	• Another site was proposed for a TSDF, but it has not been realized yet.
Bengaluru Metropolitan Area	• Hazardous waste generated in Bengaluru Metropolitan Area is treated in these facilities. • TSDF is located in Bengaluru Rural District. In addition, four common incinerators are located in the metropolitan area (Bengaluru Urban District: Two incinerators, Bengaluru Rural District: one incinerator, Ramanagara District: one incinerator).	
Tamil Nadu	• There is only one TSDF and one common incinerator in Tiruvalluru District.	• For other two proposed sites, public hearings are being conducted. AFR pre-processing facilities will be constructed after year 2015.
Chennai Metropolitan Area	• Hazardous waste generated in Chennai Metropolitan Area is treated in these facilities.	

Note:
- TSDF: Treatment, Storage and Disposal Facility
- AFR: Alternative Fuels & Raw materials pre-processing facility

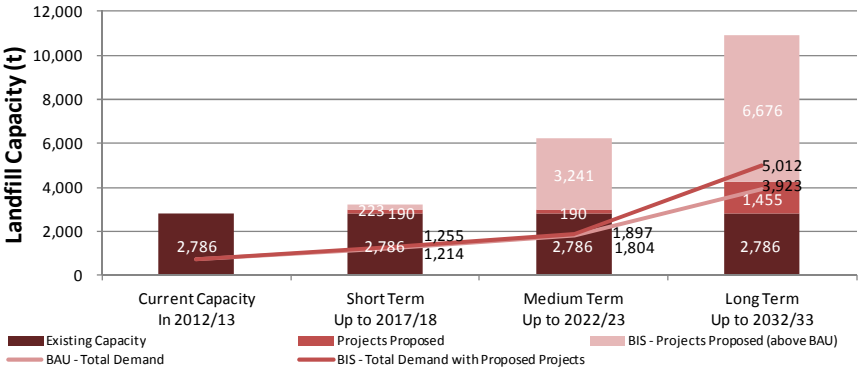
Source: Arranged by JICA Study Team based on the information collected from the state governments

The landfill capacity is insufficient compared to the amount of waste generated, creating the first gap (referred to as "Gap 1"), in all three states. However, the actual amount of hazardous waste disposed at the landfill is less than the landfill capacity, creating the second gap (referred to as "Gap 2"). Gap 1 indicates the lack of TSDFs and Gap 2 indicates that waste is temporarily stored within each factory area. Governments have promoted the development of hazardous waste treatment facilities to improve the current environmental situation. However, governments have been unable to provide sufficient treatment facilities in their states due to "Not In My Back Yard (NIMBY)" problems.

The future amount of hazardous waste generation of each waste type (landfillable, incinerable, and recycled) was calculated in BIS case. In Tamil Nadu the amount of incinerable hazardous waste will exceed the incineration capacity from year 2022, and the amount of landfillable hazardous waste will exceed the landfillable capacity from year 2029. In Karnataka, the landfillable capacity will be saturated from year 2022, and the incineration capacity does not meet even current demand as well as future demand. Since CBIC area in Andhra Pradesh does not have the facilities, there will be a supply volume gap.

In order to meet the future demand, new landfill and incineration facilities are necessary. In addition, since reduction of waste generation is also important, new AFR pre-processing facilities, which make it possible to reduce amount of waste by recycling, are required. Those facilities should be located in new industrial areas due to lower transportation cost and fewer issues related to land acquisition.

The total project cost is 206.3 million USD under the BIS case. The project costs of each term are 95.7 million USD in short-term, 50.5 million USD in medium-term, and 60.1 million USD in long-term under BIS case. The following figure shows a comparison of the supply-demand gap in BAU and BIS cases with /without proposed projects.



Source: JICA Study Team

Figure 51 Comparison of Landfill Supply and Demand

Phasing Plan

Based on the analyses of the above Chapters, the node and industry development plan, infrastructure development plan are proposed. The structure of overall phasing plan is summarized below. The implementation stage of CBIC development is divided to three phases: short-term (2014-18); medium term (2019-23); and long term (2024-3033).

In the short term, urgent needs of existing industries to improve hard and soft infrastructure will be focused. Hard and soft infrastructure development for the improvement of regional connectivity will contribute further node development to be implemented in the medium and long term. To increase investments, achieve the corridor's vision and overcome the current bottlenecks in the corridor it would be essential to focus on implementation and planning of the short and medium term projects that are planned and also those that have been proposed.

The summary of infrastructure investment is noted below and the detail project list is attached in the annex.

Investments required for infrastructure development

Investments required by phase

To meet the enormous economic growth and infrastructure development planned in the Corridor region, a total funding of around USD 174 bn shall be required over the next 20 years to meet the development goals of CBIC under BIS. These investments shall be distributed among various sectors including industrial infrastructure, logistics, ports, airports, energy, railways, roads, solid waste management, urban transport, water etc. Over the short term (i.e. upto 2018) around USD 44 bn investments in infrastructure shall be needed and the same amount of investments shall be required from the short to medium term (2018-2023) as well. Over the long term (2023-2033) around USD 87 bn shall be required to finance the infrastructure development requirements in the region.

