INDIA'S FIRST COASTAL CORRIDOR

VIZAG–CHENNAI INDUSTRIAL CORRIDOR Conceptual Development Plan

FINAL REPORT

ASIAN DEVELOPMENT BANK

INDIA'S FIRST COASTAL CORRIDOR

VIZAG–CHENNAI INDUSTRIAL CORRIDOR

Conceptual Development Plan

FINAL REPORT

ASIAN DEVELOPMENT BANK

Contents

List of Figures and Tables

EXECUTIVE SUMMARY

FIGURE

INTRODUCTION

FIGURES

TABLES

CHAPTER 1

FIGURES

TABLES

CHAPTER 2

FIGURES

TABLES

CHAPTER 3

FIGURES

TABLES

CHAPTER 4

FIGURES

TABLES

Acknowledgments

We would like to express our gratitude to Mr. N. Chandrababu Naidu, Honorable Chief Minister of Andhra Pradesh, and Ms. Nirmala Sitaraman, Honorable Minister of State for Commerce and Industries, Government of India, for their leadership and strong interest during the preparation of this report. We sincerely acknowledge the valuable direction given by Mr. Amitabh Kant, Secretary, Department of Industrial Policy and Promotion (DIPP), Government of India and Mr. I.Y.R. Krishna Rao, Chief Secretary, Andhra Pradesh. Mr. Shatrughna Singh, Additional Secretary, DIPP; Mr. Nilaya Mitash, former Joint Secretary (Multilateral Institutions), Department of Economic Affairs (DEA) and Mr. Tarun Bajaj, Joint Secretary, DEA provided continuous guidance and support during all stages.

The work has involved intensive consultations with various entities within the state government, including the office of the Chief Minister and the departments of industries, roads and bridges, urban and municipal affairs, infrastructure and investment, and ports. We would like to convey special thanks to Mr. Armane Giridhar, Principal Secretary to the Chief Minister, Andhra Pradesh for his dedicated cooperation and hospitality in welcoming us at all times. We thankfully acknowledge the valuable contributions and inputs of Mr. B. Sam Bob, Principal Secretary, Roads and Bridges; Mr. D. Sambasiva Rao, Principal Secretary, Investment and Infrastructure, and Municipal Affairs; Mr. J.S.V. Prasad, Principal Secretary, Industries; and Mr. Gulzar Natarajan, Managing Director, Infrastructure Corporation of Andhra Pradesh.

Several brainstorming sessions with stakeholders, including think-tanks was undertaken. Mr. Rajat Kumar, Commissioner Industries, Andhra Pradesh, played a pivotal role in these meetings, especially on the regulatory aspects and reform agenda prescribed in the report. We also thank Mr. Talleen Kumar, Joint Secretary, DIPP, for sharing his experience on the Delhi-Mumbai Industrial Corridor.

We thank Ms. Sunita Yadav, Director, DIPP; Mr. A.K. Singh, Director, DIPP; Ms. Sheyphali Bhargava Sharan, Director, DEA; Mr. J. Satyanarayana, Managing Director, Andhra Pradesh Industrial Infrastructure Corporation; Mr Jaganatha Rao, Chief Engineer, Andhra Pradesh Road Development Corporaiton and Ms. Padmavati, Department of Industries, for the smooth facilitation they have provided at every juncture.

Executive Summary

Introduction

India's economy has expanded at a healthy pace over the past two decades. It is now time to consolidate the gains and tackle the remaining barriers to growth, generate more jobs, raise productivity, and expand economic opportunities for all. While the services sector has anchored India's recent growth, the manufacturing sector must be the engine of future growth and job creation.

The government's "Make in India" initiative is a growth strategy based upon development of economic corridors whereby policy initiatives to spur manufacturing and overall growth are coordinated with transport corridors linking both developed and backward regions. The vision is to create a globally competitive manufacturing sector supported by world class infrastructure, logistics facilities, and a liberal policy regime.

Industrial development is to be built around a set of industries that either exist in the country and account for a growing proportion of national and global economic activities, or represent frontier industries or niche sub-sectors that are expanding but have not yet established a foothold in India. Their development is to be accelerated through the creation of economic zones and manufacturing clusters served by efficient logistics services. The development of these zones and clusters requires the acquisition of land that is of sufficient scale and well-connected to sources of labor and other local inputs. This requires effective zone management to attract enterprises and support their growth, and a regulatory regime that facilitates the establishment of enterprises; allows uninterrupted operations; and facilitates the development of integrated national supply chains—including embedding micro, small, and medium-sized enterprises (MSMEs) and linking them with global production networks for the delivery of inputs and distribution of outputs in domestic and global markets.

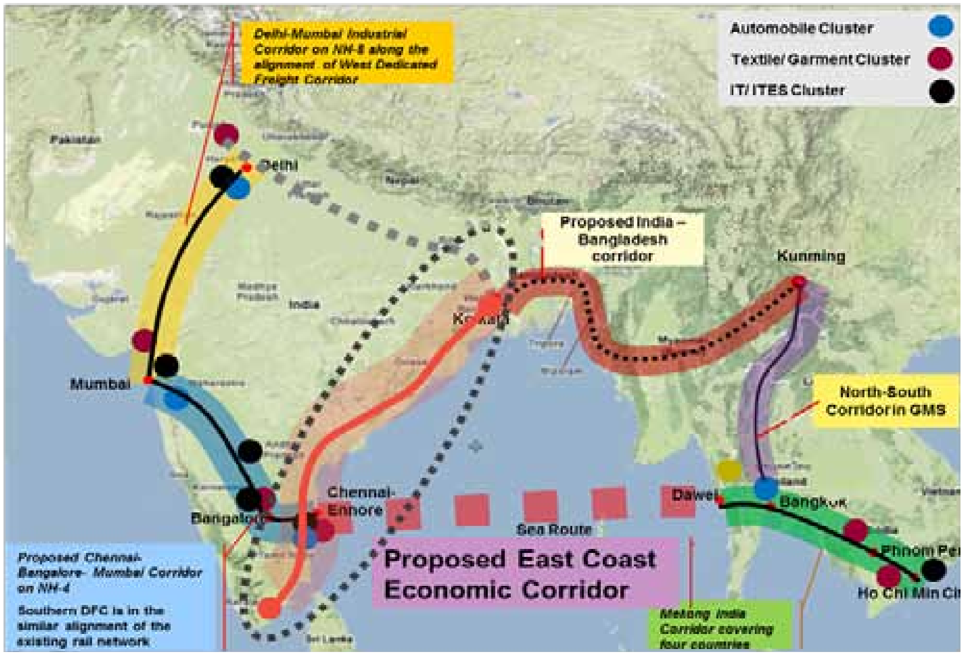
Vizag–Chennai Industrial Corridor

The Vizag–Chennai Industrial Corridor (VCIC) is a key part of the planned East Coast Economic Corridor, India's first coastal corridor (see Figure E1).[1] VCIC is aligned with the Golden Quadrilateral and is poised to play a critical role in driving India's new "Act East Policy."

---

1 This report excludes the areas that overlap with the Chennai–Bengaluru Industrial Corridor (CBIC). As a result, the discussion is largely focused on the newly created state of Andhra Pradesh.

Figure E1: **East Coast Economic Corridor: India's First Coastal Corridor**



Source: Study team compilation.

India's "Act East Policy," as recently outlined by Prime Minister Narendra Modi, is a proactive initiative focused on increasing the integration of the Indian economy with the economies of the Association of Southeast Asian Nations (ASEAN). The Act East Policy is based upon the establishment of programs and projects, with defined timelines for the achievement of milestones, that support this integration.

In the traditional framework, an economic corridor has three complementary components: (i) a trade and transport corridor, (ii) production clusters producing goods for both consumption in the surrounding region and for global trade, and (iii) urban centers along the corridor. VCIC's long coastline and strategically located ports provide it with an opportunity to create multiple international gateways to connect India with the vibrant global production networks of Southeast and East Asia that form the bedrock of global manufacturing today. The ports are critical to unlocking the potential of VCIC and should be seen as a source of value-added to domestic and global supply chains.

At the heart of VCIC is a transport corridor that extends north–south over 800 kilometers along the coast connecting a set of economic nodes where industries will be located. The corridor includes National Highway 5, which is part of the Golden Quadrilateral, the Kolkata–Chennai rail route, and seven non-captive operational[2] ports.

[2] Kakinada Anchorage Port and Kakinada Deep Water Port are considered as a single port.

While economic growth in Andhra Pradesh has matched the national growth rate over the last decade, the recent division of the state poses significant challenges to growth because it excludes industrial activity (including information technology activities) around Hyderabad. However, the development of the metallurgical, pharmaceutical and petrochemical industries in the north and the continued expansion of industrial activity in the food processing sector and, the industrial development within Sri City in the south will contribute to Andhra Pradesh's industrial base, while growth in traffic through the seaports and increasing power generation capacity will facilitate further economic development. Growth will be buttressed by domestic investment in existing industries and foreign direct investment (FDI) in existing and new industrial activities. Regulatory reforms and institutional changes that (i) improve the investment climate under which firms start and operate their businesses, (ii) enable goods and services to move seamlessly within and beyond the corridor, and (iii) allow for more synchronized industrial and urban planning in and around industrial clusters and zones will result in rising levels of domestic investment and FDI. At the same time, the impacts of domestic investment and FDI will be amplified by the development of the VCIC's major ports and industrial clusters.

Sector- and Node-Based Development

The following sectors and sub-sectors were identified as drivers of industrial development: (i) food processing, (ii) pharmaceuticals, (iii) auto and auto components, (iv) textiles, (v) metallurgy, (vi) chemicals and petrochemicals, and (vii) electronics. Small and medium-sized enterprise (SME) development will also be a key priority within the corridor, with an emphasis on developing supply chains to integrate SMEs. By clustering producers and suppliers in the same location, their regular interactions will be strengthened and domestic suppliers can observe the business models and practices used by global firms and suppliers.

Four geographic nodes will drive the growth of these industries, supported by a network of multi-modal transport to demand centers, urban clusters, and international gateways. These four nodes were selected based on the following criteria: (i) current level of industrial agglomeration, (ii) availability of land for development of new industrial clusters, (iii) proximity to urban centers and seaports, (iv) rail and road connectivity, and (v) availability of power and water. The industries in the sectors and sub-sectors identified above will be located in these four identified nodes and connected through a multimodal transport network to demand centers, urban clusters, and international gateways.

The northern node is centered around Visakhapatnam and is in close proximity to the ports of Visakhapatnam and Gangavaram, and the industrial activities in the immediate hinterland of these ports. The southern node is close to the urban centers of Tirupati and Nellore, the port cluster from north of Chennai to Krishnapatnam, and the industrial zones in their immediate hinterland, most notably Sri City. The two nodes in the central region are primarily green field. One extends from Gannavaram to Kankipadu, with Vijaywada as the major urban cluster. Itt serves the surrounding industrial clusters and will be served in the future by the port of Machilipatnam. The other node is around the port of Kakinada and the urban centers of Kakinada and Rahjamundry.

The node-based industrialization strategy proposed for VCIC is targeted to achieve regional and global competitiveness. Infrastructure development and urbanization are critical to attain this core objective. While there are pockets of major urban and industrial clusters in the north and south of Andhra Pradesh, the rest of the state, including the two nodes in the central region, faces a challenge. This challenge can be overcome by putting in a place a synchronized infrastructure and urbanization strategy.

The study recommends a two-fold approach: (i) a plan to upgrade and strengthen the spinal routes (north–south alignment) along the corridor to enable connectivity between industries and ports, and strengthen the grid network from the gateways and the nodes to the hinterland; and (ii) a policy of node-centric infrastructure development. Access to and the cost of power and water are other important elements of any strategy to augment VCIC's capacity to support value-added manufacturing.

Industrial development inevitably promotes urbanization, and a certain level of urbanization is necessary to support industrialization. Therefore, a strategy of proactive urbanization is proposed as well as a more pragmatic approach to land assembly for industrial development and regional infrastructure and urban development.

Policy and Regulatory Reforms

The action plan for any successful economic corridor hinges on three elements: (i) infrastructure, (ii) institutions and regulations supporting the ease of doing business, and (iii) planning and management of clusters. Investment in infrastructure is important and can be managed through innovative public–private partnerships. However, the development of institutional capacities and facilitation of trade remain among the greatest challenges.

Two types of regulatory issues need to be addressed to facilitate industrial development in the corridor (i) regulatory issues specific to VCIC that improve the investment climate and facilitate the establishment of enterprises, such as a Single Window system for start-up related approvals and the ongoing operations of existing firms; and (ii) regulatory issues involving more than one state, such as the transit of goods across state borders or through ports. Therefore, trade facilitation and implementation of the Single Window system are critical to reducing the cost of doing business and integrating into global value chains.

To achieve the first objective, each state in the corridor has to undertake critical policy, institutional, and process reforms associated with regulatory compliance. The study team has worked with the Government of Andhra Pradesh to reform and streamline the Single Window system. Under the proposed framework, approvals for setting up new enterprises[3] can be obtained within 15 days for green industries and between 45 days and 60 days for other types of industries.

For inter-state issues, the appropriate institutional framework needs to be adopted to harmonize regulatory standards and compliance processes. The National Industrial Corridor

[3] For all categories, the time frame is achievable if units have the land and does not require surface water.

Development Authority proposed by the Department of Industrial Policy and Promotion is envisaged to play a key role in facilitating the institutional mechanisms for addressing these regulatory issues along with ensuring corridor development.

The other critical element involves the planning and management of industrial clusters. Industrial development has evolved from building industrial estates to creating and servicing large-scale economic zones housing single or multi-product clusters. Global investors expect high levels of quality in the planning, design, construction, and management of these developments.

The two emerging models of planning and governance are that of private-sector-led Sri City in Andhra Pradesh, and the Special Investment Region format in Gujarat where a Regional Development Authority has been created and empowered to undertake planning and development, including the use of land pooling. These models need to be complemented by a comprehensive governance framework that supports the management and planning of zones and clusters in VCIC. The challenge is to consolidate the fragmented governance mandates of the federal, state, city, and rural authorities under one zonal or cluster management entity that allows business to operate seamlessly and efficiently. The Government of Andhra Pradesh's Industrial Local Area Authority and the amendments providing Local Authority status to the Andhra Pradesh Industrial Investment Corporation (APIIC) offer a framework that can be further improved upon. The goal is to provide for flexibility in engaging government and private entities to perform specific roles in the planning, development, and management of zones and clusters through the delegation of powers or contractual arrangements as needed.

Conclusion

To summarize, this study identifies the nodes to be taken up for industrial development; industries for future development, including MSMEs; an infrastructure strategy; and a set of priority projects, particularly last-mile connectivity projects, to unlock the near-term potential of the corridor. The study also recommends a set of policies to streamline the regulatory process for setting up and operating businesses efficiently.

The next phase of the study will involve preparation of a comprehensive Regional Perspective Plan, econometric modelling and demand surveys for infrastructure requirements, locational and global benchmarking analysis for selected industries, and the design of policy interventions to improve the regulatory environment in VCIC. Simultaneously, a Master Plan and a Development Plan for selected nodes along the corridor will be prepared.

Introduction

India has undergone rapid structural transformation and achieved strong growth in the past two decades. To preserve these hard-won gains and remove the remaining barriers to growth, it has to continue creating economic opportunities. India also has to broaden access to these opportunities. Indeed, with the proportion of India's workforce that depends on agriculture declining, and given the large numbers of new entrants into its labor force—estimated to be around 12 million per year—one of the most pressing policy challenges is to create more productive and well-paying jobs. Such jobs are vital not only for sustaining high growth, but also for ensuring that growth is inclusive.

While India's services sector has anchored both economic growth and job creation in recent decades, it is now time for India's manufacturing sector to be an engine of growth and jobs. In many ways, India's manufacturing sector has been and continues to be well-poised to play this role. India has an abundant labor supply, especially semi-skilled labor, and has developed the capabilities required for a diversified and dynamic manufacturing sector. This may be seen not only in terms of the sheer range of manufactured products produced in the country, but also in terms of India's manufacturing export basket, which includes relatively sophisticated chemical, pharmaceutical, and auto component products.

Unfortunately, for many years now the manufacturing sector has contributed only around 15% of gross domestic product (GDP) and 12% of employment. By comparison, the manufacturing sectors of the People's Republic of China (PRC), Malaysia, Thailand, and Viet Nam account for nearly 25% or more of GDP. In addition, while manufacturing's employment shares in some of these countries are not too different from India's—for example, a little above 15% in the case of Thailand—the large majority of Indian manufacturing employment is concentrated in small-sized, informal sector enterprises where low productivity, earnings, and wages are the norm.

Recognizing the importance of a more dynamic manufacturing sector, the Government of India has unveiled the National Manufacturing Policy (NMP), which calls for boosting the share of manufacturing to 25% of GDP and employing around 100 million workers (from around 50 million today) by 2022. To achieve these targets, the NMP is spearheading rationalization and simplification of business regulations, including the use of a Single Window clearance mechanism; an "exit policy" that aims to balance firms' needs for adjusting employment levels in response to market conditions with workers' needs for income security; financial and institutional mechanisms for technology development, especially for small and medium-sized enterprises; large-scale infrastructure development; and clustering by means of setting up National Investment and Manufacturing Zones.

A unique opportunity to achieve the goals of the NMP exists via a second initiative of the government: the promotion of economic and industrial corridors. These corridors have the potential to kick start the country's manufacturing sector and provide employment to millions entering the workforce, contributing significantly to the aims of NMP.

Indeed, economic corridors present a unique opportunity for implementing the NMP and ensuring that India's manufacturing sector performs at or close to its potential.

The government's "Make in India" initiative also identifies economic corridors as policy instruments to spur manufacturing and overall economic growth. There are five major economic corridors at various stages of planning and implementation. The oldest and most advanced is the Delhi–Mumbai Industrial Corridor (DMICDC). Others include the Chennai–Bengaluru Industrial Corridor (CBIC); Bengaluru–Mumbai Economic Corridor (BMEC); Amritsar–Kolkata Industrial Corridor (AKIC); and the East Coast Economic Corridor (ECEC), India's first coastal corridor. The Vizag–Chennai Industrial Corridor (VCIC) comprises the first phase of ECEC.

While there are various definitions of an economic corridor, it essentially involves the creation of an efficient multimodal transport network within a defined geography and supported by quality infrastructure; logistics; a policy framework that facilitates doing business (e.g., trade facilitation); and distribution networks that link production centers, urban clusters, and international getaways. Once created, these corridors facilitate growth by easing infrastructure bottlenecks, improving access to markets, stimulating trade and investment, and boosting productivity and efficiency through associated network externalities and agglomeration effects.

Economic corridors promote inclusive growth by expanding economic opportunities in backward regions and providing forward linkages with urban centers and industrial clusters. Strategically located national economic corridors can also boost regional cooperation and linkages with global markets through increased investment and trade by encouraging production fragmentation and linking domestic producers with global production networks.

The East Coast Economic Corridor

The project influence area of ECEC has several centers of economic activity, covering not only the resource-rich, but also the poorest, regions of Andhra Pradesh, Odisha, Tamil Nadu, and West Bengal. Nearly 48.5 million of India's poor live in the four core states along this corridor. Poverty levels vary among the four states that comprise VCIC. In 2012, Andhra Pradesh and Tamil Nadu had poverty levels of 9.2% and 11.3%, respectively, while in Odisha and West Bengal these ratios were 32.6% and 20.0%, respectively.[1] Meanwhile, industrial output and net value-added is most concentrated in Tamil Nadu, which accounts for more than 10% of total Indian industrial output and value-added.[2]

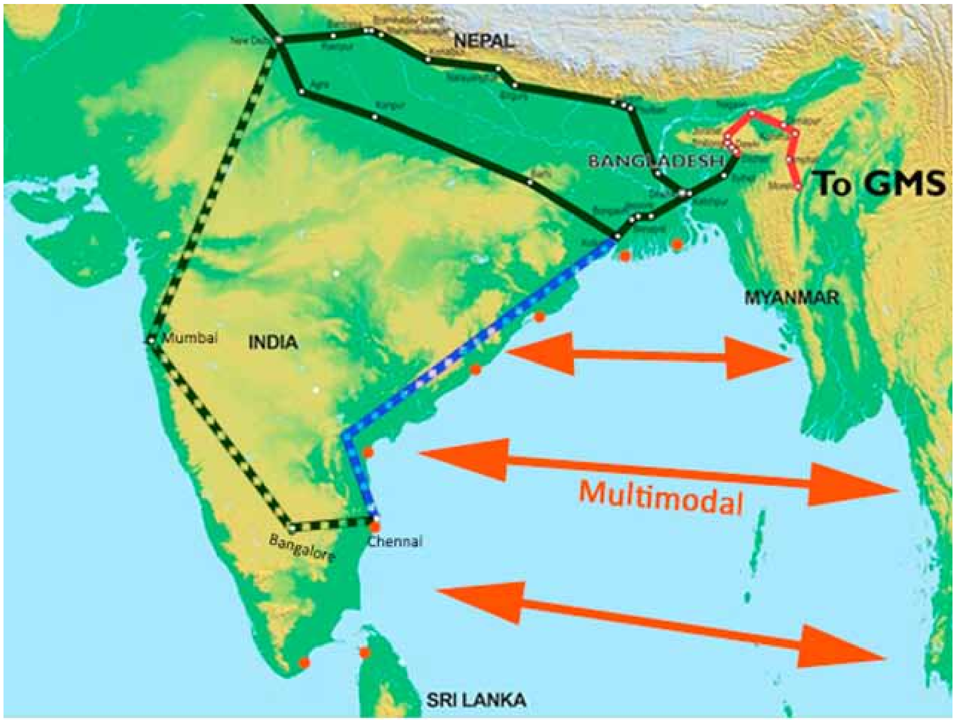
1 Reserve Bank of India. 2013. *Annual Report 2012*. New Delhi.

2 Ministry of Statistics and Program Implementation. 2013. *Annual Survey of Industries 2010–2011*. New Delhi.

Linking the lagging regions with the growing and well-established industrial clusters in Andhra Pradesh and Tamil Nadu will help create job opportunities for the poor. The two states have industrial clusters comprising automobiles, chemicals and petrochemicals, and food processing. Some of these clusters in Tamil Nadu—such as automobiles, automobile components, and niche electronic components—are already linked with the production networks of East Asia. In order to stimulate economic activities in other emerging clusters and distribute growth within the region, efficient multi-modal transport—supported by necessary infrastructure services, efficient logistics, distribution networks, and an institutional framework—is necessary.

The presence of a strong information and communication technology (ICT) industry in Kolkata, Visakhapatnam, Hyderabad, and Chennai can lend support to ECEC's communications network; provide a platform for skills development in other related service sectors; and facilitate implementation of e-governance systems for maintenance, monitoring, and evaluation of corridor development activities.

Figure A: **Multi-Modal links between ECEC's Gateway Ports and ASEAN Production Networks**



ASEAN = Association of Southeast Asian Nations, ECEC = East Coast Economic Corridor
Source: ADB.

ECEC will be the nation's first coastal corridor. It stands out in comparison with other proposed national corridors as it hosts several ports along the east coast that serve not only as international gateways, but more importantly as critical links in supply chains (Figure A). In the latter role, ports are a source of value creation for firms that provide services— ranging from logistics to packaging—to production clusters and distribution centers, and play a significant role in economic development.

While there have been no previous efforts to develop a coastal economic corridor, there are examples of the development of a coastline in support of economic growth and development. These can be divided between examples in which (i) a number of ports were developed along the coastline with each one serving a separate hinterland, but with some overlap allowing for inter-port competition; and (ii) industrial and commercial activity was developed along a coastline between ports.

A good example of the formation of a gateway region is the Rhine–Scheldt Delta in Western Europe, one of the largest logistics clusters with capacity for large cargo consolidation. The ports in the delta make a direct contribution of around 8% of GDP in Belgium and Netherland, in addition to indirect contributions and job creation. The other oft-cited example is the phased development of special economic zones around ports in the PRC since 1980, and their subsequent transformation into economic clusters that paved the way for creation of the world's most important manufacturing cluster in the Pearl River Delta.

The major ports on the east coast of India are Kolkata, Haldia, Paradip, Visakhapatnam, Ennore, and Chennai. These are supported by private ports in in Kattupalli, Krishnapatnam, Dhamra, Gangavaram, and Karaikal. Three port clusters are emerging: (i) upper east coast, comprising Kolkata, Haldia, Dhamra, and the proposed Sagar port; (ii) central east coast, comprising Visakhapatnam, Gangavaram, and Kakinada; (iii) lower east coast, comprising Chennai, Tuticorin, Krishnapatnam, Kattupalli, and the planned port at Durgarajpatnam.

The Vizag–Chennai Industrial Corridor

VCIC is a part of ECEC and aligned with the Golden Quadrilateral and therefore poised to play a critical role in India's "Act East Policy". Its long coastline and strategically located ports are expected to help India connect with dynamic Southeast and East Asia, particularly their vibrant global production networks that form the bedrock of global manufacturing today. VCIC is positioned as India's first industrial corridor.

The corridor between Vizag and Chennai will have an influence area across Andhra Pradesh and Tamil Nadu, and already makes a significant contribution to India's GDP and total manufacturing output. The strategy to develop VCIC is part of the plan to achieve accelerated development and regional industry agglomeration in the focus states. Regional industry agglomeration could be achieved by attracting companies in the value chain of other companies already based in the corridor, attracting particular industries that the corridor provides with geographical advantages, or building and maintaining advanced infrastructure to support industries. The advantages to industries operating along the corridor include benefits arising from smooth access to industrial production units, decreased transportation and logistics costs, improved delivery time, and a reduction in inventory costs.

VCIC is thus intended to facilitate development of a well-planned and efficient industrial base served by world-class connectivity infrastructure. The availability of world-class infrastructure along the corridor will bring increased private investment in manufacturing and industrial activity in the two states. Attracting more private companies, particularly second- and third-tier manufacturing companies, will strengthen the global competitiveness of local manufacturers, thus promoting regional development. As VCIC overlaps with the Chennai–Bengaluru Industrial Corridor (CBIC), the report will not examine the areas that are taken up under CBIC.

Additionally, by investing in improved connectivity between the corridor and backward regions in the hinterlands, VCIC will promote inclusive growth well beyond its immediate vicinity. When combined with efforts to integrate micro, small, and medium-sized enterprises (MSMEs) in sectors such as textiles and food processing into modern supply chains, increased connectivity between VCIC and backward regions will expand economic opportunities by providing MSMEs with forward linkages to vibrant urban centers and industrial clusters.

The Framework for India's First Coastal Corridor

The goal of ECEC is to create a more competitive environment for the development of trade and industry in the states along the corridor in order to boost production, create decent jobs, and to reap the benefits of India's population dividend.

In the traditional framework, an economic corridor has three complementary components: (i) a trade and transport corridor (discussed above), (ii) production clusters producing goods for both consumption in the surrounding region and for international trade, and (iii) urban centers. The latter are not only major markets for goods from the production centers and imported through the international gateways, but also a source of labor, technology, knowledge, and innovation (Figure B).

Since the basic infrastructure is available, most of the challenge in developing this corridor is how to facilitate production activities, trade, and transport between clusters of production and consumption, and increase value-added contributions to domestic and international supply chains.

VCIC should be conceived as a market and service area for the principal economic clusters in the corridor. Each cluster comprises an urban center, a port, and one or more production enclaves, each contributing to the activities of the others (Figure C). The physical separation between these three components varies. In some cases they overlap within a metropolitan area, and in others they are physically separate but connected by trunk roads and railway lines.

In order to facilitate the economic development of these clusters, it is important to strengthen the linkages between the port, the urban center, and the production enclave. This includes not only the physical infrastructure connecting them, but also the supply chains used to exchange goods and services, and the information flows needed to coordinate and expedite transactions. Since each component has a separate governance structure, a mechanism for collaboration is required not only to improve the physical infrastructure that connects

Figure B: **Three Components of an Economic Corridor**

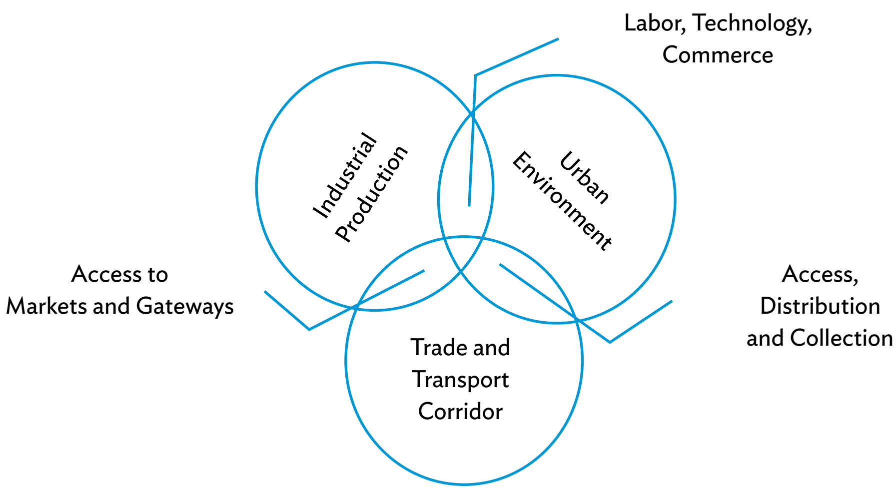


Figure C: **Economic Clusters**

them, but also to integrate the activities in the supply chains that link them and expand the information flows between them.

(i) **Strengthening Linkages**

Linkages can be strengthened through the establishment of

- inland container depots near the urban center and/or production enclave that are connected to the port by rail;
- distribution centers for goods imported to and exported from the immediate hinterlands;
- information systems for facilitating transactions associated with moving goods through a port and monitoring the status or shipments;
- zone management systems to facilitate the establishment of businesses, provide information on procedures related to business operations, and deliver services to these businesses;
- e-governance platforms providing similar services; and
- port community organizations for improving coordination between border agencies, port authorities, shippers, shipping lines, and logistics service providers.

So far, the focus has been on the linkages connecting the three components in an economic cluster. In addition, there are linkages that connect the different economic clusters in the VCIC, allowing them to share services and access each other's markets. As a result, they can specialize and achieve economies of scale by obtaining goods and services from suppliers throughout the corridor and delivering their outputs to other clusters. This would be in addition to the international trade in goods through the port (and airport) in each cluster.

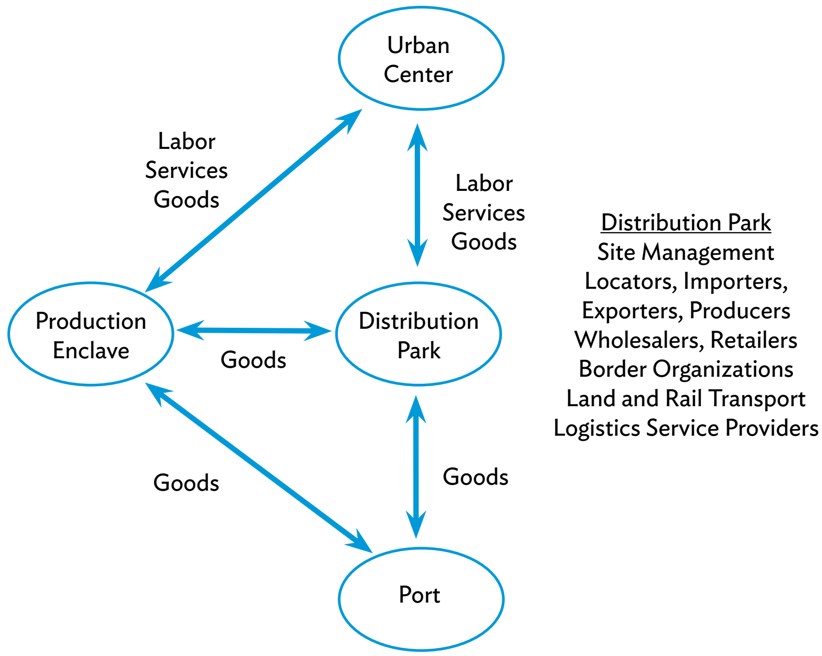
(ii) **Improving Distribution**

International trade is primarily east–west in orientation, in contrast to the north–south axis of VCIC. Goods from both Europe and East and Southeast Asia are delivered to VCIC ports primarily through feeder services from Singapore and Colombo. The goods, a majority of which are containerized, are then distributed throughout the port's adjacent hinterlands. Some containers are delivered direct to the consignee while others are delivered to storage facilities where they are de-stuffed and their contents subsequently distributed.

Globally, the efficiency of distribution networks has improved dramatically with the introduction of modern logistics, the primary component of which has been the distribution center. These have replaced the traditional *godowns* (warehouse) with larger warehouses that provide automated inventory management systems, including vendor-managed inventory, and efficient cargo transfer capabilities, including cross-docking. Distribution centers are typically located near one of three places: the point of production, the final market, or a modal interchange. For the typical cluster, they would be within the production enclave at the periphery of the urban center or in the area behind the port.

While many factories produce against fixed orders and do not hold stock, most producers of consumer goods, especially fast-moving consumer goods, stock an inventory that is

Figure D: **Distribution Parks**



maintained near the factory or final market. Distributors and large retailers place orders for restocking inventory. This inventory is located at a site that can receive large shipments from suppliers, which can be delivered via smaller shipments to various buyers and stores.

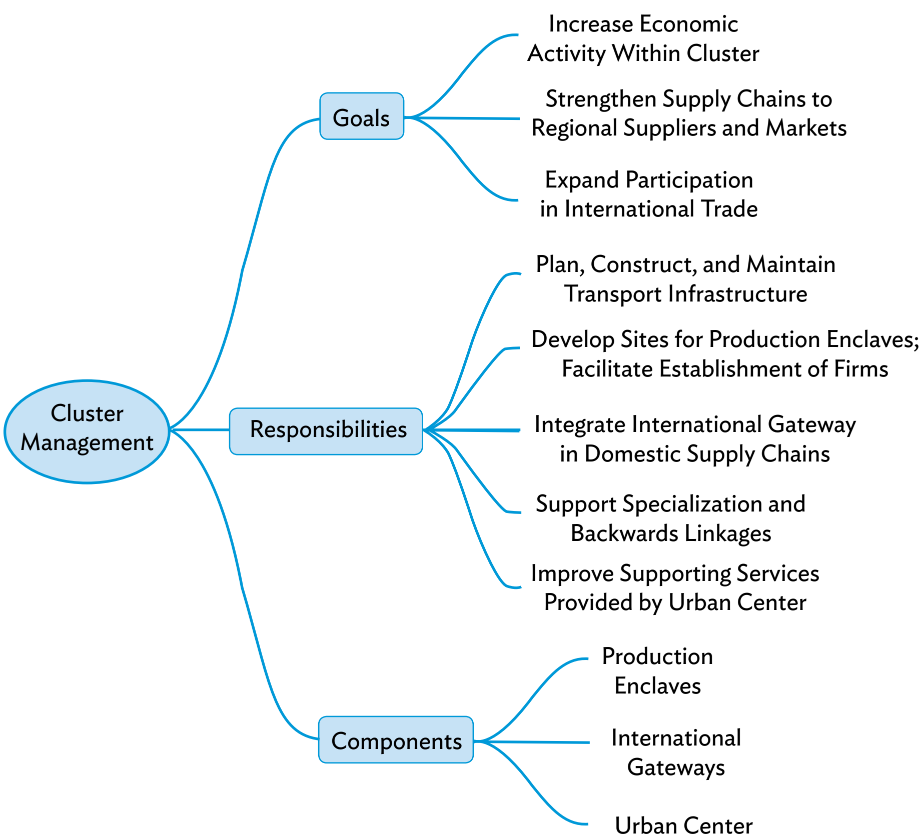
Urban ports have played a limited role in distribution because of their limited backup area, although some regional *entrepôt* (e.g., Singapore and Rotterdam) developed distriparks near their ports specifically for this purpose. Newer ports, most notably those in the Middle East, have been designed to include large areas for warehousing and distribution activities.

Large distribution centers are usually located far from urban centers, while smaller warehouses are established on the periphery. In order to better serve growing demand in urban markets, distribution parks have been established on the periphery of urban centers at a reasonable cost and with good access to trunk roads and the urban road network. While production enclaves have been developed with separate areas for logistics services, most distribution centers are extensions of production facilities (Figure D).

Development of VCIC

The development of VCIC into an integrated market with efficient supply chains connecting regional suppliers, producers, and markets begins with strengthening the economic clusters

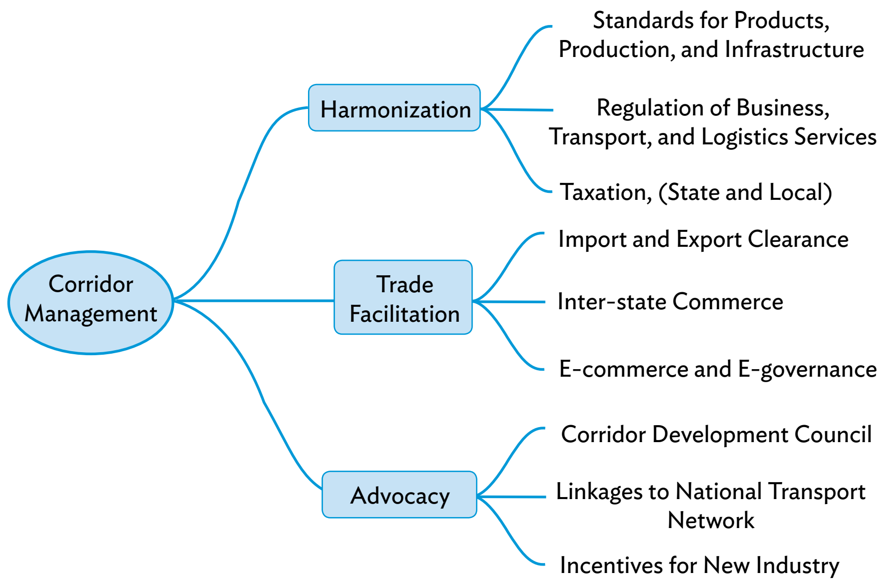
Figure E: **Role of Cluster Management**



(Figure E). The current trunk roads and rail network are sufficient to support this development, however, capacity will have to be increased as economic activity grows. More important, the linkages between cluster components need to be strengthened to allow reliable delivery of goods and services. The gateway seaports need to improve their container handling facilities. The flow of goods through ports needs to be more efficient and better integrated. A port should function not as an impediment to trade but rather as a part of the supply chains serving international trade.

Activity in the production enclaves needs to be increased. This may involve the expansion of industrial, zones, the simplification of regulations related to doing business, and improvements in supporting services provided by the management of these zones. The urban center supports production activities in a variety of ways, for example, by providing housing, education, and other services for the persons working in the industrial enclaves. It also supports the delivery of goods produced through the development of urban freight distribution networks.

Figure F: **Role of Corridor Management**



Collaboration at the regional level is required to address a number of challenges facing VCIC, including the need for harmonization, trade facilitation, and advocacy (Figure F). Harmonization and trade facilitation are needed to improve access for primary economic clusters to markets throughout the corridor. Trade facilitation applies to both international and inter-state trade. Advocacy involves attracting new industry to the region and ensuring that each cluster has a reasonable level of access to the national transport network.

A uniform set of standards is necessary to minimize reputational risk from substandard products, while avoiding competition based on the level of regulation. This is especially important for the food processing and pharmaceutical industries. Harmonization of business regulations and logistics services should be combined with simplification of these regulations in order to encourage competition. Harmonization of taxes is a continuing problem because of the diversity of state and local tax rates. These affect not only the location of businesses, but also the structure of the supply chains, and lead to inefficiencies.

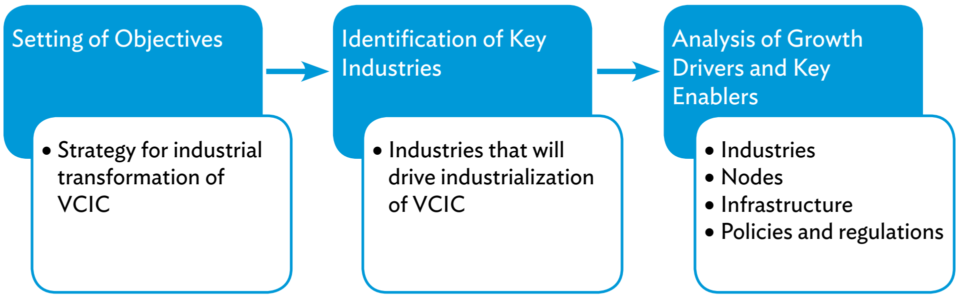
The need for collaboration among various government entities within a corridor can be addressed through the formation of a development council. The council can attract new industry to the corridor by providing incentives at both the regional and local level. It can also solicit support for the development of linkages between the economic clusters and the national transport network.

Study Approach and Summary of Findings

The overall objective of this exercise is to craft a strategy for industrial transformation of the Vizag–Chennai Industrial Corridor (VCIC). The approach employed was to first identify the industries that will drive growth in VCIC and the nodes in which they will be strategically located, taking into account land availability. Of course, another key driver is infrastructure. As VCIC is a coastal corridor, ports play a significant role in the infrastructure strategy, as well as other industrialization enablers such as power and water supply. While their availability is a necessary condition for building a corridor, other critical elements include institutional frameworks, policies, and regulations that create a favorable investment climate, and the ease of doing business for investors, both domestic and foreign (Figure G).

In this section, we briefly summarize the study's approach and conclusions with respect to the (i) selection of industries, (ii) selection of economic nodes, (iii) infrastructure strategy, and (iv) policies and regulations that improve the ease of doing business.

Figure G: **Crafting a Strategy for the Industrial Transformation of VICC**



Industrial Transformation in VCIC

VCIC, will be one of the key drivers for economic growth in both southern India and the country as a whole. VCIC has the advantages of a long coastline, the presence of key ports and urban agglomerations, and a workforce that will help it achieve the following industrial transformation objectives:

- **Increase the manufacturing sector's contribution to state and national output.** The manufacturing sector's share of the gross domestic product (GDP) of the two states comprising VCIC—Andhra Pradesh and Tamil Nadu—is 10% and 17%, respectively. In the case of Andhra Pradesh, this share is less than India's average of 15%. In countries like the People's Republic of China (PRC) and Thailand, the manufacturing sector's contribution is more than 30%, suggesting that there is enormous potential for the manufacturing sector in both VCIC and in India as a whole. Improving the manufacturing sector's contribution to state-level GDP will be critical.

- **Level regional industrialization.** VCIC's success will be dependent on addressing the issues of skewed industrialization within the region as evidenced by strong manufacturing sector performances in key districts like Visakhapatnam and East Godavari. Visakhapatnam's manufacturing sector comprises 22% of the district's GDP, and in East Godavari this share is 13%. Many districts in VCIC have manufacturing sector's that contribute less than 10% to district-level GDP. Additionally, improved connectivity between VCIC and hinterland regions (especially backward ones) and programs that spur dynamism among hinterland MSMEs will expand economic opportunities for the latter, thereby contributing to the leveling of regional industrialization within VCIC states.
- **Improve labor productivity.** Many industries in VCIC are engaged in labor-intensive activities in the formal sector where the small scales of operation and lack of technology result in low-levels of productivity and wages. The focus needs to be on deploying more capital to boost productivity and creating more jobs in the formal sector. There also needs to be an effort to assist MSMEs, especially in employment-intensive sectors, upgrade and link up with modern supply chains and/or vibrant demand centers.
- **Enhance regional and global competitiveness.** Industries in VCIC should seek to link with global value chains to drive export growth and competitiveness.

Industries That Will Drive the Industrial Transformation of VCIC

To achieve the industrial transformation of VCIC, it is necessary to identify the right set of industries for promotion. These include industries that

- are projected to attain high growth rates driven by domestic and/or export demand;
- offer competitive and comparative advantages at both the state and country levels;
- create employment opportunities and drive wages higher; and
- are new and/or expanding, and can be attracted to the corridor (sunrise industries).

A two-step analysis was undertaken to identify industries for promotion:

- **Step 1:** Generate a shortlist of industries that will drive industrial transformation.
- **Step 2:** Identify industries that will drive the growth of certain sectors.

Market analysis was undertaken for 78 industries, as per the National Industries Classification (NIC). These were grouped into 25 distinct sectors that could potentially be attracted to VCIC. The parametric assessment comprised two stages: (i) "what is" analysis to identify existing strengths in particular sectors, and (ii) "what could be" analysis to identify underdeveloped sectors with potential for growth. The analyses were undertaken at the state, country, and global levels using parameters such as trends in foreign direct investment (FDI), other investment, exports, output, dynamic revealed comparative advantage, and relative trade advantage, among others. Using the "what is" and "what could be" analyses, a list of sectors was identified as potential winners for the proposed VCIC (Figure H).

The sectors included in Figure H comprise 34 sub-sectors (as per 3-digit NIC codes), which were further analyzed to identify the top sub-sectors from three different aspects:

Figure H: **Sectors Identified as Potential Winners in VCIC**

Food Processing	Pharmaceuticals	Auto and Auto Components	Textiles	Metallurgy	Chemicals and Petrochemicals	Electronics

- export-driven, with potential for increasing VCIC exports;
- domestic-demand-driven, with potential for expansion in domestic markets; and
- employment-intensive, with potential for providing more jobs.

Each of the sub-sectors was tested for relevance (i) on a global scale, (ii) in the Indian context, and (iii) in the context of Andhra Pradesh (95% of VCIC falls within the state), as presented in Appendix A.

Analysis of Sectors and Key Enablers for Industrial Development

The study team has undertaken detailed industry analysis of the shortlisted sectors, including

- global, country, and state level scenarios of investment and growth;
- industry structures (e.g., segments driving output, employment, productivity, and growth);
- benchmarking against sector performances in key Indian states;
- infrastructure and supply chain issues in key industrial clusters in Andhra Pradesh;
- assessment of MSMEs, including the employment-intensive textiles and food processing sectors;
- approaches to leveraging established supply chains (including global production networks) for SME growth and development; and
- policy and institutional enablers.