The table below depicts the investments required over the short, medium and long term divided across various infrastructure sectors:

Table 26: Invetsments by Sector

Investments by sector (USD mn)	Short Term (up to 2018)	Medium Term (2018-23)	Long Term (2023-33)	Total
Transport	***5,357***	***10,912***	***15,938***	***32,208***
Airports	287	3,236	777	4,299
Ports	1,193	2,295	3,600	7,088
Railway	1,344	716	9,506	11,566
Roads	2,433	2,087	1,843	6,363
Logistics	-	196	-	196
Urban Transport	100	2,383	213	2,696
Energy	***25,051***	***17,270***	***66,968***	***109,289***
Utilities	***5,574***	***3,861***	***3,603***	***13,038***
Solid Waste Management	120	26	60	206
Water	5,454	3,835	3,542	12,831
Industrial infrastructure	***8,206***	***11,667***	***70***	***19,943***
Grand Total	**44,188**	**43,710**	**86,579**	**174,477**

The requirement of the investment amounts depicted in the table above shall be based on the time of actual project need and hence may be required earlier in case the project timeline is advanced to an earlier stage. Also, the investments required over the long term reflect the BIS outcome expectations and may require calibration based on the regional economic development patterns. As visible from the table above, the majority of the investments (more than USD 100 bn) are required for development of energy infrastructure in the region to meet the growing energy requirements of the region and to ensure good quality and regular supply of power to the industries in the region. Transport (especially trunk infrastructure and gateway development) is the second area where significant investments (around USD 32 bn) shall be required to ensure seamless connectivity within the corridor and to the gateways. At the same time, significant investments shall also be needed for the development of industrial infrastructure and utilities in the region.

Short-term investment requirement

Over the short-term (i.e. upto 2018) maximum investments in infrastructure development shall be required by the state of Andhra Pradesh followed by Tamil Nadu. Around 46% (i.e. around USD 20 bn) of the total investments required for infrastructure development in the corridor shall be required by the state of Andhra Pradesh with around 75% of demand for these investment requirements arising from the planned energy infrastructure creation. Government of Tamil Nadu shall require to attract around 25% of the total investments needed for infrastructure development in the region with more than 50% of these investments (around USD 5 bn) required for development of energy infrastructure only. The remaining around 15% and 14% investments shall be required for projects planned to be developed or the projects required by the state of Karnataka and the Central government respectively. Of the total investments of around USD 6 bn required for Karnataka, around 52% of these investments shall be needed for industrial infrastructure development and another 32% shall be required for utilities. Karnataka shall not require additional investments in the development of energy infrastructure over the short term as shown in the table below:

Table 27: Investments by Sector over the Short Term

Investments by sector over the short term (USD mn)	GoTN	GoK	GoAP	Central	Total
Transport	***389***	***1,036***	***1,223***	***2,709***	***5,357***
Airports	-	287	-	-	287
Ports	-	-	-	1,193	1,193
Railway	-	-	-	1,344	1,344
Roads	339	700	1,223	172	2,433
Logistics	-	-	-	-	-
Urban Transport	50	50	-	-	100
Energy	***5,946***	***-***	***15,772***	***3,333***	***25,051***
Utilities	***2,332***	***2,048***	***1,194***	***-***	***5,574***
Solid Waste Management	-	111	9	-	120
Water	2,332	1,937	1,185	-	5,454
Industrial infrastructure	***2,538***	***3,361***	***2,307***	***-***	***8,206***
Grand Total	**11,205**	**6,446**	**20,496**	**6,042**	**44,188**

Medium-term investment requirement for infrastructure development

Around USD 44 bn investments shall be required for infrastructure development over the medium term for the entire corridor region. The table below shows the approximate value of investments needed for infrastructure development over the medium term (2018-2023).

Table 28: Investments by Sector over the Medium Term

Investments by sector over the medium term (USD mn)	GoTN	GoK	GoAP	Central	TBD	Total
Transport	***3,377***	***1,180***	***2,432***	***3,772***	***150***	***10,912***
Airports	-	287	-	2,949	-	3,236
Ports	-	-	2,250	45	-	2,295
Railway	-	-	-	716	-	716
Roads	1,606	236	182	62	-	2,087
Logistics	46	-	-	-	150	196
Urban Transport	1,725	658	-	-	-	2,383
Energy	***-***	***-***	***-***	***-***	***17,270***	***17,270***
Utilities	***2,241***	***1,609***	***11***	***-***	***-***	***3,861***
Solid Waste Management	26	-	-	-	-	26
Water	2,215	1,609	11	-	-	3,835
Industrial infrastructure	***3,268***	***4,974***	***3,425***	***-***	***-***	***11,667***
Grand Total	**8,887**	**7,763**	**5,868**	**3,772**	**17,420**	**43,710**

Over the medium term, the state of Tamil Nadu shall require the maximum amount of investments for infrastructure development while another USD 17 bn is required to be allocated to the agency responsible for development of energy infrastructure in the region. At present, while the overall state-level energy requirement over the medium term has been estimated, the exact geographical location of the energy infrastructure projects is difficult to determine. The investments required for energy infrastructure represent the investments needed for energy infrastructure development for the entire states of Tamil Nadu, Andhra Pradesh and Karnataka. The exact geographical location of the energy infrastructure projects may be determined only at a later stage.

Investments for industrial infrastructure and transportation infrastructure development in the region shall account for around 27% and 25%, respectively. GoAP shall require investments of around USD 2.2 bn for development of port infrastructure in the state while the central government shall require around USD 2.9 bn investments for airport infrastructure development in the corridor region.

During the time period 2018-2023, around 20% of the total investment requirement demand shall be generated by the State of Tamil Nadu followed by around 18% of the total investment demand from the state of Karnataka. Government of Andhra Pradesh shall require around 13% of the total investments projected over the medium term while only 9% shall be required for central government projects. Another 40% of the total investment amount for infrastructure development is yet to be allocated to specific states / agencies.

Long-term investment requirement for infrastructure development

The table below depicts the investments required for infrastructure development over the long term (2023-2033) in the corridor region.

Table 29: Investments by Sector over the Long Term

Investments by sector over the long term (USD mn)	GoTN	GoK	GoAP	Central	TBD	Total
Transport	***1,192***	***499***	***574***	***13,673***	***-***	***15,938***
Airports	-	287	-	490	-	777
Ports	-	-	-	3,600	-	3,600
Railway	-	-	-	9,506	-	9,506
Roads	1,091	101	574	77	-	1,843
Logistics	-	-	-	-	-	-
Urban Transport	101	112	-	-	-	213
Energy	***-***	***-***	***-***	***-***	***66,968***	***66,968***
Utilities	***1,615***	***965***	***1,022***	***-***	***-***	***3,603***
Solid Waste Management	60	-	-	-	-	60
Water	1,555	965	1,022	-	-	3,542
Industrial infrastructure	***67***	***2***	***1***	***-***	***-***	***70***
Grand Total	**2,874**	**1,467**	**1,597**	**13,673**	**66,968**	**86,579**

While the investment requirement for energy infrastructure in the region (around USD 6 bn) is yet to be allocated to the concerned agencies. At present, while the overall state-level energy requirement over the long term has been estimated, the exact geographical location of the energy infrastructure projects is difficult to determine. The investments required for energy infrastructure represent the investments needed for energy infrastructure development for the entire states of Tamil Nadu, Andhra Pradesh and Karnataka. The geographical location of the energy infrastructure projects may be determined only at a later stage.

The transport infrastructure development shall require close to USD 14 bn funding mainly for the development of ports and railway network in the region. Additionally the need for investments in development of water infrastructure shall also reach around USD 3.5 bn by 2033.

Summary of investment requirement by Implementing Agengy:

The table below shows the infrastructure investments requirement as per the respective agencies:

Table 30: Summary of Investments Required by Implementing Agency (amount)

Investments in USD mn	Short term	Medium Term	Long Term	Total
GoTN	11,205	8,887	2,874	22,965
GoK	6,446	7,763	1,467	15,676
GoAP	20,496	5,868	1,597	27,961
Central	6,042	3,772	13,673	23,487
Unallocated *	-	17,420	66,968	84,388
Total	**44,188**	**43,710**	**86,579**	**174,477**

*Primarily energy

Out of the allocated / identified investments, the maximum investments for infrastructure development shall be required for the state of Andhra Pradesh (around 16% of total investments) over the short, medium and long

term followed by the state of Tamil Nadu (13%), the investments required for central government infrastructure projects (14%) and the state of Karnataka (9%). At present around 48% of the total infrastructure investment requirement in the region cannot be allocated. This is mainly related to the investments needed for energy infrastructure development over the medium and long term in the CBIC region.

Table 31: Summary of Investments Required by Implementing Agency (%)

Total investments by stakeholders	Short term	Medium Term	Long Term	Total
GoTN	25%	20%	3%	13%
GoK	15%	18%	2%	9%
GoAP	46%	13%	2%	16%
Central	14%	9%	16%	13%
Unallocated *	0%	40%	77%	48%
Total	**100%**	**100%**	**100%**	**100%**

*Primarily energy

As visible from the table above, around 46% of the total infrastructure investment demand is likely to emanate from Andhra Pradesh while 25% of the overall investment requirement over the short term shall arise from Tamil Nadu. Over the medium term, Tamil Nadu shall lead the need for infrastructure investments in the region followed by Karnataka and Andhra Pradesh for the identified / allocated projects. Over the long term, the central government projects shall require maximum investments, around 16%, of the total investments requirements identified till date for infrastructure development in the region while around 77% of the total investment demand remains unallocated for the long term.