The above analysis led to the identification of (i) structural issues within Andhra Pradesh in each sector, (ii) key segments that are driving growth and productivity in other states, and (iii) success factors that will impact investment decisions and possible locations for the shortlisted industries. This analysis helped in identifying four districts to serve as industrial nodes within VCIC: Visakhapatnam, East Godavari, Krishna, and Chittoor. Together, the four districts contribute around 55% of the state's manufacturing output. Visakhapatnam and East Godavari are also key contributors to the state's manufacturing employment. Visakhapatnam has the highest level of value-added at INR10 *lakh* (100,000) per employee, compared with INR3 *lakh* per employee in Chittoor and East Godavari, on account of greater investment in the chemicals and petrochemicals sector. Across all four districts, over 60% of total employment is in the unorganized sector, with the food processing and textiles industries being the major employers.

The study team interacted with select stakeholders operating in the node areas to understand their concerns about industrial infrastructure development. The team also benchmarked the industrial infrastructure of successful industrial parks and clusters elswhere in Asia, including the Hsinchu Science Park in Taipei,China; TEDA Industrial Park in Tianjin in the PRC; and Suzhou Industrial Park in the PRC.

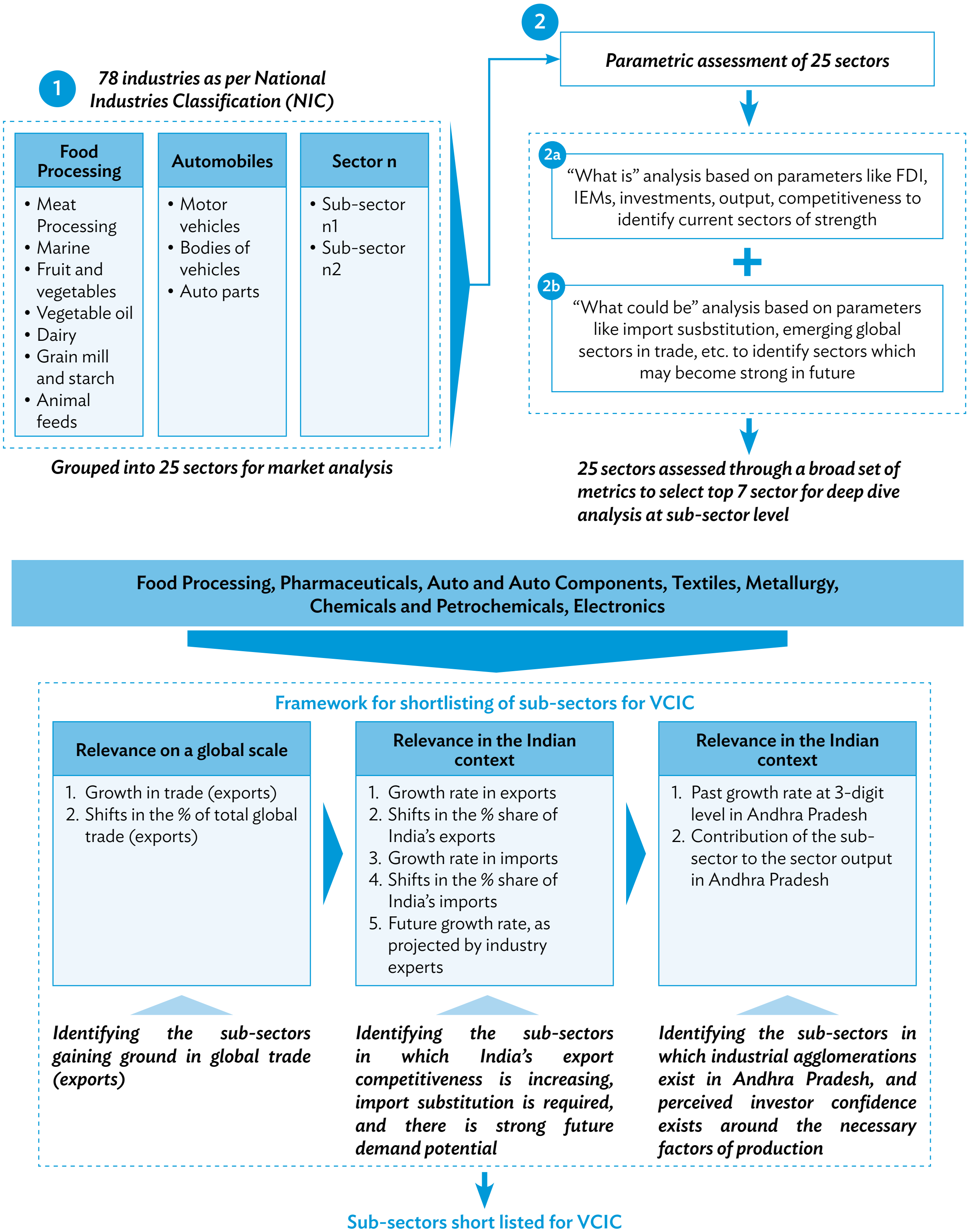
Connectivity infrastructure, logistics facilities, urban connectivity, and skilled manpower availability emerge as the key success factors from benchmarking globally successful industrial hubs.

Regulations and their implementation mechanisms are critical for realizing the full economic potential of any industrial corridor. Key recommendations for the VCIC include

- defining a Single Window system, and augmenting the roles and capacities of the relevant nodal agency(s), to provide a uniform regulatory compliance experience to current and potential investors;
- introducing information technology (IT)-enabled systems with user dashboards for the relevant committees to monitor agency clearances;
- creating integrated check-posts at borders with the participation of relevant state enforcement agencies; and
- rationalizing value-added taxes and entry tax structures across participating states, including goods- and area-based tax exemptions;

Finally, the Corridor Management Authority proposed by the Department of Industrial Policy Promotion needs to play a facilitating role in addressing many of the inter-state issues listed above.

Appendix A: Methodology for Selection of Sectors and Sub-Sectors



VCIC Industrial Nodes

Approach for node identification

One of the objectives of the study was to identify suitable nodes for industrial development within the corridor area. The study team has carried out (i) identification of the land parcels available with the government and in private industrial parks, and (ii) analysis of potential nodes for development using "must have" and "good to have" criteria. The prioritization of industrial nodes for the master plan will take place under Phase 2.

Based on the discussions undertaken with state government officials, 119 locations in government industrial park and special economic zones (SEZs) and private industrial parks and SEZs were identified as having vacant land. (All locations were in Andhra Pradesh as districts in Tamil Nadu did not feature any vacant land.) The locations also included vacant government revenue lands available for consideration. The focus of VCIC's industrial transformation has been on enabling existing industrial agglomerations. Hence, all locations that were shortlisted for node development have been analyzed for the presence of industrial units in close proximity to the shortlisted land parcels. In addition, instead of identifying a single contiguous land parcel, attempts have been made to identify a cluster of land parcels in close proximity to create nodes of substantial size. Detailed analysis based on the framework in Figure I was undertaken to identify potential zones for development.

Figure I: **Identification of Locations for Industrial Nodes**

Long list of APIIC and private Industrial Parks/SEZs

Assessing vacant land in the APIIC and private Industrial Parks/SEZs and including governmental lands available for consideration—**119 identified**

Stage 1—must haves for the lands identified to be considered as industrial nodes

- Locations with lands in excess of 500 acres or having over 2,000 acres of land in close proximity (<30–35 km)
- Land away from CRZ, forest, restricted and flood line areas
- Availability of water (Ground Water—Safe zone or access to surface water)
- Existing industrial agglomeration (Rs.1,000 crore of investment since 2000 within 50 km radius)
- Zone not considered for Master Planning under the Chennai Bengaluru Industrial Corridor

11 nodes have been identified after the stage 1

Table A: **Potential Clusters in VICC**

Cluster in Andhra Pradesh	Area or Region
Atchutapuram	Visakhapatnam
Nakkapalli	Visakhapatnam
Bheemunipatnam	Visakhapatnam
Pydi Bhimavaram	Srikakulam
Kakinada	East Godavari
Kankipadu	Krishna
Gannavaram	Krishna
Jaggayyapeta	Krishna
Kopparthy	Kadapa
Yerpedu–Srikalahasti	Chittoor
Sri City	Chittoor

Zones that are being considered under other corridor projects, such as the Chennai–Bengaluru Industrial Corridor, were not considered under this project to eliminate duplication of developmental efforts. Based on the above analysis, 11 potentials clusters were identified (Table A).

The potential zones listed above were further analyzed on a set of important (good-to-have) factors:

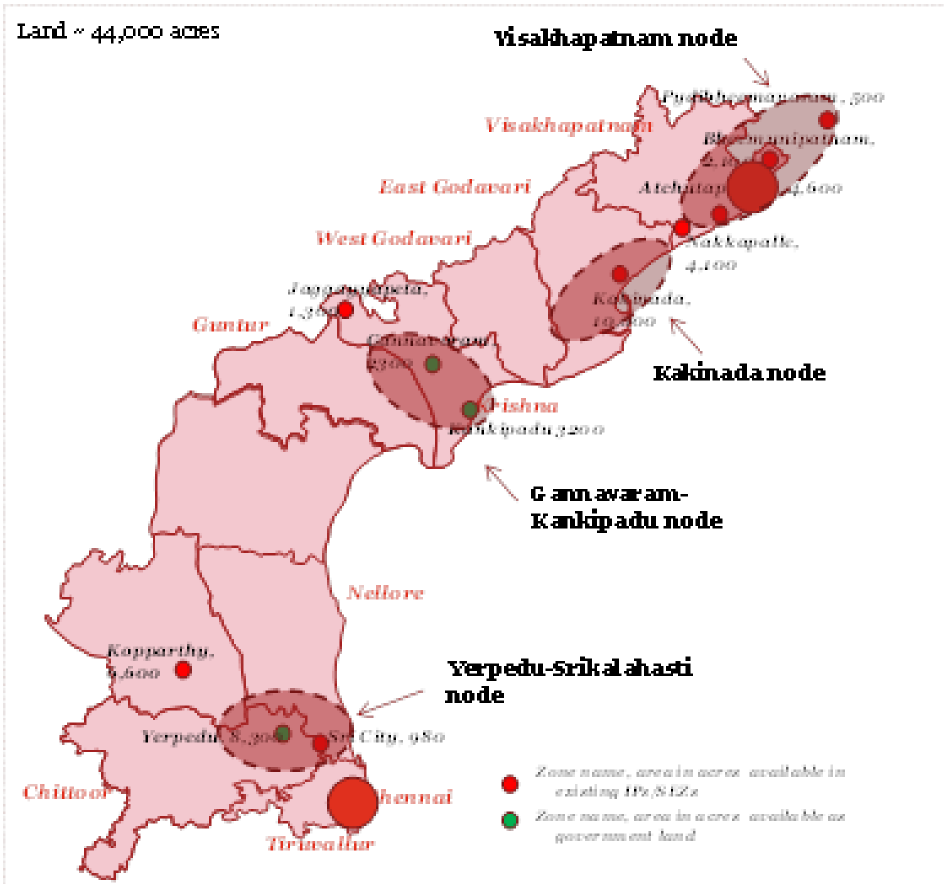
- proximity to existing or planned ports of less than 50 kilometers (km) for industries such as metallurgy, chemicals and petrochemicals, and textiles;
- proximity to raw materials (<25 km) for industries such as food processing; and
- proximity to a city (<50 km) for industries such as automobiles, pharmaceuticals, medical equipment, electronics, and aerospace.

Each location was further analyzed on the existing availability of connectivity infrastructure, skilled manpower, and logistics infrastructure. As part of the Concept Development Plan, discussions were conducted with government officials from Andhra Pradesh to understand their views on the shortlist of potential nodes. Based on the analysis and these discussions, locations were identified for node development (Table B and Figure J).

Table B: **Locations for Node Development in VICC**

Node	Land of Parcels	District	Area (acres)
1	Pydibheemavaram, Bheemunipatnam, Atchutapuram, Nakkapalle	Visakhapatnam	11,300
2	Kakinada	East Godavari	10,000
3	Kankipadu Gannavaram	Krishna	5,500
4	Yerpedu, Srikalahasti	Chittoor	9,280

Figure J: **Potential Nodes in the Corridor**



Enabling Competitive Manufacturing through Infrastructure Development

The node-based industrialization strategy proposed for VCIC is targeted to achieve regional and global competitiveness. Infrastructure development is one of the most important levers needed to attain this core objective. As the corridor will be primarily oriented toward manufacturing, the focus of infrastructure development can be categorized as follows:

- **Multi-modal transport infrastructure to enable competitive supply chains.** Nodes of manufacturing do not function in isolation, but as part of a supply chain, aligning with domestic or global value networks. Inbound and outbound logistics from the industrial nodes will need to consider capacity and service provision at key infrastructure gateways like ports and airports, as well as the network connectivity between the nodes, gateways, and hinterland consumption centers.
- **Other infrastructure to enable competitive value-added.** Industry and node selection has implicitly factored in resource-linked advantages (e.g., land availability

and skilled manpower). These advantages will need to be complemented by other input factors that enable competitive value-added such as access to and the cost of power and water.

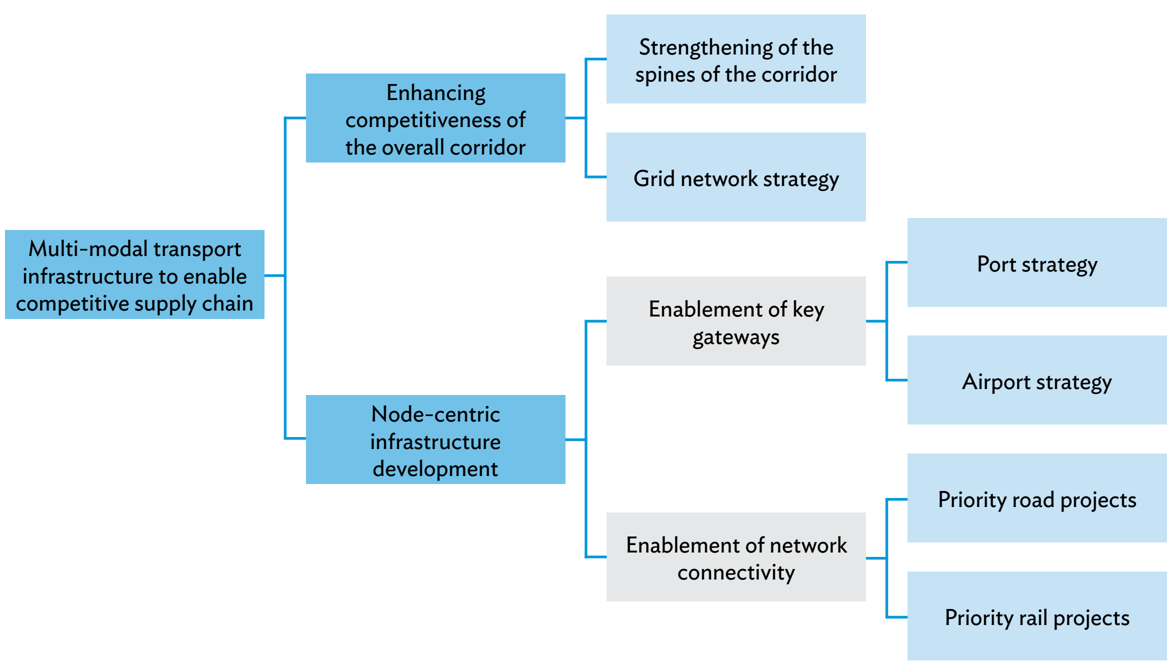
Approach for Infrastructure Development

In this phase of the study, the focus has been on assessing the current state of infrastructure, both in terms of quantity and quality across categories, and identifying critical capacity gaps and other issues. This assessment was then compared with a supply-side assessment of key initiatives at various stages of execution in the pipeline. The initiatives were assessed for their strategic importance for VCIC, as well as for their readiness for implementation. Using this sequential assessment, a near-term roadmap was developed and the approach adapted to the specific context of different infrastructure categories.

Multi-Modal Transport Infrastructure to Enable Competitive Supply Chains

The availability and quality of the core transport infrastructure is the most important foundation on which competitive supply chains can be designed for various industries. The framework for assessing the enabling transport infrastructure is divided into two parts as illustrated in Figure K.

Figure K: **Framework for Assessment**



1. **Infrastructure to enhance the overall competitiveness of the VCIC corridor**

VCIC is a coastal corridor, designed around National Highway 5 (NH5) and the Chennai–Kolkata trunk railway line, which together form the spines of the corridor. The corridor is also surrounded by several other strategic National Highway routes and other trunk rail routes, which are largely linear in nature and lacking in cross-connectivity.

A two-fold strategy to enhance spinal and grid connectivity is proposed to enhance the overall competitiveness of the corridor:

a) **Strengthen existing spinal routes.** Existing spinal routes should be upgraded with state-of-the-art connectivity to enable ports and industries in the region to become integrated within the overall East Coast Economic Corridor network. Some of the projects that are considered for this purpose include the 6-laning of the entire stretch of NH5, a parallel expressway close to the coastline, and a dedicated freight corridor (DFC) on the Chennai–Kolkata route.

b) **Strengthen the grid network.** The grid network should provide cross-connectivity between important linearly aligned National Highway and trunk rail routes to reduce the overall time, cost, and distance of evacuation of cargo from gateways and nodes to the hinterlands. For this purpose, a select set of road and rail links are proposed to fill the existing gaps in cross-connectivity. Since several projects in the grid network will pass through regions of Andhra Pradesh that are relatively under-developed at present, these projects will also serve to economically integrate such regions.

2. **Node-centric transport infrastructure development**

As part of the industrialization strategy, four nodes have been selected along the corridor for anchoring VCIC's industrial strategy. As candidates for hosting manufacturing-oriented industries, they will need to be connected to sources of raw materials and key consumption centers, both domestic and international. This will spawn a need for efficient transport linkages along two dimensions.

a) **Enablement of key gateways proximal to nodes.** Capacity and quality of service at gateways like ports and airports are important factors that affect cost of logistics for cargo. For the purpose of this study, each node in the current set has been mapped to a set of proximal gateway port clusters and airports as follows:
   - An assessment of the current capacities, throughput, and operational performances of these gateways was conducted, both in absolute and comparative terms, through secondary and focused primary interactions.
   - The assessment was supplemented by analysis of supply projections, bandwidth available for capacity expansion, and future development plans, as well as an assessment of technical constraints in project execution. This was tested against a range of demand scenarios, based on benchmarks and independent estimates.
   - The assessment was complemented by current and expected network and usage trends from shipping lines and airlines in terms of route development, and developments in competing gateway clusters, and their implications for capacity development.

- The assessment helped evaluate the sufficiency of port and airport capacity in the short-to medium-term. It also helped identify key strategic and operational enablers and measures of performance for supporting the development objectives of VCIC.

b) **Enablement of network connectivity centered on nodes and node-linked gateways.** Having defined the nodes and gateways, it is important to enable the network of connectivity anchored around the two points of the supply chain, through both road and rail, for supply chain competitiveness. It is also important to consider hinterland source and distribution centers for domestic movement, as well as other neighboring gateways. For the purpose of defining the network centered on nodes, five different categories of road and rail connectivity were considered:
   - **Node–VCIC gateway connectivity.** This entails connecting nodes to identified port and airport gateways, through last-mile road and rail connectivity.
   - **Node–hinterland connectivity.** This entails strengthening middle-mile connectivity between nodes and selected hinterland source and distribution centers, within and outside VCIC to enable domestic movement.
   - **Hinterland–VCIC gateway connectivity.** Several sources of industrial production located outside the VCIC region may generate demand for cargo throughput at VCIC ports. Facilitation of throughput via VCIC gateways that is driven by better connectivity can bestow scale advantages to the corridor by facilitating greater cargo agglomeration and reducing unit costs of logistics infrastructure and services. The hinterland connectivity projects that pass through backward districts of Andhra Pradesh would also serve as spines along which the economic development could spread to neighboring regions.
   - **Node–ex-VCIC gateway connectivity.** Similarly, VCIC nodes may also find it convenient to be connected to other gateway nodes outside the VCIC region. This is especially true for airports, as the region is located near three of the top six international airports in the country.
   - **Intra-node connectivity.** Finally, analysis of the micro-environment of each node provided visibility into localized issues in connectivity within the node. Certain road connectivity projects are proposed in this category.

A detailed list of pipeline projects under consideration by various executive agencies for roads and railways at both the country and state levels was collected, followed by interactions with these agencies to understand the status of projects. The list was supplemented by fresh project ideas that are currently at the conceptualization stage but deemed necessary to achieve certain targeted benefits relevant for VCIC.

The list of projects was then analyzed along the five node-centric connectivity categories defined above, as well as against the corridor-level projects proposed for spinal and grid connectivity. The list was then consolidated to remove redundant projects.

The list was prioritized along one dimension for various levels of strategic importance for the corridor (critical, need-to-have, and good-to-have) and projects were assessed based on their ability to fulfill each of the five needs of network connectivity as defined above. The state of readiness of these projects was defined on a scale of 1 to 5: (1) conceptualization, (2) feasibility being studied, (3) feasibility assessed, (4) procurement, and (5) implementation.

Based on the matrix of level of urgency and level of preparedness, projects for immediate-, medium-, and long-term execution were identified. The region has a history of inland waterways, and potential for coastal shipping. The cost-benefit of these, and their integration with road and rail networks, would be done at the Perspective Planning stage, when a comprehensive Transport Network plan is developed.

Other Infrastructure to Enable Competitive Value-Added

Access to and the cost of power are important elements for augmenting the ability for value-added manufacturing. Several industries proposed for VCIC's industrialization strategy—including pharmaceuticals, automobiles, textiles and apparels, and electronics—have a high dependence on either or both of these two enablers.

For the purpose of this study, a current-state assessment of supply and demand was conducted, including the differential trends in industrial and other segments. The needs of the VCIC region were then assessed against pipeline initiatives and key conclusions were drawn.

(i) **Power strategy.** In the current scenario, access to power was determined to be more important than industrial tariffs because the alternatives to grid-based supply are prohibitively expensive for industries. Therefore, the study focused on current and future trends in demand and supply for generation and transmission of power for the VCIC region through various supply mixes at the country, regional, and state levels. Analysis of future generation capacity was benchmarked against the demand forecasted by the 18th Electricity Power Survey and gaps were identified.

The list of generation and transmission projects in the pipeline was analyzed and a degree of strategic importance (low, medium, or high) and a state of readiness was assessed. In this manner, a set of projects for immediate-, medium-, and long-term execution was identified.

(ii) **Water strategy.** The industrial water scenario in the districts of the corridor was profiled in terms of groundwater and surface water availability and demand. Water demand in VCIC was projected for the next 10 years based on available data and industrial water demand in the corridor districts nearest to the nodes was estimated. Nodes requiring industrial water supply projects were identified, too. Trends in the recycling of water and water use efficiency were compared against international benchmarks. Commercial, regulatory, and institutional interventions were also studied for recommending strategic interventions.

Infrastructure to Enable Competitive Supply Chains: Conclusions and Recommendations

Corridor-Level Intervention: Strengthening Spinal and Grid Network Connectivity

Strengthening the Road Spine and Grid

The design of a strong spine is critical from the perspective of the overall competitiveness of VCIC as it is part of the larger East Coast Corridor from Chennai to Kolkata that is anchored around the entire stretch of NH5. The road is strategically linked at both ends to other industrial corridors and regional multi-modal connectivity networks. Effective integration into such multi-modal networks will demand a strong backbone.

- **Critical: 6-laning of NH5.** The stretch from Visakhapatnam to Chennai is currently 4-laned. As part of Phase V of the National Highways Development Programme (NHDP), the entire stretch is proposed for 6-laning.
- **Critical: Strengthening parallel access segments of NH214, NH214A, and State Highway (SH) 103.** Upgrading of these parallel access segments into 2- and 4-lane connectivity is recommended.
- **Critical: New NH and SH projects.** Prominent national highways surrounding the corridor (e.g., NH5 and NH7) are aligned in a linear direction. For the purpose of facilitating direct connectivity to the central and distant hinterlands, seven state and national highway projects are proposed. All of these projects provide linkages between the central spine of NH5 and other highways like NH7, NH18, NH9, NH214, and NH221. Several of these (e.g. Tada-Kadapa, Guntur-Anantpur, Nellore – Gooty - Bellary, and Guntur-Kurnool) would, in time, act as spines along which other districts of Andhra Pradesh would get better economic connectivity to the corridor nodes.

Strengthening the Rail Spine and Grid

VCIC is served mainly by the Chennai–Visakhapatnam segment of the Chennai–Kolkata line, which is one of the seven high-density corridors in the Indian Railways network. The spine is co-terminus with the Vijayawada division of the South Central Railway Zone, which is one of its busiest routes. Analysis of line capacity and utilization figures suggests that the capacity utilization of the entire stretch is more than 80%.

- **Need to Have: Development of DFCs.** While short-term measures for capacity augmentation like tripling and quadrupling signaling technologies or increasing train speeds may be considered, they will have a limited effect in the long-term considering demand in the corridor. Therefore, development of two segments of the DFC (Delhi–Chennai and Visakhapatnam–Vijayawada) is proposed to be taken up for further study. The needs and time horizons for development of these DFCs is expected to be determined at the regional perspective planning stage of this study, based on when execution planning can commence.
- **Critical: Nine new rail links.** The railway network of the VCIC region has several gaps in direct connectivity, predominantly in the southern part of the network, which impedes direct connectivity between hinterland centers and the coast. Nine new rail links already under consideration by Indian Railways (six in the southern network and three in the northern network) are proposed to be taken up for accelerated execution to close these gaps. These include projects that are physically outside the corridor delineation, but are critical to connecting the corridor.

Node-Level Intervention 1: Enablement of Key Gateways Proximal to Nodes

As part of the VCIC strategy, four industrial nodes was identified, and an assessment of the core gateway ports and airports proximal to the nodes was conducted. Each node was mapped against a specific port cluster and airport node:

- **Yerpedu–Srikalahasthi:** Krishnapatnam Port cluster and Tirupati Airport
- **Gannavaram–Kankipadu:** Machilipatnam Port cluster and Vijayawada Airport
- **Kakinada:** Kakinada cluster and Rajahmundry Airport
- **Visakhapatnam:** Vizag-Gangavaram Port cluster and Vizag Airport

As a first step, the state of ports and airports were considered in the context of VCIC's development needs, and based on this analysis, strategies will be proposed for the future integrated development of the corridor.

Strategy for Enabling Port Gateways

VCIC aims to leverage its nautical advantage for the benefit of the industrialization strategy.

Current-state assessment

- The ports of the VCIC region north of Chennai handled around 115 million tons of cargo in 2013–14. However, except Vizag, none of the ports of the VCIC region rank is among the top 10 ports in the country. Vizag port is also declining in traffic and losing its prominence among Indian ports, due to the effects of the economic downturn and the poor state of cargo development along the coastline.
- There is a marked imbalance in cargo throughput toward bulk cargo. However, to enable manufacturing-oriented growth, it is critical to focus on container throughput. Compared with the rest of India, VCIC's ports handle a very low proportion of container cargo (less than 3%), and this is only through Visakhapatnam and Krishnapatnam ports.
- Further, there is poor development of container shipping services. Except Chennai, none of the ports on the east coast have direct services to the destination ports. Instead, they host smaller parcel container vessels in feeder routes, through vessels of small parcel sizes and limited frequencies. This increases the direct and indirect costs of container logistics.

Development imperatives

- The fleet capacity of shipping liners is changing toward a preference for larger vessels. As they are replaced by larger vessels, existing mainline vessels are expected to cascade down to feeder routes. Such an effect will increase the pressure on ports to increase their sea-side, land-side, and evacuation capacities.
- At the same time, the container port of Chennai is getting increasingly congested due to lack of evacuation and land for a back-up area. This points to a development opportunity for ports like Krishnapatnam that have deep drafts, land for expansion in areas without urban sprawl, and superior connectivity. Direct services will provide several logistical advantages by increasing choices for services, facilitating greater agglomeration, and bringing down unit costs of services.
- However, for this to happen the ports of the VCIC region need to be enabled for sufficient cargo agglomeration and ease of direct connectivity. This will involve strategies to tap into the industrial cargo hinterlands beyond the VCIC region, and investments in connectivity and logistics infrastructure.

Port cluster assessment

- The coastline can be logically divided into three clusters of port locations:
  - o The northern cluster comprises the ports of Visakhapatnam and Gangavaram, which dominate the current throughput via the corridor (mainly for bulk cargo and low-value containerized traffic from proximal centers). Vizag port is the only port handling container cargo. Analysis suggests that Gangavaram port is likely to continue to be preferred by users and liners for bulk cargo, and will eat into the share of Vizag port. This suggests a need for re-balancing in terms of investments in container capacity at Vizag in the medium- to long-term.
  - o The central cluster comprises the ports around the Krishna Godavari basin (Kakinada and Machilipatnam clusters). These ports typically have channel, draft, and land-side restrictions, and limited operations. Therefore, they may not be able to develop as large port locations. However, they are well-suited to service the captive needs of industrial users. While Machilipatnam port has plans to invest in container capacity, it has yet to commence construction. Kakinada SEZ port may be an alternate location for future container capacity, subject to overcoming technical constraints.
  - o The southern cluster of ports is anchored around the operational port of Krishnapatnam. The availability of deep drafts, land, and spinal connectivity, and lack of urban sprawl are key advantages in this cluster, providing bandwidth for expansion as large ports. While currently focused on coal cargo for a limited set of users, the southern cluster is expected to see large containerized movement owing to the development of VCIC and Chennai–Bangalore Industrial Corridor nodes, as well as from the gradual shift of container traffic from the congested Chennai port to the southern cluster.

Assessment of demand–supply gaps in the "business-as-usual" scenario

Against the current demand estimate, there is significant bandwidth for capacity expansion at several ports.

If the cargo growth mirrors past trends along the Andhra Pradesh and Indian coastlines, then the resultant growth in demand is expected to be met by the addition in capacity at the four operational ports, considering their master-planned capacity.

The ports of Krishnapatnam and Visakhapatnam can expand from their current container capacities of 1.7 million twenty-foot equivalent units (mTEUs) to 7.5 mTEUs with relative ease. Therefore, considering capacity augmentation at these two ports, expected capacity is seen to surpass demand.

The expected augmentation of capacity to 6.0 mTEUs at Krishnapatnam will allow for the handling of overflow cargo coming from Chennai port in the immediate-term.

The above projections are based on business-as-usual scenario and have not taken account of additional aspects like localized demand–supply scenario. A more granular view on the port cluster's demand–supply assessment is expected to be undertaken in Phase 2, which will consider the demand created by development of VCIC nodes.

Summary of recommendations

The port-centric development strategy aims to align with large-scale, manufacturing-led economic development through the nodes and integrate India into global manufacturing supply chains.

The port development strategy should target brownfield development of two or three mega container ports close to the nodes (primary candidates are the Vizag–Gangavaram and Krishnapatnam clusters), with the ability to handle large container vessels of 10,000+ TEUs and the necessary supporting multi-modal connectivity and supply chain and logistics infrastructure.

From a bulk cargo perspective, the state may enable port capacity creation across the coastline by prioritizing movement of energy cargo (thermal coal, liquid natural gas) that will be important for the development of the VCIC region.

Rather than focusing on further capacity development, which is best left to market forces, the strategy should primarily aim at accelerating cargo agglomeration in the region and making the ports competitive for direct calls from major container hubs. This can be achieved by

- focusing on supply-chain efficiency and cargo agglomeration so that the state can lead in containerization trends, with increasing sophistication and value-added through container cargo;
- ensuring last-mile connectivity to attract cargo from neighboring hinterlands; and
- connecting distant hinterland centers to capture traffic from neighboring and distant hinterlands, and east-bound traffic.

Strategy for Enabling Airport Gateways

Assessment of services

- The VCIC region is home to all four operational airports in the state of Andhra Pradesh. Their combined level of demand is very low with annual throughput of less than 1.5 million passengers (<1% of India's air passenger traffic) and less than 2,000 metric tons of cargo (<0.1% of India's air cargo traffic). The low level of incumbent demand is mirrored in the lack of airline network penetration and network development.
- Cargo traffic is limited to Visakhapatnam airport. Despite its status as a customs airport with limited connectivity to two international locations, it does not handle any international cargo.
- All airports in the state operate at less than 60% utilization of their rated capacity for passenger traffic. Passenger traffic projections based on Airports Authority of India (AAI) estimates indicate that the capacity already commissioned or planned is more than sufficient to handle the next 10 years of baseline traffic.

- Visakhapatnam airport, the only VCIC airport to handle cargo traffic, has recently developed a new cargo complex, which is yet to be commissioned. Other airports have plans to develop cargo terminals.
- It does not seem likely that the incumbent air traffic can support sufficient airline demand aggregation in the near future to warrant creation of large airport hubs for the state. For this level of incumbent demand, ongoing brownfield capacity development proposals by AAI are expected to be sufficient to handle traffic growth in the short-term.

Future opportunities and development considerations

- Demand from the VCIC industrial nodes (both for passenger and cargo traffic) will need to be considered in the medium- to long-term. Cargo demand is expected to be triggered by a few industries that are dependent on time-sensitive and secure movements of high-value cargo (like electronics). This may require specific capacity augmentation through appropriate development models to be considered at the master planning stage.
- In the future, specific political and economic development trends in the hinterlands (e.g., development of the capital city at Vijayawada) may act as triggers for airline network development. The implications and their impact on neighboring airports are outside the scope of this study, but will need to be considered at the time of master planning for VCIC.

Summary of recommendations

- The airport development strategy for the VCIC region should carefully consider the very low level of current incumbent air passenger and cargo traffic. This study recommends considering future airport development in two different time horizons:
- **Short- to medium-term.** Sufficient capacity exists to cater to the expected base demand. Therefore, the strategy should be focused on two initiatives:
    - Attention is required to enhance the base demand by incentivizing direct airline services to the existing airports through service upgrades (e.g., 24x7 operations, night landing facilities, customs and immigration) and operational de-bottlenecking.
    - Considering the short distance to the neighboring airport hubs (three of India's top six international airports), facilitating excellent road connectivity to these hubs from the cities and cargo-generating centers is likely to be more capital-efficient in the short-term.
- **Long-term (beyond 10 years).** Master-planning of the VCIC region should consider demand from business-induced scenarios resulting from political developments in the overall state, development of the coastal corridor, and additional economic investments.

Node-Level Intervention 2: Enablement of Network Connectivity Centered on Nodes and Node-Linked Gateways

- The strategy for network connectivity considers the need to inter-connect nodes, gateways, and hinterland centers outside the VCIC region.
- Besides the gateways and nodes, key hinterland centers have been identified within and outside VCIC, that directly provide sourcing and distribution opportunities, or behave as transit nodes for onward movement. Enablement of hinterland centers by superior connectivity to the gateways can have the following beneficial effects:
  - accelerate cargo agglomeration in the VCIC region and re-balance the export–import mix, and accelerate development of shipping services, container capacity, and logistics infrastructure; and
  - reduce unit costs of logistics infrastructure and services by increasing utilization of fixed infrastructure and fleets of trucks and railway rakes (e.g., through bi-directional movement).
- **Project long-listing.** For the purpose of evaluation, a long-list of 135 projects were considered as candidates based on detailed primary and secondary analysis, both at a corridor-level and at a node-level. These selected projects span railway and roadway connectivity, and comprise both greenfield (new capacity creation) and brownfield (existing capacity augmentation) projects.
- **Shortlisting and categorization.** Based on detailed analysis for relevance to VCIC, a shortlist of 84 projects was generated, of which 28 projects were found to be of relevance to the entire corridor and categorized as such. Ten more projects were categorized as conditional projects, which are of high importance only if another independent infrastructure project is commissioned. The remaining set of 46 projects was taken up for analysis and tested for strategic importance to the nodes across the five connectivity types (Table C).
- **Project prioritization.** A matrix was developed to assess the prioritization of the projects for implementation over the given time-frame:
- **Level of criticality.** Each of these projects were then tested for strategic importance to the node and categorized as either critical, need-to-have, or good-to-have.

Table C: **Shortlisted Connectivity Projects by Category and Node**

Connectivity Category	Yerpedu–Srikalahasthi	Gannavaram–Kankipadu	Kakinada	Vizag	Total
Node-VCIC Gateway	2	1	3	5	11
Node-Hinterland	3	-	4	7	14
Hinterland-VCIC Gateway	1	3	4	4	12
Node-ex VCIC Gateway	-	-	1	-	1
Intra-Node	2	2	3	1	8
Total	**8**	**6**	**15**	**17**	**46**

- **State of readiness.** The status of project preparation was then assessed on a scale of 1 to 5: (1) conceptualization, (2) feasibility being studied, (3) feasibility assessed, (4) procurement, and (5) implementation.
- Critical and need-to-have projects that are in a high state of readiness are proposed for immediate- or short-term execution. Projects that are good-to-have or have a low state of readiness are proposed for medium- or long-term execution.
- **Summary of recommendations**
  - Of the 46 projects, 18 were judged to be critical and 18 as need-to-have projects.
  - However, of the 46 projects, only 16 are ready for execution in terms of project preparation. Fourteen projects are awaiting completion of their feasibility studies.
- **A time-line-driven view is recommended for execution of action steps:**
  - *Immediate priority.* Twelve projects (five road and seven rail) are considered ready either for monitoring or immediate execution. Projects that have already commenced execution are suggested to be monitored on a mission mode.
  - *Short-term.* Three rail projects are considered ready for short-term execution.
  - *Medium-term.* Apart from one project ready for execution, focused attention is required for accelerated completion of feasibility reports for 21 projects (15 road and six rail). Of these, six projects (four road and two rail) are critical for VCIC's development.
  - *Long-term.* Nine projects (five road and four rail) are considered to be ready for long-term execution.
- The list of all the projects along with their rationale is provided in the main section of the report.

Multi-Modal Transport Infrastructure to Enable Competitive Value-Added: Conclusions and Recommendations

Power Strategy

Current-state assessment

- Power availability, rather than the cost of power, is a more critical challenge in the VCIC region, which is part of India's southern grid in the country. The southern grid had India's highest levels of energy and peak shortages in 2013–14 at 6.8% and 7.6%, respectively.
- The energy supply in the southern region is dominated by thermal coal, which forms more than 55% of the overall supply capacity in the country. Supply shortages have been experienced due to lack of fuel availability. On the transmission side, inter-regional transmission capacity is constrained in meeting the growing demand in the southern region and the commissioning of new links have not kept pace with growing demand.

Capacity development

- Twenty-nine generation projects have been proposed in the region over the next 10 years with cumulative capacity of nearly 34 gigawatts (GW). Fifty-one transmission projects have also been proposed over the same period with evacuation capacity of close to 22 GW. The addition of generation capacity is expected to be dominated by independent power producers, whereas transmission capacity will come predominantly through state investments.

- Based on the energy demand forecasts in the 18th Electrical Power Survey, it is expected that the state of Andhra Pradesh and the VCIC region will have surplus power-generation capacity by 2017. Therefore, the existing pipeline of projects is determined to be sufficient.

Project prioritization

- Based on the state of readiness and strategic importance to meet growing demand, the current pipeline of generation and transmission projects within the state of Andhra Pradesh have been categorized for either immediate-, medium-, or long-term execution:
    - **Immediate-term.** Eight generation projects (8.5 GW) and 48 transmission projects (19.8 GW)
    - **Medium-term.** Two generation projects (4.0 GW) and three transmission projects (2.0 GW)
    - **Long-term.** 19 generation projects (21.7 GW)

Water Strategy

Current-state assessment

- The state of Andhra Pradesh has total cumulative water resources of 108 billion cubic meters (BCM), of which 78 BCM is surface water. About 65 BCM of surface water is being utilized, predominantly for irrigation. Per capita consumption of water for urban domestic users is one of the lowest in the country.
- Providing water for industrial use has been a challenge in the past. Districts closer to the coast have higher surface and ground water availability, while the westward districts have limited supply of both the sources of water.

Future demand assessment

- Over the next 10 years, around three-fourths of the state's projected industrial water demand is expected to arise from districts within the VCIC region.
- Among corridor districts, the four nodal districts—Visakhapatnam, East Godavari, Krishna, and Chittoor—together account for around 60% of VCIC's water demand.
- Two shortlisted nodes (Kakinada and Gannavaram–Kankipadu) are currently dependent on groundwater for industrial demand; and there is a consequent need to plan industrial water supply projects. Industries in the other two nodes (Visakhapatnam and Yerpedu–Srikalahasti) are using surface water, but its availability is uncertain and the supply is heavily dependent on rainfall.

Key conclusions and recommendations

In order to increase the reliability and availability of industrial water in the state of Andhra Pradesh, the following steps need to be taken:

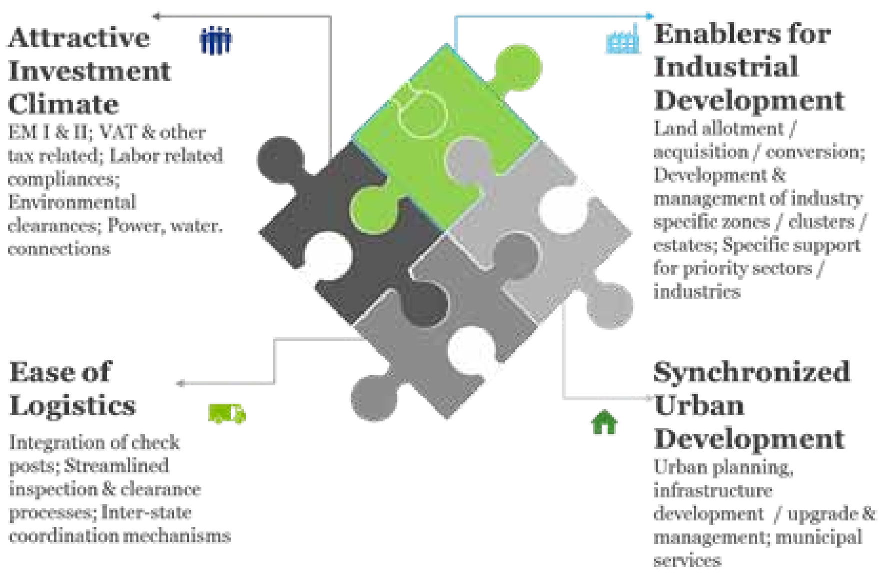
- identify need for new reservoirs or desalination projects in areas with poor surface water availability;
- develop reservoirs at key industrial nodes;
- focus on water use efficiency to increase productivity in the shortlisted industry sectors, and introduce water recycling in the shortlisted industries based on international standards;
- rationalize and/or remove differential water tariffs to incentivize water recycling and water use efficiency; and
- establish a dedicated agency for water planning and management to drive industrial water policy for the entire VCIC region.

The Regulatory Framework

The regulatory environment in India is relatively complex, with the power to administer individual regulations being vested with multiple agencies at the central, state, and district government levels, leading to the need for suitable institutional frameworks to ensure a coordinated approach.

There are four essential components of the regulatory framework (Figure L).

Figure L: **Regulatory Framework Components**



Attractive investment climate. This involves making the investment climate conducive for the establishment and operation of industrial investments through simplified and timely clearances and compliances for (i) setting up new units or expanding existing units, and (ii) operating a business in its normal course (Table D).

Table D: **Attractive Investment Climate**

<table>
<tr><th></th><th>Parameter</th><th>Characteristics</th></tr>
<tr><td rowspan="4">Prior to commencement</td><td>• Multiple agencies responsible for individual approvals (state and district governments)</td><td>• Presence of Single Window system
– Departments and clearances covered
– Use of common application Form</td></tr>
<tr><td>• Time taken for issuing approvals by concerned competent authorities</td><td>• Presence of citizen charters at respective agencies giving timeframe within which to issue approvals
• Provision of deemed approval in case concerned competent authority does not issue approval within notified time frame</td></tr>
<tr><td>• Institutional framework for processing applications</td><td>• Constitution and empowerment of state and district level committees
• Empowerment and operational flexibility of Single Window nodal agency
• Extent of exemptions, delegation of powers</td></tr>
<tr><td>• Monitoring framework for application processing and clearances</td><td>• Deployment of IT-enabled application for tracking application status with dashboard; MIS reports available to concerned competent authorities, Single Window nodal agency, and state and district level committees
• Availability of e-mail and SMS alerts to applicant on change in application status</td></tr>
<tr><td rowspan="3">Post-commencement of operations, in normal course of business</td><td>• Multiplicity of inspections at different points in time</td><td>• Presence of policy for coordinated and joint inspections by (i) officials within same departments and (ii) by different departments and agencies</td></tr>
<tr><td>• Procedure for inspection</td><td>• Presence of standard operating procedures and approved check lists for inspections
• Availability of such standard operating procedures and approved checklists in public domain</td></tr>
<tr><td>• Multiple registers with same set of information required by multiple government agencies at different points in time</td><td>• Policy for using online repository of information whereby relevant information to be made available to respective government agency based on requirement</td></tr>
</table>

Table E: **Assessment Framework—Ease of Logistics**

	Parameter	Characteristics
Intra- and inter- state movement of goods	• Multiple state level regulating and enforcement agencies responsible for supervising movement of goods	• Presence of integrated check-posts having representatives from the respective enforcement agency • Presence of integrated check-posts at border having representatives from both states for joint inspections with institutional mechanism for capturing and sharing data of mutual interest
Inter-state movement of goods	• Uniformity in levy of Entry Tax on goods	• Applicability of Entry Tax on goods in state • Presence of differential Entry Tax rates for same goods in different states
	• Uniformity in levy of state VAT for same commodities across states	• Presence of differential state VAT rates for same commodities in different states
	• Uniformity in forms and processes for documenting movement of goods across state borders	• Presence of uniform set of forms, processes, and procedures in terms of waybill format and common platform for generating waybills

Ease of Logistics. Logistics in the context of industrial and economic corridors essentially covers (i) intra-state movement of inputs and outputs across separate administrative jurisdiction (e.g., districts), (ii) inter-state movement of goods, and (iii) movement of goods across international borders. Table E provides an assessment framework that covers the intra- and inter-state movement of goods.