Policy Recommendation on Improvement of Soft Issues

As indicated in the previous chapters, despite the significant potential of the region, investors and industry players show concerns on current and future investment environment. There are various actions which are recommended by investors and industry players in order to make CBIC as a preferred destination of their investment. They can be categorized into two types due to the level of the issues and commonalities of the actions: actions need to be taken by state government, and actions need to be taken by the central government (or CBIC unit positioned at the central level). This section summarizes the latter. It is recommended to set up a necessary program to consider the detail action plans on soft issues in the next phase.

Improvement of Investment Environment

Policy support

To Provide mid- long term policy guidance for private sector

Many of the private sectors suffer from the unexpected change in the policy from the government. Especially when the leading party changes where the company invested, the incentive programme or subsidy committed by the previous authority can be altered or even cancelled, that it affects the business feasibility of the private sector. Such anxiety has become hurdle for the company to make investment on their own risk.

It is strongly recommended that the central government be involved in the discussion on the key policy that affects the private sector's business decision, and provide a certain level of necessary commitment from the central government to keep the promise to the private sector and to promote private investments and FDI even if the political party changes take place at the state level. Such commitment is expected to provide confidence to the private sector, and is to encourage them to conduct a large scale investment from their own budget.

Implementing Agency: DIPP, MOF, Ministries in charge of each sector

To Establish infrastructure to support IPR

The number of the patent application has increased rapidly over the 10 years, and the number of those received by the authority has reached over 40,000, four times more than that of 10 years back. The number has already reached the 8th largest in the world, following Germany and Russia, and is expected to increase more.

However, despite such sharp increase in the interest, many investors and industry players show their strong concern over the insufficient understanding of the patent system in India. Some of the reason is attributed to the lack of knowledge from investor sides, but some parts are argued that the government needs to take proactive actions if the Government of India requests manufacturing industry to shift from other countries in India, which are considered most patent related industry.

To that end, the central government is expected to take three activities to establish the solid foundation for intellectual property: i) to conduct seminars for private sectors to enhance awareness on Patent law and application process/requirement in India and to encourage IPR registration; ii) to conduct workshops for Government IPR officials to familiarize with the concepts; and iii) to play a role of PMU to appoint a point of contact person in charge of any IPR related matter including litigations, who can coordinate with relevant Government IPR officials when required. The IPR is a very complicated area from the foreign companies' point of view, those types of knowledge sharing approach are strongly in need.

Implementing Agency: DIPP

To Set up appropriate standards on technical and environmental aspects

Along with the increasing volume of the foreign investment and the expanding number of foreign residents, the sustainability has become one of the key issues. Especially foreign companies, who already have their footholds in the India, strongly request further approaches to be taken by central government on technical and environmental standards in order to enhance environmental friendly, sustainable development, and eventually improve the living and working conditions.

It is, however, noted that such standards will increase the cost for the installation and establishment of facilities, especially the cost of technologies utilized. Given the many of the state government suffer from the budget deficit and cost oriented decision making tends to be made, the overall direction needs to be made by the central government, and needs to start from pilot cases and to be evangelized across the country.

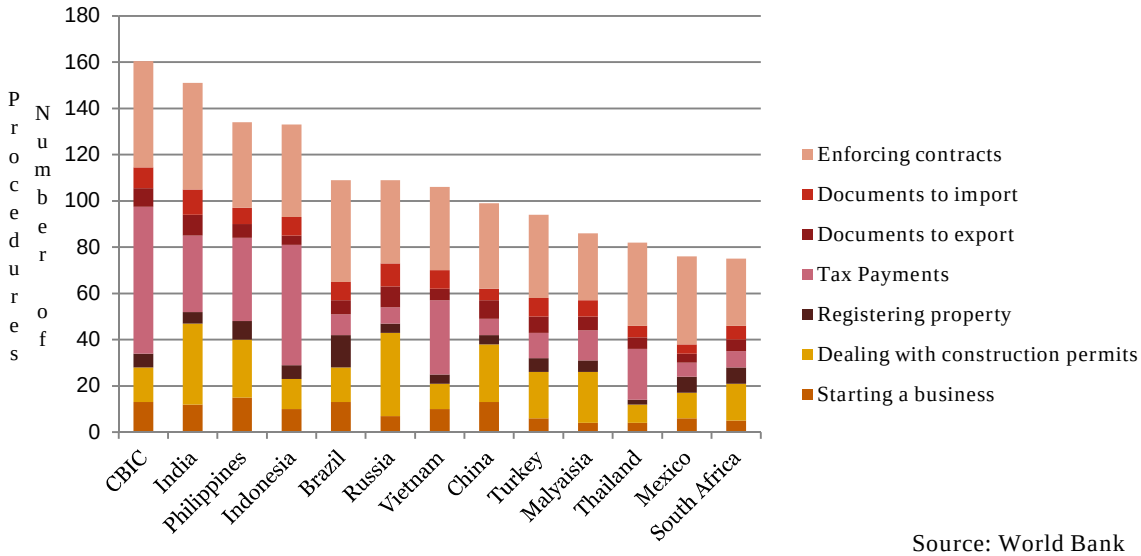
The recommendation for the central government, thus, is three steps: i) to develop the framework/guidelines for development of industrial parks with safety and environmental standards; ii) to test the above standards in specific industrial parks with governmental initiative and adjust the framework/guidelines based on the feedback; and iii) to hold a round table discussion with State's representatives on a regular basis to share successful models and the experiences

Implementing Agency: DIPP

To Reduce, Simplify and Clarify Procedures on Approval and Authorization

In order to develop CBIC to a world class investment destination, the Government of India and the related State Governments are recommended to reduce, simplify and clarify the procedures for approval and authorization.

The comparison analysis in the previous chapter shows that doing business in CBIC is highly time and cost consuming. The situation is summarised in the following figure and table.



Source: World Bank

Figure 52: Number of Procedures

The comparison of necessary periods of major administrative procedures in CBIC and 12 countries are shown in the table below. The Best Practice and Average show the most competitive practice and the average, respectively, among 12 countries. It is recommended for CBIC Region to set the target period at least at the level of the average in order to enhance the global competitiveness.

Table 32: Period of Procedures in CBIC Region

Name of Procedures	Period of Procedures in CBIC Region	Comparison with Rival Countries/Regions		Authority in Charge	
		Best Practice	Average	Gov. of India	State Gov.
Starting a business	37 days	6 days (Mexico)	31 days	√	√
Dealing with construction permits	120 days	77 days (Philippines)	181 days	√	√
Registering property	38 days	2 days (Thailand)	33 days	√	√
Trading across borders Export	25 days	11 days (Mexico)	17 days	√	
Trading across borders Import	22 days	11 days (Mexico)	18 days	√	

Name of Procedures	Period of Procedures in CBIC Region	Comparison with Rival Countries/Regions		Authority in Charge	
		Best Practice	Average	Gov. of India	State Gov.
Enforcing contracts	968 days	270 days (Russia)	533 days	√	
Paying taxes	292 hours	133 hours (Malaysia)	292 days	√	√

The interview survey for the investors in CBIC also highlighted the perception on above mentioned status. The land acquisition, import/export procedures, and environmental assessment are the most frequently identified areas where bottlenecks of soft-infrastructure exist. The challenges are summarized below.

Table 33: Key Bottlenecks in Administrative Issue in CBIC Region

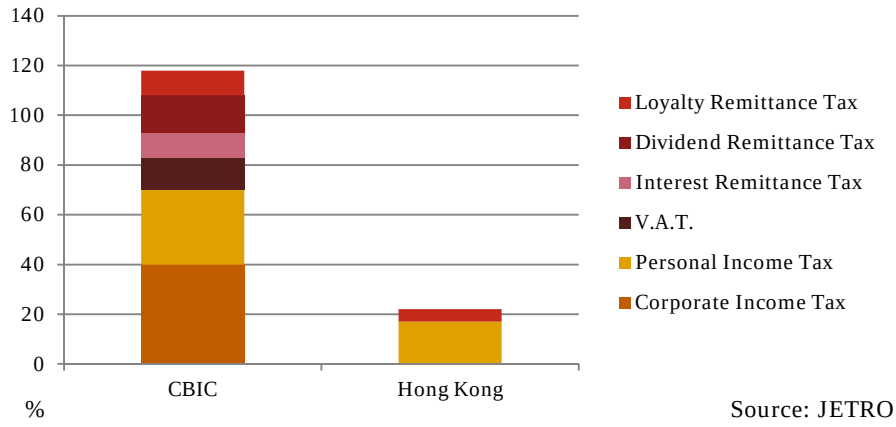
Key Issues	Bottlenecks
1. Land Acquisition on Industrial Parks	■ When serious problems occur on land acquisition in industrial park, private company has to solve by taking all responsibilities. ■ Information on industrial park is closed and difficult to know for potential investors unless they have connection with the Government officials.
2. Import/Export at Ports and Airports	■ Due to lack of integrated guidelines, rules of mandatory submitting documents and licenses for clearance are frequently changed by orders of officers at the port or airport. ■ Number of local rules and regulations which are not officially enforced by the Government exist in each port and airport. ■ One invoice needs to be provided to Taxation Bureau per part when receiving a refund on VAT. As the invoice is requested in hard copy, more than 10,000 invoices are required.
3. Environmental Assessment and Approval of New Projects	■ Environmental assessment takes too much time, i.e., 3-4 months on average. ■Approvals for new projects, such as approvals of State's high level committee and issues of official approval letters are taking too much time.