Enablers for industrial development. One of the first challenges for facilitating new industrial development is acquiring land. There is the need to have enabling laws and effective institutional arrangements to facilitate land management. This includes the introduction of mechanisms (e.g., land pooling) and revamping the land acquisition mechanism to make it more fair and equitable.

Synchronized urban development. Currently, urban development and management agencies are focused on land use planning and municipal service provision. Local economic development is not part of their mandate and there is no focus on supporting economic activity. Cities do not do much to influence the location of economic activities by providing supporting infrastructure or services.

Agencies that promote industrial development focus on the economics of setting up and operationalizing industrial facilities. The only attention paid (if at all) to urbanization is for the limited provision of workforce housing. As a result, new industrial developments arise in locations away from existing cities and new urban agglomerations form around them in an unplanned and haphazard manner.

The Conceptual Development Plan of VCIC recognizes these issues and provides a framework for industrial development that promotes urbanization and assumes that a certain level of urbanization is necessary to support industrialization.

CHAPTER 1

Industry Analysis

Potential of the Corridor Region

Corridor's Vision and Objectives

The Government of India's vision is to ensure that India emerges as a preferred manufacturing destination for investors while creating a large number of employment opportunities. The National Manufacturing Policy, 2011 puts forward a vision for the manufacturing sector with the following six objectives:

(i) Increase manufacturing sector's annual growth to 12%–14% and raise manufacturing's contribution to GDP to 25% by 2022
(ii) Create 100 million additional jobs by 2022
(iii) Develop appropriate skills set among rural migrants and the urban poor to enable inclusive growth, including strengthening of traditional industries.
(iv) Increase domestic value-added and technological depth in manufacturing
(v) Enhance global competitiveness of manufacturing through appropriate policy support
(vi) Ensure environmental sustainability

VCIC, India's first coastal corridor, will be one of the key drivers for economic growth in the country and will be a strong contributor to the economic growth of South India in particular. The corridor assumes one of the prime positions on the development landscape. VCIC will have the advantages of a long coastline, major ports, key urban agglomerations, and workforce to draw upon for achieving the following objectives:

Expanding industrial output

- Increase the manufacturing sector's contribution to GDP and boost exports

Expanding employment opportunities

- Increase employment opportunities in the formal sector

Increasing labor productivity and wages

- Focus on labor productivity improvements, and rising wages

Promoting dynamic SMEs

- Focus on leveraging existing supply chains

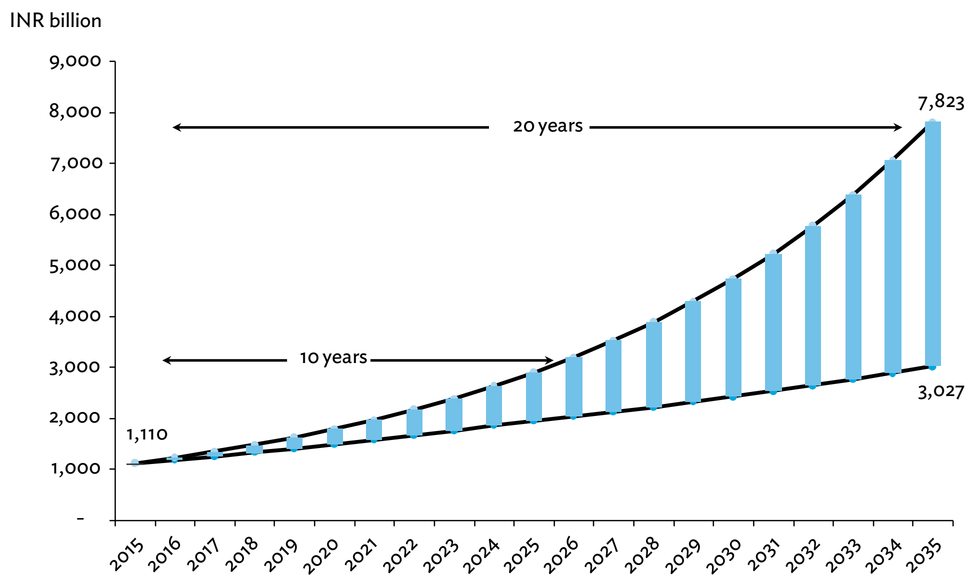
VCIC has enormous potential to stimulate economic activities in emerging clusters and distribute growth spatially within the region. Node development will promote spin-off by connecting backward districts to economic hubs. This can be achieved with an efficient multi-modal transport system, supported by necessary infrastructure services, efficient logistics, distribution networks, and an institutional framework. The corridor's potential over the next 20 years has been projected under two scenarios:

- **Business-as-usual scenario (BAU).** Corridor growth trends forecasted by correlating the manufacturing sector's growth in nine Andhra Pradesh districts with India's projected GDP growth.
- **Business-induced scenario (BIS).** Forecast of short-listed industrial sectors at growth rates pursued by relevant stakeholders.[1]

Driving Manufacturing Sector Output

Over 20 years starting 2015, under the BAU scenario, the output of the corridor is expected to increase from INR1,110 billion to around INR3,000 billion; under the BIS scenario, output is expected to increase to more than INR7,800 billion (Figure 1.1).

Figure 1.1: **Output of the Corridor under the BAU and BIS Scenarios**



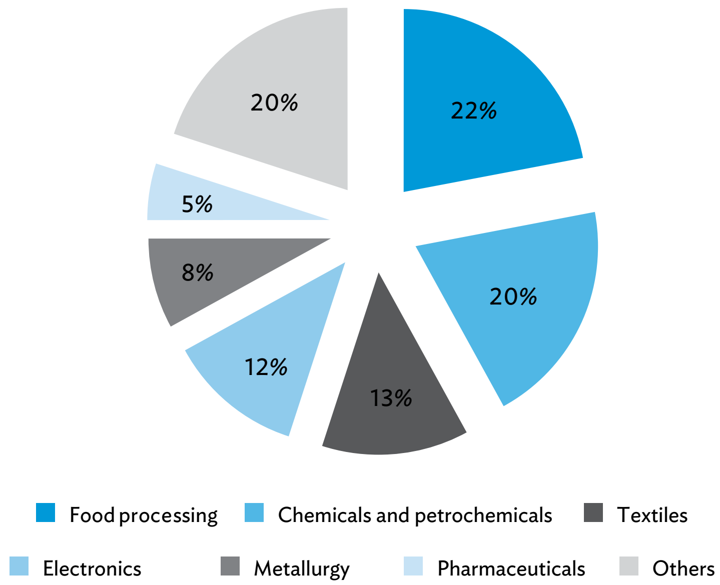
Sources: Annual Survey of Industries (ASI) 2010-11 Andhra Pradesh (AP), District Domestic Product AP 2010-11, various sector reports.

[1] The BAU scenario is based on the correlation of the VCIC's GDP with India's GDP, hence, is sector growth agnostic. For the BIS scenario, the growth rate assumptions are shown in Appendix 5.

VCIC's output is expected to increase 2.7 times and 7.0 times between 2015 and 2035 under the BAU and BIS scenarios, respectively.

The key sectors contributing around two-thirds of the corridor's output under the BIS scenario in 2034–35 are food processing, chemicals and petrochemicals, textiles, and electronics (Figure 1.2).

Figure 1.2: **Contribution to Corridor's Output by Sector, by 2034-35, Business-Induced Scenario**



Source: ASI 2010-11, District Domestic Product AP 2010-11, various sector reports.

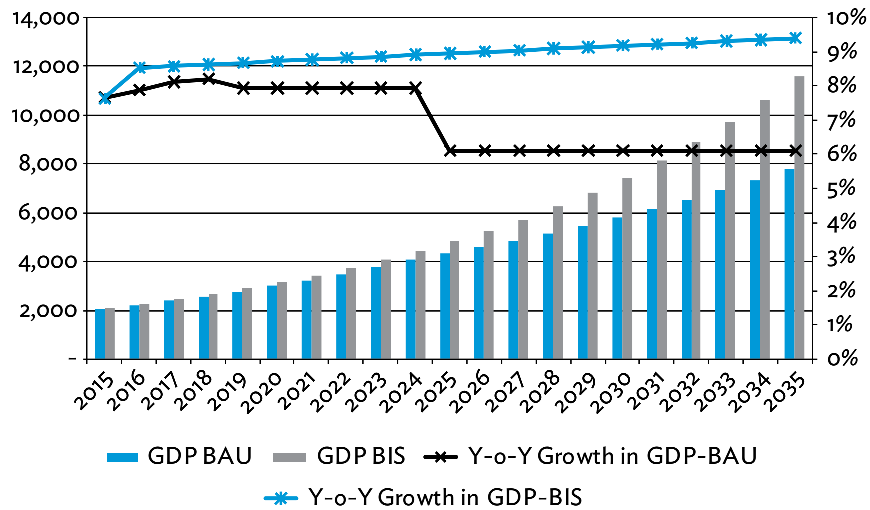
GDP

Over the next two decades, under the BIS scenario, VCIC has the potential to increase the GDP in the Corridor districts by six times. The average year-on-year growth rate is at 11% compared under the BIS scenario, while 7% growth under the BAU scenario. (Figure 1.3)

Manufacturing GVA

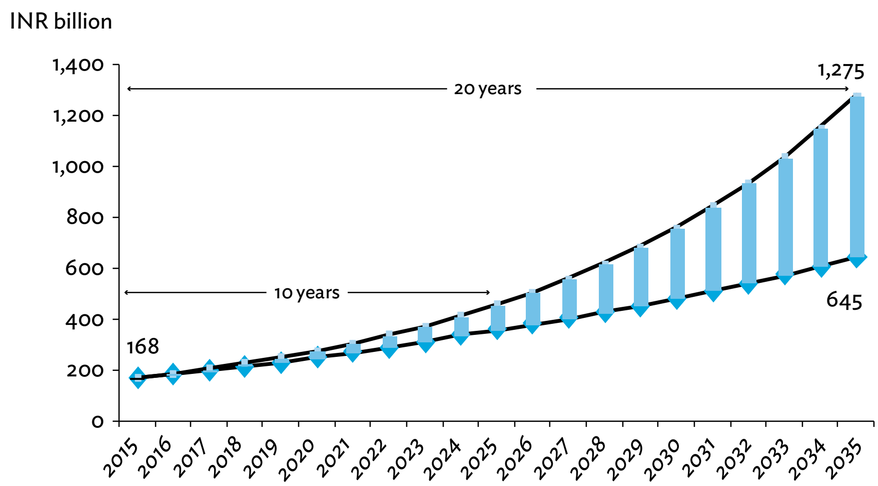
Gross value-added (GVA) approach measures the contribution of a sector to the economy and is used in the computation of GDP. Over 20 years, under the BAU scenario, the GVA of the corridor's manufacturing sector is expected to increase from INR168 billion to around INR645 billion; under the BIS scenario, the GVA is expected to increase to over INR1,275 billion (Figure 1.4).

Figure 1.3: **GVA of the Corridor under BAU and BIS Scenario**



Source: ASI 2010-11, District Domestic Product AP 2010-11, various sector reports.

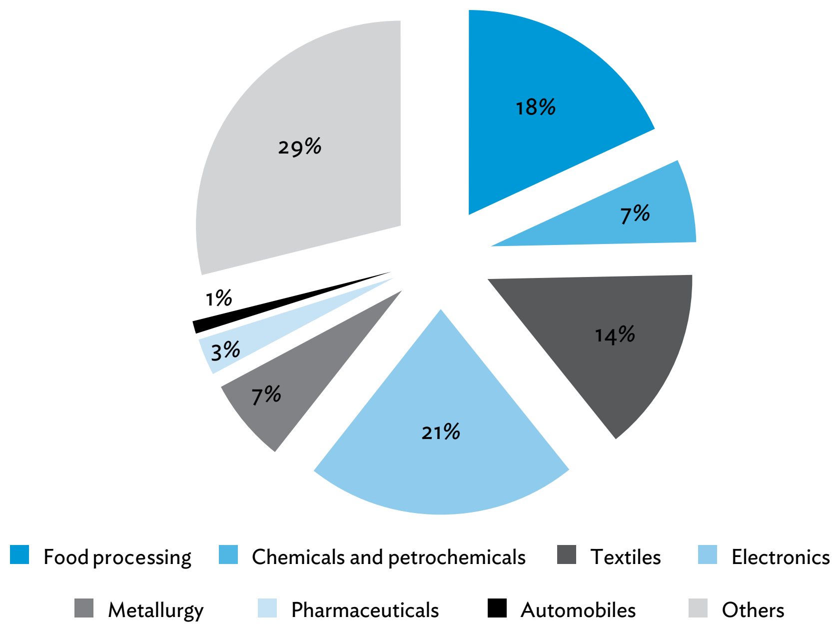
Figure 1.4: **GVA of the Corridor's Manufacturing Sector under BAU and BIS Scenario**



Source: ASI 2010-11, District Domestic Product AP 2010-11, various sector reports.

The GVA of VCIC is expected to increase 2.7 times and 7.8 times between 2015 and 2035 under the BAU and BIS scenarios, respectively.

Figure 1.5: **Contribution to Corridor's Manufacturing GVA by Sector, by 2034-35, Business-Induced Scenario**



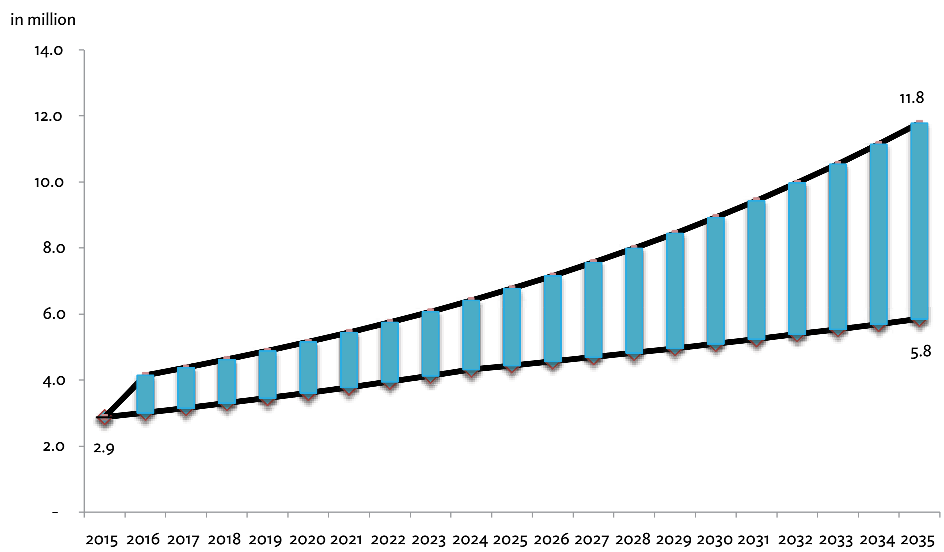
Source: ASI 2010-11, District Domestic Product AP 2010-11, various sector reports.

As per our analysis, manufacturing sectors with high GVA (value wise) include electronics and food processing (Figure 1.5). These two sectors together contribute nearly 40% of the total manufacturing sector in the corridor, followed by the textile industry, which contributes around 13%. The low GVA of the automobile industry in the corridor is due to the lack of operational investments.

Driving Employment Opportunities and Higher Wages

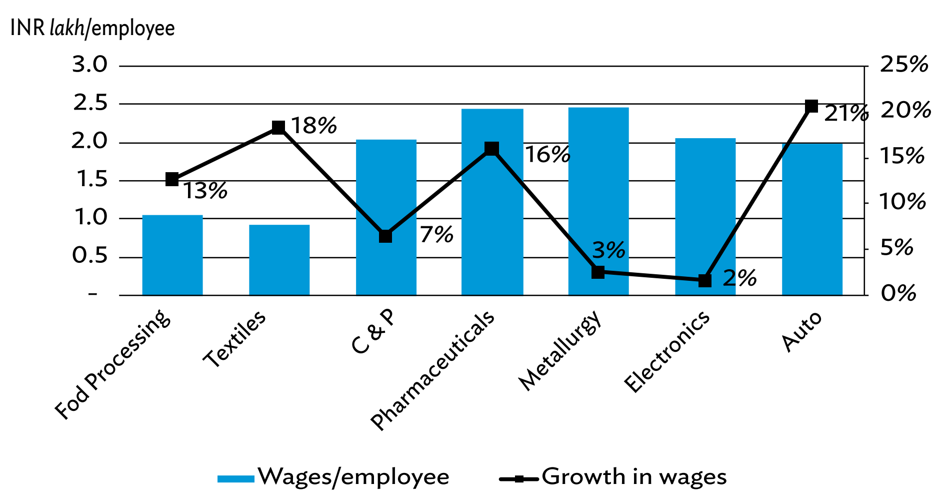
Over the next 20 years under the BAU scenario, employment in selected growth sectors is expected to increase from 2.9 million to 5.8 million; under the BIS scenario, employment is expected to increase from 2.9 million to over 11.8 million (Figure 1.6).

Figure 1.6: **Employment of the Corridor under BAU and BIS Scenario**



Source: ASI 2010-11 AP, District Domestic Product AP 2010-11, various sector reports, Labor intensity report 2008.

Figure 1.7: **Wages per Employee in Andhra Pradesh (average from 2008-09 to 2011-12), by Sector**



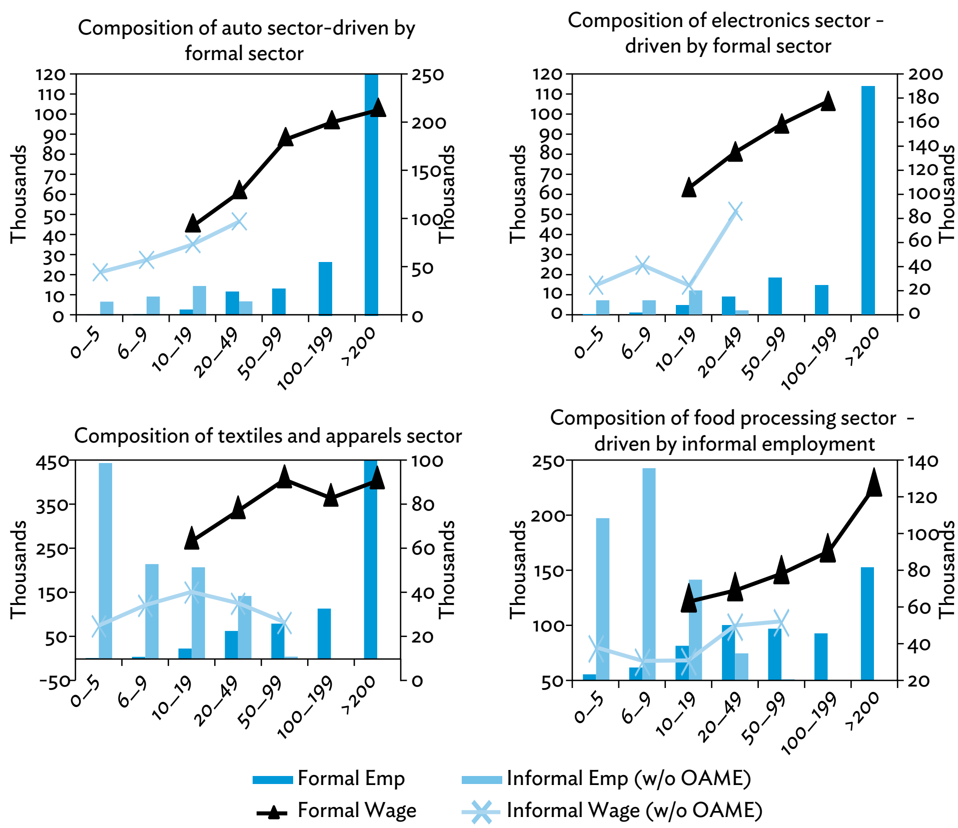
Source: ASI 2008-09 to 2011-12.

Based on the current numbers and past trends of wages and employment, it may be inferred that while textiles, electronics, and food processing have the potential to generate significant employment opportunities, pharmaceuticals and automobiles can generate higher wages for industrial workers (Figure 1.7).

It is evident from the charts (Figure 1.8) that workers in pharmaceuticals, electronics and auto sector earn much higher wages than their counterparts in textiles and food processing. This wage differential is attributable to two factors: 1) large firms pay higher wages than small firms within the same sector, and 2) formal/registered firms pay much higher wages than their informal counterparts in the same sector. This is driven by the fact that larger/formal firms tend be more productive and tend to employ more skilled workers as compared to the smaller/informal firms. Textiles and food processing are currently dominated by very small sized enterprises operating in the informal segment. Thus, if we could ensure that the expansion of textiles and food processing is driven by more "dynamic" (formal, large, and more productive) enterprises through an appropriate set of policies, we will see not only employment growth, but also growth in wages.

The automobile and electronics sectors create more formal jobs in Andhra Pradesh and have positively impacted on the wages of employees much more than textiles and food processing (Figure 1.8).

Figure 1.8: **Composition of Sectors – Employment and Wages in Andhra Pradesh**



OAME = Own Account Manufacturing Enterprise.

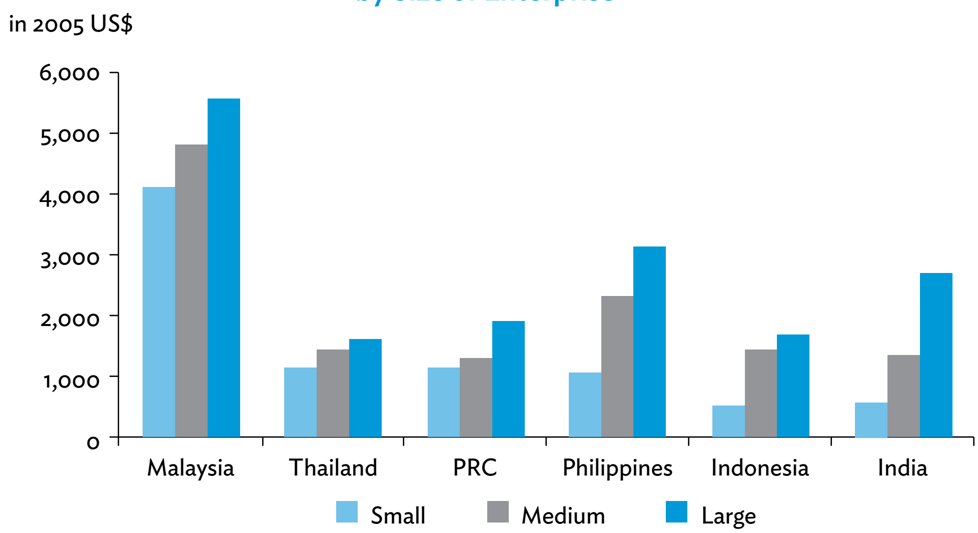
Source: ASI and NSSO, 2010-11.

Promoting Dynamic SMEs

Micro, small, and medium-sized enterprises (MSMEs) in developing countries have consistently generated significant employment opportunities. However, past studies have also established that wage levels and employment terms vary considerably with enterprise size, with average wages in small enterprises being significantly lower than medium-sized enterprises (Figure 1.9). This is due to a number of factors like higher labor productivity and skill levels in larger firms, differing regulatory implications with respect to employee protection laws, collective bargaining provisions, and minimum wage regulations that vary with firm size.[2]

A large proportion of micro-enterprises represent self-employed people running very small operations with limited earnings, many of whom would opt for stable wage employment given an opportunity. Based on an analysis of household survey data from 13 developing countries, a similar conclusion was drawn by Banerjee and Duflo (2007), who report that these entrepreneurs "...run businesses, but, for the most part, only because they are still relatively poor and every little bit helps. If they could only find the right salaried job, they might be quite content to shut their business down."

Figure 1.9: **Average Annual Wages – India vis-à-vis Other Countries, by Size of Enterprise**

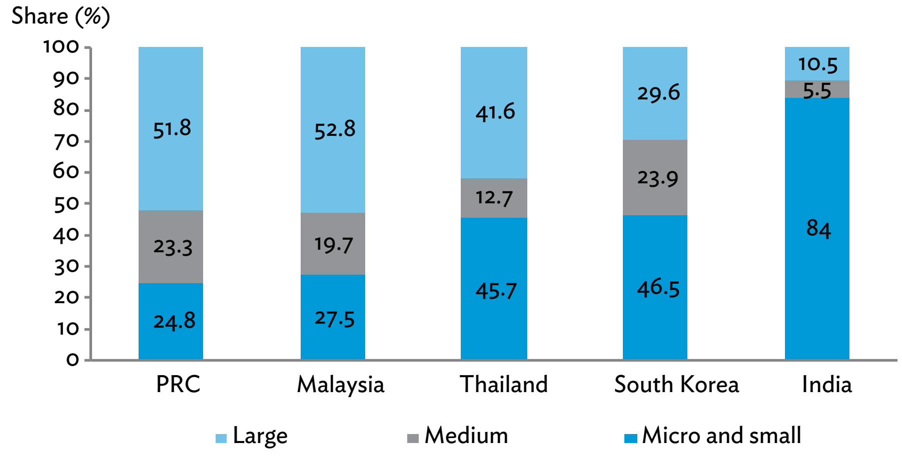


Small: 5-49 workers other than the PRC (9-49 workers) and Thailand (16-50 workers); Medium: 50-199 workers other than Thailand (51-200 workers); Large: 200 or more workers other than Thailand (>200 workers); PRC = People's Republic of China.

Source: ADB. 2009. Enterprises in Asia: Fostering Dynamism in SMEs.

2 ADB. 2009. *Enterprises in Asia: Fostering Dynamism in SMEs.* Manila.

Figure 1.10: **Share of Manufacturing Employment, by Size of Enterprise**



Small: 5-49 workers other than the PRC (9-49 workers) and Thailand (16-50 workers); Medium: 50-199 workers other than Thailand (51-200 workers); Large: 200 or more workers other than Thailand (>200 workers); PRC = People's Republic of China.

Sources: ADB. 2009. Enterprises in Asia: Fostering Dynamism in SMEs.

In India, the impact of the wage differential across enterprises is magnified by the share of employment among firms of different sizes. Unlike the PRC, Malaysia, and Thailand, where a significant part of the workforce is employed by larger enterprises, the relative share of employment in micro and small enterprises vis-à-vis medium-sized and large enterprises is quite high in India (Figure 1.10).

As a result, the large wage differentials within enterprises, often impact living standards. It is therefore important to focus separately on MSMEs with minimum value-added and scales of operation to (i) achieve sustainable and consistent growth in the manufacturing sector, and (ii) create paying jobs that require a skilled workforce with a high level of productivity and the ability to produce quality output. The vast majority of micro-enterprises would typically fall outside this category given their focus on relatively low-technology products catering to their surrounding markets and associated low productivity levels. For such enterprises, the objective is to help them forge business linkages with bigger companies that already have well established value chains. This will not only help the micro-entrepreneurs in reaching out to outside markets (other than the surrounding markets) but also in upgrading their skill sets, which play an instrumental role in enhancing productivity levels.

Leveraging Established Supply Chains (Including Global Production Networks) for SME Growth and Development

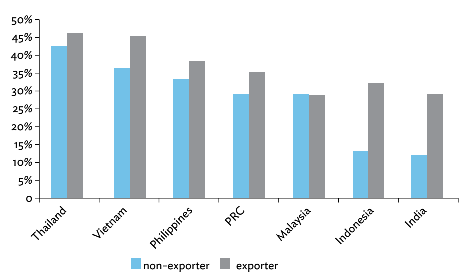
Continued dependence on traditional technologies, which in most cases are not cost effective, limited technical skills, and lack of access to finance and markets are some of the key factors adversely impacting SME growth in most developing countries, including India. Past studies have established that SMEs with linkages to large companies or existing supply chains are better placed to overcome many of these difficulties. An analysis leveraging the World Bank's Enterprise Survey 2014 demonstrated that SME exporters are more likely to introduce new technologies, especially in lower-middle-income countries such as India and Indonesia. Exporting SMEs are also likely to have a higher share of bank financing among their working capital (Figure 1.11).[3]

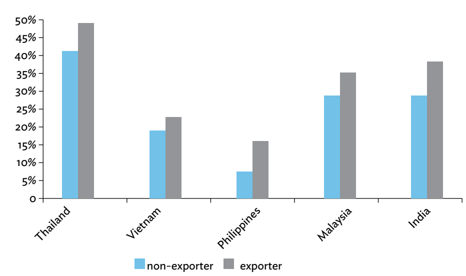
Studies have shown that SMEs linked to established supply chains tend to be more dynamic and innovative in order to ensure competitiveness. They also benefit immensely through knowledge-sharing initiatives of larger companies in the supply chain.

A number of developing countries have focused on policy level interventions to integrate their domestic SMEs with existing supply chains, including global production networks. This approach has been quite successful in East and Southeast Asia, which has seen the emergence of a regional supply chain in the automobile industry linked to the larger global automotive production network. The network comprises major automobile companies like Ford, Daimler, BMW, General Motors, Toyota, Honda, and Mitsubishi, together with their key ancillaries and component suppliers.

SMEs in countries like Indonesia, Malaysia, the Philippines, and Thailand constitute an integral part of this automobile supply chain and have been key beneficiaries in the fragmentation of production across individual countries in the region. While governments have played a facilitative role by adopting an appropriate policy mix, the large global companies forged partnerships with local SMEs and helped them scale up operations by providing a ready market, sharing technology and production-related knowledge, and facilitating the availability of finance.

Figure 1.11: **Introduction of New Technology and Access to Bank Finance – Exporting & Other SMEs**



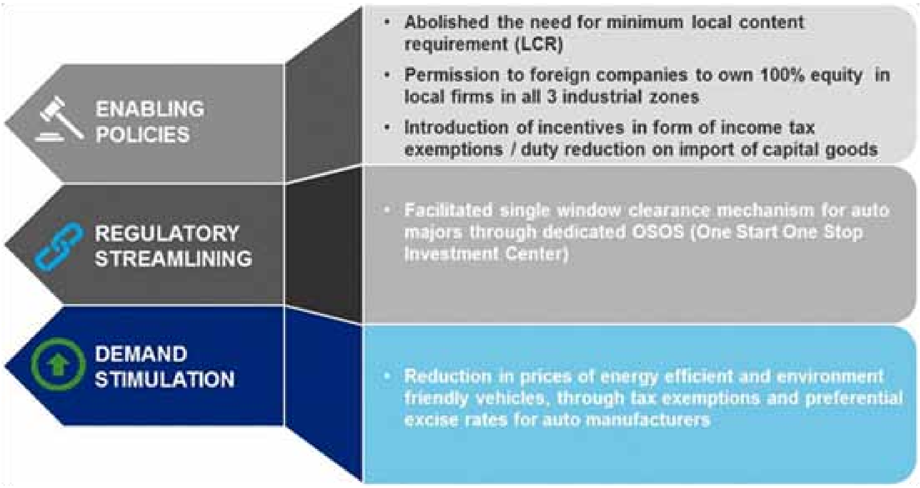


Note: PRC = People's Republic of China.

Source: ADB. 2009. Enterprises in Asia: Fostering Dynamism in SMEs.

3 ADB. 2009. *Enterprises in Asia: Fostering Dynamism in SMEs.* Manila.

Figure 1.12: **Policy Measures Taken in Thailand to Develop Automotive Industry**



Sources: Study team analysis.

Highlights of the transformation of SMEs in the automobile industry in Thailand are presented in the case study below.

Case study: Thailand's SMEs and the global automotive production network

In the early 1990s, the automobile industry in Thailand was in a nascent stage, with exports of around US$0.5 billion, accounting for only around 1% of the country's manufacturing exports. The government, with a view to developing the domestic industry by attracting large global players, initiated a number of policy measures (Figure 1.12).

The measures undertaken by the government led a number of global major automobile companies like Ford, General Motors, and BMW to set up manufacturing units in the country both for meeting domestic demand and serving other regional markets in Southeast Asia and East Asia. While this led to many Tier 1 component suppliers to these major automobile companies setting up operations in the country, Thailand still lacked an adequate number of Tier 2 and 3 suppliers as domestic SMEs were not equipped to play this role.[4] The Government of Thailand, in consultation with key industry bodies, put in place a number

[4] Definition of Tier 1/2/3 component suppliers is as follows: Tier 1 suppliers: Firms that sell finished components (for e.g. seats, dashboards, electronic modules, brake-axle-suspension etc.) directly to the vehicle manufacturers. Tier 2 suppliers: Firms supplying products / services (for e.g. carbon brush, window glasses etc.) directly to Tier 1 suppliers. Tier 3 suppliers: Firms supplying raw materials / basic engineering products (for e.g. plastic compound, synthetic rubber, steel) used in production of components to Tier 2 suppliers.

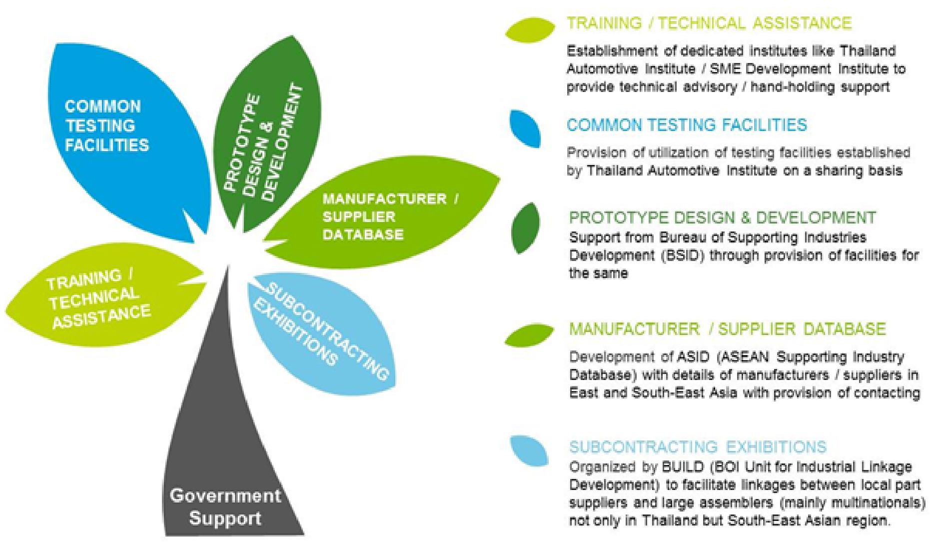
of facilitation mechanisms aimed at developing SME capacity to enable them to meet the specific requirements of the sector (Figure 1.13).

With initial support from the government, SMEs in Thailand have managed to establish a mutually beneficial relationship with major global automobile companies and their Tier 1 suppliers. In 2012, Thailand was the 13th largest exporter of automobiles in the world, with the sector employing more than 600,000 people, representing a five-fold increase from the early 1990s. The sector today comprises a mix of large global players supported by a network of Tier 1 and Tier 2 and 3 suppliers (Figure 1.14).

Domestic SMEs have benefitted significantly by participating in the global value chain:

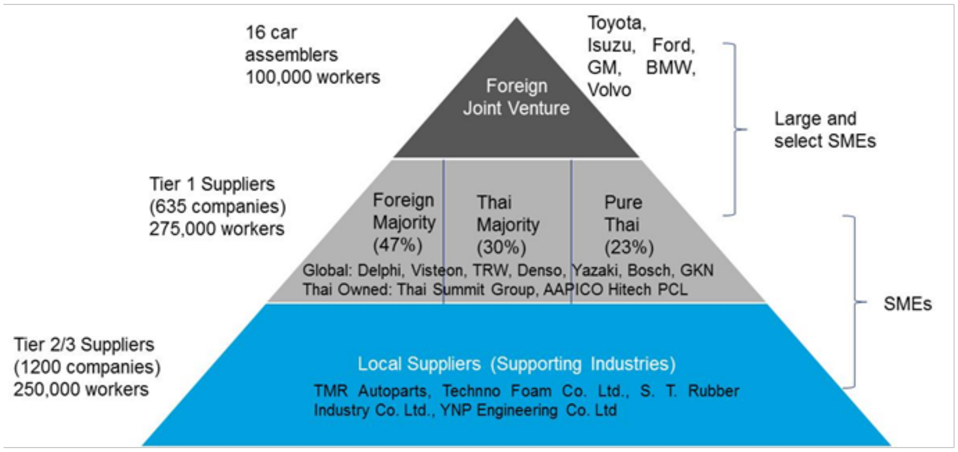
- Local SMEs initially serving as Tier 2 and 3 suppliers have scaled up to become Tier 1 suppliers on the back of investments in technology upgrades and knowledge sharing with bigger Tier 1 suppliers. As a result, local players currently hold a majority or complete stake in 53% of existing Tier 1 suppliers.
- A number of Tier 1 suppliers, including relatively large SMEs, have been involved in high value-added activities like product design and development. Specific inputs are taken from these local players with respect to the product engineering required for local market adaptation as part of product design. For example, one of the local suppliers, Aapico, was involved in the design, testing, and supply of low-volume jigs to firms like Daimler for the entire Southeast Asian market.

Figure 1.13: **Facilitation Mechanisms Aimed at Developing SME Capacity in Thailand**



Sources: Study team analysis.

Figure 1.14: **Network of Tier 1 and Tier 2 and 3 Suppliers – Automobile Industry in Thailand**



Source: Thailand Automotive Institute (TAI) - July 2011.

- There has also been an increased level of knowledge sharing and technology transfer from global majors to local SME suppliers, with indigenization levels being around 70% for passenger cars to 100% for motorcycles.
- Increased focus on specialization in select components has helped SMEs address not only the domestic market but also exports to other countries in the region, requiring components that are common among different models of the same auto manufacturer.
- The automobile industry's output has grown from a share of around 2% of GDP in the late 1990s to around 10%–15% in the late 2000s. The value-added per employee has consistently increased, with its contribution to the country's GDP outpacing the share of overall employment, which was estimated at around 5% in the late 2000s.

Industries that Can Drive Growth in the Proposed Corridor

To achieve the objectives of Industrial transformation of VCIC, identifying the right set of industries will be critical. The ensuing section presents the methodology adopted to identify a short list of industries.

Objectives for industry selection for VCIC

To achieve higher manufacturing growth and create employment opportunities within VCIC, industries with the following characteristics need to be identified:

- projected to grow at rapid rates driven by either domestic or export demand,
- offering competitive and comparative advantages for India and Andhra Pradesh, and
- offering employment opportunities that will drive higher wages.

In addition, VCIC should attract "sunrise" industries willing to expand or relocate to the corridor, and strengthen "traditional" industries. Traditional industries, for the purpose of this study, is defined as those not using electricity for major production purposes and employing less than 10 workers, educated up to primary school levels. It includes, amongst others, handloom textiles.

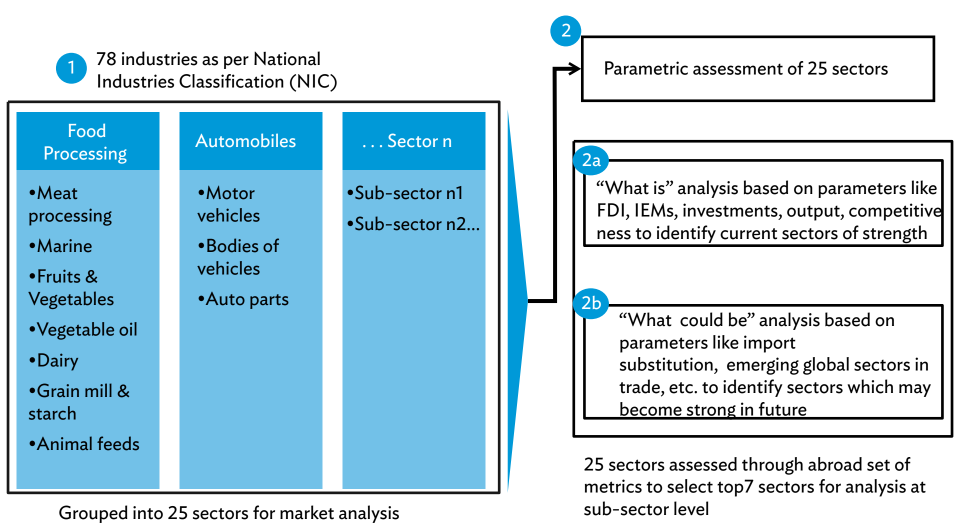
Approach

A two-step analysis was undertaken to identify industries that meet the above objectives of industrialization in VCIC.

The First Stage Identified a Set of Sectors that Potentially Meet the Desired Requirements of Industry Selection

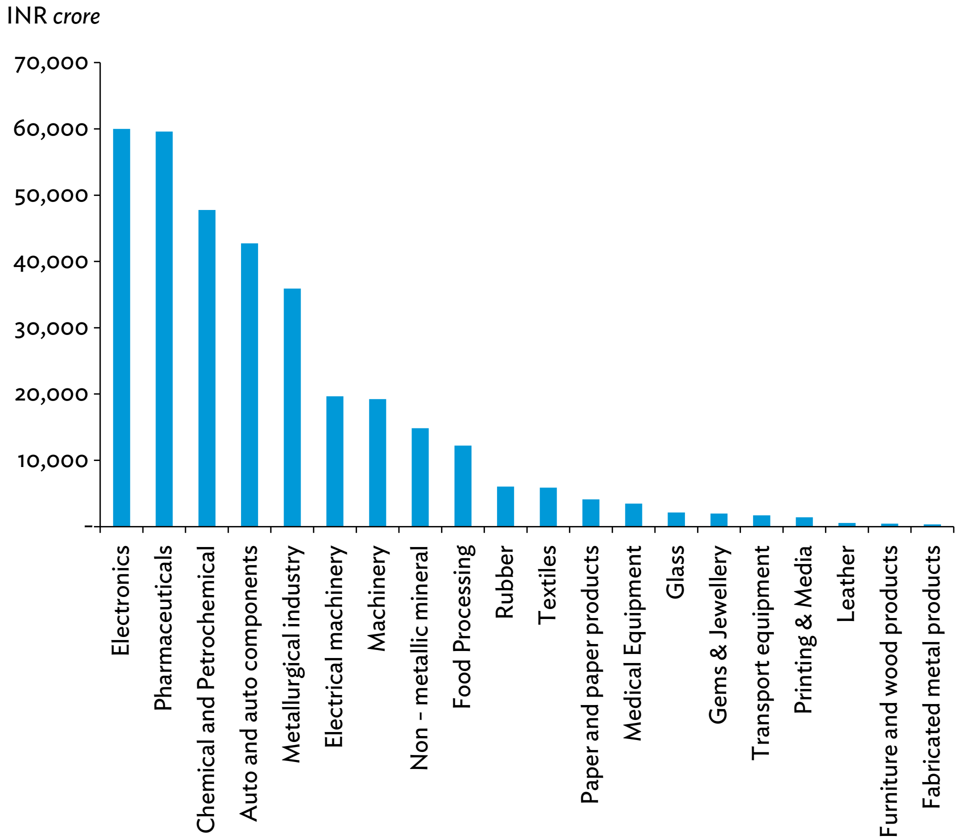
Market analysis was undertaken for 78 industries (as per National Industries Classification) and grouped into 25 distinct sectors at the country and corridor levels to identify sectors that can potentially be attracted to the proposed corridor. The 25 sectors were assessed through a broad set of metrics to select the top six or seven sectors. The overall approach for sector selection is shown in Figure 1.15.

Figure 1.15: **Approach for Sector Selection**



Sources: Study team analysis.

Figure 1.16: **Foreign Direct Investment in Manufacturing Sectors in India, April 2000–July 2013**



Source: Indiastat.

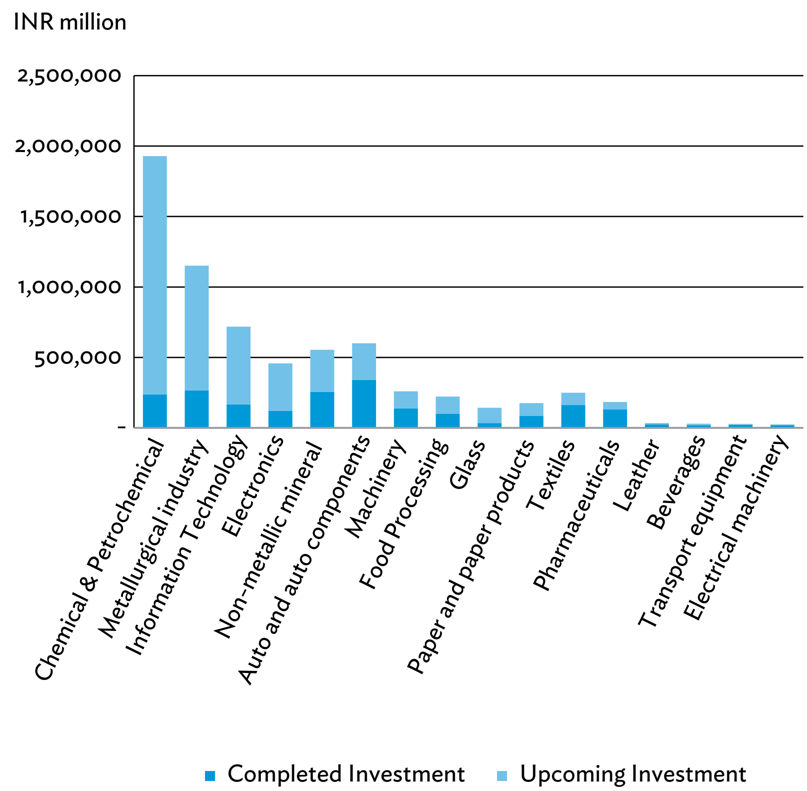
The parametric assessment comprised "what is" analysis to identify current sectors of strength for the corridor and the "what could be" analysis to identify sectors that show promise for the future. The "what is" analysis was done with a view to shortlist sectors with a strong demand pull and also to showcase the presence of factors of production along the proposed corridor. The parameters were evaluated through standard proxies like trends in foreign direct investment (FDI), Industrial Entrepreneurs Memorandums (IEMs), exports, and output and future investments, among others.

Inward FDI is reflective of the opportunity to attract investments across sectors. Hence, this analysis helps in identifying sectors that have been attracting high levels of investment into the country. For the analysis, cumulative figures from April 2000 through July 2013 have been used. Electronics, pharmaceuticals, chemicals and petrochemicals, automobiles, and metallurgical industries are the five sectors with largest amounts of FDI in India, cumulatively accounting for more than 70% of total FDI during the period under review (Figure 1.16).