The central government can improve the situation in four ways: i) the central government coordinate the technical consultant to establish IT base solution to enable single window process and simplified procedure, which include in the area of import/export operation at ports/airports, environment approvals etc., and enhance the usability of the system; ii) along with the digitization, it can also increase the information itself accessible to the public, which is expected to enlighten the citizen and the private sector, and encourage them to proactively take action in driving the business; iii) to assign PMU to monitor the business process status regularly and evaluate based on the feedback from the field, so that the central government can provide incentives to each government to stimulate the competition, and promote the improvement of the entire states; and iv) to show strong commitment to lead the initiatives on debottlenecking, such as land acquisitions of strategic industrial parks etc.

Implementing Agency: DIPP, Ministries in charge of each sector

To Set Competitive Tax Rate

As has been identified by investors for a long time, the tax burden for foreign investors in CBIC region is more than the other rival countries and regions. The higher tax rates critically deteriorate the attractiveness of CBIC as an investment destination.



Source: JETRO

Figure 53 : Comparison of Tax Rates between CBIC Region and Hong Kong

Comparison of major tax rates in CBIC and other rival countries are shown below. The Best Rate and Average Rate show the most competitive practice and the average, respectively, among 12 countries. It is considered to be necessary for CBIC Region to achieve at least the average tax rates in order to be a globally competitive investment destination which is chosen and preferred by major global investors.

Table 34: Current and Recommended Tax Rates for CBIC

Name of Tax	Current Rate	Comparison with Rival Countries/Regions		Authority in Charge	
		Best Rate	Average Rate	Gov. of India	State Gov.
Corporate Income Tax	40%	0%	17%	√	
Personal Income Tax	30%	17%	31%	√	
V.A.T.	13-15%	0%	8%		√
Interest Remittance Tax	10%	0%	8%	√	
Dividend Remittance Tax	15%	0%	9%	√	
Loyalty Remittance Tax	10%	0%	10%	√	
State Entry Tax	Varies	0%	0%		√
Import Tax	25%	10%	15%	√	

The central government can improve the situation by reviewing the optimal tax system considering the competitiveness of the CBIC region as a destination of investments.

Implementing Agency: DIPP, MOF

Business profitability

To Enable private participation in Node Development

Some of the foreign companies, especially the infrastructure related service provider, argue that it is difficult for them to establish the sustainable business model in India without the government subsidy or incentives to cover uncontrollable risks by the private sectors, such as tariff, demand etc. This means that given the government support tends to be time limited, many of the projects are not likely to be profitable for the private sectors in the long term, which make them hesitate to investment in the first place.

One of the key reasons why the above mentioned issue has often been observed is that many companies tend to be receptive to the government tender, and not be able to take part in from the planning phase. In other words, they argue that they cannot build their positions as business partner to the government, rather stay as simple vendors to individual projects. As long as such sentiment is shared and hard to be taken away in some of the key private sectors, the win-win relation between India and Japan cannot be sustainable.

One solution for the central government to take is to establish a foundation for collaboration between India and Japan from upstream phase; that is, the central government can build framework for private sectors to be involved in the development planning phase in the node, and to actively build the new business model in tight collaboration with the government. The business model can be built with integration of the various sectors businesses such as real state, power, railway etc., or in collaboration with the international financial organization.

Implementing Agency: DIPP, Ministries in charge of each sector

To Enable the infrastructure service provider to sustain the user charge based business

As described in the previous section, to build the profitable business model is difficult for some of the private sector; especially for the infrastructure related service provider, establishment of the user charge based business is crucial, but at the same time, hard to establish in India. This makes it hard for them to collect the initial investment cost, and also re-invest to maintain the business in the long term.

To support the private sector, the central government may provide guarantee funding to sustain the business at least till the private sector to collect the initial investment cost. Also, it can support the private sector to establish PPP model through assisting the operation in the initial phase. To make the user charge based business more efficiently, the government can also invest into the smart meter as common asset and deploy across the CBIC area for all the relevant service providers.

Implementing Agency: DIPP, Ministries in charge of each sector

Cross state business enhancement

To Establish interstate infrastructure

Issues that block the smooth interstate business, such as CST, stamp duty, interstate transportation system etc., have been addressed by the central government and dealt with by some approaches. Nevertheless, many of the companies still show their frustration regarding those issues by highlighting the slow progress in the remedial approaches and the insufficient information provided from the government on the progress.

To address this, it is crucial for central government to share the status of each project through online channel, and set PMU at the central level to monitor and coordinate the stakeholder to make sure the progress to be made along with the planned timeline.

Implementing Agency: Ministries in charge of each sector

To launch reform initiatives in regulation

The difference of regulation, business process, and business related law etc. are inevitable, but they are often the key blocker for the private sector to expand the business across the state. Many of the companies contend that a certain standard or unification of the process would help the smooth business operation, and would provide incentive for them to expand the business. Especially if the CBIC is addressed as the cross state industrial corridor, such support would enhance the attractiveness of the region to the investors.

The central government can provide support to them by firstly organizing the discussion committee to identify and share the key issues in current regulation/laws (especially Labour laws, environment related regulation);

and then it can encourage the state governments to hold round table discussion with representatives on regular basis to share successful models and experiences to resolve the issues.

In order to effectively improve the investment environment of CBIC by taking the above mentioned measures, the Government could consider incentivizing investors and designating CBIC as a national "special region", which allows flexible arrangement of business/investment rules and regulations beyond the regular arrangements in the other regions of India. With the status, the issues which the central Government is in charge, such as most items on taxation, import/export procedures and environment assessment, are easier to be addressed.

Implementing Agency: DIPP, Ministries in charge of each sector

Investment Promotion Program

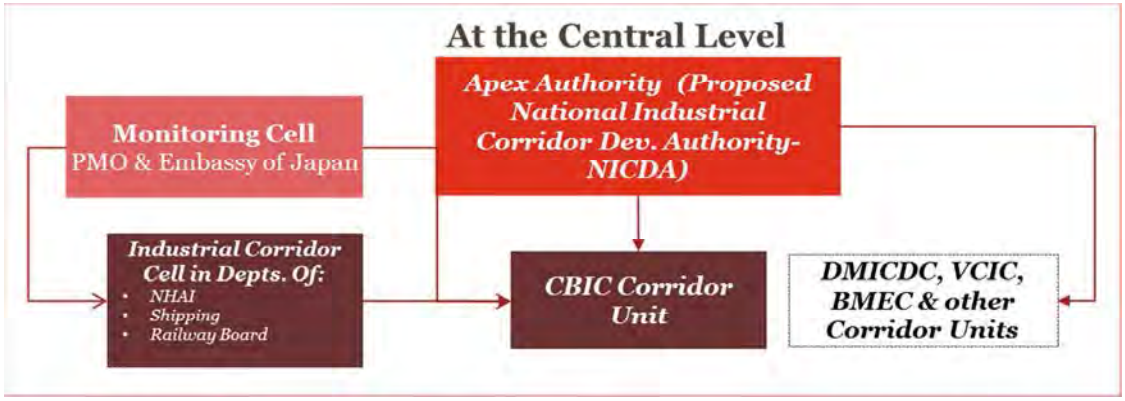
The above mentioned issues and recommendations would be considered to be dealt under the integrated programme focusing on urgent needs of debottlenecking in hard and soft infrastructure and improve investment environment.

JICA has set up a program loan for Tamil Nadu State which deals with existing infrastructure bottlenecks as well as policy issues. The similar initiatives would be necessary for further promotion of business environment in the region.

The program loan to Tamil Nadu Government is supposed to be the concessional loan of 13 billion yen (approximately Rs. 767 Crore) in 2015 under the JICA's program entitled "Sector Program Loan for Tamil Nadu Investment Promotion Program." The main purpose of the program is the improvement of investment environment in Tamil Nadu. The expected outcome consists of the following four components: 1) improvement of investment application process, 2) enhancement of land acquisition system, 3) promotion of capacity development for industrial workers, and 4) development of the Governmental mechanism on construction of link infrastructures, e.g., road, power and water, surrounding key industrial parks where foreign companies/investors are in operation. The fund will be disbursed in stages upon the result of annual joint monitoring by the Tamil Nadu Government and JICA for evaluating the degree of improvement in investment environment. Similar arrangement and funding support from JICA should be applicable for Karnataka and Andhra Pradesh.

Proposed Institutional Structur for Central Government

Taking into key considerations the key learnings for CBIC and suggestions from State Governments, the following institutional structure has been proposed for Krishnapatnam Node:



- Proposed National Industrial Corridor Development Authority (NICDA) to oversee all industrial corridor development in India including DMIC
- NICDA will act as a project development partner to all SPVs and State Government agencies for implementation of industrial cities/projects in the various industrial corridors
- CBIC corridor unit to be formed below NICDA
- Key central agencies such as NHAI, Ministry of Shipping & Railway Board will be represented on the NICDA Board. They may form special cells within each department to facilitate planning, implementing and monitoring of critical external infrastructure projects
- Monitoring cell comprising of PMO and Japan embassy to form the apex level monitoring body

Co- ordinated planning of industrial corridors & Strong commitment at Central Level:

At the Central Level, an apex body in the form of NICDA is proposed to oversee co- ordinated planning, funding and monitoring of industrial corridors in India. It is proposed that a CBIC corridor unit be formed under NICDA to periodically update NICDA upon the progress of CBIC.