Electronics, pharmaceuticals, chemical and petrochemicals, auto and auto components, and metallurgical industries are the five sectors with the largest amounts of FDI in India, accounting for more than 70% of total FDI.

An IEM is an application for acknowledgement of an industry/establishment and the number of IEMs filed reveals which sectors have experienced high demand in the last few years.[5] For the purpose of our analysis, IEMs filed in India between 2008 and August 2013 have been considered. The top sectors in Andhra Pradesh and Tamil Nadu—electrical machinery, metallurgical industry, chemicals and petrochemicals, non-metallic minerals, and textiles—contributed to over 90% of total investment in India and accounted for more than 65% of IEMs filled across all sectors (Figures 1.17, 1.18).

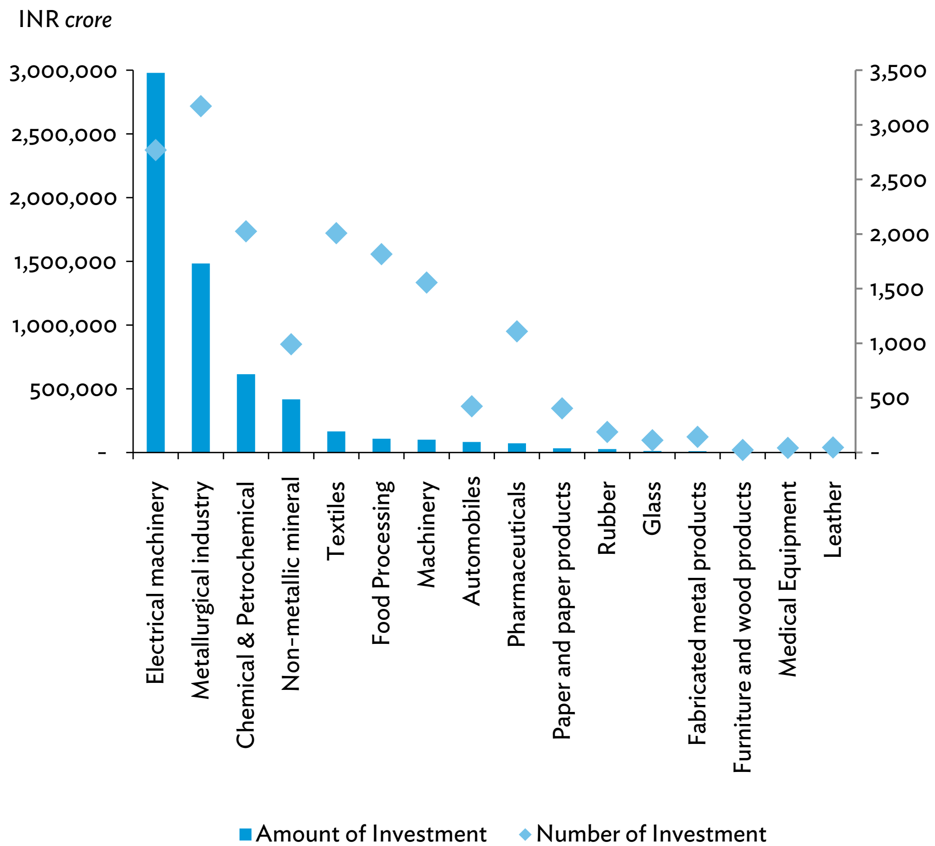
Figure 1.17: **Completed Investment Trend in Andhra Pradesh and Tamil Nadu (1985–2013)**



Source: Center for Monitoring Indian Economy (CMIE), Department of Industrial Policy and Promotion (DIPP).

[5] Industrial promoters can file IEM to set up a new industrial undertaking, to effect substantial expansion of the industrial undertaking, to manufacture a new article, or to carry on business of existing small scale industry units after graduating into large scale industry.

Figure 1.18: **Industrial Entrepreneurs Memorandums (IEMs) Filed between 2008 and 2013 in India, by Sector**



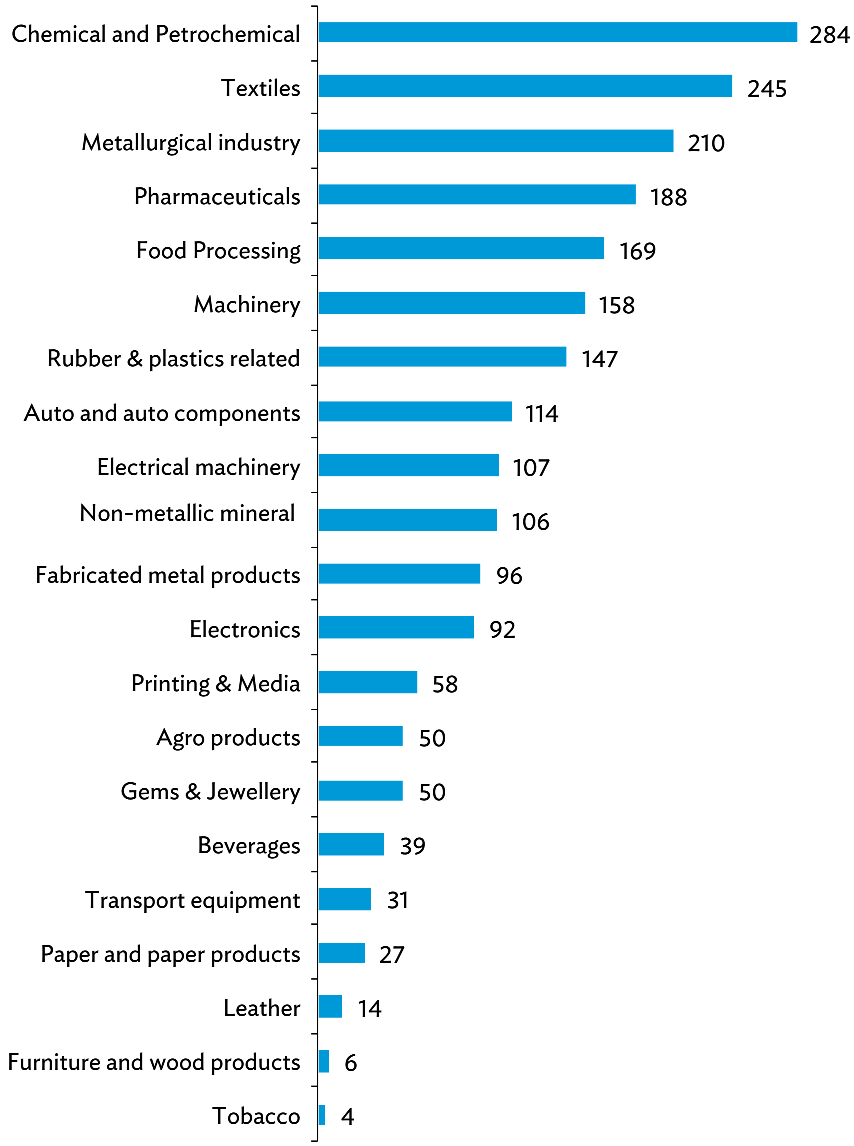
Source: DIPP, CMIE.

Investment trends in Andhra Pradesh and Tamil Nadu for completed and upcoming projects suggest that chemicals and petrochemicals, metallurgy, electronics, and auto and auto components are emerging as the top sectors in attracting investors.

Corporate restructuring is one of the most widely used strategic tools for business expansions and has facilitated thousands of companies to re-establish their competitive advantage and respond more quickly and effectively to new opportunities and unexpected challenges. Merger and acquisition (M&A) trends can provide insights on the attractiveness of a sector, albeit with a key limitation being the possible objectives of such deals when M&A trends can align with inorganic growth strategies that do not result in greenfield projects. Figure 1.19 provides the details of cumulative M&A deals in each sector between 2008–2009 and 2012–2013.

We also analyzed India's top 10 sectors by output through relative trade advantage (RTA) analysis to identify the most competitive sectors from trade perspective, as the proposed corridor enjoys a vast coastline which may spur growth in trade-based sectors. Food processing, textiles, chemicals and petrochemicals, pharmaceuticals, metallurgy, fabricated

Figure 1.19: **Merger and Acquisition (M&A) Deals in the Past Five years, by Sector 2008–09 to 2012–13**

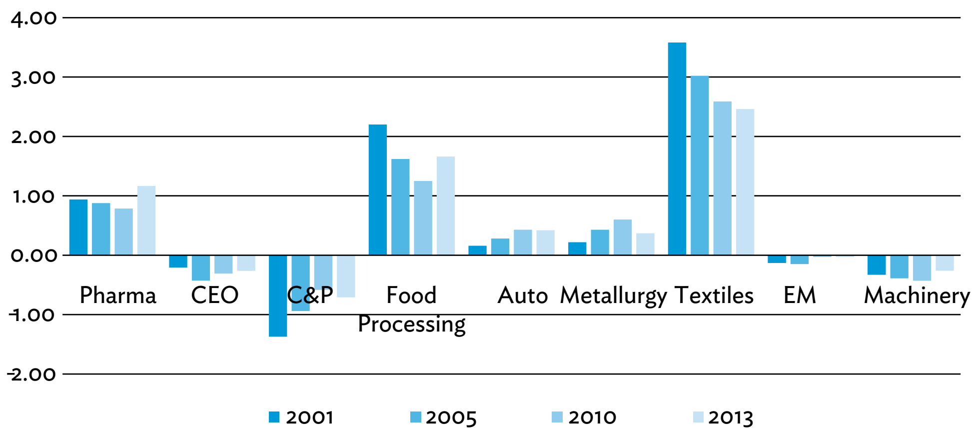


Source: CMIE Economic Outlook Database.

metal products, electrical machinery, machinery, auto and auto parts, and gems and jewellery sectors are showcased in Figure 1.20. An exception to this list was made to include electronics, which has huge domestic demand. On the other hand, fabricated metal products and gems and jewellery were dropped from the list as the corridor has seen very little investment in these sectors in the past.

Chemicals and petrochemicals, textiles, metallurgy, pharmaceuticals, and food processing are the five sectors with the highest levels of M&A activity in India over the last five year.

Figure 1.20: **Relative Trade Advantage of India**



Source: Study team analysis.

India has competitive advantage in pharmaceuticals, food processing, textiles, auto and auto components, and metallurgy.

The RTA is the difference of the relative comparative advantage (RCA) in India's exports and the RCA in imports (or the disadvantage in imports) at the country level. For a given sector, an RTA above 1 signifies that India has a net advantage in exporting in that sector, and the global acceptability of Indian manufactured products is high in that sector. Similarly, an RTA below 1 reveals that India has yet to gain ground or is losing ground in the overall trade of products in the given sector.

The shortlisted sectors in India based on output were also analyzed for RCA at the corridor level by comparing Andhra Pradesh and Tamil Nadu, the two corridor states, with the other major manufacturing destinations in the country. The RCA analysis at state level was done using the GVA for each of these sectors to identify where corridor states are doing better than other leading manufacturing states like Gujarat, Maharashtra, and Karnataka. The state-wise RCA analysis revealed that while Andhra Pradesh has a clear advantage in sectors like pharmaceuticals, electrical machinery and food processing, Tamil Nadu leads in machinery, textiles, electronics, and auto and auto components (Table 1.1).

Table 1.1: **Revealed Comparative Advantage Analysis of States by Sector**

Comparative analysis - AP, TN, GJ, KA and MH						
Sector	**AP and TN**	**AP**	**TN**	**GJ**	**KA**	**MH**
Food processing	1.12	1.41	0.83	0.78	1.03	0.81
Auto & auto components	1.28	0.16	2.40	0.62	0.75	0.84
Chemicals & petrochemicals	0.37	0.42	0.32	1.71	1.26	1.69
Metallurgical industries	0.81	0.77	0.84	0.72	0.83	0.78
Machinery	1.02	0.43	1.60	1.05	1.15	1.18
Electronics	0.98	0.77	1.19	0.78	1.19	0.90
Electrical machinery	0.96	1.19	0.74	0.93	1.22	1.10
Textiles	1.42	0.56	2.27	0.86	0.86	0.79
Pharmaceuticals	1.22	2.18	0.25	0.78	0.82	0.75

AP = Andhra Pradesh, GJ = Gujarat, KA = Karnataka, MH= Maharashtra, and TN = Tamil Nadu.

Source: ASI 2010-11.

On juxtaposing the outputs of RTA analysis at the country level and RCA analysis at the state level, with the initial shortlist of the top 10 sectors based on "what is" analysis, it was observed that food processing and pharmaceuticals emerge as the key focus sectors for the proposed industrial corridor. As the proposed corridor is along the coastline and is envisaged to emerge as a gateway to Southeast Asian economies, we believe that sectors where India enjoys trade competitiveness may also be picked up for further analyses. Hence, textiles, auto and auto components, and metallurgy may also be included in the priority sectors list.

The industry shortlist was further ratified using a "what could be" analysis to identify sectors that are currently not strong areas for India or the proposed corridor region; however, these sectors may hold the potential to emerge as winners in the long-term. The parameters of the "what could be" analysis focused on multiple aspects:

- India's comparative disadvantage in trade;
- Sectors gaining global importance;and
- Sectors with high domestic demand being met through imports, and sectors where the government intends to focus in the future.

The RCA analysis of the electronics and chemicals and petrochemicals sectors have showcased the huge dependency of India on imports. This presents an opportunity to be tapped as domestic manufacturing capacities are not able to meet domestic market demand. Based on the "what could be" analysis, the electronics and chemicals and petrochemicals sectors emerge as potential sectors for long-term focus within the proposed industrial corridor. The other identified sub-sectors will be separately analyzed at a later stage of the study. Using the abovementioned analyses based on multiple parameters (represented by different proxies), the final list of sectors identified as potential winners for the proposed VCIC are detailed in Table 1.2.

Table 1.2: **Sectors Identified for VCIC**

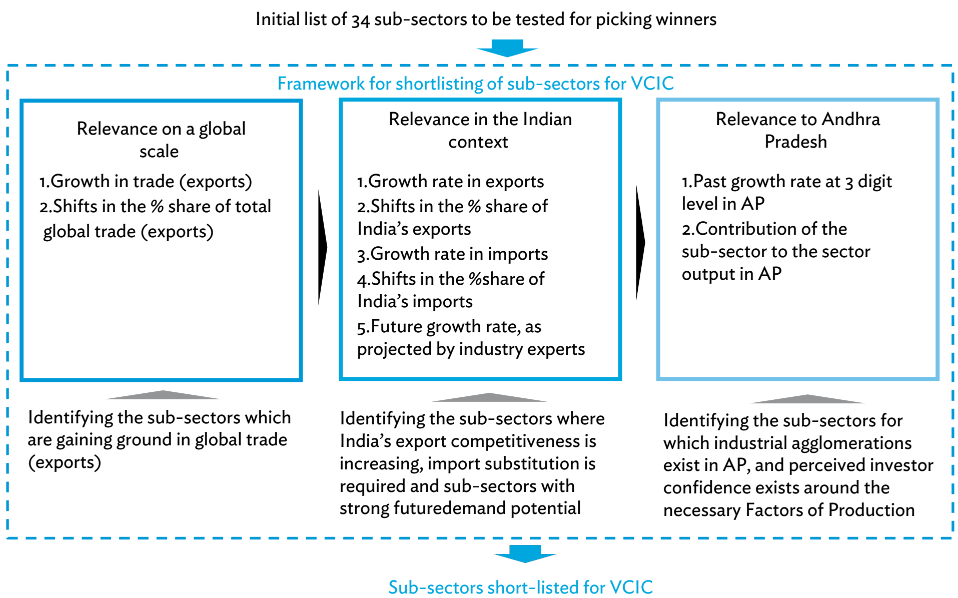
Sector	Characteristics attractive to investors
Food Processing	• Major contributor to Indian exports; India has a global trade advantage in the sector. The food processing sector doubled its share among total Indian exports between 2001 and 2013; exports grew at a compound annual growth rate(CAGR) of 17% during this period. India has a RCA of 1.7 in the global export arena. • High M&A activity in India in the sector, showcasing high investor interest • VCIC districts are rich in food resources and have necessary factors of production to attract investors • High employment potential
Chemical and Petrochemicals	• India's imports in the chemicals and petrochemicals sector account for about 50% of its total imports. Domestic market is expected to grow more than 10% per year in the medium-term. • High level of imports to India and high domestic demand envisaged for the sector • High M&A activity in India in the sector, showcasing high investor interest • Petroleum, Chemicals, and Petrochemicals Investment Regions in Andhra Pradesh will lead to the right factors of production for the sector • High employment potential
Textiles	• Major contributor to India's exports; India has a global trade advantage in the sector. India has a 5.2% share in global textiles exports, growing at a CAGR of 12% in 2001–2013. India has a RCA of 2.76 in global textile exports, showcasing its strong competitiveness globally. • High M&A activity in India in the sector, showcasing high investor interest • VCIC districts provide the necessary factors of production for attracting investments in the sector • High employment potential
Pharmaceuticals	• Major contributor to India's exports; India has a global trade advantage in the sector. India increased its share of exports in the pharmaceutical sector 2.7 times between 2001 and 2012 at a CAGR of 21%. India has an RCA of 1.3 in global pharmaceutical exports, showcasing its strong position in the sector • High domestic demand envisaged • High M&A activity in India in the sector, showcasing high investor interest • High potential to generate employment with higher wages • Knowledge-based sector
Metallurgy	• Major contributor to India's exports; India has a global trade advantage in the sector. India's metallurgy sector is expected to grow at around 7% per year, driven by iron and steel sector which is expected to grow at over 10% per year. • High M&A activity in India in the sector, showcasing high investor interest • VCIC districts rich in natural mineral resources • High employment potential
Electronics	• High domestic demand envisaged, with high potential for import substitution • India's electronics market is expected to grow more than 20% per year across most sub-segments, while it is highly import-dependent, with imports growing at more than 15% per year and contributing to 6% of India's imports • Potential sunrise sector for India • High employment potential in the future with higher wages
Auto and Auto Components	• Major contributor to India's exports; India has a global trade advantage in the sector. India's exports have grown at a CAGR of 26% during 2001–2013, and its share of global exports increased about 7 times during the same period. • High M&A activity in India in the sector, showcasing high investor interest • High potential to generate employment with higher wages

Source: Various sector reports, Study team analysis.

The Second Stage Identified a Set of Industries within the Sectors that will Help Achieve the Objectives of Industrialization in VCIC

Each of the sub-sectors was tested on three different levels: (i) relevance on a global scale, (ii) relevance in the Indian context, and (iii) relevance to Andhra Pradesh (about 95% of current phase of the corridor passes through Andhra Pradesh). The approach for further analysis at the sub-sector level is depicted in Figure 1.21.

Figure 1.21: **Framework for Shortlisting Sub-Sectors**



Source: Study team analysis.

Industries that are gaining ground in global exports have been shortlisted by analyzing growth in exports (2001–2013) and the shift in the share of the sub-sector in global exports (between 2001 and 2013). Similarly, relevance in the Indian context was analyzed to pick sectors which increase India's exports or reduce its import dependencies. Hence, sub-sectors with high growth rates and increasing shares in exports were picked. Similarly, sub-sectors with very high import growth rates and high shares in imports to India were also considered for the corridor. Another important parameter which was tested was future growth rate for these sub-sectors, as projected by industry experts. Although these projections are short-term (2014–2020), these were taken as a proxy for identifying the high growth sub-sectors of the future.

The data on supply and demand side parameters used for identification of target sectors is in Appendix 2.

In Andhra Pradesh, the past growth rates of these sub-sectors, the contribution of these sub-sectors to sector output, and the investment trends across these sub-sectors were analyzed to identify sub-sectors for which perceived investor confidence exists around the factors of production. Based on these analyses, the 34 sub-sectors can be categorized as follows (Table 1.3).

Table 1.3: **Summary of Sub-Sectors Chosen for Industrialization in VCIC**

No.	Sub-sector description	NIC code	Export driven	Domestic demand driven	Employment driven
	Food Processing				
1	Meat processing	101	√		
2	Marine processing	102	√		
3	Fruit and vegetables	103			
4	Vegetable and animal oils and fats	104			√
5	Dairy products	105	√		
6	Grain mill, starches and starch Product	106	√	√	√
7	Ready to Eat	107		√	√
8	Animal feeds	108			
	Textiles				
9	Spinning, weaving and finishing of textiles	131			√
10	Other textiles	139		√	√
11	Wearing apparel, except fur apparel	141		√	
12	Manufacture of articles of fur	142			
13	Manufacture of knitted and crocheted apparel	143	√		
	Chemicals & Petrochemicals				
14	Coke oven products	191			
15	Refined petroleum products	192	√	√	
16	Basic chemicals, fertilizer and nitrogen compounds, plastics and synthetic rubber in primary forms	201	√		√
17	Other chemical products	202		√	
18	Man-made fibers	203			
19	Plastics products	222	√	√	√
	Pharmaceuticals				
20	Pharmaceuticals	210	√	√	√
	Metallurgy				
21	Basic iron and steel	241	√	√	
22	Basic precious and other non-ferrous metals	242	√		
23	Casting of metals	243		√	

continued on next page

Table 1.3 *continued*

No.	Sub-sector description	NIC code	Export driven	Domestic demand driven	Employment driven
	Electronics				
24	Electronic components	261		√	
25	Computers and peripheral equipment	262		√	
26	Communication equipment	263	√	√	
27	Consumer electronics	264			
28	Measuring, testing, navigating and control equipment; watches and clocks	265			
29	Irradiation, electro-medical and electrotherapeutic equipment	266			
30	Optical instruments and equipment	267	√		
31	Magnetic and optical media	268			
	Auto & Auto components				
32	Motor vehicles	291	√	√	
33	Bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	292	√	√	
34	Parts and accessories for motor vehicles	293	√	√	

Source: Study team analysis.

Global Value Chain Perspectives for VCIC

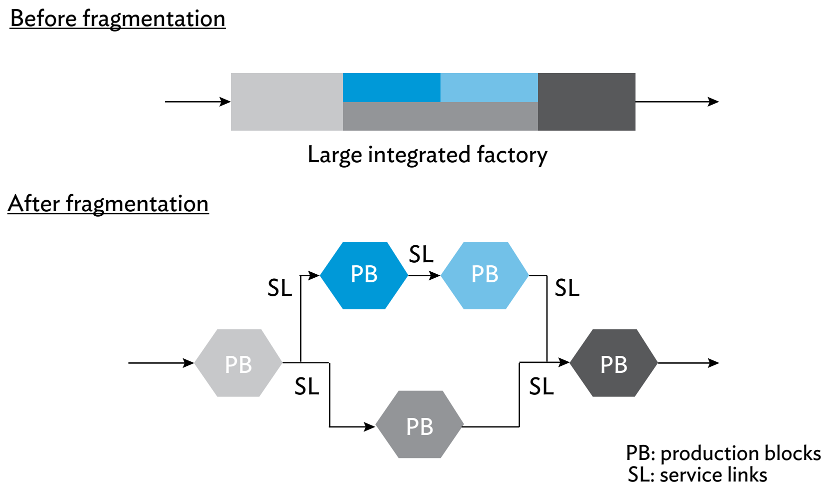
Global Production Networks and Domestic Supply Chains

One of the most significant features of international trade is the emergence of global production networks (GPNs) and the rise of global value chains (GVCs). Global production sharing in the manufacturing sector has been the key driver of the shift in manufacturing exports from developed to developing countries in the past two decades. In this process, firms slice manufacturing production blocks (both intra-firm and inter-firm) across borders and locate them in destinations with the lowest costs. As a result, global trade today is not just an exchange of final products, but increasingly an exchange of the parts and components that make them. Jones and Kierzkowski (1990) were the first to point out the distinction between trade in intermediate goods and trade in finished products, particularly in the flexibility of a firm's decision and ability to slice production blocks, and the existence of service link costs.

The Fragmentation Theory: Production Blocks and Service Links

An array of alternative terms has been used to describe GPNs, including international production fragmentation, vertical specialization, slicing the value chain, GVC, and outsourcing (Figure 1.22). GPNs open up opportunities for countries to specialize in different slices (tasks) of the production process depending on their relative cost advantage and other relevant economic fundamentals. Consequently, parts and components are now exchanged

Figure 1.22: **The Fragmentation Theory: Production Blocks and Service Links**



Source: Kimura and Kobayashi (2009).

across borders at a faster rate than final goods. In this context, decisions of how much to produce and for which market have to be combined with decisions of where to produce and with what degree of intra-product specialization.[6]

By focusing on the sequences of tangible and intangible value-added activities, from conception and production to end use, GVC analysis provides a holistic view of global industries from the top-down (e.g., examining how lead firms govern their global-scale affiliates and supplier networks) and from the bottom- up (e.g., example, asking how these business decisions affect the trajectory of economic and social upgrading or downgrading in specific countries and regions).

There are four basic dimensions that define GVC methodology: (i) an input–output structure, which describes the process of transforming raw materials into final products; (ii) a geographical consideration; (iii) a governance structure, which explains how the value chain is controlled; and (iv) an institutional context in which the industry value chain is embedded (Figure 1.23).[7]

Each of these dimensions plays a major role in creating strategies for alignment with the GPN for any industry. In the context of VCIC, the industrialization strategy will have to incorporate an understanding of these dimensions to comply with the GPN requirements for

---

6 Chandra and Athukorala (2006). *Global production sharing and trade patterns in East Asia.*

7 Gereffi and Fernandez-Stark (1995). *Global Value Chain Analysis: A Primer.*

Figure 1.23: **Basic Dimensions of GVC Methodology**

1	Input-Output structure	a. Identification of the main activities and segments in a global value chain (GVC) b. Identification of the dynamics and structure of companies under each segment of the GVC
2	Geographic scope	Identification of lead firms in each segment and mapping the shifts in geographical scope of these global industries
3	Governance	Understanding the buyer–supplier relationships that govern the financial, material, and human resource allocation and flows across the various segments
4	Institutional context	Understanding how local (e.g., manpower availability, manpower costs, available infrastructure, access to finance, and access to education), national (e.g., tax and labor regulation, subsidies, and education and innovation policies), and international conditions and policies shape globalization in each stage of the GVC

Source: Gereffi (1995).

any industry. We analyzed two cases to reflect the impact of these dimensions in the context of understanding what the Government of India and the state governments can do to align VCIC's industrial growth with GPNs.

Before discussing these case studies, we describe the state of India's participation in GPNs.

India in GPNs

While India has achieved some success in linking its automobiles, auto components, and (lately) sound recording equipment industries to GPNs, it still largely remains a fringe player in the global network trade. Network exports as a share of total manufacturing exports stood at around 23%.

Tewari (2013) finds evidence of steady growth in India's integration with global production networks during the 10-year period from 2000 to 2010 when India's intermediate exports grew much faster (25% per year) than its aggregate manufactured exports (18% per year) and India's share of network exports (assembled end products) doubled from about 6% in 2000 to 12% in 2011. Imports showed a similar trend over this period. Furthermore, India's engagement with the Association of Southeast Asian Nations (ASEAN) grew at a faster pace than multilateral trade during this period. This was led by exports, which grew at an impressive rate of 35% a year. Tables 1.4 and 1.5 show network products as a share of India's total exports of manufactured products to the world and to ASEAN, respectively.

Table 1.4: **Share of Network Products in India's Total Exports of Manufactured Products to the World (%)**

	Parts and Components			Assembled Products			Total		
	2000/01	2004/05	2010/11	2000/01	2004/05	2010/11	2000/01	2004/05	2010/11
Office machines and automatic data processing machines (SITC 75)	0.57	0.38	0.15	0.64	0.48	0.59	1.21	0.87	0.74
Telecommunication and sound recording equipment (SITC 76)	0.07	0.10	0.41	0.28	0.31	1.78	0.35	0.41	2.19
Electrical machinery (SITC 77)	1.58	1.71	2.25	0.79	0.93	0.97	2.38	2.65	3.22
Road vehicles (SITC 78)	1.50	1.66	1.68	0.88	2.17	3.61	2.39	3.83	5.29
Professional and scientific equipment (SITC 87)	0.13	0.12	0.26	0.30	0.36	0.43	0.43	0.48	0.69
Photographic apparatus (SITC 88)	0.15	0.13	0.06	0.14	0.09	0.03	0.30	0.22	0.09
Total Network Products	4.01	4.10	4.80	3.04	4.34	7.41	7.05	8.44	12.22

Note: These shares are 2-year averages.

Source: INTRACEN.

Table 1.5: **Share of Network Products in India's Total Exports of Manufactured Products to ASEAN (%)**

	Parts and Components			Assembled Products			Total		
	2000/01	2004/05	2010/11	2000/01	2004/05	2010/11	2000/01	2004/05	2010/11
Office machines and automatic data processing machines (SITC 75)	6.49	1.28	0.47	1.31	0.66	0.90	7.79	1.94	1.37
Telecommunication and sound recording equipment (SITC 76)	0.17	0.11	0.12	0.37	0.24	2.40	0.54	0.35	2.53
Electrical machinery (SITC 77)	1.96	1.39	1.73	0.99	1.24	1.46	2.95	2.63	3.19
Road vehicles (SITC 78)	1.19	1.69	2.14	0.55	0.49	4.33	1.74	2.18	6.47
Professional and scientific equipment (SITC 87)	0.07	0.11	0.49	0.40	0.45	0.79	0.47	0.56	1.28
Photographic apparatus (SITC 88)	0.20	0.15	0.11	0.10	0.10	0.09	0.31	0.24	0.20
Total Network Products	10.08	4.73	5.07	3.73	3.18	9.97	13.81	7.91	15.04

Note: These shares are 2-year averages.

Source: INTRACEN.

The analysis in the paper also indicated shifts in the structure of India's exports toward more capital-intensive (e.g., machinery, transport equipment, and instruments) and natural-resource intensive products (e.g., chemicals, metals, and rubber). Thus, despite the current low volumes of network trade, there is potential for increasing India's engagement in GPNs through expansion of intermediate exports—such as electronics, electrical machinery, and telecommunications and transmission equipment—while also building on existing strengths in the chemicals sector, particularly high-value added chemicals, and also moving up the value chain in automobiles, auto components, and sound recording equipment. There is significant scope for trade in electronics and related equipment.

This study, through analysis of disaggregated data and surveys, cites three structural constraints hindering deeper integration of Indian manufacturers with production networks: (i) Indian firm's focus on the large domestic market over exports; (ii) the low-value added of Indian manufacturing companies leads to low-value added exports; and (iii) sub-optimal scales of production in key intermediate sectors, lack of quality inputs due to lagging R&D, technology, and skills development. Other factors include poor infrastructure, logistics, and distribution facilities; a lack of reliable power supplies; and high costs of financing and land acquisition needed to set up manufacturing and related service facilities.

We now present two case studies that provide important takeaways for VCIC, particularly in the context of the above-mentioned constraints.

Case Studies

HDD Industry in Thailand. The first case was the development of the hard disk drive (HDD) industry in Thailand over two periods: 1980–2000 and 2000–2010.[8] Thailand is well integrated into the global production network of the multinational enterprises (MNEs). Starting with assembling for further processing, the affiliates in Thailand gradually acquired more technological capabilities and reached the process engineering stage in which the affiliates are capable of developing basic and detailed designs for the production process. At this developmental stage, industrial clustering started, as there was need for intensive cooperation between HDD makers and suppliers to create effective coordination and achieve virtual integration of the entire system. HDD production in Thailand began around 1983 when Seagate shifted its head-stack assembly, one of the most labor-intensive segments in the HDD production process, to Thailand, due to the availability of relative low-wage manpower and a conducive investment climate in the country. The Government of Thailand had offered tariff exemptions for the export-oriented units, as part of investment promotion policies. Secondly, the tariffs in the HDD industry (on both intermediate and final goods) were relatively lower than other industries. Eventually, Thailand emerged as an attractive location for export-oriented labor-intensive FDI for East Asian investors. Toward the later stage of the 1980s, the government brought about a policy shift to strengthen the supply-side capability of the firms: promotion of human capital development, financial support for R&D projects, and strengthened links from MNEs to indigenous enterprises. This had a major impact on revamping the HDD industry in the country. The government incentivized R&D through schemes like an additional year of tax holiday for firms having average R&D or

[8] Case sourced from International Production Networks vs Industrial Clusters, by Archanun Kohpaiboon, Faculty of Economics, Thammasat University

design expenditures for the first 3 years of not less than 1%–2% of annual total sales; not less than THB50 million for HDD manufacturing, or not less than THB15 million for HDD parts manufacturing. Secondly, at least 5% of the total workforce in the first three years should consist of science and technology personnel with a minimum of a bachelor's degree in science, engineering, or other fields related to technology, R&D, or design. Finally, the average costs to train Thai staff for the first three years should be at least 1% of total payroll costs. These proactive measures coupled with the industry's response in providing training resulted in the industry shifting to higher value-added. Seagate shifted from pure head-stack assembly to high-volume production of head drive assembly in 1987. In 1991, IBM collaborated with Thai conglomerate, Saha Union to manufacture HDD in Thailand, and Fujitsu also entered the Thai HDD production market. This was followed by the entry of Western Digital in 2001, Hitachi Global in 2004, and Toshiba in 2008. During the same period, a number of foreign-owned parts suppliers entered the Thai HDD manufacturing market like NMB, Nidec, K R Precision, Magnetric, and TPW. By the end of the 1990s, industrial clustering started taking place as the original equipment manufacturers (OEMs) production capacities increased, spawning multiple indigenous suppliers like Eiwa, Habiro, Nippon Super, Thai Okoku Rubber, and Shin-Ei Daido. These developments propelled the HDD industry in Thailand onto a global pedestal, accounting for 45% of Thailand's IT and electronics hardware exports and 15% of total exports in 2008, and making Thailand the second-largest exporter of HDD in the world by 2008 (17% global share), next to the PRC (35% global share).

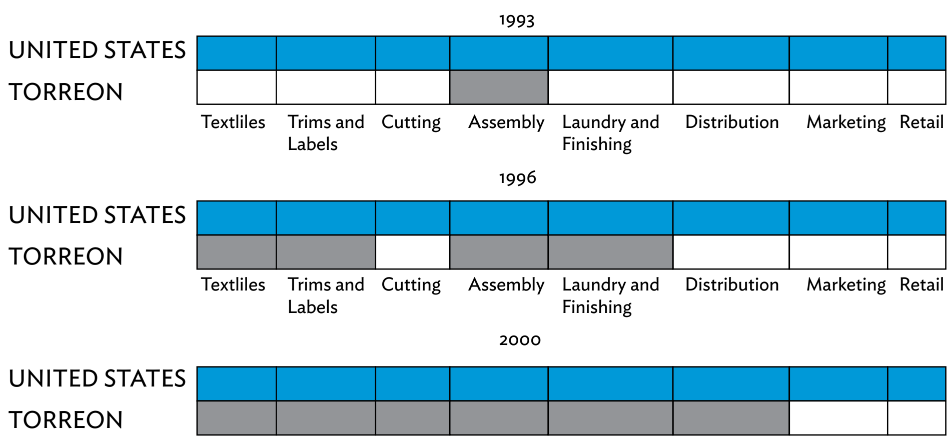
A key policy inference for VCIC from this case is that industrial clustering may co-exist with a GPN and may be a result of the efforts to be a part of a GPN. However, industrial clustering may not be a synonym for complete localization, rather local supplier contributions to a GPN may increase as skill levels in the region increase, depending on cost–benefit analysis. The increase in contributions to a GPN would most likely occur naturally only after the affiliates in the manufacturing region reach a certain level of technological capability.

Policy measures like tax incentives alone will not be able to help industries align with GPNs, as it largely depends on supply-side capabilities. Hence, the government will have to focus on improving the investment climate by enhancing the ease of business through mechanisms like Single Window, encouraging skills development through policies that promote R&D, and manpower training within private firms, and financing projects aimed at improving manpower quality in the proposed corridor districts.

Apparel Industry in Mexico. The apparel industry's development in Torreon, Mexico is another classic example of alignment with a GPN and gradual upgrading of Torreon apparel firms from Tier 1 and 2 suppliers to OEMs to original brand name manufacturer (OBMs) and eventually to original design manufacturers (ODMs).[9] Apparel suppliers in Torreon initially entered the blue jeans industry in the assembly stage of the global value chain, but they

[9] G. Gereffi and K. Fernandez-Stark. 2001. Global Value Chain Analysis: A Primer. Raleigh, NC: Duke University.

Figure 1.24: **US–Torreon Apparel Value Chain: Activities and Location**



Source: G. Gereffi and K. Fernandez-Stark. 2001. *Global Value Chain Analysis: A Primer.* Raleigh, NC: Duke University.

quickly developed expertise in providing trim and labels, and distinct washes and finishes. By year 2000, operations based in Torreon had also developed expertise in distribution, shipping their products directly to the point of sale (Figure 1.24).

In 1993, only four United States (US) manufacturers—Farah, Sun Apparel, Wrangler, and Levi Strauss & Co.—had a significant presence in Torreon. By 2000, the number of export customers grew to more than two dozen. In the early 1990s, the assembly plants on the Mexican side of the border received cut parts from US manufacturers or brokers. These cut parts were sewn into garments and then re-exported to the US under the *maquila* regime, which allowed tariff-free inputs to be sent from the US to Mexico as long as they were included in Mexican production for re-export to the US. Brand marketers and retailers "pulled" Mexican firms to increase their production volumes and the range of activities performed. Upgrading thus occurred at the firm level in Torreon, in conjunction with the increasing demands of US buyers for full-package production. However, the full-package model did not guarantee long-term success. Blue jean exports from Torreon slumped with the decline in US export demand after 2000, and apparel employment in Torreon, which rose from 12,000 jobs in 1993 to an estimated 75,000 in 2000, but declined to 40,000 in 2004. Maintaining a role in the US market in the face of stiff competition from the PRC and other international suppliers required Torreon's blue jeans cluster to continue to upgrade beyond OEM to the OBM and ODM stages of the value chain through the development of local brands, regional marketing directly to US buyers, and the establishment of a local design center in the region.

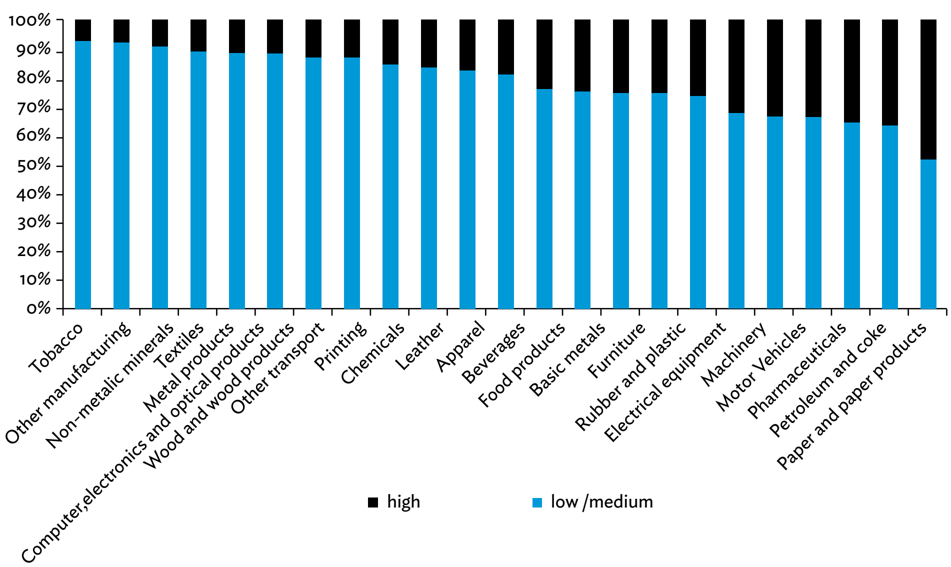
A key understanding for VCIC from the Torreon case is that upgrading patterns differ by both industry and country based on the input–output structure of the value chain and the institutional context of each country. Certain industries require linear upgrading and countries must gain expertise in one segment of the value chain before upgrading to the next segment.

Diverse mixes of government policies, institutions, corporate strategies, technologies, and worker skills are associated with upgrading success. VCIC will have to focus on these aspects to align industrial growth in the corridor to GPNs.

Skills Analysis for VCIC

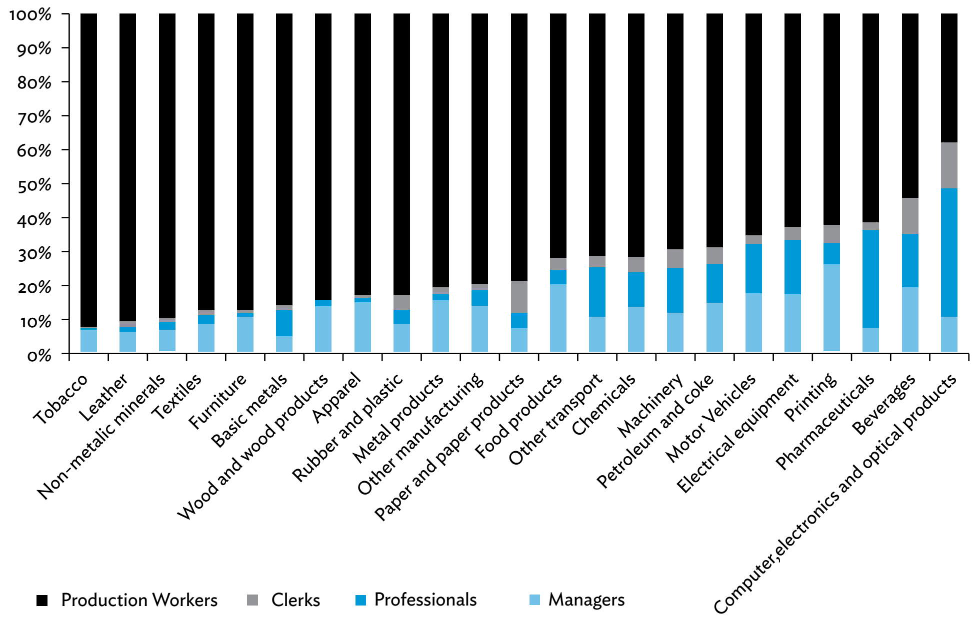
A key understanding from the industry analysis is that to develop the corridor into a dynamic industrial hub and integrate with GPNs, ensuring the availability of skilled, semi-skilled, and unskilled labor in required quantities and quality is essential. This requirement of skilled labor is time and again emphasized by the stakeholders; however, the requirements vary across sectors. Country-level breakdown of skill requirement across sectors in India is presented in Figure 1.25 and 1.26.

Figure 1.25: **Skill Analysis at Industry level**



Source: NSS Employment Unemployment Survey for 2011-12.

Figure 1.26: **Distribution of Workers by Occupation**



Source: NSS Employment Unemployment Survey for 2011-12.

Electronics, pharmaceuticals, and chemicals and petrochemicals have much greater need skilled laborcompared to food processing and textiles.

Current State of MSMEs in the Corridor States[10]

The MSME sector in India contributes around 9% of GDP.[11] It accounts for around 45% of the manufacturing output and 30% of exports. An estimated 361 *lakh* MSME units in the country provide employment to around 805 *lakh* people. As per the Fourth All-India Census of Registered MSMEs (2006–2007), 95% of MSME units are microenterprises (accounting for around 70% of MSME employment), with the balance primarily comprising small enterprises (around 25% of MSME employment).

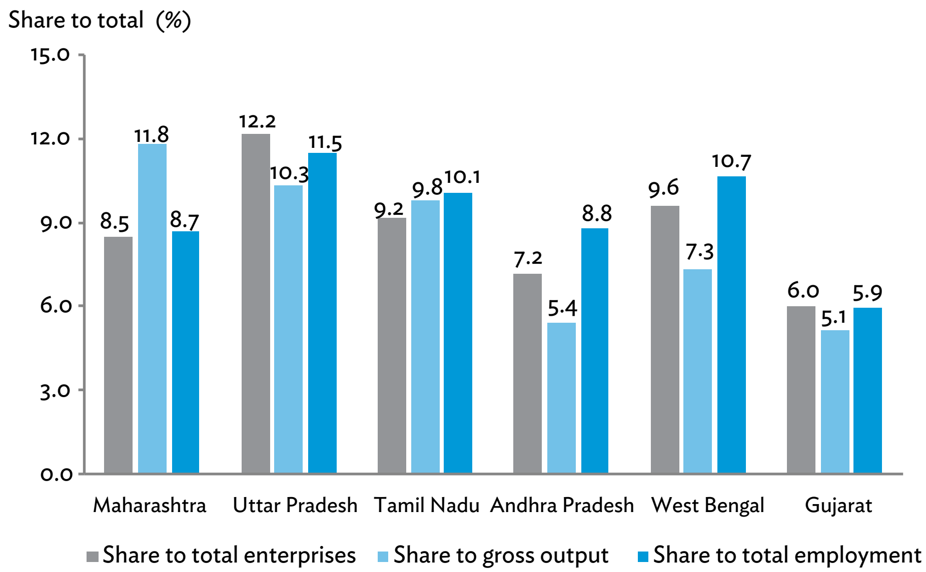
The VCIC corridor states of Andhra Pradesh and Tamil Nadu have one of the largest MSME concentrations in the country, accounting for around 16% of total MSME units, 15% of total MSME output, and 19% of total employment by MSMEs (Figure 1.27).[12]

[10] Definition of MSMEs is as per the MSME Development Act, 2006.

[11] http://www.smetimes.in/smetimes/in-depth/2014/Mar/25/factsheet-of-msme630815.html

[12] Fourth MSME Census (2006–2007).

Figure 1.27: **MSME Share to Total Employment, Enterprises, and Gross Output, by State**



Note: Gross Output data as per Census does not include details for enterprises classified under wholesale/retail trade, legal, education & social services, hotel & restaurants, transports and storage & warehousing (except cold storage).

Source: 4th All India Census of Micro, Small & Medium Enterprises, 2006-07.

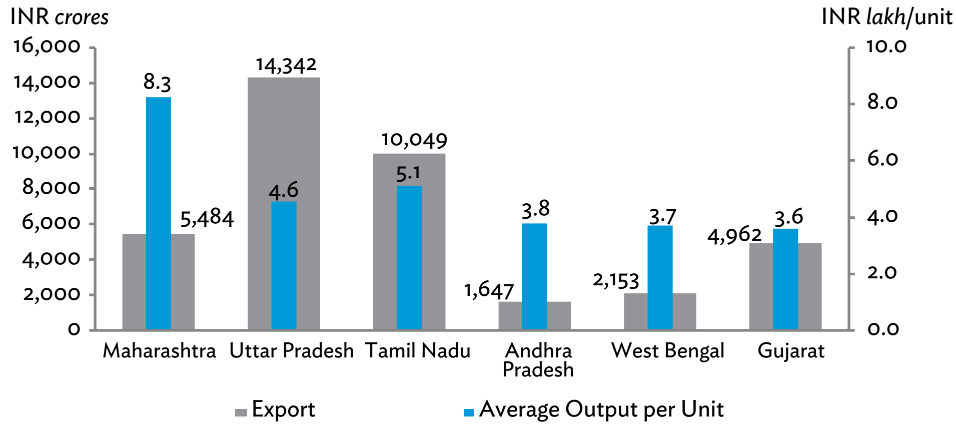
However, there appear to be significant differences between both states in terms of the nature of MSMEs. While the number of MSME units in both states is almost similar (26 *lakh* units in Andhra Pradesh and 33 *lakh* units in Tamil Nadu),[13] as are the number of employees (71 *lakh* people in Andhra Pradesh and 81 *lakh* people in Tamil Nadu),[14] the value of average output per unit is significantly higher in Tamil Nadu (Figure 1.28), which seems to suggest a higher scale of operations. The relative contribution of the MSME sector to each state's 2006–2007 GDP was also higher for Tamil Nadu at around 34% compared with around 19% for Andhra Pradesh.[15] Additionally, exports from registered working MSMEs based out of Tamil Nadu were around INR10,049 *crores*, per the findings of Fourth MSME Census (2006–07), compared with INR1,647 *crores* for MSMEs in Andhra Pradesh.

[13] Ibid.

[14] Ibid.

[15] Ibid; Government of India, Ministry of Statistics and Programme Implementation.

Figure 1.28: **Exports and Average Output of MSME, by State**



Note: Data on Average Output as per Census does not include details for enterprises classified under wholesale/retail trade, legal, education & social services, hotel & restaurants, transports and storage & warehousing (except cold storage). Export data as per Census is applicable for working & registered enterprises only.

Source: 4th All India Census of Micro, Small & Medium Enterprises, 2006–07.

Figure 1.29: **Andhra Pradesh: Key MSME Clusters by Districts**

Source: Foundation for MSME Clusters (http://clusterobservatory.in) and District Industry Profiles by MSME Development Institute (2010-11).

Andhra Pradesh

Out of a total of around 1.74 *lakh* registered MSME units employing around 18.11 *lakh* people in the state, the key coastal districts of the proposed corridor are estimated to account for around 36 % of total units and 27% of total employment.[16] The key MSME clusters in each of these districts (employing more than 3,000 people) have been highlighted in Figure 1.29, with additional details in Table 1.6.

16 Andhra Pradesh Annual Plan 2012–2013 presentation to the Planning Commission, Government of India and District Profile of identified coastal districts published by MSME Development Institutes and District Industry Centres.

Table 1.6: **Andhra Pradesh: Key MSME Clusters, by District**

Cluster & Products	No. of units*	Turnover (INR *crore*)*	% Contribution to District Domestic Product (DDP)**	Employment (nos.)*	Value-added / employee (INR *lakh*)
Visakhapatnam					
• Steel Fabrication	475	150	0.35	3,000	5.0
East Godavari					
• Kakinada Mango Jelly cluster	750	8	0.02	3,000	0.27
• Rice Mills, Rice bran oil	550	800	2.37	20,000	4.0
West Godavari					
• Rice mills, rice bran oil	482	600	2.23	15,000	4.0
• Narsapur: Crochet Lace, lace garments	50 SHGs	50	0.19	200,000	0.02
Krishna					
• Rice milling & food processing	459	1,090	3.04	12,000	9.08
• Vijaywada pharmaceuticals – bulk drugs / formulations	50	400	1.12	5,500	7.27
• Vijaywada Auto Cluster* – auto components	1400	800	2	11,000	7.27
• Machilipatnam – Imitation Jewellery	450	70	0.20	4,000	1.75
Guntur					
• Power loom textiles – cotton yarn	865	5,000	16.76	66,000	7.57
• Piduguralla – Burnt lime	392	86.4	0.29	22,000	0.39
Prakasam					
• Chimakurthy – Granite processing	127	47	0.22	15,000	0.31
Nellore					
No information available for any significant SME clusters					

continued on next page

Table 1.6 *continued*

Cluster & Products	No. of units*	Turnover (INR *crore*)*	% Contribution to District Domestic Product (DDP)**	Employment (nos.)*	Value-added / employee (INR *lakh*)
Chittoor					
• Fruit processing, fruit pulp, concentrates, purees	67	455	2.04	20,000	2.27
• Rice milling	153	400	1.79	6,000	6.66
• Nagari: Power loom cotton yarn	530	200	0.90	24,000	0.83
• Madanapally: Bus body building	242	11	0.05	3,000	0.37
Srikakulam					
• Palasa: Cashew processing	89	255	2.15	9,000	2.83
• Rice milling	150	300	2.53	8,000	3.75
YSR Cuddapah					
No information available for any significant SME clusters					

Source: * Foundation for MSME Clusters (http://clusterobservatory.in) and District Industry Profiles by MSME Development Institute (2010-11); ** DDPs for the year 2010-11 as available on website of Government of Andhra Pradesh (http://www.aponline.gov.in/Apportal/Downloads/Socio%20Economic%20Survey/Annexures%202.pdf); Feedback received during a visit to cluster.

As can be seen from Table 1.6,

- MSME presence is somewhat limited in districts like Visakhapatnam and Nellore, with the economic activity in these districts being driven by large industrial units like the (i) 2.9 mTPA RINL steel plant, 8.3 mmpta HPCL refinery, fertilizer plant of Coromandel International Ltd, and NTPC Thermal Power Plant in Visakhapatnam' and (ii) Pioneer Aqua Estates India & Adithya Aquaculture Ltd (sea-food processing) and Gemini Edibles & Fats (vegetable oil refining) in Nellore. There may be scope for developing additional SME clusters in these districts based on linkages with these large units (e.g., scaling up the steel fabrication cluster in Visakhapatnam for higher level value-added through re-rolling of steel billets produced at RINL plant).
- Some of the coastal districts like East Godavari, West Godavari, Krishna, Chittoor, and Srikakulam are agriculture-intensive (around 20% of district GDP from agriculture[17]) and have large rice milling clusters contributing around 2%–3% of their district GDP. With the exception of Chittoor and Srikakulam, where there are only around 150 such

17 Information 2010-11 as available on website of Government of Andhra Pradesh (http://www.aponline.gov.in/Apportal/Downloads/Socio%20Economic%20Survey/Annexures%202.pdf

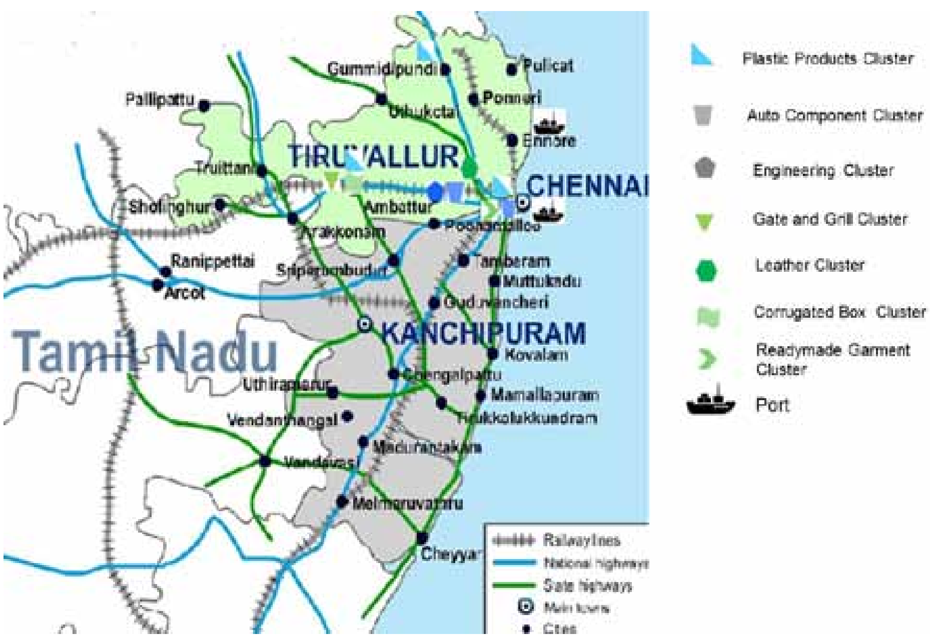
units, most other districts have around 400–500 rice mills employing around 15,000–20,000 people. Most of these units sell their output to traders indomestic markets, both within and outside the state.

- Many of the clusters like the mango jelly cluster at Kakinada (East Godavari), lace products cluster at Narsapur (West Godavari), imitation jewellery cluster at Machillipatnam (Krishna), and burnt lime cluster at Piduguralla (Guntur) primarily comprise micro-enterprises which lack scale (less than 10 employees per unit with capital investment of less than INR25 *lakhs*) and provide employment opportunities with low wages.

Tamil Nadu

Out of a total of around 8.4 *lakh* registered MSME units employing around 58.8 *lakh* people in the state, the two districts of the proposed corridor are estimated to account for around 10% of total units and 7% of total employment.[18] The key MSME clusters in each of these districts (employing more than 3,000 people) have been highlighted in Figure 1.30, with additional details in Table 1.7.

Figure 1.30: **Tamil Nadu: Key MSME Clusters, by District**



Source: Information on website maintained by MSME Development Institute Chennai (http://www.mseclusters-tn.com) and District Industry Profiles by MSME Development Institute(2012-13).

18 Policy Note 2013–2014 published by MSME department, Government of Tamil Nadu and District Profile of Chennai and Thiruvallur published by MSME Development Institutes.

Table 1.7: **Tamil Nadu: Key MSME Clusters, by District**

Cluster & Products	No. of units*	Turn-over (INR *crore*)*	% contribution to District Domestic Product (DDP)**	Employment (nos.)*	Value-added / employee (INR *lakh*)
Chennai					
• Auto cluster	607	4,200	20.1	125,000	3.36
• Readymade garment cluster	689	400	1.9	100,000	0.4
• Plastic cluster	2,500	1,400	6.7	20,000	7.0
Thiruvallur					
• Ambattur: Auto cluster	700	1,200	8.5	150,000	0.8
• Ambattur: Engineering cluster	1,266	400	2.8	25,000	1.6
• Gate & grills cluster	3,000	500	3.5	25,000	2.0
• Madhavaram: Leather cluster	566	880	6.2	7,400	11.9
• Carton & corrugated box cluster	650	1,500	10.6	16,000	9.3
• Plastic cluster	2,210	800	5.7	25,000	3.2

Source: *Information on website maintained by MSME Development Institute Chennai (http://www.mseclusters-tn.com) and District Industry Profiles by MSME Development Institute (2012-13); **DDPs for the year 2006-07 as available on website of Government of Tamil Nadu (http://www.tn.gov.in/dear/tab/2.5.pdf).

As observed from Table 1.7

- The two districts of the proposed corridor in Tamil Nadu have a significant presence of MSMEs, with an estimated share of 10% of all registered MSME units within the state. Further, the key clusters in the two districts appear to facilitate linkages of MSMEs as suppliers and subcontractors to the larger units present in Chennai. For example, MSMEs in the auto, engineering, and plastics clusters in Chennai and Thiruvallur serve as suppliers to Tier 1 suppliers of leading OEMs like Ashok Leyland, Ford, Hyundai, Nissan, Renault, and TVS Group.
- Many of the clusters like the ready-made garment and plastics cluster in Chennai and the engineering, gates and grills, and plastics clusters in Thiruvallur primarily have micro-enterprises which lack scale and provide employment opportunities with low wages.

SME Clusters with Potential for Scaling Up through Strengthened Linkages with Larger Supply Chains

There are a number of SME clusters in both Andhra Pradesh and Tamil Nadu that demonstrate the potential for sustainable performance through increased supply chain linkages with larger corporates. Going forward, it is recommended that particular attention be devoted to such clusters in terms of overcoming key constraints and facilitating rapid growth as many of these clusters have the potential to contribute significantly to local economic development.

Andhra Pradesh

Pharmaceutical cluster at Vijaywada (Krishna district)

- The cluster comprises around 50 units, with the average turnover per unit being INR8 *crores* annually.
- Units in this cluster primarily manufacture bulk drugs and drug intermediaries, primarily for off-patent generic drugs.
- Based on feedback received from units, only some of the larger units have the required good manufacturing practices certification necessary to become contract manufacturers for large pharmaceutical companies in the state, including Dr. Reddy's, Aurobindo Pharma, Hetero Drugs, and Divi's Lab. Some of the units also export to formulation units and traders based in Europe, the PRC, the Republic of Korea, and Japan.
- Raw materials are largely procured from domestic sources with some imports from the PRC.
- The availability of requisite skilled workers at affordable costs is also a cause for concern; around 20%–25% of workers are migrants, which results in high rates of absenteeism.
- Further expansion opportunities are limited on account of the unavailability of plots in existing clusters as well as the high cost of land with the emergence of Vijaywada as a large urban center in close proximity to the proposed capital of the new state of Andhra Pradesh.

Auto cluster in Vijaywada (Krishna district)

- There are around 400 manufacturing units and around 1,000 servicing and repair units in this cluster. It was observed that the cluster primarily caters to the auto parts replacement market with only a few larger units catering to the export market.
- Most of the units source raw materials locally.
- With no large automobile manufacturer in the vicinity to act as an anchor unit, the units do not have access to the required technology for meeting OEM quality standards.
- Based on feedback from units, other constraining factors identified were (i) availability of skilled workers at reasonable cost; and (ii) distance of the cluster from existing automobile hubs, about 400–450 kilometers(km) from Chennai and Sri City), with OEMs preferring component suppliers to be within a radius of at most 200 km of their plants for "just in time" production processes.
- Given the above, there appears to be limited opportunities for this cluster to scale up without linkage to large OEMs.

Power loom cotton yarn cluster in and around Guntur town(Guntur district)

- The cluster has around 865 units and an average turnover per unit of around INR6 *crores* annually. Most of the cotton yarn from this cluster is currently being sold to processing units in other states like Tamil Nadu, West Bengal, Gujarat, and Maharashtra.
- With Andhra Pradesh being the third-largest cotton producing state in the country, the raw materials are procured locally.

- Further growth of this cluster may be possible if appropriate linkages with apparel manufacturers and retailers can be forged.
- For cost effective operation of SMEs, common effluent treatment facilities will be required for fabric bleaching and dyeing-related processes in the clusters.
- Availability of requisite skilled workers at affordable costs is also another critical success factor for growth.

Fruit processing cluster in Chittoor and adjoining villages(Chittoor district)

- There are around 67 units with an average annual turnover of INR7 *crores*.
- With the district being a large producer of horticultural produce like mangoes, papayas, and tomatoes, raw materials are sourced locally for processing.
- Products from this cluster meet the requirements of domestic retail chains (Reliance, Heritage Foods) as well as large food and beverage companies like Coca Cola (mango pulp for Mazaa).
- We also understand that some of the domestic retail chains like Heritage Foods with a presence in this cluster also act as sourcing partners for global players like TESCO.

Rice milling cluster in and around Eluru (West Godavari) and Rajahmundry (East Godavari)

In most of the agri-intensive districts like East and West Godavari, there is a large concentration of rice mills that are supplied by the significant paddy cultivation in the region. There may be opportunities for higher value-added activities through increased downstream processing of the rice for manufacturing products like rice bran oil and rice flakes.

Tamil Nadu

Auto cluster in Chennai and Ambattur (Thiruvallur district)

- The cluster comprises around 1,300 units with the average annual turnover per unit being around INR4 *crores.*
- Units in this cluster primarily manufacture various auto components like engine parts, transmission and steering parts, suspension and brakes, electrical equipment (spark plugs, motors, and generators) for meeting the requirements of Tier 1 suppliers to OEMs located in the vicinity like Ashok Leyland, Hindustan Motors, Ford, Hyundai, Nissan, Renault, TVS Group, TAFE, and Royal Enfield. The cluster also includes units engaged in foundries and forging units.[19] Some of the units also cater to the replacement and export markets.
- Most of the units are located in industrial parks having required facilities and infrastructure to support SMEs.
- Raw materials, which primarily comprise steel and aluminum, are sourced locally.
- Easy availability of trained and skilled manpower given the urbanized location has been a key factor for growth.

[19] Diagnostic study report of Auto Component Cluster in Chennai, Ministry of MSME.

- The region has traditionally been an engineering center with domestic automobile manufacturers like Ashok Leyland, TVS Group, Amalgamated Group, TAFE, and Royal Enfielddriving growth. With the entry of foreign OEMs in the past decade it now has the potential to become the key automobile hub in the country providing significant growth opportunities for SMEs to link with OEMs in the vicinity, and to join the global production network for the automobile sector in Southeast Asia.

Leather cluster in Madhavaram (Thiruvallur district)

- The cluster comprises over 550 units having an average turnover per unit of around INR1.5 *crores* annually.
- Key products include finished leather, leather footwear, and other leather products.
- Most of the units serve as outsourced production units for large leather goods manufacturers who provide design inputs. These products are sold in domestic markets through linkages with leading national players like Bata and Reliance, and are exported to leading international players like Clarks, Ann Taylor, ZARA, and Hush Puppies.
- Raw material comprising hides and from cows, goats, and sheep are sourced from the state as well as neighboring states.
- Easy availability of skilled labor is a key factor for the growth of the cluster.
- Given its proximity to the urbanized location of Chennai and having established linkages to domestic and international retail chains and port facilities, there is potential for further growth of the cluster.

Carton and corrugated box cluster in Ambattur, Thiruvallur, and Gumudipoondi (Thiruvallur district)

- There are around 650 units having an average turnover of around INR2.3 *crores* annually.
- The cluster primarily supports the packaging requirements of the leather and readymade garment clusters in the state.
- Raw material primarily comprising paper and paperboard are sourced locally.
- As the cluster supports the packaging needs of other industries in the vicinity, its growth is linked to the growth of industries for which it is part of their supply chains.

Facilitating MSME Growth and Development in VCIC–Key issues and Recommendations

Based on our assessment, we have listed in Table 1.8 some of the key constraints and challenges which would need to be addressed to facilitate MSME growth along the corridor, together with our recommendations.

Table 1.8: **Key Issues and Challenges in Facilitating MSME Growth**

Issues and Challenges	Recommendations
As in other states, most MSMEs lack knowledge and access to state-of-art technology and manufacturing processes, thereby resulting in competitive disadvantages and lack of cost competiveness	• There exists significant scope to provide requisite technical support to MSMEs through the host of schemes available under the National Manufacturing Competitiveness Programme. Representative schemes include the application of lean manufacturing, establishment of mini tool rooms, technology and quality upgrading support, design clinic scheme, quality management standards and quality technology tools. Other key sector-specific schemes facilitating technical support to MSMEs include Technology Upgradation Fund Scheme for textiles, Scheme for Technology Upgradation, Establishment, and Modernization of Food Processing Industries. • The Industries Department(s) can play a proactive role in connecting to the MSME-Development Institutes (MSME DIs) in the state. Technical Support organizations like the Central Leather Research Institute for leather, Textile Research Associations (TRAs) for textiles, National Institute of Pharmaceutical Educational Research for pharmaceuticals, Central Food Technological Research Institute in Mysore for food processing, Central Pulp & Paper Research Institute in Saharanpur for paper and pulp, can also provide requisite support to MSMEs. Suitable provisions for innovative support mechanisms like using vouchers with part-financing from the recipient MSME can also be considered for inclusion in the State Industrial Policy. Given the usual location of MSMEs, the District Industries Centers are likely to play a key role in the efficient delivery of support and would need to be strengthened for this purpose.
Linkages to larger value chains	• Focused investment promotion strategy may be pursued by the Industries Department targeting potential anchor investors for specific districts. • Capacity building of SMEs through quality-focused National Manufacturing Competitiveness Program schemes can be facilitated by leveraging the designated nodal agencies (National Institute of Design) in the state. • The Industries Department can collaborate with MSME-DIs to facilitate SME linkage to large public sector units leveraging the provisions of the Public Procurement Policy notified by Government of India (March 2012)
Land availability and cost for SME establishment and expansion	• Reserving limited space for MSMEs in all existing and proposed parks with compensatory government support in case of private developers
Need for scaling up common facilities in existing MSME clusters	• Leveraging provisions of existing schemes better through proper coordination between District Industries Centers, Industries Department, and MSME-DIs
Infrastructure linkage constraints	• To be addressed through the proposed infrastructure upgrade plan throughout the corridor, which specifically focuses on last mile connectivity

continued on next page

Table 1.8 *continued*

Issues and Challenges	Recommendations
Shortage of requisite skills for adopting higher technology; Ability to attract talent at reasonable cost	• Leverage MSME-DIs for conducting sector specific training and up- skilling programs with course inputs from concerned industry bodies • Support from Entrepreneurship Development Institute (EDI), National Institute of Entrepreneurship & Small Business Development (NIESBD), and National Institute for MSME (NIMSME) in facilitating entrepreneurship development and promotion related initiatives • Leverage support available from sector-specific institutes like Sardar Vallabhbhai Patel International School of Textiles & Management for textiles, International Food Technology Training Centre, National Institute of Food Technology, and Entrepreneurship & Management (NIFTEM) for food processing. • Involve large companies in adopting local IT institutes and support sector-specific skills training as part of their corporate social responsibility initiatives • Encourage private sector players to establish sector-specific skill training centers in identified locations in public–private partnership(PPP) mode with the state government facilitating funding through the National Skill Development Corporation (NSDC)
Financing constraints	• Facilitating linkages to MSME-focused financing institutions like SIDBI and NABARD
Increasing ease of doing business	• Separately addressed as part of the chapter on regulatory framework

Source: Study team analysis.

Critical Success Factors that Investors Consider before Making an Investment Decisions were Mapped to Identify Possible Locations for the Shortlisted Industries

Food Processing

The study team interacted with a host of industry players to identify critical success factors evaluated by them before making an investment decision. Key requirements for each of the segments of food processing are presented in Table 1.9. The food processing sector primarily needs proximity to raw materials, a good supply chain network, and availability of ample quantities of water and power. Table 1.9 also displays the relative importance of various success factors for sub-sectors of the food processing sector.

Marine farming is prevalent in the districts of Kakinada and Chittoor. Similarly, vegetable oil companies are mostly concentrated near the Krishnapatnam port in the Nellore district of Andhra Pradesh. The presence of support infrastructure (warehouses, cold chain, packaging centers, value-added centers, modern abattoirs) efficient labor laws and availability of skilled labor, availability and cost effective access to raw materials, research and development for technology upgradation are some of the major factors that determine the competitiveness of a region in the food processing sector.

Table 1.9: **Key Success Factors – Food Processing, by Sub-Sector**

Key factors	Marine	Vegetable oil	Fruits & Vegetables	Ready to eat	Grain mills
Proximity to raw material	√√	√	√√	√√	√√
Presence of hatcheries and farms	√√	√	√	√	√
Port proximity	√√	√	√	√	√
Adequate port infrastructure	√	√√	√	√	√
Cold chain	√√	√	√√	√	√
Effective transport link	√√	√√	√√	√√	√√
Away from polluting industries	√√	√√	√	√	√√
Power availability	√√	√√	√√	√√	√√
Water supply	√√	√√	√√	√√	√√
Existing industrial agglomeration	Kakinada and Chittoor	Nellore	Chittoor, Krishna	Chittoor	Kakinada, Krishna and Godavari

Source: Study team analysis.

Table 1.10: **Key Success Factors – Textiles, by Sub-Sector**

Key factors	Spinning and weaving	Weaving apparel
Availability of continuous power supply	√√	√√
Availability of skilled manpower	√√	√√
Access to raw materials	√√	√√
Excellent connectivity (road and rail) required for distribution logistics	√√	√√
Existing industrial agglomeration	Guntur	Vizag

Source: Study team analysis.

Textiles

The key requirements of each of the segments of the textiles industry are presented in Table 1.10. The key success factors for this sector are access to raw materials and excellent road and rail connectivity for distribution logistics.

A robust policy regime, world class quality of production through usage of updated technologies, reasonable costs of production, efficient labor productivity, and quality infrastructure are the key success factors for the sector to improve the competitiveness of the state.

Visakhapatnam, Chittoor, Prakasam, and Guntur are the key districts with textiles industry agglomerations. Brandix Apparel Special Economic Zone with companies like Pioneer Elastic Fibre, Ocean India, Quantum Clothing, Fountain Set Group, and Limited Brands is in Visakhapatnam. There are about 2,300 power loom units established in and around Nagari area in Chittoor district. These units have 13,000 power looms operating and providing employment to 40,000 people. Thirteen spinning mills with 3.5 *lakh* spindles capacity are producing cotton yarn. Chirala in Prakasam has a concentration of textiles processing units, with more than 90,000 weavers in the region. Low count yarn dyeing, knitted wear, and readymade garments are also prevalent in the region.

Chemicals and Petrochemicals

The key requirements of each of segment of the chemicals and petrochemicals industry are presented in Table 1.11. This sector primarily needs feedstock availability, sea port accessibility for exporting finished products and importing certain raw materials, adequate port infrastructure to handle liquid chemicals and hazardous chemicals, skilled labor (especially for knowledge-based chemicals), and the availability of ample quantities of water and power.

Visakhapatnam has key chemicals players like LG Polymers, HPCL refinery, the bottling units of IOCL and BPCL, and JN Pharma City. ONGC mini oil refinery, Nagarjuna Fertilizers, and Coromondal fertilizers are key chemical and petrochemical players in the Kakinada region. The proposed Visakhapatnam- Kakinada Petroleum, Chemical and Petrochemical Investment Region (PCPIR) will have Vizag and Kakinada districts within its influence zone.

Table 1.11: **Key Success Factors – Chemical and Petrochemical, by Sub-Sector**

Key factors	Refined petroleum	Basic chemicals	Plastics
Feedstock availability	√	√√	√
Sea port accessibility	√√	√√	√√
Adequate port infrastructure	√√	√	√
Availability of labour	√√	√√	√√
Power availability	√√	√√	√√
Water supply	√√	√√	√
Existing industrial agglomeration	Vizag	Vizag, Kakinada, Machilipatnam	Vizag, Kakinada, Machilipatnam

Source: Study team analysis.

Pharmaceuticals

The key requirements of each segment of the pharmaceuticals industry are presented in Table 1.12. The availability of skilled labor, excellent road and rail connectivity, proximity to seaport, access to high quality raw materials, urban proximity, and water availability are the critical success factors for the pharmaceuticals sector.

Table 1.12: **Key Success Factors – Pharmaceuticals, by Sub-Sector**

Key factors	Pharmaceuticals
Availability of highly skilled labour	√√
Excellent connectivity (road and rail) required for distribution logistics	√√
Proximity to seaport is critical for units having an export focus	√
Access to high quality raw materials	√√
Proximity to city infrastructure for easy access to high quality skilled workforce	√
Water availability	√√
Existing industrial agglomeration	Vizag

Source: Study team analysis.

R&D is one of the major drivers of competitiveness in the sector. An efficient regulatory environment providing patent protection can be a major enabler for the sector's success.

Pariwada in Visakhapatnam and Vijayawada in Krishna are the key pharmaceuticals industry agglomerations along the corridor. The JN Pharma City in Visakhapatnam houses some of the major pharma players in the state. There are about 50 pharmaceutical formulation units and eight bulk drug units in the surrounding area of Vijayawada. SIRIS pharma is also a key company.

Metallurgy

Access to raw materials, excellent road and rail connectivity, and low-cost power availability are the key success factors for the metallurgy sector (Table 1.13).

Visakhapatnam, Chittoor, and Nellore are the key districts for the metallurgy sector along the corridor. Visakhapatnam Steel Plant, Jindal Stainless Steels, Rashtriya Ispat, Kutch Alumina Power and Coke, Hindustan Zinc, and Balaji Steel Corporation are some of the key companies in the sector.

Table 1.13: **Key Success Factors – Metallurgy, by Sub-Sector**

Key factors	Basic iron & steel
Access to raw materials	√√
Excellent connectivity (road and rail)	√√
Power availability and tariff	√√
Existing industrial agglomeration	Chittoor

Source: Study team analysis.

Electronics

The key success factors for this sector are sea port and airport accessibility, uninterrupted high quality power supply, availability of skilled manpower and institutions for skills development, water supply, distance from polluting industries, and availability of well-developed social infrastructure (Table 1.14).

Technical R&D is another factor that could help the sector to become more integrated with the GPNs.

Andhra Pradesh has a modest contribution to the production of electronics at the national level. Electronic components and communication equipment comprise the largest share of the state's electronics output at around 70%. Visakhapatnam is a key node for electronics sector development along the corridor.

Table 1.14: **Key Success Factors – Electronics, by Sub-Sector**

Key factors	Electronic components	Computer peripherals	Telecommunication equipment
Sea port airport accessibility	√	√	√
Airport accessibility	√√	√√	√√
Uninterrupted high quality power supply	√√	√√	√√
Availability of skilled manpower and institutions for skill development in proximity	√√	√√	√√
Water supply and availability of pure water or ultra-pure water (UPW)	√√	√	√
Away from polluting industries	√√	√√	√√
Availability of well developed social infrastructure	√√	√√	√√
Existing industrial agglomeration	√	√	√

Source: Study team analysis.

Auto and Auto Components

Based on stakeholder consultations, the key success factors for this sector are state government support for incentives, proximity between OEMs and suppliers, proximity to seaport (critical for export focus), rail and road connectivity, and power availability (Table 1.15).

Table 1.15: **Key Success Factors – Auto and Auto Components, by Sub-Sector**

Key factors	Auto	Auto components
State Government support for incentives	√	√
Proximity between OEMs & Suppliers	√	√ √
Proximity to seaport is critical for units having an export focus	√ √	√ √
Logistics connectivity (rail & road)	√	√
Power availability	√ √	√ √
Skilled labour	√ √	√ √
Existing industrial agglomeration	Krishna and Chittoor	Krishna

Source: Study team analysis.

R&D facilities, a good quality supply chain, and efficient labor productivity are a few more factors that augment the key success factors and drive the auto and auto components sector.

Auto Nagar in Vijayawada is a citadel for the manufacture of automobile spare parts. There are a number of units engaged in the manufacture of items such as cylinder liners, leaf springs, wheel bolts, U-clamps, oil filters, brake drums, gaskets, body building, and automobile workshops. A government-sanctioned auto cluster with infrastructure such as roads, lighting drainage, and effluent treatment plants exists around Auto Nagar. Gudivada, in Krishna, has a concentration of units manufacturing tractor trailers and other agriculture implements. There are 45 units in and around the town that manufacture tractor trailers, which are in demand in the state of Andhra Pradesh.

While the above analysis reveals the set of industries that will drive the industrial transformation of VCIC, the potential location of industries is critical. The next section presents node identification methodology and recommendations.

Proposed Nodes to Anchor the Industries

VCIC is poised to play a pivotal role as one of the key contributors to the economic development of the southern part of India as well as the whole country. One of the objectives for the VCIC study is to identify suitable nodes to be taken up for industrial development within the corridor area. In this regard, ADB (i) identified the land bank available in government-owned lands and in private industrial parks,(ii) analysed node development potential at a broad level, including assessment of potential of districts for development of the industrial nodes; and (iii) proposed the industrial nodes for the master plan and development plan to be formulated under Phase II of this study. The results are described in this chapter (Figure 1.31).

Approach for identification and selection of nodes

The corridor houses many industrial parks and Special Economic Zones (SEZs), both existing and planned ones, and is capable of supporting both brownfield and greenfield developments. However, the key criterion identified to influence the Industrial Development Plan of the region is availability of land for development. In order to ensure a smooth development process along the Corridor, it would be an advantage if land is available at the nodes that would be shortlisted for industrial development.

There is a difference in the concept of node in DMIC and VCIC. DMIC node typically consists of a continuous large land parcel, typically more than 500 acres. Based on the DMIC experience, the Secretary of DIPP advised looking at a host of smaller industrial clusters of about 25–30 acres, separated by rural or urban conglomerations, as part of a single node.

Based on the discussions undertaken with state governments, 119 locations in government industrial parks and SEZs, and private industrial parks and SEZs were identified to have vacant land. Districts in Tamil Nadu did not feature any vacant land. The locations also included vacant government revenue lands available for consideration. Detailed analysis was undertaken on the 119 locations to identify the potential zones for development.

Figure 1.31: **Methodology for Node Selection**

Long list of APIIC and private Industrial Parks/SEZs

Assessing vacant land in the APIIC and private Industrial Parks/SEZs and including government lands available for consideration –119 identified

Must haves for the lands identified to be considered as industrial nodes

- Locations with lands in excess of 500 acres or having over 2,000 acres of land in close proximity (<30 -35 km) existing brown field agglomerations
- Land away from CRZ, forest, restricted and flood line areas
- Availability of water (Ground Water –Safe zone or access to surface water)
- Existing industrial agglomeration (INR 1000 *crore* of investment since 2000 within 50 km radius)
- Zone not considered for Master Planning under the Chennai Bengaluru Industrial Corridor

11 nodes have been identified after stage 1

Stage 2: Shortlisted nodes were further tested on the comparative advantages (good-to-have) they offer such as proximity to ports, proximity to raw materials, and proximity to urban centers. The Government of Andhra Pradesh's inputs were considered.

4 nodes were shortlisted

Source: Study team analysis.

Based on the team's analysis of development of industrial nodes and benchmarking with other parts of the country, the following pre-requisites for development were identified:

- land area in excess of 500 acres or 2,000 acres of land in close proximity (less than 30 km–35 km) from existing brown field agglomerations;
- land away from commercial and residential zones, forests, and restricted and flood line areas;
- availability of water (ground water—safe zone or access to surface water); and
- existing industrial agglomeration (INR1,000 *crores* of investment since 2000 within a 50 km radius).

Additionally, zones that are being considered under predecessor corridor projects, such as the Chennai Bengaluru Industrial Corridor for Master Planning, were not considered under this project to eliminate duplication of developmental plans. Based on the above analysis, 11 potentials clusters were identified (Table 1.16).

Table 1.16: Potential Clusters Proposed by State Governments

State	Area or Region of the Cluster	Area or Region
Andhra Pradesh	Atchutapuram	Visakhapatnam
	Nakkapalli	Visakhapatnam
	Bheemunipatnam	Visakhapatnam
	Pydi Bhimavaram	Srikakulam
	Kakinada	East Godavari
	Kankipadu	Krishna
	Gannavaram	Krishna
	Jaggayyapeta	Krishna
	Kopparthy	Kadapa
	Yerpedu–Srikalahasti	Chittoor
	Sri City	Chittoor

Source: Study team compilation from interactions with the state governments.

The potential zones listed above were further analyzed using a set of important (good-to-have) factors for industrial sectors to thrive (Table 1.17):

- proximity to ports (<50 km), both existing and planned for Type A industries such as metallurgy, chemicals and petrochemicals, and textiles;
- proximity to raw materials (<25 km) for Type B industries such as food processing; and
- proximity to a city (<50 km) for Type C industries such as automobiles, pharmaceuticals, medical equipment, electronics, and aerospace.

Further analyses were conducted with the following set of factors:

- accessibility to regional trunk roads,
- accessibility to rail connectivity (<25 km),
- availability of skilled manpower (>state average), and
- availability of logistics infrastructure (<100 km).

Table 1.17: Node Selection: The Two-Stage Process

Stage 1 – Assessment of Land Availability			
Cluster	Extent of land in Acres Available or to be Available	Status of land available	
Pydibhimavaram	500	Government land to be reassigned or acquired	
Atchutapuram	4,600	In the possession of GoAP	
Nakkapalle	4,000	600 acres acquired, rest is yet to be acquired	
Bheemunipatnam	2,100	In the possession of GoAP	
Kakinada	10,000	In the possession of a private player	
Chintakomadine – Kopparthy	6,600	In the possession of GoAP	
Srikalahasti- Yerpedu	8,300	Government land to be reassigned or acquired	
Sri City	980	In the possession of a private player	
Gannavaram	2,300	Around 550 acres is in the possession of GoAP and rest is Government land to be reassigned or acquired	
Kankipadu	3,200	Government land to be reassigned or acquired	
Jaggayyapeta	1,300	In the possession of GoAP	
Stage 2 – Shortlisted Nodes Tested on Comparative Advantages These Nodes Offer			
	Type A	Type B	Type C
Comparative advantage prescribed	Proximity to Ports (<50 km) – existing and planned	Proximity to raw material - (<25 km)	Urban proximity - Proximity to a city (< 50 km)

continued on next page

Table 1.17 *continued*

Stage 2 – Shortlisted Nodes Tested on Comparative Advantages These Nodes Offer			
	Type A	Type B	Type C
Types of industries	Metallurgy Chemicals and Petrochemicals Textiles	Food Processing	Automobiles Pharmaceuticals Medical Equipment Electronics Aerospace
Nodes having the comparative advantages for type of industries	1. Atchutapuram 2. Nakkapalli 3. Bheemunipatnam 4. Kakinada 5. Kankipadu	1. Kakinada 2. Gannavaram 3. Kankipadu 4. Jaggayyapeta 5. Donakonda-Darsi 6. Kopparthy 7. Srikalahasti- Yerpedu 8. Sri City 9. Pydi Bheemavaram	1. Atchutapuram 2. Bheemunipatnam 3. Kakinada 4. Gannavaram 5. Kankipadu 6. Kopparthy 7. Srikalahasti- Yerpedu 8. Sri City

Notes: 1. Kakinada and Kankipadu have advantages for setting up all types of industries. 2. Jaggayyapeta and Donakonda-Darsi have advantages for Food Processing only. 3. Nakkapalli has advantages for Type A industries only. 4. Rest of the nodes have advantages for Type B and C industries.

Source: Study team compilation from interactions with the state governments.

Table 1.18: **Short-listed Clusters and Node Formation**

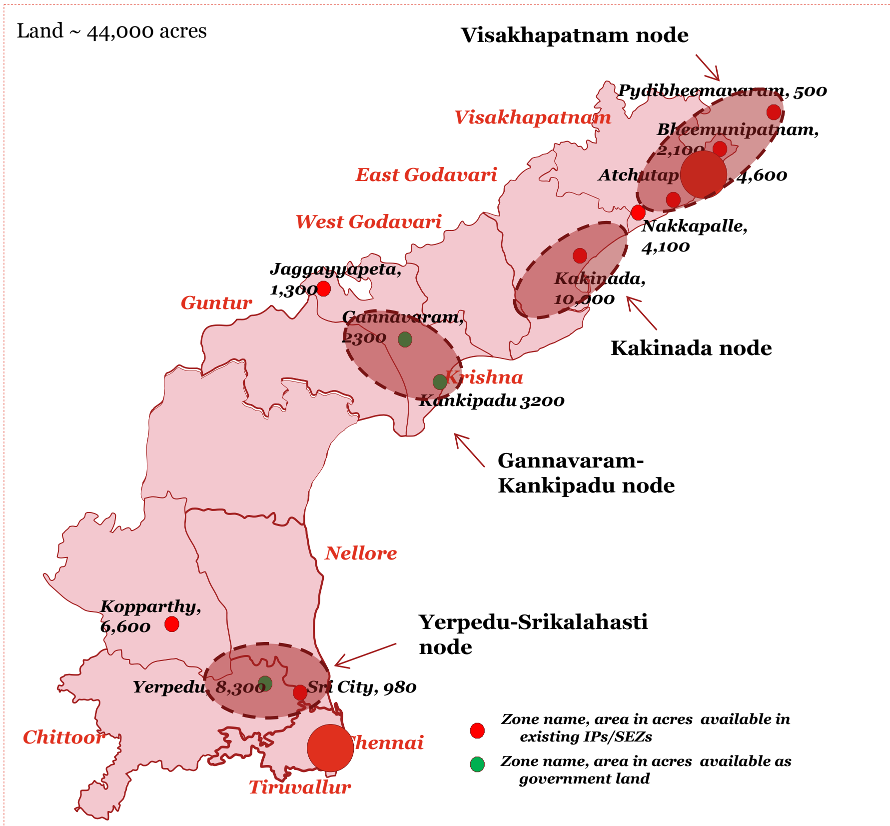
Node	Cluster	Extent of land in acres available or to be available	Status of land available
Visakhapatnam	Pydibhimavaram	500	Government land to be reassigned or acquired
	Atchutapuram	4,600	In the possession of Govt. of AP
	Nakkapalle	4,000	600 acres acquired, rest is yet to be acquired
	Bheemunipatnam	2,100	In the possession of Govt. of AP
Kakinada node	Kakinada	10,000	In the possession of a private player
Srikalahasti-Yerpedu	Srikalahasti- Yerpedu	8,300	Government land in Musalipadu, Empedu, and Chintalapalem to be reassigned or acquired
	Sri City	980	In the possession of a private player
Gannavaram and Kankipadu	Gannavaram	2,300	Around 550 acres is in the possession of Govt. of AP and rest is government land to be reassigned or acquired
	Kankipadu	3,200	Complete government land to be reassigned or acquired

Source: APIIC.

As part of the Concept Development Plan, discussions were undertaken with the Government of Andhra Pradesh to understand their views on the selection of potential nodes. The locations were proposed by the state government based on factors such as the presence of existing ecosystems, demand from industries, government's vision for the region, and intended development plans of the states. Short-listed clusters have been grouped to form four nodes to benefit from agglomeration: Visakhapatnam, Kakinada, Kankipadu–Gannavaram, and Yerpedu–Srikalahasti (Figure 1.32 and Table 1.18).

The nodes identified have a requirement of reassignment of government land or alliance with the private landholders in the node area. Along with prioritization based on the strengths of the nodes and views of the stakeholder, and the status of the land with the revenue department of the government, the process of assignment to the nodal department that is going to steer the development of industrial nodes in the corridor should be initiated. Where the land is in the possession of private players, memorandums of understanding need to be signed to enable unhindered future planning of the node's development. Another common

Figure 1.32: **Potential Nodes in the Corridor**



Source: APIIC.

factor for all four nodes is the need for a conducive business regulatory environment that enables ease of doing business.

The node based development strategy for VCIC is different from expansion of existing industrial hubs in essence that it encompasses an urban center (proximity to a city <50 km), is in close proximity to raw materials (<25 km for certain industries like Food processing) and is linked to a port (port in proximity <50 km). This enables it to create sustainable industrial growth synergies with an urban center, a production enclave, and a servicing port, leading to eventually developing into an economic node or growth center.

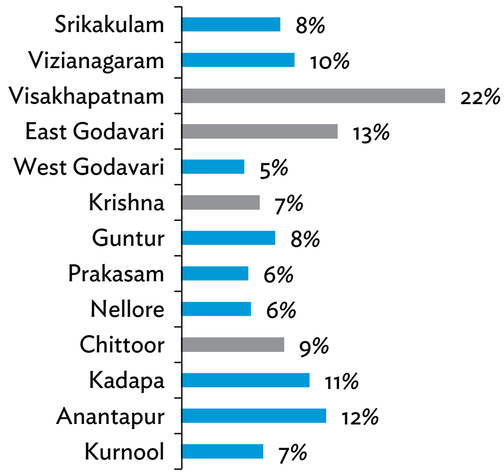
Analysis of nodes

Macro analysis—district level

Manufacturing's contribution to state-level GDP

Within the state of Andhra Pradesh, the manufacturing sector's contribution to state GDP is the highest in Visakhapatnam and East Godavari. Visakhapatnam's manufacturing sector contributes 22% of district GDP and East Godavari contributes 13% (Figure 1.33). The four

Figure 1.33: **Manufacturing Sector's Contribution to State GDP, by District**



Source: World Bank, District Domestic Product, AP, RBI Handbook of Statistics.

VCIC nodes—Visakhapatnam, East Godavari, Krishna and Chittoor—together contribute around 55% of the state's manufacturing GDP.

Investments

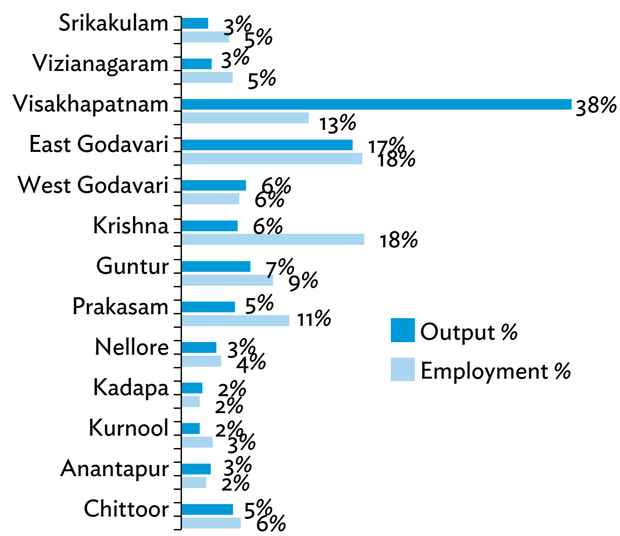
In terms of investments, the districts that fall in the influence region of the corridor account for 44% of total manufacturing investments in the states of Andhra Pradesh and Tamil Nadu. Chennai, Nellore, East Godavari, and Visakhapatnam have in the past accounted for around 80% of total investments along the corridor. The trend of future investments in the corridor is expected to be in sync with the historic trend. Visakhapatnam, East Godavari, Krishna, and Nellore emerge as top choices, with 80% share of total investment along the corridor.