Proposed representation of NICDA:

- *Chaired by Union Finance Minister*
- *Minister for Commerce & Industry*
- *PMO*
- *GOJ/multi- lateral agencies*
- *Proposed Nitti Aayog*
- *MoEF*
- *Other relevant cabinet ministers*
- *Chairman- NHAI/ Railways/Shipping/ AAI*
- *High level representation of participating states- State finance depts. and chief minister's offices*

Strong commitment at State Level:

The AP State Govt. has proposed for creation of an apex body at state level namely the **"State Economic Board"** which will be formed as a high powered apex body to provide direction to economic and industrial promotion activities and projects across the state. The Board being sufficiently empowered will facilitate policy decisions and prioritization of corridor development related projects. The Economic

Proposed representation of State Economic Board:

- *Chief Secretary (Convenor)*
- *Cabinet Ministers*
- *PS Industries Dept.*
- *PS Revenue Dept.*
- *PS Finance Dept.*
- *PS I&I*

Enhancement of the collaboration between Japan and India

Collaboration with Japan is crucial to shift the plan into implementation and bring about the tangible result to the CBIC states. However, despite the fact that the collaboration has been driven forward at the central level, it takes a while for the decision or order from the central to the field at the state level; sometimes the private sector cannot endure the time taken for the decision to be made and to take effect. It also applies to the bottom up case; the decision agreed at the state level often takes time to reach to the central level, resulting in the missing the opportunity for the private sectors.

As the recommendation to solve the issue, the multi-layer collaboration needs to be promoted; Japanese experts are to be assigned at the multi layers of the organization as the collaboration liaison for Japanese companies and India companies as well as governments.

At the central level, the key bottleneck for the Japanese companies is that they need to negotiate with various ministries in order to obtain approval and agree on conditions, which takes a large volume of men-hours. The

expert can support and facilitate the process by handling the procedure likely to take place at the central level for the CBIC projects.

At the CBIC special unit level, coordination between CBIC as a region and state government is to be a key; as the state government may have the different priority in the projects which are not aligned with CBIC, the balance of those needs to be controlled as the situation changes. If such coordination is delegated to an each private company, it is likely to block their actual business operation and discourages them to conduct further investment. Some personnel assigned as a coordinator will help both of India and Japan to build the win-win relation.

And the expert at the state level also takes important role. It is often contended that the investors or industry experts find it hard to communicate with the state government since they do not have much relationship at each state level; however, it is also told that the network at the state level is indispensable for smooth business operation in all the states in India. The expert will support to build in tight collaborative relation between India and Japan, then maximize the benefit of the collaboration.

All those experts need to work closely, exchange information, monitor the situation, and collaborate with Government of India and Japan to conduct further approach, if required.

Conclusion and Way forward

This master plan is expected to provide the significant value to both of Japan and India. For Japan, this can be utilized as the massive source of the valuable information for potential investors to make decision, and the comprehensive plan for existing companies to pursue more opportunity. For India, this master plan provides the blue print of the collaboration from Japanese government, and shows the direction on where the India companies should expand the business.

However, without any concrete steps, the plan stays as a plan and no execution will follow. To make the CBIC master plan as the key step for the implementation to follow, JICA Study team thinks that the following 5 actions are key milestones in the upcoming 2-3 years

1. Setting up PMUs at Central and State level for smooth collaboration

Objective:

- Support planning and implementation of Master Plan and conduct the investment facilitation in the Node

Action recommended:

- Establish PMU to support planning and implementation of Master Plan, which may include:
  - Coordination with Ministries and state governments
  - Coordination with stakeholders for SPV formulation and Node level Share Holder Agreements (SHA)
  - Supporting state governments in finalization of State Support Agreements (SSA) with the Node SPVs
  - Support for states on funding by project/program loans
  - Establishing monitoring scheme to operate PDCA with appropriate KPIs.
- Promotion of Industrial Node through developing marketing material and investor roadshows
- Enable private sector partnership for planning, implementation and O&M of the node

2. Drive Investment Environment Improvement at Central and State level

Objective:

- Provide a mid-long term Policy Guidance for private investor with improvement of the ease of doing business initiatives

Action recommended:

- Set programme for Policy Planning and Design
- Set program for implementing Procedural and Infrastructure solutions for implementing Ease of Doing Business
- Establish a panel for coordination between states at central governments
- Strengthen IPR Regime Governance

3. Enhance the industry competitiveness through government program

Objective:

- Skill Development, R&D and Technology transfer
- Encourage private participation in Industrial Node development

Action recommended:

- Set up an industrial knowledge park inside the each Node
- Incentivize industries to participate in the Training and Placement of workforce through State Policy Development
- Develop competitive and reliable utility services and pricing
- Establish indigenous support facilities such as Equipment Testing, Quality Control

4. Implement the priority project for quick win to build momentum

Objective:

- Expedite the priority project (25+19)

Action recommended:

- Establish Corridor Units in each Line Ministry
- Set up funding from GoI/State and Japan to actually drive forward the project

5. Institutionalize collaboration between India and Japan to attain mid-long term healthy growth

Objective:

- Institutionalise collaboration between Japan and India

Action recommended:

- Establish framework for multi-layer collaboration between Japan and India at Central, Corridor, and State Level
- Organise Working Groups between Japanese Agencies and State Governments

Disclaimer

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