Output and employment

As seen in Figure 1.34, Visakhapatnam and East Godavari are also key contributors to the state's manufacturing output and employment. These two districts together contribute around 55% of the state's manufacturing output and over 30% of overall manufacturing employment. Visakhapatnam, East Godavari, Krishna, and Chittoor districts together contribute to almost two-thirds of the state's manufacturing output and generate over half the state's manufacturing employment. While the four districts contribute around 55% of the state's manufacturing GDP, they contribute to over 65% of the state's manufacturing output.

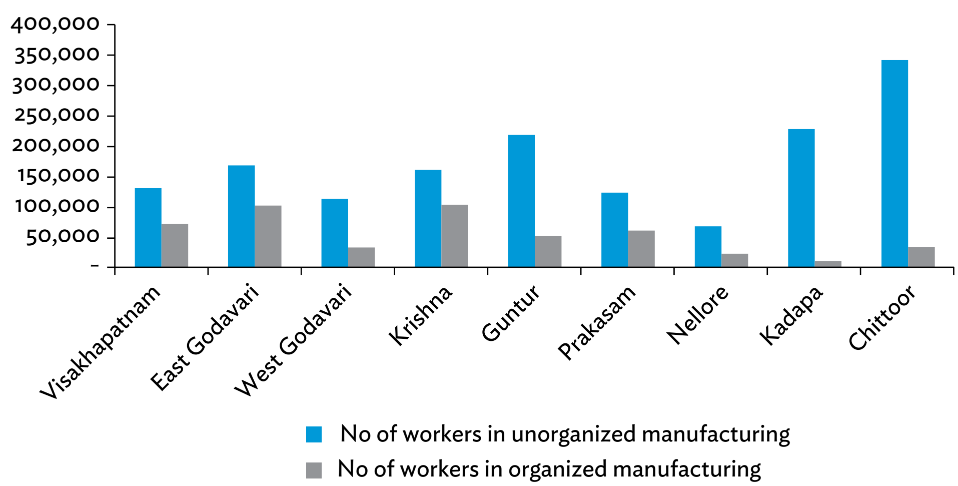
The four districts together contribute to almost two-thirds of the state's manufacturing output and generate over half the state's manufacturing employment.

Figure 1.34: **Contribution to State's Manufacturing Output & Employment, by District**



Source: ASI, AP 2010-11, Study team analysis

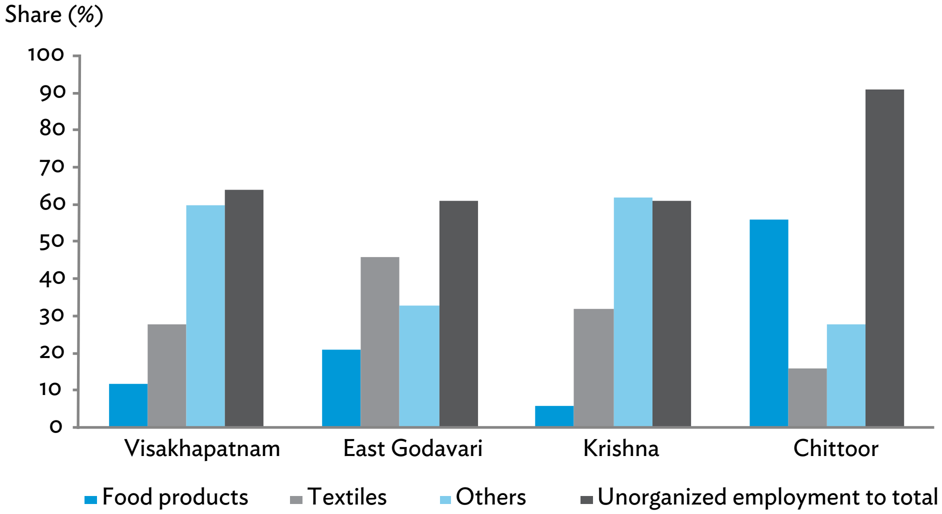
Figure 1.35: **Employment in Manufacturing, by District**



Source: ASI AP, 2010-11, NSSO 2010-11.

Employment in the unorganized sector is a major contributor to overall employment in manufacturing in all four districts. Chittoor has the highest share of employment in the unorganized sector at over 90%. The unorganized sector share in each of the other three districts is over 60% (Figure 1.35).

Figure 1.36: **Employment in the Unorganized Sector, by District**



Source: ASI AP 2010-11, NSSO 2010-11.

Food processing and textiles are the major sectors contributing to employment in the unorganized sector. These two sectors together contribute to around 40% of unorganized sector employment in Visakhapatnam and Krishna, and to over 65% in East Godavari and Chittoor (Figure 1.36). The share of other sectors like automobiles, electronics, chemicals and petrochemicals, metallurgy, and pharmaceuticals in the unorganized sector is insignificant.

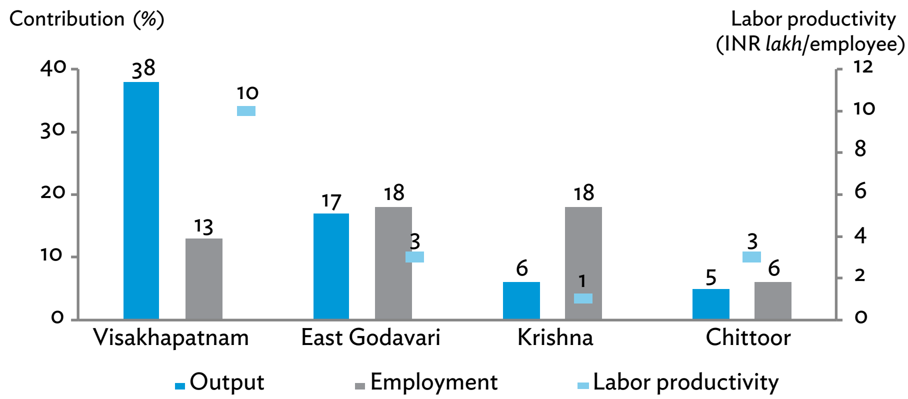
Across all four districts, over 60% of total employment is in the unorganized sector; the food processing and textile sectors have the highest shares of workers in the unorganized segment.

Sector mix

As shown in Figure 1.37, Visakhapatnam is the top contributor to the state's output, with a contribution of around 38%. However, against this output contribution, the district's contribution to employment is only 13%. On the other hand, though Krishna district contributes only 6% of Andhra Pradesh's output, it generates 18% of the state's employment.

Visakhapatnam has the highest value-added at INR10 *lakh* per employee against INR3 *lakh* per employee in Chittoor and East Godavari. This is mostly driven by the choice of sectors. Visakhapatnam is home to capital-intensive sectors like chemicals and petrochemicals, resulting in higher productivity and a lower employment contribution.

Figure 1.37: **Contribution of Shortlisted Nodes to State's Output and Employment**



Source: ASI AP 2010-11, Study team analysis.

Table 1.19: **Existing Sector Mix – Output and Employment, by District**

	Visakhapatnam		East Godavari		Krishna		Chittoor	
Food Processing	3%	18%	67%	82%	57%	72%	35%	32%
Textiles					9%	4%	6%	15%
Chemical & Petrochemical	54%	7%	24%	3%				
Metallurgy	30%	26%			5%	2%	13%	3%
Total	**87%**	**51%**	**91%**	**85%**	**71%**	**78%**	**54%**	**50%**

Output %, Employment %

Source: ASI 2010-11.

On the other hand, East Godavari and Krishna districts have employment-intensive sectors like food processing and textiles, leading to a greater contribution to the state's employment Table 1.19.

Along with employment-intensive sectors like food processing and textiles, steps need to be taken to attract sectors with high productivity like automobiles and electronics.

While Visakhapatnam is the major contributor to Andhra Pradesh's output, East Godavari and Krishna are major contributors to employment, which is mostly influenced by choice of sectors.

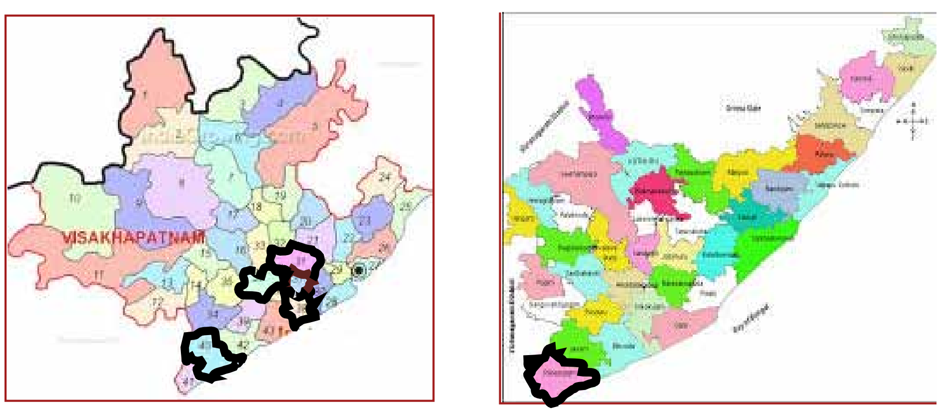
Locational analysis: Visakhapatnam node

<u>Physical, economic, and educational profile</u>

Strategic role in corridor

Visakhapatnam, also known as Vizag, is the 17th largest city in India, the third-largest city on the east coast of India, the largest city in Andhra Pradesh, and it has the highest per capita income in the state. Visakhapatnam has developed into a major economic destination. The city was identified as one of the fastest-growing in the world, economically and demographically. Several factors have contributed to its economic growth, including the natural harbor and rail, road, and air connectivity to national and international destinations. Visakhapatnam encompasses 5 *mandals* with existing industries (Figure 1.38). At the same time, the population density in Visakhapatnam is one-tenth of metro cities in India and one-fourth of cities like Hyderabad, Ahmedabad, and Surat. The node is poised to be the anchor for industrial development in the corridor. It is strategically located in the northern end of the corridor with access to the eastern and central hinterlands of India. The node has a substantial presence of industries that can provide support to launch further industrial development.

Figure 1.38: **Mandals in Visakhapatnam Node**



1. Visakhapatnam node

Mandals

- Atchutapuram
- Anakapally
- Kasimkota
- Nakkapally
- Ranastalam

Source: Study team compilation.

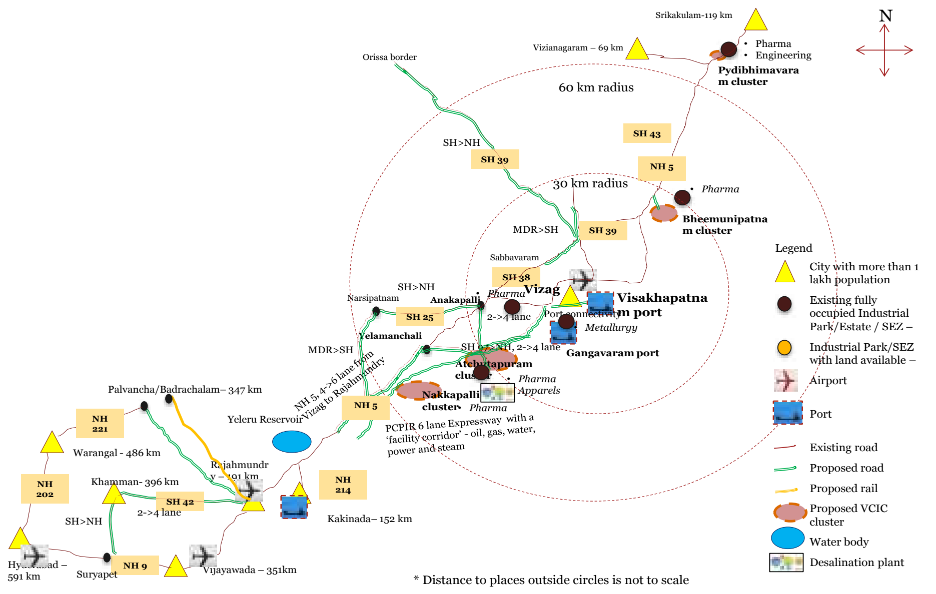
Strengths of the node

Visakhapatnam has an advantage in the presence of industries since 1970s (Figure 1.39). The presence of public sector undertakings triggered the growth of industries in and around Visakhapatnam within a radius of 40 km. There are successfully operating SEZs and Industrial Parks in the region that also have expansion plans. The per capita income is the highest in the state owing to it being industrially developed. Visakhapatnam has many educational institutions to serve industries with skilled labor. The node region is well connected by road and rail in a linear fashion. It is well-placed to attract traffic from Telangana and central, eastern, and southern India. The node has two operating ports with a container terminal and multiple bulk handling terminals, which are poised to handle the cargo from central and western India and to become a gateway to traffic toward East and Southeast Asia. The node has the largest airport in Andhra Pradesh and there are plans to build a greenfield international airport to complement the anticipated developments. The planned PCPIR Expressway will help in easing traffic on National Highway 5. The facilities corridor will be useful for cargo movement between clusters in the node. Industrial water is being supplied by VIWSCO, which ensures reliability and a 100 million liters of drinking water per day desalination plant is planned at Pudimadaka (Figure 1.40).

Figure 1.39: **Major Industries in the Visakhapatnam Node**

Source: Study team compilation.

Figure 1.40: **Analysis of Visakhapatnam Node**



Source: Study team compilation.

The major investments in Visakhapatnam district are around urban clusters. The three major industrial clusters in Visakhapatnam are around Atchutapuram, Nakkapalli, and Bheemunipatnam. The major industries and clusters include Visakhapatnam Steel Plant, Hindustan Petroleum Corporation Ltd., NTPC Limited, Jawaharlal Nehru Pharma City (Ramky), Atchutapuram SEZ, Brandix India Apparel City, Hetero Drugs Pvt. Ltd., and Divi's labs. These industries account for over 60% of the total investment in Visakhapatnam district.

Visakhapatnam is considered to be a center for education in Andhra Pradesh and there are a number of primary and high schools, and colleges in the city. The average literacy rate of Visakhapatnam city was 82.3% in 2011. In addition to state-run schools there are private institutions, missionary schools, and colleges. The Indian Maritime University is a central university poised to play a role in the development of human resources for the maritime sector. Visakhapatnam also has the National Institute of Oceanography and other famous universities such as the Andhra University (AU), Integral Institute of Advanced Management (IIAM), Damodaram Sanjivayya National Law University, and GITAM University.

Visakhapatnam node is the most industrially developed node among the identified potential nodes. It has operating ports and an eco-system to support future industrial development.

The study team conducted discussions with select stakeholders to understand their key concerns. The summary of the discussions is presented below and in Table 1.20. The concerns highlighted shall be taken into consideration during the planning of Phase II of the project.

Requirements for development

- The ports in the node need greater connectivity, especially in providing land access to the container terminal.
- The Vizag ports needs expansion of berths and the backup area available with the port.
- There upgrading of a few intra-node roads is required.
- The node needs lateral connectivity to the hinterlands in the central and western India, and last mile connectivity projects to ports and airports.
- The NH 5 road stretching to Rajahmundry needs to be upgraded.
- The planned PCPIR Expressway with a facilities corridor should be implemented.
- Facilities at the airport and ports need to be enhanced.

Table 1.20: **Summary of Key Concerns of Stakeholder – Visakhapatnam Node**

Power	• Power cuts are a major issue. Long hours of power cuts (scheduled and unscheduled) and power holidays to industries are a concern. Friday is a power holiday in one of the clusters. Dependence on DG sets increases the power cost by almost four times. • Some of the industries operating in the cluster are power intensive. Reliable quality of power is essential and is lacking.
Road	• The road connecting the APSEZ and National Highway 5 is a 2 lane road (approximately 15 km) and is a key constraint. At least 100 buses ply from Visakhapatnam to and fro the SEZ carrying employees. The road needs to be four laned. • Exports are done via Chennai Port as the volume is not enough to export using Vizag Port. Liners do not operate from the ports with less quantity to be exported. NH 5 needs to be six laned throughout till Chennai.
Airport	• Air cargo has to be transported to Hyderabad or Chennai airport as Vizag airport does not have a testing facility for pharmaceutical and marine industries.
Port	• Container tank forms which are required to store the raw material for bulk drugs are not available in Vizag port and hence are sourced from Kakinada port
Labor	• Availability of skilled labor is an issue in the region as there is a mismatch between what is taught in college and the skills required in factories
Raw material	• The raw materials required for manufacturing of bulk drugs are imported from the PRC. These industries are not setting up base in India because cost of utilities is almost double. (Water is available at over INR40 and power at INR6.)

Source: Stakeholder consultations.

Kakinada node

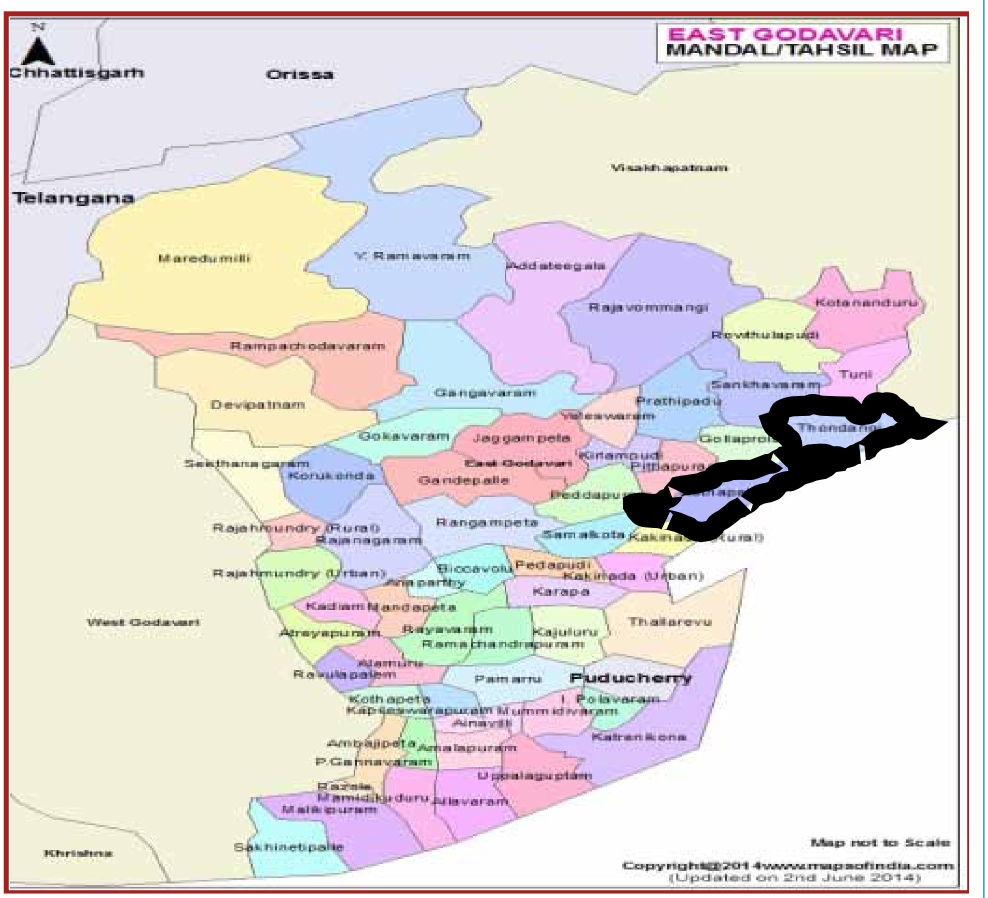
Strategic role in corridor

Kakinada, its adjoining area (Figure 1.41), and the port is envisaged to be a key driver of economic growth in the region with a special focus on hardware manufacturing. With the focus on increasing indigenous production of IT hardware, the Government of India has recently identified Kakinada for hardware manufacturing in Andhra Pradesh.East Godavari has already entered the software segment with Sarpavaram SEZ, where Cyinet (formerly Infotech Enterprises) is operating. The local IT institutes, polytechnic, and engineering colleges could meet the manpower requirements of the hardware cluster.

Strengths of the node

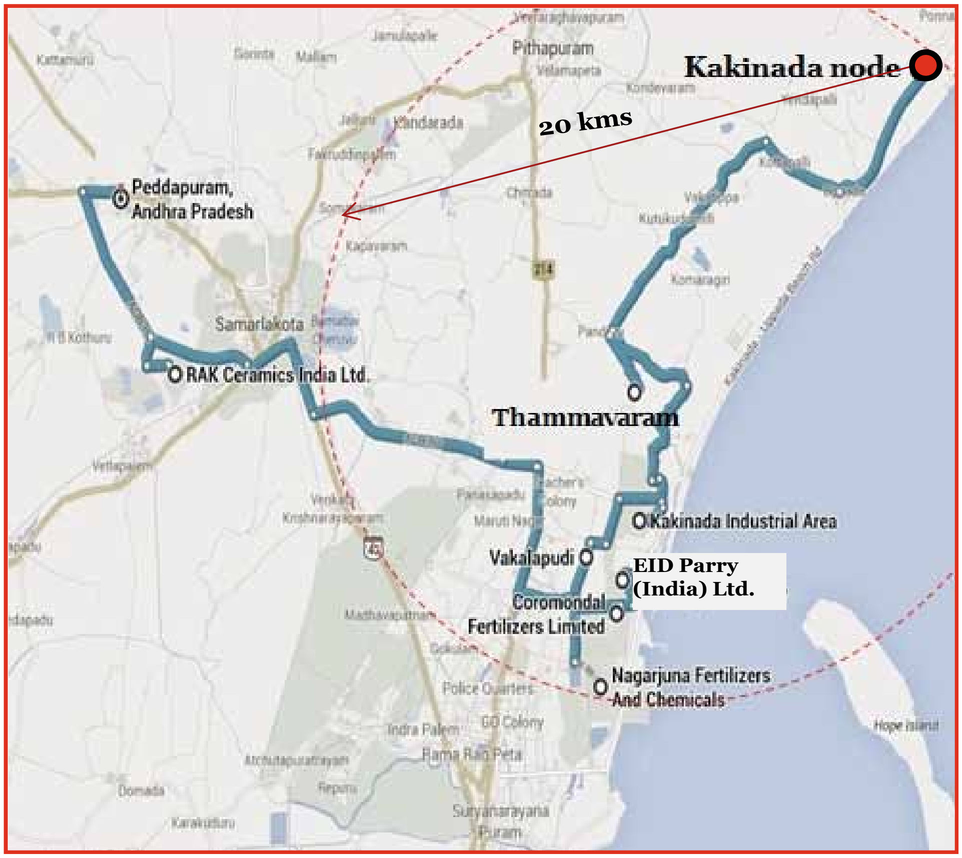
Kakinada is a municipal corporation in Andhra Pradesh (Figure 1.42). It is located 215 km east of Vijayawada and 65 kilometres east of Rajahmundry. It is the headquarters and largest city

Figure 1.41: **Mandals in Kakinada Node**



Source: Study team compilation.

Figure 1.42: **Major Industries in the Kakinada Node**

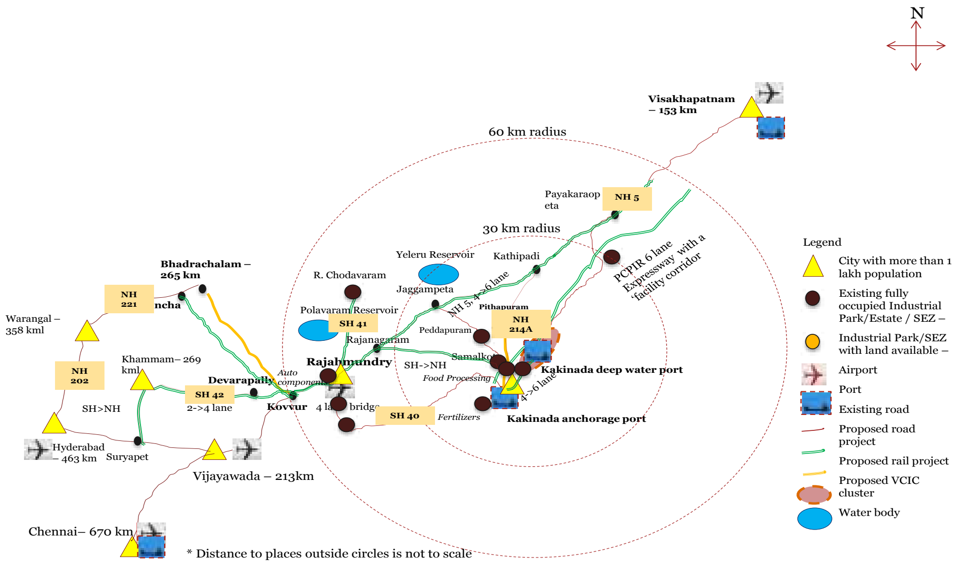


Source: Study team compilation.

in the East Godavari district. Kakinada has an SEZ; industrial clusters like Thammavaram IP, Vakalapudi IP, Kakinada IP, and Peddapuram IP; and is part of the proposed PCPIR. Until the early 1980s (before the fertilizer companies began operation), the local economy revolved around the textile industry, auto parts, steel-related ancillary units, agriculture, and fishing. Kakinada's economy is diverse, due to its seaport and port-based industries.

Kakinada is known as the "Fertilizer City of Andhra Pradesh." The city is home to two fertilizer producers: Nagarjuna Fertilizers (the largest urea manufacturer in coastal Andhra Pradesh) and Godavari Fertilizers (owned by Murugappa Group, and producing diammonium hydrogen phosphate). Over 55% of the total investments in Kakinada are in the fertilizer segment. The key industries in Kakinada include Nagarjuna Fertilizers, EID Parry (India) Ltd., Coromandel International Ltd., and RAK Ceramics. The above industries constitute over half of the investment in the district. The other major companies include International Paper, Agarwal industries, Good Health Agro, and Acalmar Oils & Fats Ltd.

Figure 1.43: **Analysis of Kakinada Node**



Source: Study team compilation.

Kakinada is an educational hub, meeting the growing educational demands of the state. Several professional colleges in Kakinada offer courses in engineering, medicine, information technology and management at the graduate and postgraduate levels. The Jawaharlal Nehru Technological University, Kakinada offers engineering courses and has a business school, while Rangaraya Medical College is a respected medical college. It also has the Andhra University Postgraduate Centre. Kakinada's literacy rate was 81.3% in 2011.

In terms of connectivity, Kakinada is well connected by road and rail (Figure 1.43). The Kakinada node has dense industrial development around it within a radius of 20 km. It has traditionally been a center for chemical industries and has attracted two of the largest fertilizer companies in the state. The node is well-connected to Rajahmundry, which is 70 km away and one of the local urban centers with a population of more than 400,000. The region is in the catchment area of the Godavari river and its canals. The PCPIR Expressway will help in easing traffic on NH 5. The facilities corridor will be useful to clusters in the node.

Kakinada node is a part of the industrial development plans of the Governments of Andhra Pradesh and India (EHM cluster). It has large tracks of land and a port with a deep draft.

The study team had discussions with select stakeholders to understand their key concerns. The summary of the discussions is presented below and in Table 1.21. The concerns highlighted shall be taken into consideration during the planning of Phase II of the project.

Requirements for development

- There is need for lateral connectivity toward western and central India.
- The road link from Kakinada to Rajahmundry needs to be upgraded.
- Last mile connectivity to the anchorage port and the captive port planned in the node area is required.
- The Rajahmundry airport is 70 km away and does not have cargo facilities; hence, dependence is high on the Visakhapatnam or Hyderabad airports.
- The new rail line between Pithapuram and Kakinada shall be prioritized.

Table 1.21: **Summary of Key Concerns of Stakeholder – Kakinada Node**

Power	• Power cuts are a major issue. Long hours of power cuts (scheduled and unscheduled) and power holidays to industries is a concern. Some of the industries operating in the cluster are power intensive. Reliable quality of power is essential but is lacking.
Water	• Groundwater cannot be used for industrial purposes as water is saline. • Water is supplied from the Godavari basin in Rajahmundry through a canal. • Government has no role to play in water supply. Water is supplied by private players and hence is expensive. • Currently there is sufficient water available. But with increase in the number of industries and usage, there may be shortage of water. There should be a plan for desalination
Ports	• The port can only handle bulk materials. It does not have container handling facilities. The draft of the port is not very good. The maximum draft is 10 km. The infrastructure of the port is also not very well developed and does not have adequate storage facilities.
Airport	• The Rajahmundry airport though is 70 km does not have cargo facilities, hence dependence on Visakhapatnam or Hyderabad airports.
Railway	• There is a single track with less capacity from Samalkota to Kakinada port. • Further, Samarlakota is not directly connected to Chennai. The goods have to be routed through Pithapuram. Currently, there is no railway line between Samalkota and Pithapuram. There is a proposal to develop this 21 km railway line. • CFL faces problems because of shortage of rakes/supply of wagons. Connectivity within the district is poor.

Source: Stakeholder consultations.

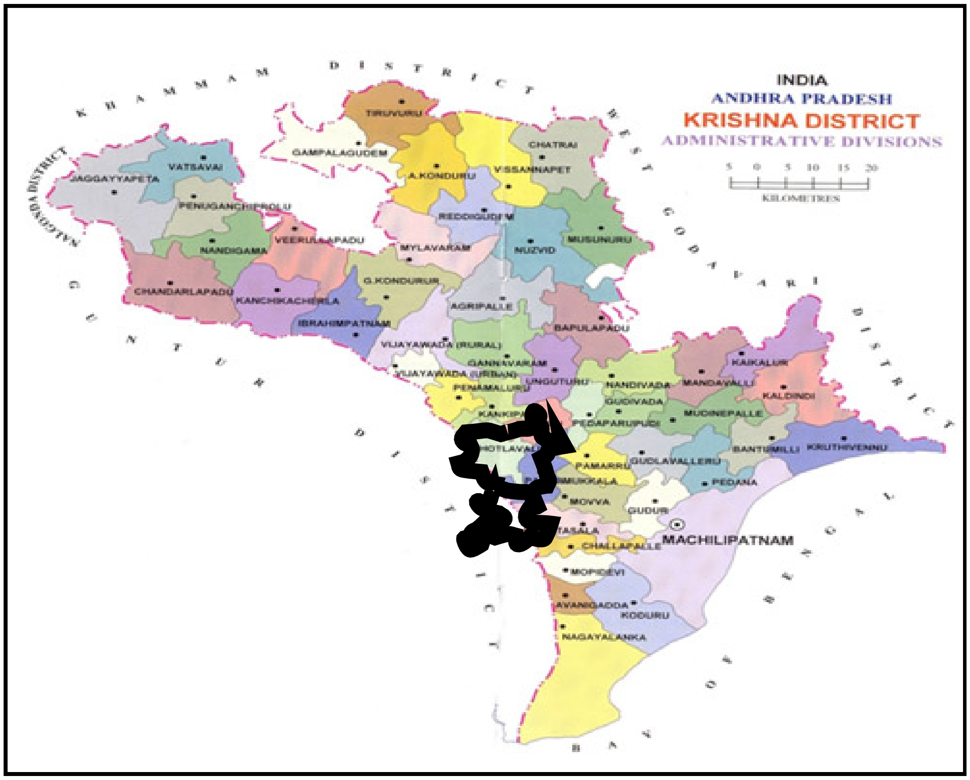
Gannavaram–Kankipadu node

Strategic role in corridor

The Gannavaram node is 20 km away from Vijayawada, which is the second-largest city in Andhra Pradesh, and about 55 km from Guntur, which is the third-largest city. The area between Vijayawada and Guntur is proposed to be the state capital (Figure 1.44). Vijayawada is one of the main education centers in Andhra Pradesh. The node is 40–60 km away from Machilipatnam, which is the administrative headquarters of the district.

The majority of the people in urban areas of Krishna district are engaged in trade and commerce (Figure 1.45). There are many large scale industries like sugar and cement, and many small-scale industries including musical instruments, gold-plated ornaments, and Kondapalli toys. The district has a rich variety of soils, and agriculture is the most important occupation with paddy the main food crop being produced. Though over 80% of investment in Krishna district is in the cement sector, over 55% of the output is from food processing. The major cement industries include Japee Balaji Cement, Ramco Cement, and KCP Cement. These industries constitute over 70% of the district's investment. The key industries in the food processing sector include Coca Cola India Pvt. Ltd, Vijayawada, KCP Sugars, Vuyyuru, Balaji Agro Oils Ltd., and Kankipadu. Cement industries are mostly located close to Jaggayyapeta, whereas food processing industries are in proximity to Gannavaram and Kakipadu.

Figure 1.44: **Mandals in Gannavaram-Kankipadu Node**

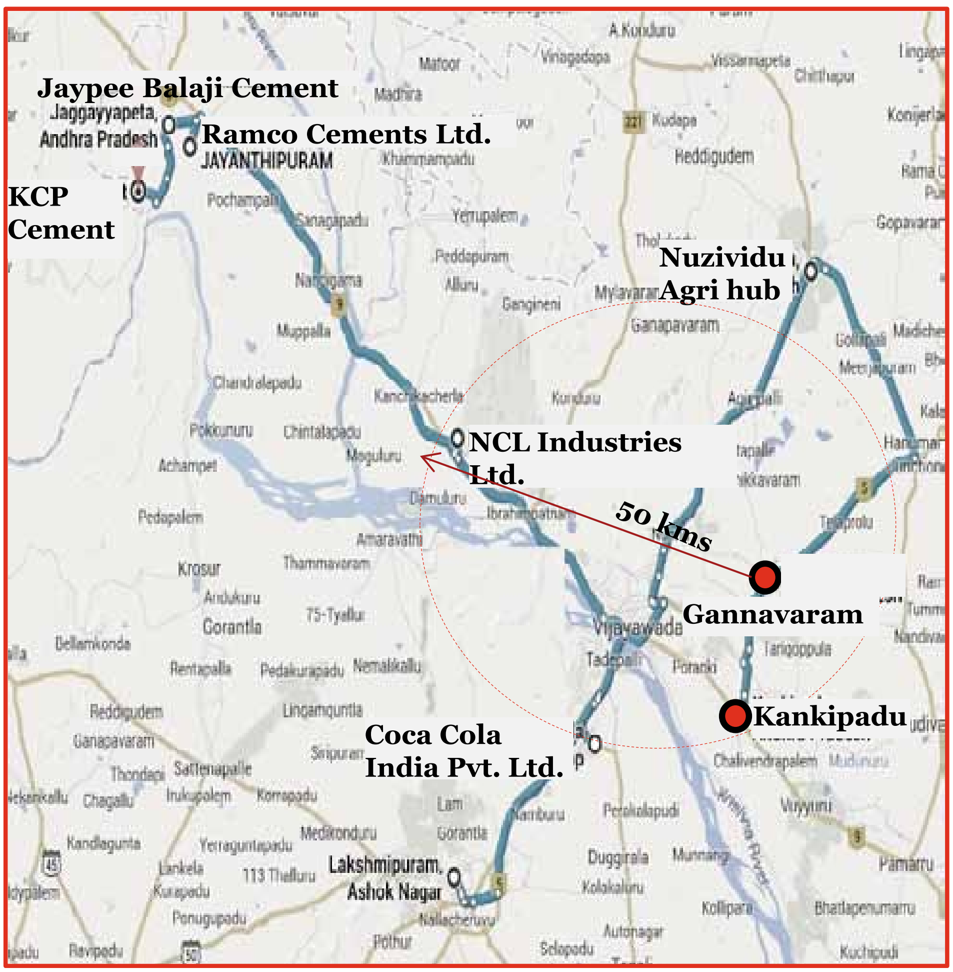


Source: Study team compilation.

Meanwhile, Vijayawada is one of the main education centers in Andhra Pradesh. NTR University of Health Sciences is located in Vijayawada. Krishna University is located in Machilipatnam. Rajiv Gandhi University of Knowledge Technologies popularly known as International Institute of Information Technology is situated in Nuzvid. School of Planning and Architecture, South Indian Chapter is present in Vijayawada.

District has numerous engineering colleges including Prasad V. Potluri Siddhartha Institute of Technology, Velagapudi Ramakrishna Siddhartha Engineering College, Lakireddy Balireddy Engineering College, Gudlavalleru Engineering College, DMS SVH College of Engineering, Govt Polytechnic Vijayawada (one of the oldest Polytechnic colleges in India), Andhra Loyola College, AANM & VVRSR (Gudlavalleru) Polytechnic College, Mary Stella college, Sidhartha Degree College are few of the many famous arts and science colleges in the district. The average literacy rate in the district was 74.4% in 2011.

Figure 1.45: **Major Industries in the Gannavaram-Kankipadu Node**



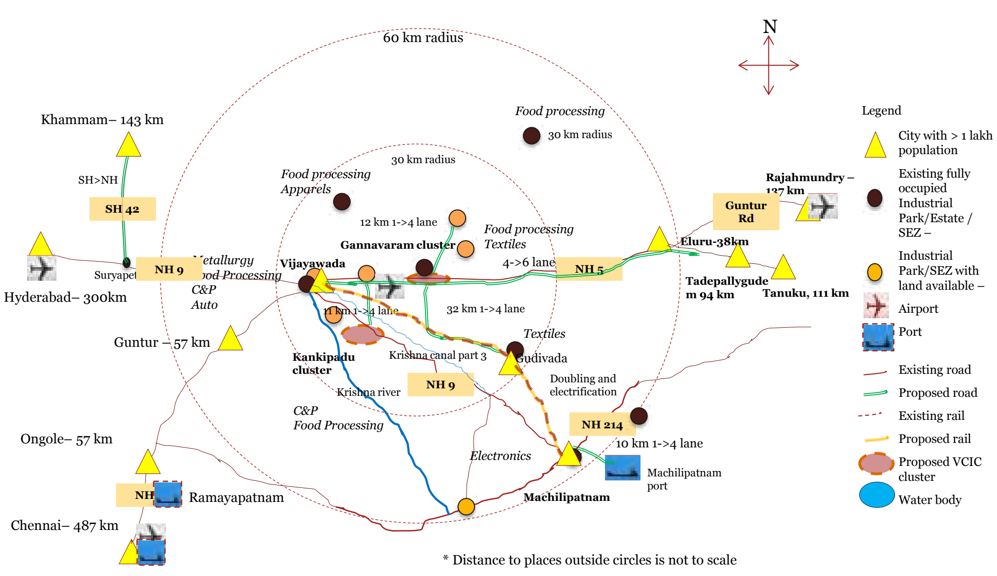
Source: Study team compilation.

Strengths of the node

The node includes Gannavaram, which is seen as an extension of Vijayawada, the most developed city in Krishna district and the state, and a candidate location for the new capital of Andhra Pradesh (Figure 1.46). The presence of existing industries has helped the region to have the second-highest per capita income in the state. Out of the four identified potential nodes, this node has the maximum number of cities with above 1 *lakh* population. The cities in the node have a presence of renowned educational institutions with the potential to provide skilled labor to the existing and planned industrial developments. Vijayawada is the most important railway junction in the South Central Railway, providing it connectivity to all important locations in the state and with neighbouring states. The region is served by the Krishna river. The port being planned at Machilipatnam will have a deep draft to facilitate the movement of large vessels and the handling of large volumes of cargo.

Gannavaram node has the advantages of proximity to the capital city, Gannavaram airport, and a planned deep draft port. It is situated in the delta region of Krishna River, which provides a year-round water supply to the district.

Figure 1.46: **Analysis of Gannavaram–Kankipadu Node**



Source: Study team compilation.

The study team also interacted with stakeholders already operating in the node area to understand their key concerns. The summary of the discussions is presented below and in Table 1.22. The concerns highlighted shall be taken into consideration during the planning for the Phase II of the project.

Requirements for development

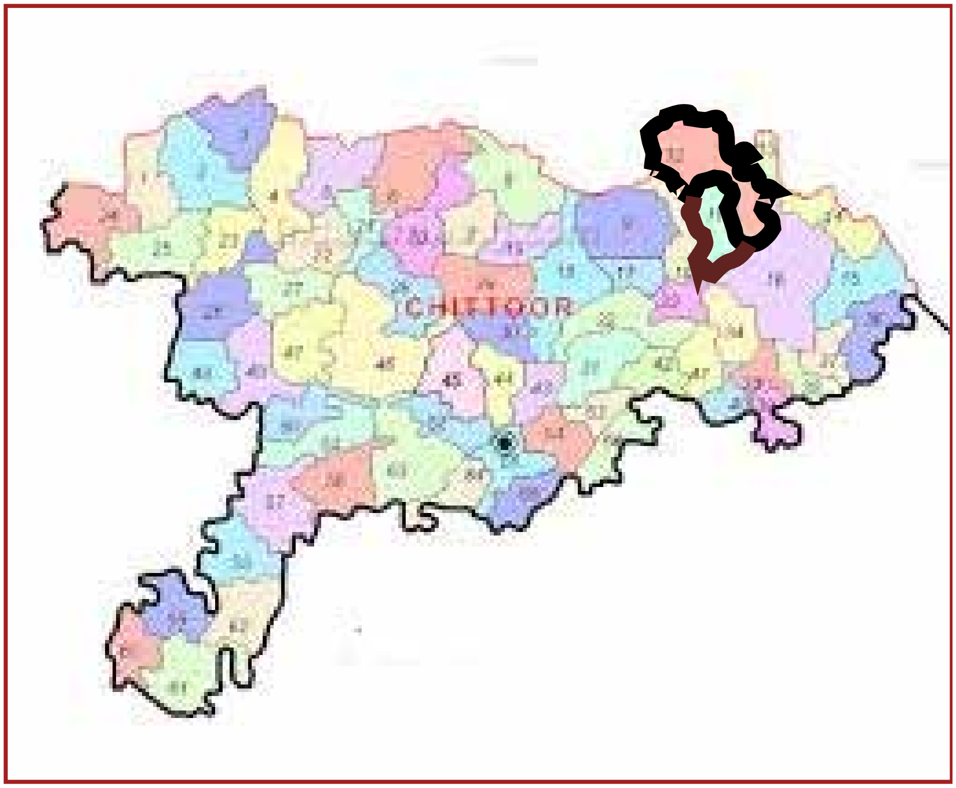
- The rail line from Vijayawada to Machilipatnam needs to be doubled and electrified.
- Last mile connectivity roads and intra-node roads need upgrading.
- Currently, there is a high level of dependence on the Chennai port for the movement of cargo from the node region. There is a deep water port planned at Machilipatnam, the development of which needs to be accelerated.

Table 1.22: **Summary of Key Concerns of Stakeholder Gannavaram-Kankipadu Node**

Power	• Power was a critical problem (with power holidays and common feeders with residential connections) which discouraged the tenants' expansion plans and forced them to consider other options like shifting to Gujarat. • However, the power situation has improved drastically after the formation of the new government and they do not experience any power cuts now.
Water	• For industrial water dependence is on groundwater. The groundwater table is good in the region.
Ports	• The units depend on the Chennai port for their exports since the cargo is containerised. However they are considering shifting to Krishnapatnam. Certain stretches of NH5 connecting to Chennai is congested and not well managed.
Airport	• The Gannavaram airport does not have connectivity to many locations within India. National and international connectivity is required as international customers find it difficult to travel to the region.
Labor	• Availability of skilled labor is an issue in the region as there is a mismatch between what is taught in college and the skills required in factories.

Source: Stakeholders' consultations.

Figure 1.47: **Mandals in Yerpedu-Srikalahasti Node**



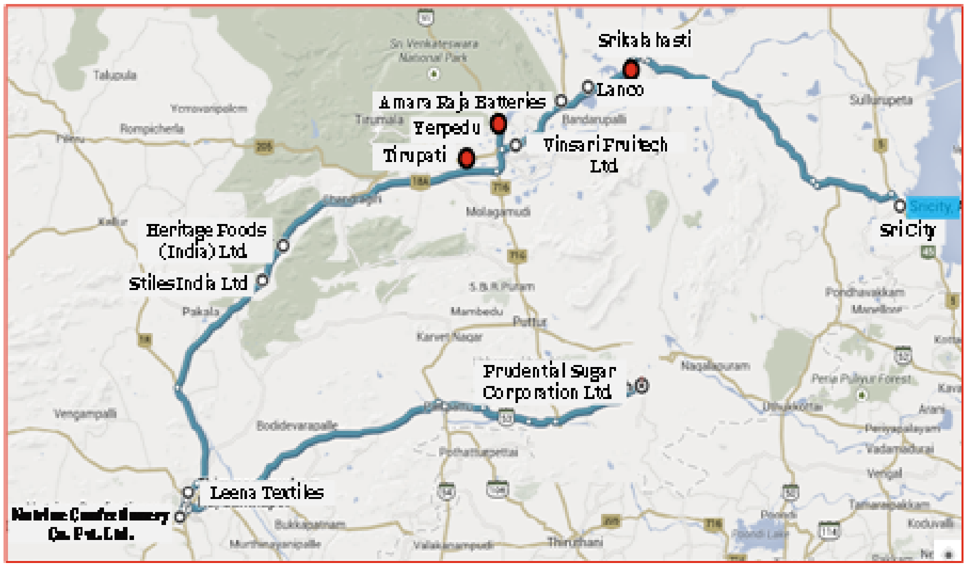
Source: Study team compilation.

Yerpedu–Srikalahasti Node

The node is strategically located at the southern end of the corridor, which is closer to Chennai and Bengaluru, and is envisaged to anchor development of southern end of corridor. Yerpedu is an extended region of Tirupati, which is the economic center and tourism hubof the state (Figure 1.47). The node comprises Sri City, which is a thriving industrial area and the other parts of the node can effectively accommodate spillover industrial activity from Chennai and Sri City. The node would be served by the multiple container terminals in Chennai–Krishnapatnam port cluster.

Tirupati is a major educational hub in Andhra Pradesh. There are several universities and colleges, including state-government- and Tirumala Tirupati Devasthanams-sponsored medical, pharmacy, agricultural and engineering colleges in the city. Sri Venkateswara University has been consistently among the top universities in India in various surveys. Other notable universities include Padmavati Mahila Visvavidyalayam, Rashtriya Sanskrit Vidyapeetham, Sri Venkateswara Veterinary University, Sri Venkateswara Vedic University, and Sri Venkateswara Institute of Medical Sciences. Tirupati also has a number of engineering

Figure 1.48: **Major Industries in the Yerpedu-Srikalahasti Node**



Source: Study team compilation.

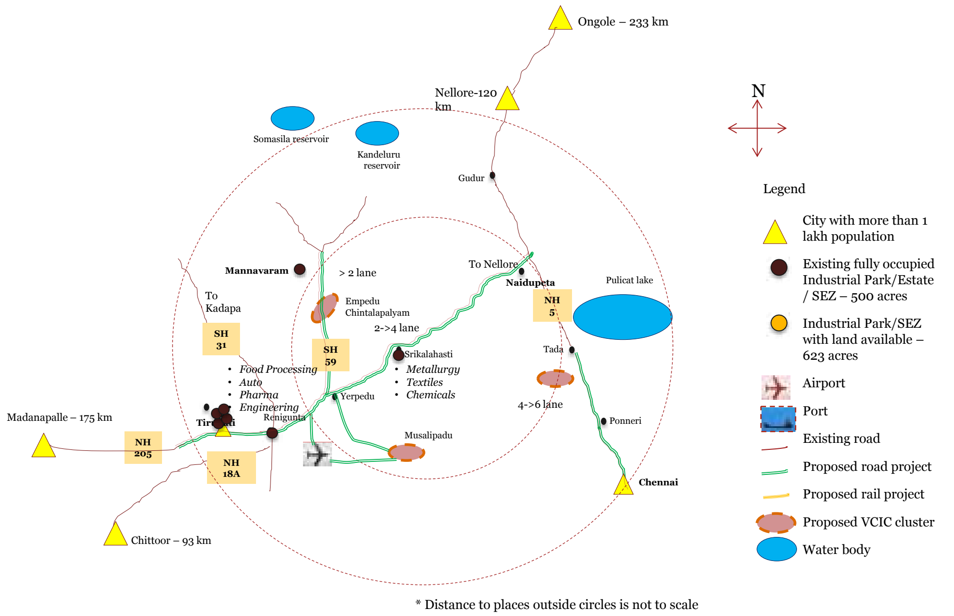
and degree colleges, including Sri Vidyanikethan Engineering College, SV College of Engineeering, Annamacharya Institute of Technology and Sciences, and SV Degree College. The literacy rate was 85.2% in 2011.

Industries in food processing, textiles, and metallurgy, which constitute around 80% of the total investments in Chittoor are around Yerpedu–Srikalahasti node. Major players include Lanco Industries, Vinsari Fruitech Ltd., Heritage Foods (India) Ltd., Stiles India Ltd., Nutrine Confectionery Co. Pvt. Ltd., Leena Textiles, Prudential Sugar Corporation Ltd., and Amara Raja Batteries. Sri City is the major industrial area in the node region (Figure 1.48)

Strengths of the node

The node is 20 km from Tirupati, which attracts 50% of tourists who visit the state. The Tirupati Airport is located 15 km from the city center and has flights to Hyderabad, Visakhapatnam, and New Delhi. Additionally, the airport offers flights to Coimbatore, Kolkata, and Mumbai. It is being upgraded to an international airport. The closest international airport is the Chennai International Airport, which is 130 km from Tirupati. The node region is just 130 km and 150 km away from Chennai and Nellore, respectively, which are the urban centers that could provide the node with skilled labor. In the node region, water is available from the Kandaleru reservoir under the Telugu Ganga project. There are few roads being planned by the Government of Andhra Pradesh that will facilitate cargo movements from Karnataka to the Krishnapatnam port, which is a private operational port nearest to the node region (Figure 1.49).

Figure 1.49: **Analysis of Yerpedu-Srikalahasti Node**



Source: Study team compilation.

Yerped–Srikalahasti node has the advantage of its proximity to Tirupati and Chennai, their international airports.

The study team interacted with stakeholders already operating in the node area to understand their key concerns. The summary of the discussions is presented below and in Table 1.23. The concerns highlighted shall be taken into consideration during the planning of Phase II of the project.

Requirements for development

- There is a need for last mile roads connecting the node region to the NH connecting Naidupeta and Tirupati.
- Currently, there is a high level of dependence on the Chennai port for movement of cargo from the node region. The last mile connectivity projects improving the access to the Krishnapatnam port will help route the cargo to Krishnapatnam port.
- Although the Tirupati airport is 20 km away, it does not have cargo facilities, increasing dependence on the Chennai airport. The planned upgrading of the airport needs to be fast-tracked.

Table 1.23: **Summary of Key Concerns of Stakeholder – Yerpedu-Srikalahasti Node**

Power	• Power was a critical problem especially the three-day power holidays. However, the power situation has improved after the formation of the new government.
Water	• For industrial water, dependence is on surface water supplied from the Kandaleru reservoir which is a part of the Telugu Ganga project. However, the water from the reservoir needs to be stored for summer months.
Roads	• There is a lot of dependence on Chennai for labor. The NH5 is being repaired and there are a lot of diversions and the road is of poor quality in many places. It needs to be completed soon. • The roads within Chennai, especially the ones reaching the airport and port, need to be upgraded, as they increase the transit time.
Social Infrastructure	• There is a need for housing and hospitals in the region to attract people to stay in the region. Hospital is a priority.
Labor	• Availability of skilled labor is an issue in the region. There is a need for a Skill Development Centre, which trains many people in a lot. It could be a combined intervention of government and the private sector.
Common facilities	• There are no heavy engineering or precision engineering workshops in the region. There is a need to set up common workshops for the benefit of industries.

Source: Stakeholders' consultations.

- There is a need for a modern common user container facility in the Krishnapatnam port.
- Access to Chennai container facilities need to be de-congested.

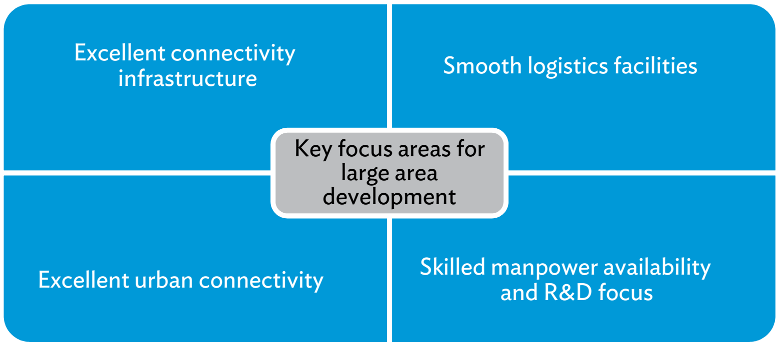
Benchmarking of Industrial nodes

Based on global benchmarking, the successful industrial parks and clusters revealed the need for integrated development of four key areas (Figure 1.50):

We benchmarked each of these focus areas against three of the successful industrial parks or clusters located around the globe: Hsinchu Science Park (HSP) in Taipei,China; Tianjin Economic-Technological Development Area (TEDA) Industrial Park in Tianjin in the PRC; and Suzhou Industrial Park (SIP) in the PRC.

Connectivity infrastructure is a critical success factor for the development of a world-class manufacturing hub. This is evident from the examples of TEDA, SIP, and HSP, with each having excellent connectivity to the gateways (ports and airports) through state-of-the-art roads and railway infrastructure (Table 1.24). A key observation was that each of these industrial parks provided the industries with seamless connectivity to at least one of the gateways within a 60-minute travel time.

Figure 1.50: **Key Focus Areas for Large Area Development**



Source: Study team analysis.

Table 1.24: **Connectivity Infrastructure Benchmark for Global Parks**

Components	TEDA	SIP	HSP	Comment
Road	Connected with 10 main highways to the domestic market (distance ranging from 0 km–60 km from TEDA)	Connected with five expressways and four state roads	Connected with two national freeways	Maximum time to connect with at least 1 major highway/ freeway – 0 min
Rail	Connected with nine major railroads to the domestic market (within 50 km)	Connected with two major express rail networks (hi-speed) (within 0 km)	Connected with hi-speed rail network (within 11.5 km)	Maximum time to connect with at least 1 major rail network – 15 min
Ports	Connected to Tianjin port – one of the largest ports in the world (within 5 km)	Connected to five key ports, including Shanghai port (within 100 km)	-	Maximum time to connect with at least 1 major port – 60 min

continued on next page

Table 1.24 *continued*

Components	TEDA	SIP	HSP	Comment
Airports	Two international airports within two hours (38 km–180 km)	Four international airports within 2 hours (80 km–200 km)	One international airport within 20 min (12 km)	Maximum time to connect with at least 1 major airport – 60 min

HSP = Hsinchu Science Park, SIP = Suzhou Industrial Park, TEDA = Tianjin Economic-Technological Development Area Industrial Park.

Source: http://en.teda.gov.cn/; http://www.chinaknowledge.com; http://www.sipa.gov.tw/english/.

Table 1.25: **Logistics Infrastructure Benchmark for Global Parks**

Components	TEDA	SIP	HSP
Key features	• Green passage service • Formal transfer agreement with ports and airports	• Institutionalised "customs clearance service hall"	• Institutionalized "science park customs clearance system"
Warehousing facility available	Yes	Yes	Yes
Size (m^2)	343,000	na	5,000
In-house clearance facility	Yes	Yes	Yes
Connectivity to road network	Yes	Yes	Yes
Connectivity to rail network	Yes	Yes	Yes
Presence of international express delivery companies	Yes	Yes	Yes

HSP = Hsinchu Science Park, SIP = Suzhou Industrial Park, TEDA = Tianjin Economic-Technological Development Area Industrial Park.

Source: http://en.teda.gov.cn/; http://www.chinaknowledge.com; http://www.sipa.gov.tw/english/.

Logistics infrastructure and facilities are also key to the success of a manufacturing hub. The benchmarking against prominent industrial parks like TEDA, SIP, and HSP showed that each of these industrial parks has excellent warehousing facilities, connectivity to ports through road and rail, and the presence of international express delivery companies (Table 1.25). A key observation was the presence of in-house and dedicated clearance facilities within the industrial park, which is aimed at reducing the transit time and the procedural delays for the export or import of goods. This is a major benefit to the industries located in these large industrial parks, and acts as a key investment decision for many MNEs.

Table 1.26: **Urban Connectivity Benchmarks for Global Parks**

Components	TEDA	SIP	HSP
Key urban centers to which proximity exists	• Located at the center of Bohai Economic Ring • Tianjin downtown (40 km) • Beijing (130 km)	• Suzhou city center (6 km) • Shanghai (80 km) • Hangzhou (150 km) • Nanjing (200 km)	• Hsinchu city center in close proximity
Mode of connectivity: Road	Beijing–Tianjin–Tanggu Expressway	Shanghai–Nanjing Expressway, Su-hu Expressway, Ring Expressway.	State roads and freeways (1 and 3)
Mode of connectivity: Rail	High-speed rail	High-speed rail	High-speed rail
Maximum time to connect with at least one urban center beyond downtown (min)	90 min	20 min	60 min

HSP = Hsinchu Science Park, SIP = Suzhou Industrial Park, TEDA = Tianjin Economic-Technological Development Area Industrial Park.

Source: http://en.teda.gov.cn/; http://www.chinaknowledge.com; http://www.sipa.gov.tw/english/.

Urban connectivity is another key feature of successful industrial parks like TEDA, SIP and HSP (Table 1.26). Although proximity to urban agglomerations is partially guided by the nature of the industries in the industrial park, the ease of commute between the industrial center and urban center is a major factor contributing to the success of an industrial park. Proximity to urban agglomerations, through good connectivity, ensures the availability of skilled manpower resources. Many of the knowledge-based manufacturing industries like automobiles, electronics, specialty chemicals, and pharmaceuticals are highly dependent on the availability of quality manpower resources. This is evident from the fact that industrial parks like TEDA, SIP, and HSP have high-speed rail connectivity to the urban agglomerations, along with expressways and good roads.

Another major factor for developing a globally recognized manufacturing hub is the presence and availability of skilled manpower and R&D resources (Table 1.27). A key USP of the major industrial parks like HSP, SIP and TEDA has been their success in creating the right kind of incubation areas and vocational training institutes, among other skills-development centers. The participating governments will have to focus on creating the right ecosystem for imparting quality education, training, and R&D opportunities in order to create a skilled-manpower-rich zone along the proposed corridor.

A benchmarking of the costs of basic raw materials like water, gas, power, labor, and logistics services suggests that India is fairly competitive in these parameters on a global scale (Table 1.28). However, the ease of doing business and the regulatory environment are major differentiating factors for the choice of investment. India is currently lagging behind on these factors and the next section captures the policy strategies that should be adopted to improve the global competitiveness of VCIC.

Table 1.27: Skilled Manpower and R&D Benchmarks in Global Parks

Components	TEDA	SIP	HSP
No. of skilled employees within the park	419,200	190,000	148,000
R&D centers, labs, institutes	55	144	8
Engineering and technology research Centres	35	7	2
Vocational training institutes	na	1	na
Incubators	12	2	na
Incubation area	480,000 m^2	3,000,000 m^2	na

HSP = Hsinchu Science Park, SIP = Suzhou Industrial Park, TEDA = Tianjin Economic-Technological Development Area Industrial Park.

Source: http://en.teda.gov.cn/; http://www.chinaknowledge.com; http://www.sipa.gov.tw/english/.

Table 1.28: Infrastructure Utility Cost Benchmarks in Global Parks

Utilities	TEDA (PRC)	SIP (PRC)	India (Andhra Pradesh)
Water (excluding waste water treatment fee)	• Resident users: US$0.63/$m^3$ • Industrial and transportation: US$1.27/$m^3$ • Services: US$1.27/$m^3$	• Resident users: US$0.43/$m^3$ • Industrial and transportation: US$0.48/$m^3$ • Services: US$0.48/$m^3$	• Residential users: 0.2 US$/kl • Industrial users: 0.7 US$/kl
Power Supply - metered electricity rate (average)	• US$0.12/KWH–US$0.18/KWH (peak hours)	• US$0.09/KWH–US$0.15/KWH	• US$0.12/KWH
Metered gas rate (Grade II Natural Gas)	• Residential: US$0.35/$m^3$ • Industrial: US$0.49/$m^3$	• Residential: US$0.35/ m^3 • Industrial: US$0.49/ m^3	• Industrial: US$0.5-US$0.6/ m^3
Average (skilled) laborcost (US$)	• US$6,968	• US$5,980 – 11,778	Ba
Logistics facilities	• Green passage service • Formal transfer agreement with ports and airports	• Institutionalised “customs clearance service hall”	na

SIP = Suzhou Industrial Park, TEDA = Tianjin Economic-Technological Development Area Industrial Park.

Source: http://en.teda.gov.cn/; http://www.chinaknowledge.com; http://www.sipa.gov.tw/english/.

Connectivity infrastructure, logistics facilities, urban connectivity, and skilled manpower availability emerge as the key success factors from benchmarking of globally successful large industrial hubs. Node development in VCIC should focus on these development priorities.

Appendix 1.1: Analysis of Industry sectors

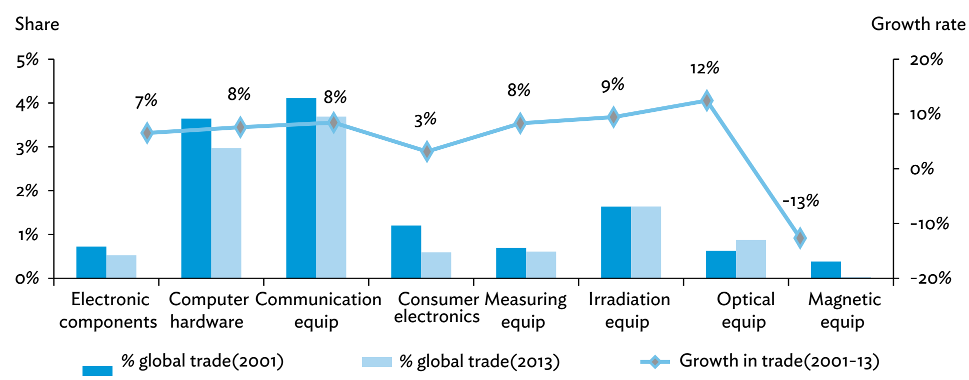
Computer, electronic, and optical products (CEO)

Global Scenario

The global electronics industry which is at US$1,750 billion is the largest and fastest growing manufacturing industry in the world.[20] The production of electronics products has continued to shift from developed countries (US, Japan, Europe) to developing countries especially in Asia Pacific region. Component manufacturers moved in the same direction. Asia's contribution to electronics components has increased from 42% in 2008 to 52%[21] in 2011. With 5 out of top 10 countries, Asia dominates the electronics market.[22] The global electronics industry is expected to reach US$2,400 billion by 2020.

Communication equipment has the major share in the global trade of this sector, followed by computer hardware. Combined, these two sub-sectors account to approximately 7% of the total global trade across all sectors (Figure 1.51). The trade in this sector (except magnetic and optical media and consumer electronics) has been growing consistently over 7% in the last 12 years.

Figure 1.51: **Contribution to Global Trade 2001-13, by Sub-Segment**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/.

---

20 Source: www.apit.ap.gov.in

21 Source: World Electronic Industries (www.decision.eu), http://www.custerconsulting.com

22 Source: Human Resource and Skill Requirements in the Electronics and IT Hardware Industry, NSDC

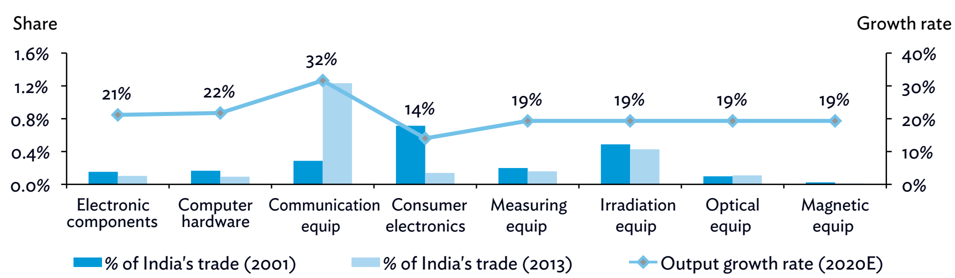
India Scenario

Over the last couple of decades India has been the epicenter of consumer demand fuelled by a phenomenal GDP growth. The electronics market in India grew at a rate of 14% between 2007-08 and 2011-12. While demand increased across all sectors, demand for high technology products, specifically electronic products has registered significant growth and going by current estimates, the demand for electronics in the country is projected to increase from US$45 billion in 2009 to US$400 billion by 2020.[23]

India exports around 17% of its total electronics hardware production. Indian electronics hardware exports have shown steady growth rates of 15% (CAGR between FY 2001 to 2008), yet India remains a net importer with electronics imports. Amongst the segments being exported, Communication and Broadcast Equipment (CBE) is the leading segment having registered a 14% 5-year CAGR (Figure 1.52). In 2011-12 CBE was predominantly exported to the Middle East countries (28%), African countries (19%), South Asian countries, including Singapore and Hong Kong (15%), EU (13%) and North America (11%). Electronic Components (EC) is the second largest segment contributing to exports that have grown at CAGR of 26%. In 2011-12 electronics components were shipped to EU (33%), North America (16%); South Asian countries, including Singapore and Hong Kong (16%) and Middle East countries (12%). Asia dominates the electronics market.[24] Over 40% of semiconductor manufacturing is done in the PRC.

India's trade in communication equipment has grown significantly over the last 12 years. Output of the sub-sector is expected to grow at a rate of 32% by 2020. Trade in consumer electronics however has seen a sharp decline over the last 12 years. All the sub-sectors have a double-digit expected output growth rate making the entire sector very attractive both at a domestic as well as international level. Electronic components, computer hardware and communication equipment are expected to grow over 20% in the next 5 years.

Figure 1.52: **Contribution to India's Trade 2001-13 & Expected Output Growth Rate 2020, by Sub-Sector**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/; DEITY.

23 Source: Task Force Report

24 Source: Human Resource and Skill Requirements in the Electronics and IT Hardware Industry, NSDC

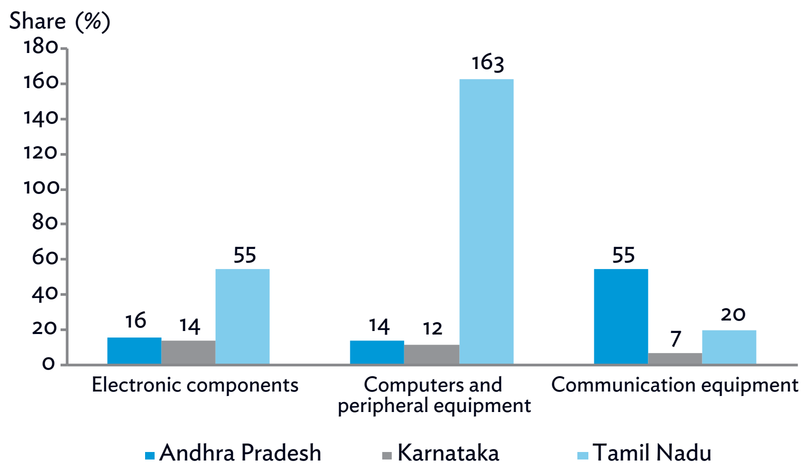
Owing to increased wage rates in the PRC, manufacturers are looking for alternate locations within Asia. Indian CEO exports are expected to increase from US$4 billion to US$80 billion by 2020.[25] Tamil Nadu leads India's CEO exports with a share of 46%, followed by Karnataka (17%), Uttar Pradesh (14%), Maharashtra (12%) and Kerala (3%).

State Scenario

Andhra Pradesh has a modest contribution in production of electronics at a national level. Electronic components and communication equipment has the highest share in AP's electronics output. Together they contribute to around 70% of the total electronics output of AP. Computer hardware sub-sector although currently has negligible contribution to AP's electronics output, it has been growing at the highest rate of 46% over 2008 to 2012. Electronic components and communication equipment have also shown a significant growth over 30% between 2008 and 2012 (Figure 1.53).

Across all key States in India - electronic components, computers and peripheral equipment and communication equipment contribute to over 60% of the output of the electronics sector. However, sub-sector composition is similar throughout the state, there are huge differences in productivity. Compared to Karnataka and Tamil Nadu, Andhra Pradesh's productivity in computer peripherals and celectronic components is lower. In communication equipment, AP has the best productivity compared to all the competings states.Computer peripherals and equipment drives the sector with a productivity of ~eight times the other sub-sectors.

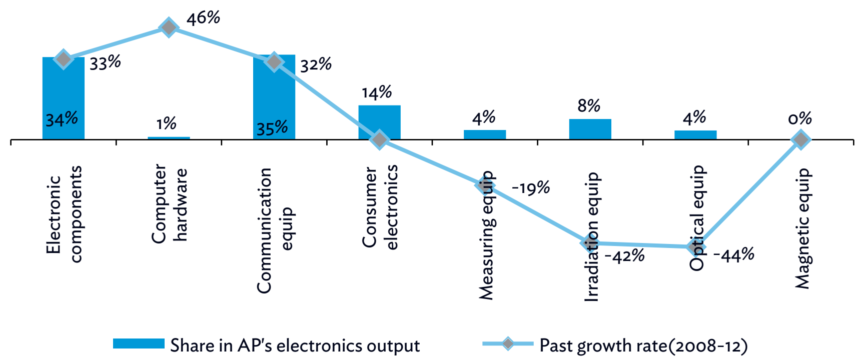
Figure 1.53: **Share in Andhra Pradesh's Electronics Output**



Source: ASI AP 2008-12.

25 Source: DEITY – National Electronics Policy 2012

Figure 1.54: **Comparison of Andhra Pradesh's Productivity in Selected Sub-Sectors with Competing States**



Source: ASI 2008-12.

Improving productivity in computer hardware may give a boost to AP's electronics output. Tamil Nadu is more than 10 times as productive than AP in computer peripherals and equipment sub-sector (Figure 1.54).

Key growth drivers for the sector

Until 1984, the CEO sector was primarily government-owned. The late 1980s witnessed a rapid growth of the electronics industry due to sweeping economic changes, resulting in the liberalization and globalization of the economy. The economic transformation was motivated by two compelling factors - the determination to boost economic growth, and the acceleration of the development of export-oriented industries, like the electronics industry. The electronics industry has recorded a very high growth in subsequent years. The easing of foreign investment restrictions, allowance of 100 percent foreign equity, reduction in custom tariffs, and de-licensing of several consumer electronic products attracted remarkable amount of foreign collaboration and investment. The domestic industry also responded favorably to the policies of the government. The opening of the electronics field to private sector enabled entrepreneurs to establish industries to meet demand.

Improvements in the electronics industry have not been limited to a particular segment, but encompass all its sectors. Strides have been made in the areas of commercial electronics, software, telecommunications, instrumentation, positioning and networking systems, and defense. The result has been a significant trade growth that began in the late 1990s.

Though all sub-segments grew at a CAGR of over 10%, CBE and EC grew at the highest CAGR – 24% and 22%, respectively, between 2008 and 2013. The largest sub-segment is CBE whose share has improved from 22% to 31% between 2008 and 2013 due to increasing mobile and broadband penetration in the country, and focus of the government on telecommunication infrastructure development. EC segment's contribution to the sector has increased to 15% in

2013 from 11% in 2007-08 on account of growing share of exports in low-end components and introduction of domestic high-end manufacturing (wafers, photovoltaic, and solar cells.)

Some of the key reasons for a spur in demand are:

- **Growth in population**
- **Growth in per-capita income and increased consumer spending for electronic products -** Electronic goods have become a necessary utility, hence, affordable. The quick rate of obsolescence in technology is making products cheaper and affordable for lower income groups as well.
- **Investment in infrastructure** - Average 37% of total annual expenditure by the Government of India has been dedicated to energy, transport and communication
- **Focus on innovative products at low cost** - India is a price-sensitive market; it has a substantial demand for cost-effective products. Products that meet basic requirements at penetration price points have good potential and can create a market
- **Increased spent on IT products** - With public and private sector in India adopting automation, the demand for IT equipment is increasing. Government of India has announced National e-governance Plan (estimated budget of more than US$9 billion). There are 31 mission mode projects being undertaken.

The Indian electronics industry offers a potential investment opportunity in various segments, which include telecommunications, consumer electronics, computer hardware and software, and medical electronic systems.

- *Consumer electronics* would be predominantly driven by digitization, higher disposable income, are availability of financing. Affordable products and retail chains are the future growth drivers for the segment. Growth in household spending would have spin off effects in Telecommunications and IT Hardware as well.
- *Communication and broadcast equipment* would be mainly driven by an increasing mobile penetration, entry-level mobile phones and an increasing rural subscriber base/ mobile penetration to B and C circles with mobile connections. Further, increasing number of wire line and wireless broadband (Broadband Wireless Access/WiMax as well as demand for Consumer Premises Equipment and Fibre to the Home are likely to drive demand in the long term).
- *Computer hardware* would be driven by increasing household spending on IT, education, as well as domestic IT demand by Indian companies especially in the small and medium businesses (SMB) segment, e-governance initiatives under the National e-Governance Programme (NEGP), IT based education in schools as well as growth of IT and ITES industry, growth in telecom infrastructure and awareness and affordability of technology will drive the market of computer hardware
- *Electronics components (EC)* and high-tech manufacturing: Wafer fabs, ATMPs, solar PV manufacturing, storage devices, displays, display panels and nano-technology products are the ones to drive the segment demand owning to industry's effort to shift to high-end products. In line with energy conservation measures, LED manufacturing is also likely to be a high-potential area. Increasing subscriber base, growth in rural mobile telephony, broadband penetration and connectivity are the major demand drivers
- *Strategic electronics* would be driven by sustained GDP growth and increasing defence spending.

Table 1.29: **List of Skills in the Computer Hardware Sub-sector**

Need Assessment
• Technical and business understanding of consumer requirements
Design
• Problem identification and quantification • Design analysis
Development
• Defining algorithm • Module definition • Software
Pre-Production
• Prototype assembly • Design for manufacturing • Material planning/Component selection
Production/testing
• Procurement • Assembly • Quality testing
Post-Production
• Logistics • Technical support
Sales/After sales
• Trouble shooting • Life cycle support services

Source: Study team analysis.

The above streams would have downstream effect on industrial electronics and components. Electronics manufacturing services and R&D-based exports will also be a major driver of growth in the industry. Increased value-added in these areas will further drive demand for production, sales and after sales support, which will increase demand for skilled human resources. For instance, Table 1.29 shows a list of skills required throughout the value chain in the computer hardware sub-sector.

Currently at the national level, 19%-21%[26] of the employee base has a skill level I (skills which are acquired with a short/modular and focussed intervention and thereby enhancing employability of those with minimal education). About 25%-27% of the employee base has a skill level II (skills which require technical training inputs, knowledge of complex operations

[26] Source: Human resource and skill requirements in Electronics and IT Hardware, NSDC

and machinery, skills of supervision). 49%-50% of the employee base has a skill level III (skills which require long drawn preparation as demonstrated by acquiring degrees and involve highly technical knowledge). 4%-5% of the employee base has a skill level IV (skills which are highly specialized involving research and design).

Metallurgy

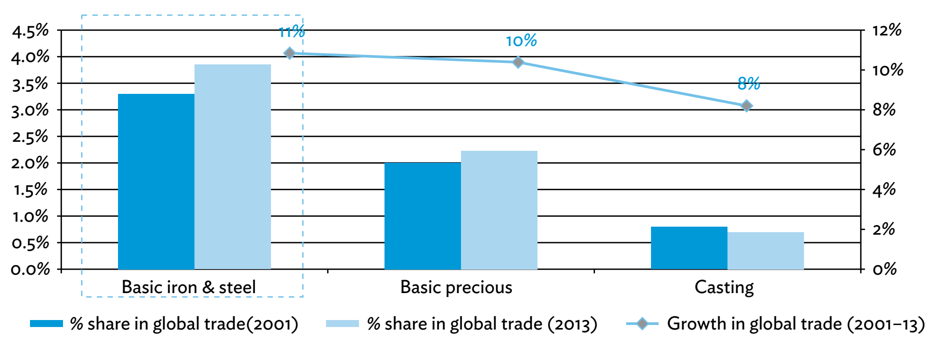
Global Scenario

Globally, metallurgy sector comprising iron & steel, aluminium, copper, nickel, lead, zinc, tin, silver and other basic metals, provides key inputs for a number of industries in the manufacturing sector.

The landscape of metallurgy sector has been changing over the past decades. While during early 70s, the production centers were primarily located at industrially advanced locations, recent years have shown significant shift of production centers to countries that have the mineral resource (iron ore, bauxite, coking coal) or are near to the mineral resource. In absence of sufficient resources in the vicinity, countering imported raw material price fluctuations by vertical integration (through acquisition of upstream assets) has been a key feature of the sectoral strategy. The second dominating factor for the structural shift has been because of energy prices. Being energy intensive industries, increasing energy prices along the west has also contributed to relocation/emergence of production centers along the less expensive destinations.

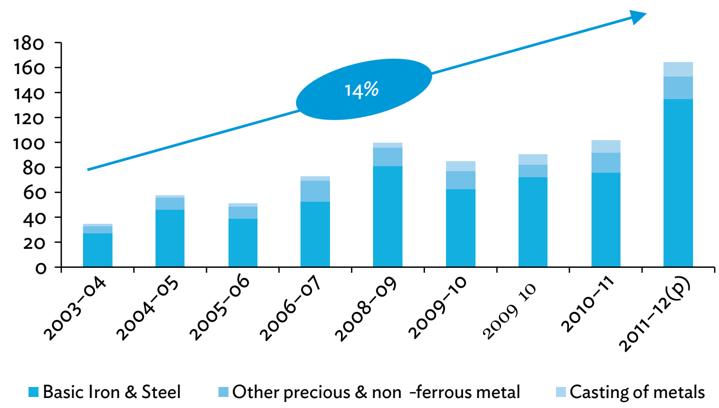
In 2012, at around US$855 billion, metallurgical sector constituted around 5% of global trade. The sectoral demand also drives the primary mining sector, which contributed about US$757 billion (around 4%) to global trade during the same period. Basic iron and steel has seen the highest growth in trade and also constitutes the major part of trade in metallurgy sector. It accounts to around 4% of the global trade across sectors. The sector has registered global trade growth over 8% across all the sub sectors (Figure 1.55).

Figure 1.55: **Contribution to Global Trade 2001-13, by Sector**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/; DEITY.

Figure 1.56: **Contribution of Sub-Sectors to Metallurgy Sector GDP**



Source: ASI 2008–12, Study team analysis.

India Scenario

In 2012, Indian metallurgy sector registered an output of around US$140 billion[27] and contributed to around 2% of the national GDP.[28] In terms of sub-sectoral contribution, Iron and Steel industry contributes to around 80% of the sectoral GDP. At constant prices, the sector has registered growth of around 14% CAGR between 2003-04 and 2011-12. The high growth rate has been primarily driven by iron and steel industry, which grew at 14.6% during the period (Figure 1.56).

However, between 2011-12 and 2013-14, India registered a slow growth rate in manufacturing sector as a whole, with 2.7%, and 1% growth rates in successive periods in 2012-13 and 2013-14. In line with national GDP and manufacturing GDP, the growth rates during these two years were expected to be around 1%. Going forward, the national demand for the sector is expected to grow between 6%-8% (Figure 1.57).[29]

Basic iron and steel sub-sector accounts for around 5% of India's exports across sectors. It has the highest contribution to this sector's exports. This sub-sector has high potential as it is expected to grow by 11% by 2020 (Figure 1.58).[30]

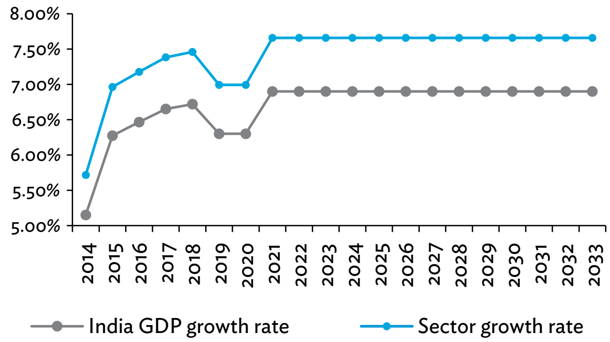
27 Exchange rate of 60 INR = 1 US$

28 Annual survey of industries data, MOSPI and Study Team analysis.

29 Based on long term India GDP projections by IMF and Standard chartered, and sectoral elasticity co-eff to GDP as indicated by Working group on Iron and Steel,2012

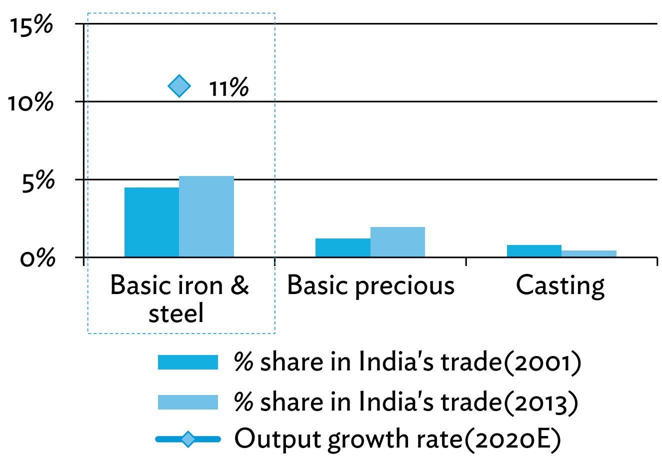
30 Draft National steel policy 2012

Figure 1.57: **Growth Rate of India's GDP vs. Metallurgy Sector**



Source: ASI data, Study team analysis.

Figure 1.58: **Contribution to India's Exports, 2001-13; Expected Output Growth Rate 2020, by Sub-Segment**

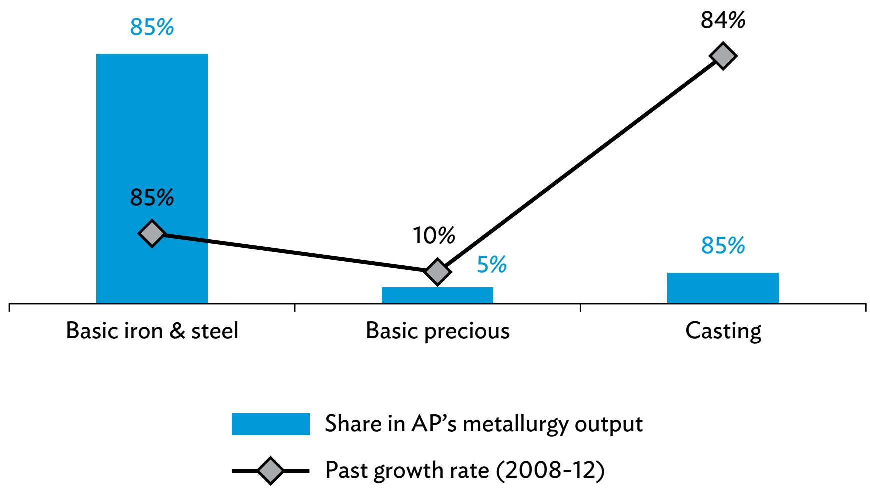


Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/; Draft National steel policy 2012.

State Scenario

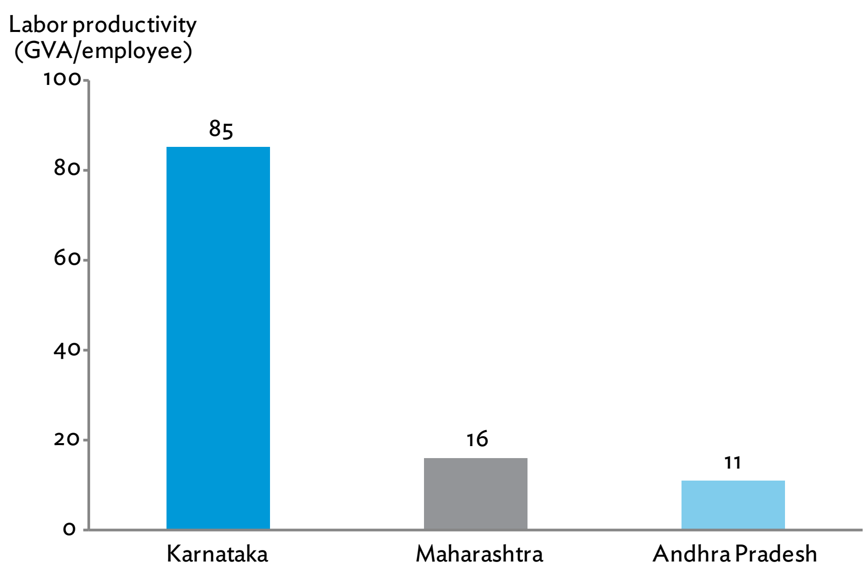
Contribution of Andhra Pradesh(AP) to country's basic iron and steel output is 7%. The output from the sector in AP has almost doubled in the past four years. Historically, basic iron and steel has been the major sub-sector in AP contributing around 85% to the state's total metallurgy output (Figure 1.59). In GVA, Karnataka is the leading state in metallurgy sector,

Figure 1.59: **Share in Andhra Pradesh's Metallurgy Output, by Sector (2011-12); Growth Rate (2008-12)**



Source: ASI 2008-12.

Figure 1.60: **Comparison of Andhra Pradesh's Productivity in Basic Iron and Steel**



Source: ASI 2008-12.

followed by Maharashtra. In basic iron and steel, Karnataka is the leading state followed by Maharashtra and AP (Figure 1.60). Compared to the leading states of Maharashtra and Karnataka, AP has lower productivity in the sub-sector which gives a scope for improvement.

Key growth drivers for the sector

The metallurgy sector output acts as feedstock or intermediate raw material for many of the end use industries like defence, aerospace, construction, machinery, electrical, packaging, and automobiles. Many of these key industries are present in the corridor. The key drivers of demand for the metallurgy sector are as highlighted below:

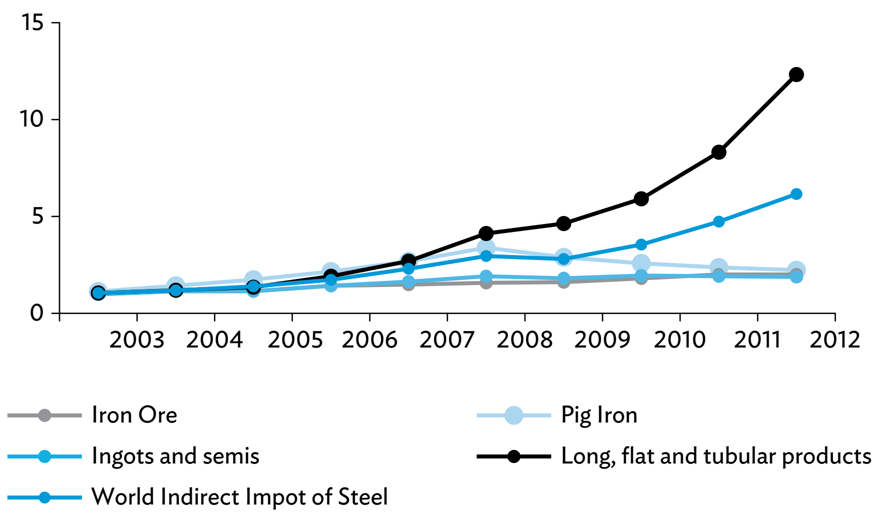
Increased consumption intensity

Given that most of the sectors like defence, aerospace, construction, machinery, electrical, packaging, and automobilescontribute to the sectoral demand in one way or the other; volume-wise the trends are likely to be in line with trade and GDP trends. Increased activity in power, infrastructure, transportation and FMCG segments are likely to drive up Iron & Steel and aluminium consumption in the country.

Increase in demand for exports

While three decades back, international trade would be usually skewed around upstream segment with ore as major commodity, trends are changing over the past decade. Along the value chain, demand for finished products is growing faster than any other segment along the value chain. For example, in Iron and steel industry- long, flat and tubular products like rod, rail, sheet, plate, and hot rolled coil are emerging as fast growing commodities of trade (Figure 1.61). Aluminim follows the same trend.

Figure 1.61: **Yearly Trade Volume of Iron and Steel Commodities Expressed as 'x' times of 2003 Trade Volume**



Source: World Steel Organisation, Study team analysis.

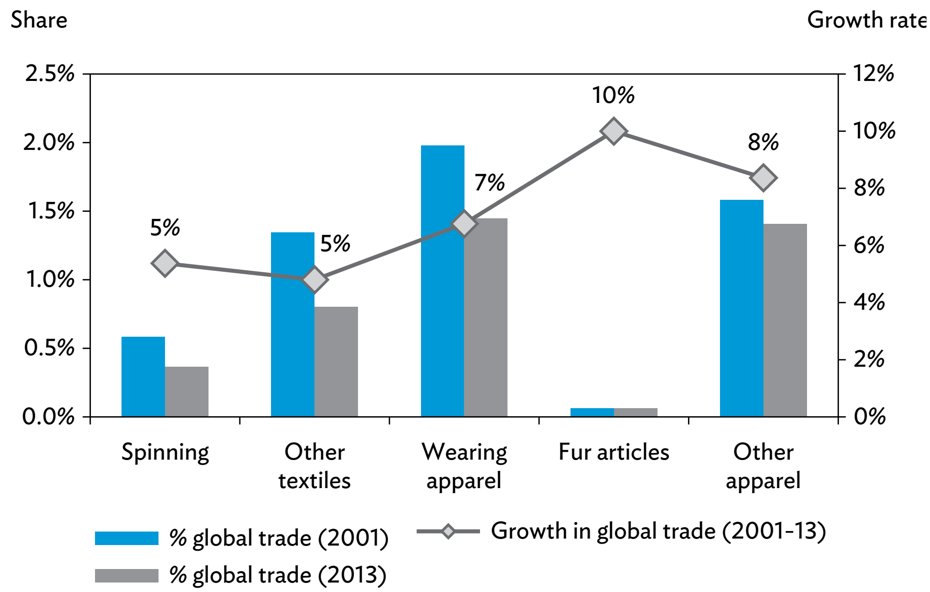
Textiles and Apparels (T&A)

Global Scenario

The world textile and apparel industry has transformed since the expiry of Multi-Fibre Arrangement in 2004, which governed the extent of textile trade between nations. The global T&A industry is estimated to be worth about US$4,395 billion. In the global T&A industry, textiles account for 60% of the market and apparel, the balance 40% of the market[31] and currently global trade in textiles and clothing stands at around US$700 bn. The US market is the largest, estimated to be growing at 5% per year, and in combination with the European Union (EU) nations, accounts for 64% of clothing consumption. Among other countries, Japan, Australia and New Zealand are significant consumers of textiles.[32] Consumption in the global apparel industry is highly concentrated in three main regions: the US, the EU, and Japan.

Apparels constitute the major share of exports in this sector. Trade in all the sub-sectors have grown at a rate of more than 5% in the last 12 years (Figure 1.62).

Figure 1.62: Contribution to Global Exports, 2001-13, by Sub-Segment



Source : http://www.intracen.org/itc/market-info-tools/trade-statistics/.

---

31 Source: IBEF

32 Source: Textile Industry Report by D&B Research

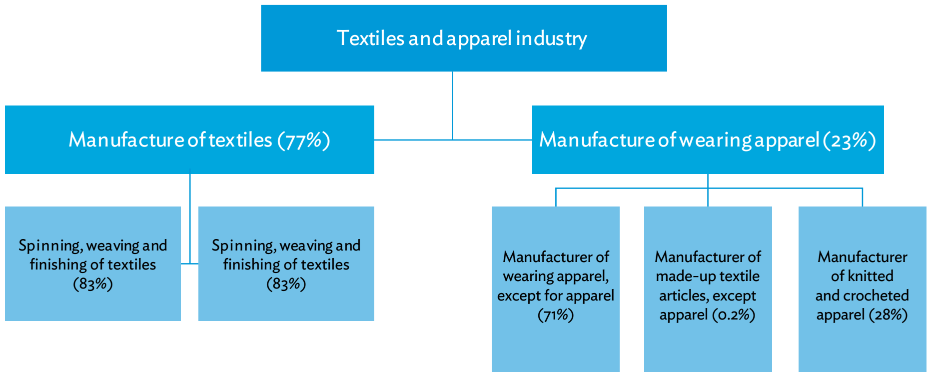
India Scenario

The Indian textile industry is one the largest and oldest sectors in the country and among the most important in the economy in terms of output, investment and employment. The T&A sector in India is valued at US$110 billion (2012).[33] The sector employs nearly 45 million people directly and 45 million people indirectly and after agriculture, it is the second highest employer in the country. Its importance is underlined by the fact that it accounts for around 4% GDP, 14% of industrial production, 9% of excise collections, 18% of employment in the industrial sector, 11% of the country's total exports earnings and 27% of foreign exchange inflows.

The textiles and apparel sector is traditionally divided into manufacture of textiles (77% of the sector) and manufacture of wearing apparel (23% of the sector). Manufacture of textiles sub-segment is further divided into spinning, weaving and finishing of textiles, which constitutes about 83% of the manufacture of textiles and manufacture of other textiles. Manufacturing of wearing apparel is constituted by manufacturing of wearing apparel, manufacturing of made-up textile articles, and manufacturing of knitted and crocheted apparel. Further segmentation in India is shown in Figure 1.63.

Technical textile[34] is an important part of the overall textile sector in India. Technical textile segment is emerging, with a huge potential to attract investment, create additional jobs and earn sizeable precious foreign exchange. Indian technical textiles segment employs 0.5 million technical people and 0.4 million non-technical people.[35] Global technical textile industry is estimated at US$135 billion, to which India contributed US$15 billion in 2012-13 (Figure 1.64).

Figure 1.63: **Composition of the Textiles and Apparels Sector**



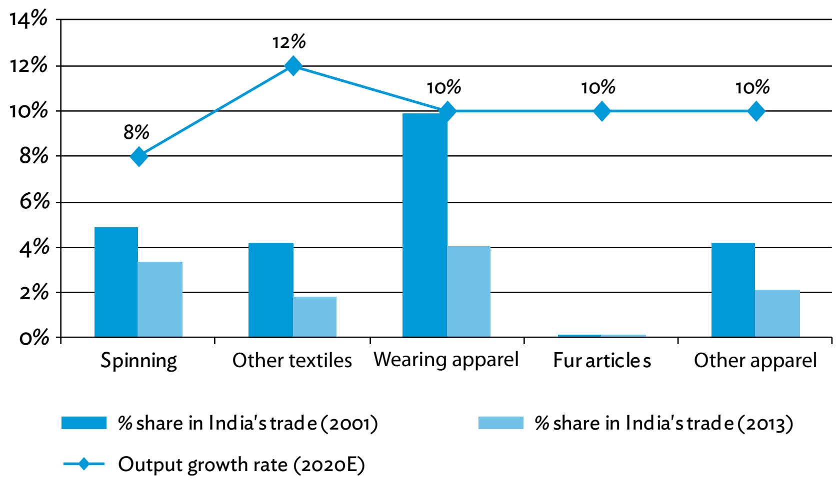
Source: Study team analysis.

33 Source: The Confederation of Indian Textile Industry (CITI).

34 Technical textiles are high performance textiles which find application in many other areas apart from clothing

35 Source: Baseline survey of the technical textile industry in India, Office of the Textile Commissioner

Figure 1.64: **Contribution to India's Exports, 2001-13; Expected Output Growth Rate 2020, by Sub-Segment**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/; Working Group on Textiles for Twelfth Five Year Plan.

The technical textiles can be classified into 12 major segments based on end use –agrotech, buildtech, clothtech, geotech, hometech, indutech, meditech, mobitech, oekotech, packtech, protech and sportech. Packtech is the largest segment with 33% share. Meditech, sportech, geotech and oekotech are smaller, but faster growing segments.

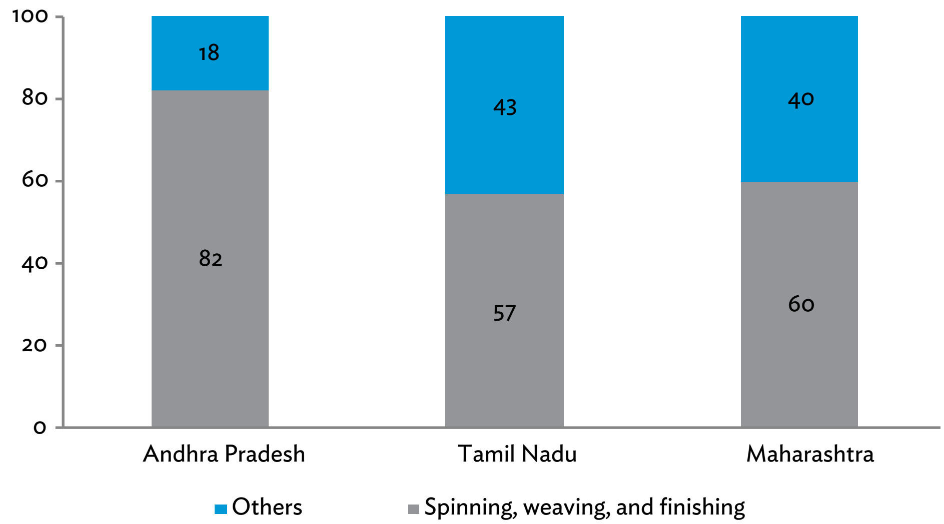
Textiles and apparels have a major share in India's exports. The sector has huge potential as all the sub-sectors are expected to grow at a rate over 8% by 2020.

State Scenario

Andhra Pradesh is one of the leading states in the textiles sector. The state secures 9% of all completed projects in T&A sector in the country. Over the past five years Textiles and Apparels (T&A) sector output has tripled in AP. About 30% of total T&A sector output is exported. In sync with the robust demand, the government has provided the necessary policy push and has developed many projects in the T&A sector. Spinning accounts to over 80% of the state's output in T&A. It has also shown a robust growth rate over 25% in the last 4 years. Apparel currently has a very low share in AP's T&A output (Figure 1.65).

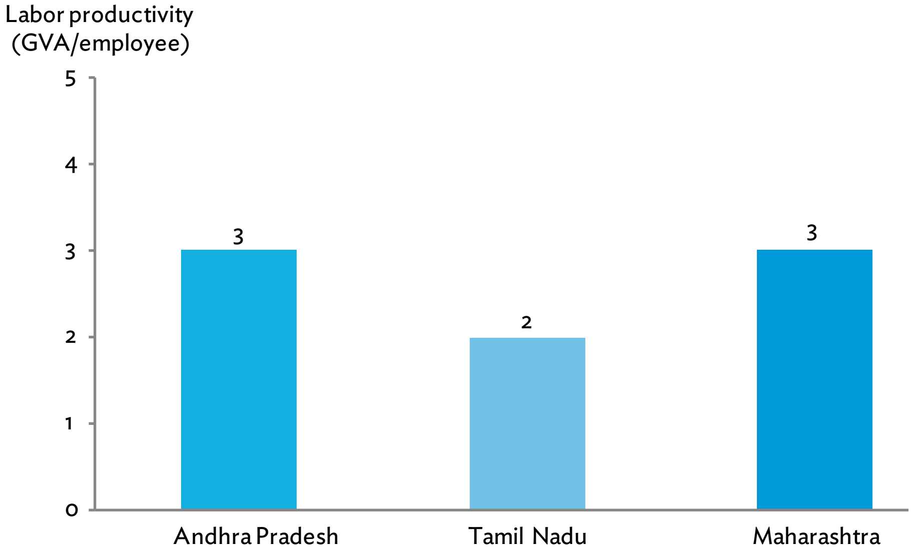
In terms of GVA, Tamil Nadu is the leading state in textile sector, followed by Maharashtra. The contribution of spinning, weaving and finishing of textiles to the GVA in these states, however, is lower than that in AP (Figure 1.66). Compared to the leading states of Tamil Nadu and Maharashtra, AP has competitive productivity in this sub-sector and has a competitive position at the national level.

Figure 1.65: **Share in State's Textile Output**



Source: ASI 2008-12.

Figure 1.66: **Comparison of Andhra Pradesh's Productivity in Spinning, Weaving, and Finishing of Textiles**



Source: ASI 2008-12.

Key growth drivers for the sector

With the growing demand in the global market for textiles, especially technical textiles and apparels, the sector in India is estimated to grow to US$220 billion by 2020.[36] During the twelfth Five Year Plan period, spinning, weaving and finishing of textiles is expected to grow at a CAGR of 8%; whereas the second component of textiles segment – other textiles – is estimated to grow at a CAGR of 12%. Manufacturing of wearing apparel is anticipated to grow at a CAGR of 10%.

India's textiles and apparel industry is one of the largest contributing sectors of India's exports worldwide. In terms of exports, it is among the top five global players, constantly expanding its share in world trade. India's exports of textiles and apparel is expected to grow to US$64 billion by 2017 and US$80 billion by 2020[37] from US$29 billion in 2011. During the year 2012-13, Readymade garments accounted for almost 39% of the total textiles exports. Apparel and cotton textiles products together contribute nearly 74% of the total textiles exports.[38] The USA and the EU account for about two-thirds of India's textiles exports. The other major export destinations are the PRC; UAE; Sri Lanka; Saudi Arabia; Republic of Korea; Bangladesh; Turkey; Pakistan; Brazil; Hong Kong, China; Canada; and Egypt.

The two-fold increase in global textile trade is also likely to drive India's exports growth. High growth of Indian exports is possible due to increased sourcing shift from developed countries to Asia. Additionally, India's strengths is a suitable alternative to the PRC for global buyers. India, in particular, is likely to benefit from the rising demand in the home textiles and apparels segment, wherein it has competitive edge against its neighbours like Bangladesh and Sri Lanka.

Some of the key reasons for a spur in demand are -

- Availability of raw material
- Availability of cheaper labor
- Increasing population and rising per capita income - in general, an increase in the population leads to greater demand for consumer products, particularly for fundamental necessities such as basic apparel. However, demand is more heavily influenced by per capita disposable income.
- Shift in preference to branded products is expected to boost the demand.
- Growth in the global textiles and apparel industry - Bangladesh, Vietnam, India, Cambodia, and Pakistan are especially expected to play key roles in the global textile industry, while exports from the PRC have been decreasing due to increased prices of raw materials and labor costs.
- Growth of new consumption markets
- Global expansion of modern retail business
- Boom of air and sea shipments
- Favorable trade policies

---

[36] IBEF (2012).

[37] Technopak.

[38] Government of India, Ministry of Textiles. *Note on Textiles and Clothing Exports of India.*

Based on the past trend of growth and estimated end user segment growth, the market size of technical textiles in India is projected to be US$36 billion[39] by 2016-17 with a growth rate of 20% per annum.

Some of the key reasons for a spur in demand for technical textiles are:

- *Growth of Industry Sectors* - various technical textile products are consumed by different industries like automotive, healthcare, infrastructure, and oil and petroleum. With increased investments in these industry sectors, higher consumption and growing exports, the industrial sector is poised for a considerable growth. This will further increase theconsumption of technical textiles.
- *Increasing Per Capita Income of Consumer* – the future growth in income is expected to increase riding on the back of a healthy growing economy. This rise will enable consumers to make more discretionary expenditure on technical textile products.
- *Increasing Adaptability Level/Acceptance of Products* - with growing awareness and income, consumers will realize, and be willing to pay for the superior functionality of technical textile products such as wipes, diapers, sanitary napkins, disposable sheets, and pads.
- Clothtech demand is driven by rising consumption of clothing and accessories
- Rising incomes and growing households to drive demand for hometech
- Rapid urbanization, rising working population, an increase in disposable income and increasing affordability of vehicles are drivers of demand for automobiles in the country and this will drive the mobitech segment.

Food Processing

Global Scenario

The global food processing industry was estimated to be US$3,200 billion in 2010.[40] The contribution of food processing sector to GDP is lowest for Japan at less than 3% and the highest for the PRC at around 25%. In India, the sector contributes to 9% of GDP and around 12% of manufacturing sector.

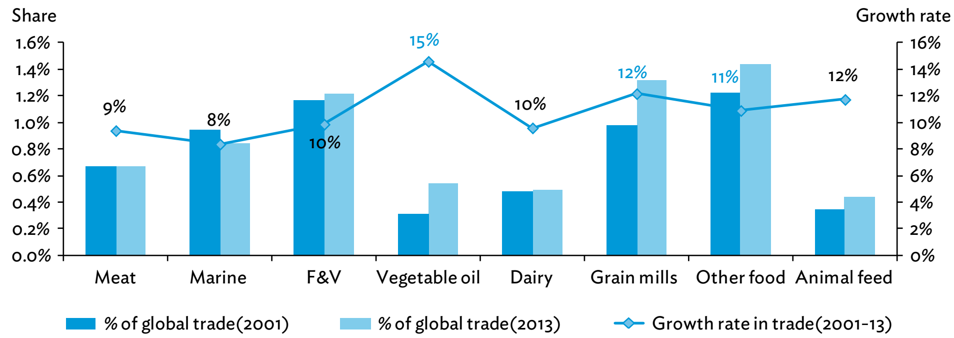
Across all regions, the major sub-sectors on the basis of demand are meat, poultry, fruits and vegetables and sugar. These sub-sectors contribute to more than 70% of the demand of food processing sector. The major regions that contribute to more than 60% of the global retail sales of processed foods are United States and the European Union. Currently, around 58% of produced food is consumed by developing countries. This is expected to increase to over 70% by 2050 supported by the fact that over 35% of the world's population currently lives in the PRC and India.

---

[39] Source: The Economic Times

[40] Gyan Research and Analytics Pvt. Ltd, 2012

Figure 1.67: **Contribution to Global Exports, 2001-13, by Sub-Segment**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics.

Food processing contributes to around 7% of the global exports. Fruits and vegetable processing, grain mill & starch, and other foods (ready to eat) are the key segments in this sector, contributing to ~4% of global exports. Vegetable oil, grain mill & starch, animal feeds, other foods and fruit & vegetable processing segments have shown growth rates above 10%. Share of grain mill & starch, vegetable oil and other foods have shown considerable increase in global exports. Share in trade has shown an increasing trend for all the sub-sectors (except marine) (Figure 1.67).

India Scenario

Food processing industry is one of the largest industries in India and is estimated to be worth US$121 billion in 2012 and accounts for 32% of country's total food market[41]. With a huge agriculture sector, abundant livestock, and cost competitiveness, India is fast emerging as a sourcing hub for processed food. Around 90% of the output of food processing sector is contributed by four sub-sectors - vegetable oil, grain mill and starch, dairy and other food products. Output of the sector has increased from over US$62 billion in 2008-09 to over US$90 billion in 2010-11[42] and is expected to grow at a CAGR of approximately 10% till 2015[43].

One of the major constraints of the food processing industry is the low level of processing in India vis-a-vis other countries. (Table 1.30)

41 D&B Research

42 Annual Survey of Industries (Conversion 1US$= 60 Rupees)

43 D&B Research

Table 1.30: **Percentage of Food Processed in India vis-a-vis in Developed Countries - 2010**

Segment	India	Developed countries
Fruits and Vegetables	2.2%	65%
Marine	27%	60%
Poultry	6%	NA
Meat	20%	70%

Source: Emerging Markets Insight.

The rate at which sub-sectors are expected to grow over the next few years is as shown in Table 1.31.

Table 1.31: **Projected Growth Rates – Food Processing, by Sub-Sector**

Segment	Growth rate
Marine	4%
Fruits and vegetables	6%
Vegetable oil	5%
Dairy	8%
Grain mill and starch*	10%

* Average growth rate of food processing sector

Source: D&B Research, ASSOCHAM, Feedback consulting.

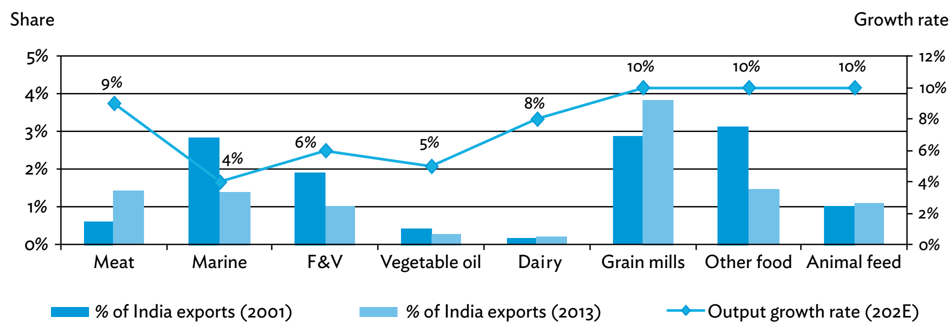
The Ministry of Food Processing Industries (MOFPI) has formulated a Vision 2015 Action Plan that includes trebling the size of the food processing industry, raising the level of processing of perishables from 6% to 20%, increasing value-added from 20% to 35%, and enhancing India's share in global food trade from 1.5% to 3 %.

The food processing sector in India has been witnessing a strong growth with a CAGR of 20%. While fruits and vegetable processing have a significant share in India's trade, the share has gone down by more than half in the last 12 years. In addition, it contributes to approximately 4% of India's food processing output. Share of grain mill & starch in trade has shown a growing trend and it also has a projected output growth of 10%. Other food is also expected to grow at a rate of 10% by 2020 (Figure 1.68).

State Scenario

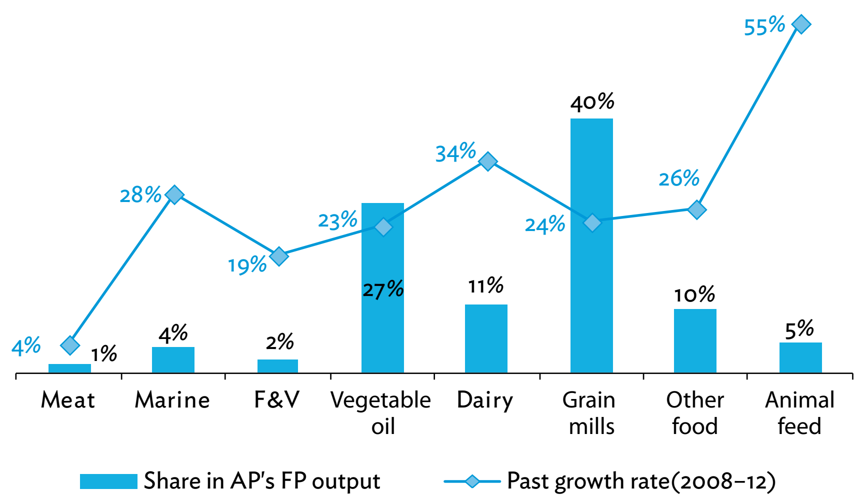
Andhra Pradesh's contribution to the country's output in food processing has increased from 11% in 2008-09 to 13% in 2010-11. Grain mill & starch, vegetable oil, dairy and other food products are the key segments, contributing to 88% of output. Barring meat processing, all other segments have shown very high growth rates in the past (Figure 1.69).

Figure 1.68: **Contribution to India's Exports, 2001-13; Expected Output Growth Rate 2020, by Sub-Segment**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics.

Figure 1.69: **Share in Andhra Pradesh's Food Processing Output (2011-12); Growth Rate (2008-12), by Sector**

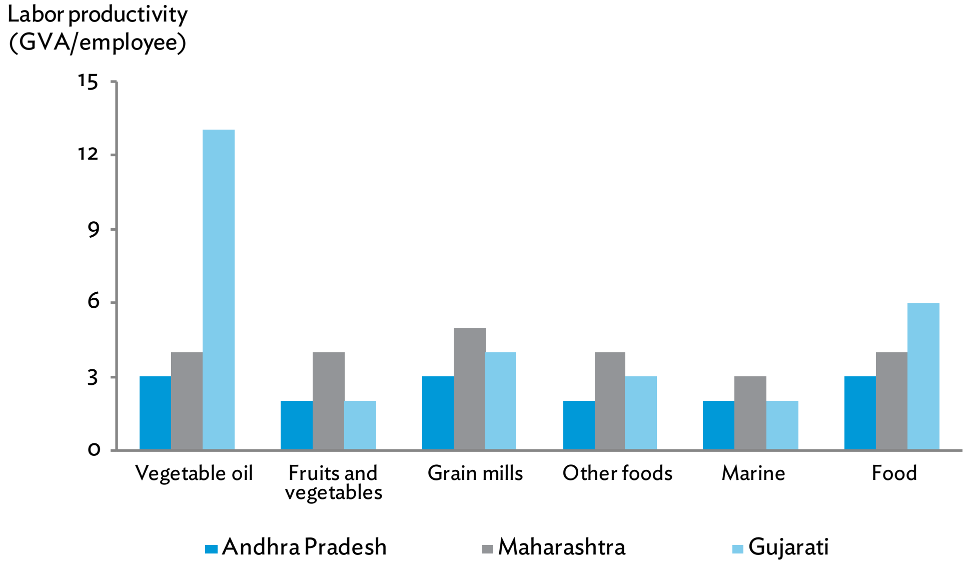


Source: ASI 2008-12.

Andhra Pradesh is the leading state in marine (by GVA) in the country.

Lower productivity compared to the major competing states is an issue across all subsectors in the state. Vegetable oil emerges as the key sub-sector productivity wise. Compared to the leading states of Maharashtra and Gujarat, AP is almost half as productive across all sub-sectors (Figure 1.70).

Figure 1.70: **Comparison of Andhra Pradesh's Productivity in Food Processing, by Sub-Segment**



Source: ASI 2008-12.

Key growth drivers for the sector

A number of growth drivers are fuelling the processed food sector in India. These include:

- **Increasing disposable incomes, rapid urbanisation and changing eating habits**
  - Increasing demand for functional food coupled with awareness about healthy/ nutritional foods has increased spending on health foods. Further, changing lifestyles has resulted in willingness to pay premium prices for quality products
- **Policy drivers**
  - Government of India has been promoting the concept of Mega Food Parks and is anticipated to set up 50 such parks across the country by the end of 12th Five Year Plan, to attract FDIs
  - Low entry barriers
  - Various tax incentives and policy initiatives taken by the government to increase the share of India processed food industry in the global market has encouraged entrepreneurs to set up food processing units, specially export oriented units
- **Availability of resources -** India has numerous advantages like availability of abundant raw materials, skilled workforce and low labor costs. Currently at the national level, 80%-81%[44] of the employee base is at skill level I, 9%-10% at skill level II, 8%-9% at skill level III and 1%-2% at skill level IV. The food processing value chain can be generally

[44] Source: Human resource and skill requirements in food processing sector, NSDC

defined in five steps – farm inputs, trade and distribution, processing, wholesale trade and food retail and food service.

- **Increasing investments in support infrastructure** – Investments have been increasing in development of infrastructure like cold chain facilities and transportation
- **India emerging as a procurement hub** - India is gradually emerging as a procurement hub for agri related produce. There has been a gradual but significant improvement in product and packaging quality over a period of time, which has infused greater confidence in the importing nations for Indian products

Pharmaceuticals

Global Scenario

Major scientific and technological advances, coupled with socio-demographic changes, increasing demand for medicines and trade liberalisation are the major factors which will drive the pharmaceuticals industry globally. The global pharmaceutical market is expected to be worth nearly $1.6 trillion by 2020.[45] With changing demographic dynamics and demand, the market is expected to shift to emerging economies. Growth markets are expected to contribute to over 30%of the global market size compared to the current share of 18%.[46] Also by 2020, the financial and intellectual investment of the last 10 years should be starting to yield big rewards.

In 2011, the global pharmaceutical market was worth $1.08 trillion[47] and was growing steadily at a rate of 7.8% year-on-year.[48] The growth in mature economies has plateaued but the growth economies are another matter. Sales in BRIC countries rose by 22.6%.[49] As the average age of the population is set to grow in the next 10 years, the demand for pharmaceutical industry will grow significantly. All the emerging economies are also focussing on improving access to healthcare through various government policies and schemes.

Pharmaceutical sector contributes to about 3% of global trade, growing at a CAGR of 13% during 2001-13. Share in India's exports have grown to 3.5%, at a CAGR of 22% (Figure 1.71).

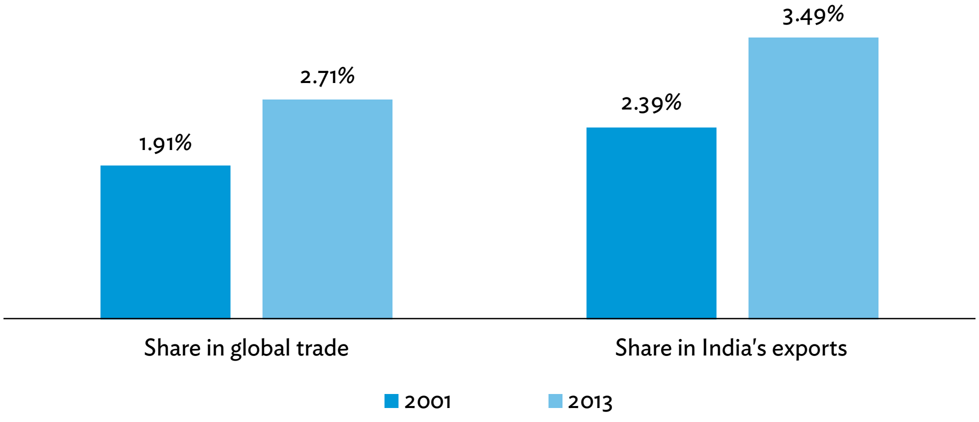
India Scenario

Indian pharmaceutical sector is estimated at approximately US$18 billion (INR 990 billion) in FY 2012.[50] The sector registered a compounded growth of about 14% during the period FY 2008-12. Indian pharma industry is expected to grow at CAGR of approximately 15% over the period FY 2012-23 to reach US$133 billion by 2023.[51] In terms of domestic and export market, the export market is expected to grow at much faster rate (CAGR of about 18-20%) than the

---

45 Source: PwC- From vision to decision – Pharma 2020
46 Source: PwC- From vision to decision – Pharma 2020
47 Source: PwC- From vision to decision – Pharma 2020
48 Source: PwC- From vision to decision – Pharma 2020
49 Source: PwC- From vision to decision – Pharma 2020
50 Sectoral Risk Outlook: Pharmaceutical sector, D&B, 2012
51 Growth projections as per Department of Pharmaceuticals, Govt. of India; Study team analysis

Figure 1.71: **Contribution to Global and India's Exports, 2001-13**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/; Annual report of Department of Pharmaceuticals 2013.

domestic market (CAGR about 12-15%). Exports are increasing due to greater acceptance of generic drugs worldwide combined with a larger number of drugs going off-patent and increasing Indian Abbreviated New Drug Application (ANDA) filings. Therefore, by 2015, the share of exports to total pharma turnover is expected to exceed the domestic market sale. The developed markets of USA and UK are the major markets for exports contributing approximately 28% of the total exports made. During the fiscal 2012, India exported approximately INR 633 billion worth of drugs & pharmaceuticals. This shows the ability of Indian pharmaceutical firms to meet the stringent quality norms of the western markets.

A key development in the past five years has been the industry's change in geographic focus, as global players have sought to offset sluggish growth within their traditional markets. To that end, emerging economies like the PRC, India, Russia, Eastern Europe, South America and the Middle East have become major growth markets for the industry. Growth in these emerging regions has been underpinned by greater government investment in healthcare, increasing demand for drugs to treat diseases and strengthening regulatory and intellectual property requirements. In addition, many companies have set up research facilities in these countries to lower costs. This shift signals the end of the industry's traditional dominance by countries like the United States, Europe and Japan. Amongst emerging economies, India is touted as one of the most attractive destination for pharmaceuticals manufacturing.

The Indian pharmaceuticals sector is subdivided into three major categories: Active Pharmaceutical Ingredients (API), Formulations and Contract Research and Manufacturing Services (CRAMS). Currently, API accounts for ~55% of the total market followed by formulations (32%) and CRAMS (12%).[52] With the demand for generics increasing in the foreseeable future, the API market is set to increase further. The high number of USFDA

[52] Sectoral Risk Outlook: Pharmaceutical sector, D&B, 2012

and UKMHRA approved plants (200+) in India, availability of talent pool and low R&D and production costs are pushing the CRAMS market, which includes contract manufacturing (CMO) and contract research (CRO).

State Scenario

Andhra Pradesh is one of the leading states (by GVA) in the pharmaceuticals sectors, ranked next to Maharashtra (Figure 1.72). AP has a strong lineage for API manufacturing and significant investments are also lined up in the state for the APIs. Pharmaceutical sector has grown at a CAGR of 25 % in the state. AP's productivity in pharmaceuticals is also competitive. Being traditionally strong in pharmaceutical manufacturing in India, AP has the potential to be the leading state in this sector. Strength lies in its strong pool of highly skilled resources, established pharma organizations like IDPL and strong R&D centers and reputed institutions like IICT, CCMB, CDFD, and NIN. The value chain of pharmaceuticals sector is defined in Table 1.32.

Currently at a national level, 20%-25%[53] of the employee base is at skill level I, 25%-30% at skill level II, 44%-45% at skill level III, and 5%-6% at skill level IV.

Key growth drivers for the sector

India's strong GDP growth, higher life expectancy, growing population, rising disposable income, improving literacy, under-penetrated market, cost advantage and higher penetration of health insurance are some of the important factors driving the pharmaceutical industry in India (Figure 1.73).

Figure 1.72: **Comparison of Andhra Pradesh's Productivity in Pharmaceuticals, Medicinal, Chemical, and Botanical Products**

Source: ASI 2008-12.

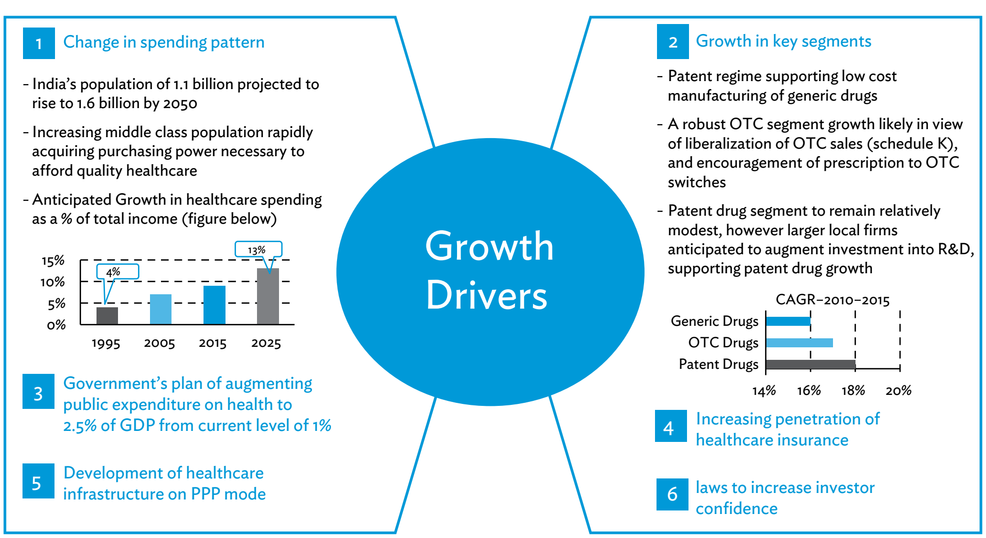
[53] Source: Human resource and skill requirements for chemicals and petrochemicals, NSDC; The numbers are for chemicals and pharmaceuticals sector

Table 1.32: **Value Chain of Pharmaceuticals Sector**

Research
• Clinical research • Formulations • Management and regulatory affairs
Production and Quality Control
• Project management • Maintenance • Plant management
Data Analysis
• Bio-statistic analysis • Sales data analysis
Purchase/logistics/supply chain
• Vendor development • Material management • Purchase management
Medical assistance
• Medical consulting to internal team • Interaction with doctors
Sales and marketing
• Brand building • Direct marketing • Market research

Source: Study team analysis.

Figure 1.73: **Demand Drivers for India's Pharmaceutical Industry**



Source: PwC "From vision to decision – Pharma 2020"; Sectoral Risk Outlook: Pharmaceutical sector, D&B, 2012.

India's large talent pool of trained chemists possesses strong technical capabilities to manufacture products with exceptional quality standards. India has credit of having the largest number of US FDA approved facilities outside the US. In addition, increasing number of Indian pharma companies have been getting international regulatory approvals for their plants from agencies like MHRA (UK), MCC (South Africa), TGA (Australia), MCC (South Africa).

Japanese Government decision to replace the expensive patented drugs with cheaper generic versions comes as a shot in the arm for the Indian pharma segment. To enable this, Japan has signed a free trade agreement with India to ensure smooth supply of API/bulk drugs from various API suppliers. This move is expected to boost the exports of the API to the world's 2nd largest pharmaceutical market.

According to Pharmexcil, pharmaceutical production costs are almost 50% lower in India when compared with developed countries.[54] This enables Indian Pharmaceutical Companies to offer low cost drugs that are 5% - 50% lower when compared with the developed nations. As a result of India's growing compliance with internationally harmonized standards such as Good Laboratory Practices (GLP), Current Good Manufacturing Practices (CGMP), and Good Clinical Practices (GCP), the country is emerging as one of the most-favored destinations for collaborative R&D for bioinformatics and CRAMS.

Chemical and petrochemicals

Global Scenario

Globally, the chemicals industry is seeing a marked shift in geographical terms, with manufacturing moving closer to the end use markets of Asia. With the gradual off-shoring of end-use industries for chemicals & petrochemicals like textiles, auto and auto components, and electronics to the Middle East and Asia, the manufacturers have shown there keen interests in expanding their presence in these markets. This also gets supported by the lower manufacturing and logistics costs in these regions. Within Asia, the PRC and India are emerging as dominant destinations, owing to a large domestic consumer base. The existing plants in European and South Korean markets are expected to become the global pressure points for plant closures, owing to lower competitiveness against peer set-ups in Asian and Middle East economies.[55] India currently has a huge opportunity to attract these international majors in chemicals manufacturing.

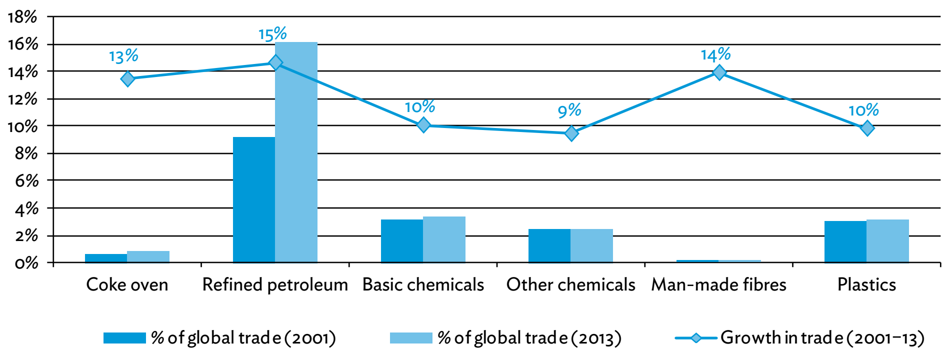
By 2030, Asia will account for 66% of the global chemical sales. Currently, chemicals and Petrochemicals account to around 26% of the total global exports across all sectors. Refined petroleum products is the largest segment with around 16% share in global trade. Basic chemicals and plastics are other key segments (approximately 7% combined). Most of the segments have grown about 10-15% rate in terms of exports (2001-13) (Figure 1.74).

---

54 Sectoral Risk Outlook: Pharmaceutical sector, D&B, 2012

55 The Future of European Chemical Industry, KPMG International

Figure 1.74: **Contribution to Global Trade and Exports Growth Rate, 2001-13, by Sub-Segment**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/.

India Scenario

The Indian chemicals and petrochemicals sector grew from US$62 billion in 2009 to ~US$94 billion in 2013 at a CAGR of 11%, and is expected to reach US$195 billion by 2023, growing at a CAGR of about 10-12%.[56] The chemical and petrochemical sector presently constitutes around 14% of the domestic industrial activity. Indian chemicals & petrochemicals sector is expected to increase its share in the global market to approximately 5% from its current 3% contribution.

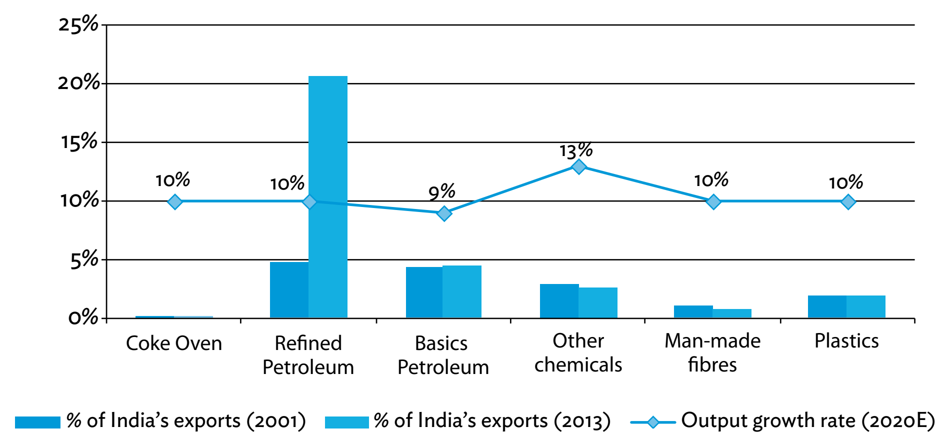
Currently, C&P sector is contributing to 30% of India's exports (2013), with refined petroleum products at 20.6% share of total C&P exports. All sub-segments have shown very high growth rate in exports growth, with refined petroleum products, plastics, basic chemicals and other chemicals growing above 10% (Figure 1.75). Chemicals and petrochemicals is a potential sector at the national level as all sub-sectors show an expected output growth rate of >10%.

State Scenario

Andhra Pradesh's contribution to India's chemical and petrochemicals output has been comparatively lower at around 5–6% in the last 4 years. The state is also attractive for sub-segments like refined petroleum products, basic chemicals and plastics due to strong availability of skilled workforce, as required in R&D for certain segments like specialty & knowledge chemicals, owing to the presence of reputable institution.

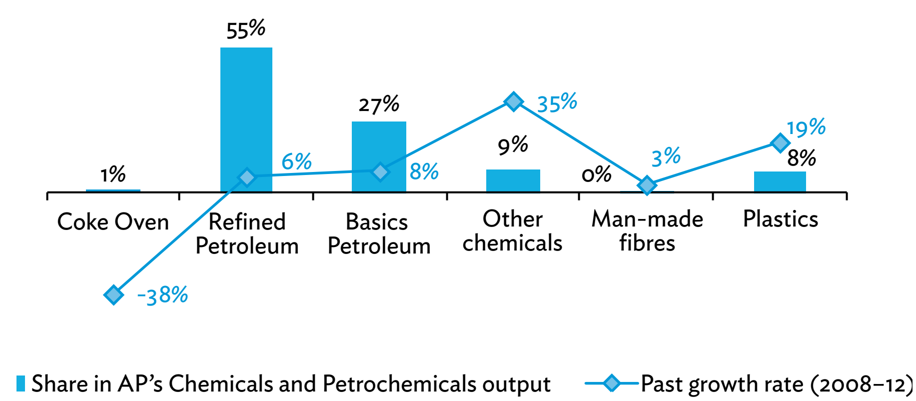
[56] Department of Chemicals and Petro-Chemicals, GoI

Figure 1.75: **Contribution to India's Exports, 2001-13**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/; Annual report of Department of Chemicals and Petro-Chemicals, GoI.

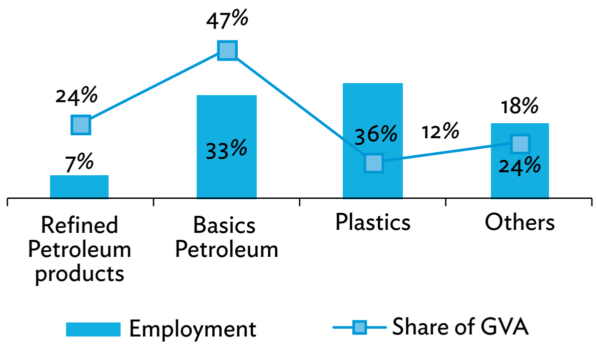
Figure 1.76: **Share in Andhra Pradesh's Chemicals and Petrochemicals Output (2011-12) and Growth Rate, by Sector**



Source: ASI 2008-12.

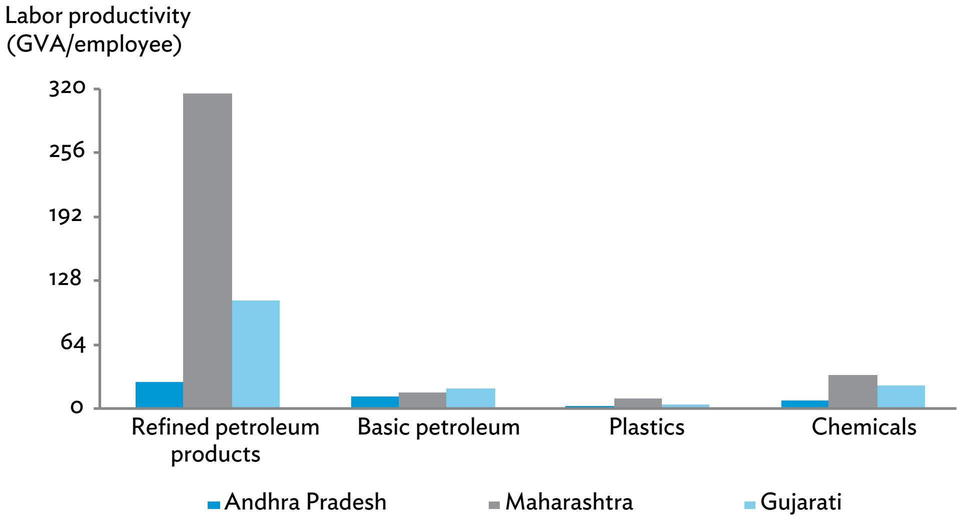
Refined petroleum, basic chemicals and plastics together account to around 90% of the states' C&P output. Plastics though have a comparatively lower share in the composition, but have been showing a robust growth rate of almost 20% in the last 4 years (Figure 1.76).

Figure 1.77: **Employment and GVA Share of Shortlisted Sub-Sectors**



Source: ASI 2008-12.

Figure 1.78: **Comparison of Andhra Pradesh's Productivity in Selected Sub-Sectors**



Source: ASI AP 2008-12.

Refined petroleum products contribute to around 24% of the states C&P GVA but employs only around 7% of the total employment base in C&P (Figure 1.77). This sub-sector is driving the productivity and output across all leading states in chemicals and petrochemicals. AP has a huge scope for improvement of productivity in this sub-sector and thus increases output and GVA. AP has comparatively lower productivity in all the selected sub-sectors and presents a scope for improvement (Figure 1.78).

Key growth drivers for the sector

The chemicals & petrochemicals sector output acts as feedstock or intermediate raw material for many of the end use industries like pharmaceuticals, auto and auto components, paints, infrastructure, food processing, glass industry, and urban asset management. The key driver for the chemical industry as a whole is the end use industry segment, which is a direct outcome of increased consumption and population across the globe. Chemicals & petrochemicals act as an intermediate raw material for most of the end use products, ranging from food additives to electronics and automotive. Many of these key industries are present in the corridor. Therefore, different set of end-use industries act as drivers for the different segments under the chemicals & petrochemicals sector.

The key drivers of demand for the chemicals and petrochemicals sector are as highlighted below:

Increased consumption intensity

Compared to the developed world (the US, Europe) or the PRC, the current penetration of specialty chemicals within India's end markets is low. With an increased focus on improving products, usage intensity of specialty chemicals within these end markets will rise in India over the next decade. For example, India's current expenditure on admixtures is only US$1/ m3 of concrete, compared to USD2/ m3 in the PRC and US$4.5/ m3 in USA. With increasing demand for higher quality construction and increasing awareness of concrete admixture benefits, the industry could double the intensity of admixture consumption in India. Similarly, the usage of pesticides in India is 0.58 kg/ha compared to 2 kg/ha in the PRC, 10.8 kg/ha in Japan, 16.5 kg/ha in South Korea and global average of 3 kg/ha.[57]

Increase in demand for exports

India's chemical sector is well poised for a strong growth in exports in certain value added segments like petrochemicals, specialty chemicals, pharmaceuticals and agrochemicals. India maintains its position as a net naphtha exporter. With the development of PCPIRs in the country, the value added segments like specialty chemicals, petrochemicals and knowledge chemicals will experience a very strong surge in exports.

Improved consumption standards

Consumption standards are policies implemented by the government to promote the safe use of products. Most developed countries (e.g. the US, Germany) have implemented stringent consumption standards across various end-use markets. As the economy develops, India will need to regulate products more stringently, and strengthen consumption standards, which in turn will promote increased usage of specialty chemicals. This would also result in phasing out of obsolete technologies and will pave the way for new technologies in the country. This would eventually result in fresh investments and therefore a strong push for the sector.

[57] Knowledge paper titled "Emerging India: Sustainable Growth of the Chemical Sector" by TSMG, 2012

Auto and auto components

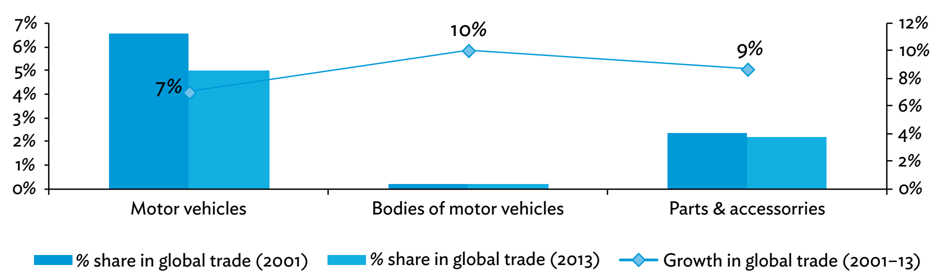
Global Scenario

The global auto industry is in the midst of dramatic growth and change. Although annual vehicle sales inthe world's mature auto markets have mostly stabilized, a newset of emerging markets—with larger and younger populations,rapidly growing economies, and low vehicle-ownership rates—have become the engine for growth. In 2010, the PRC, India, Brazil and Eastern Europe accounted for more than 50%[58] of the 73.2 million[59] light vehicles sold globally.

To serve these markets, automakers are beginning to set up local production, tailor vehicles to the needs of local consumers, and increase sales, market share, and profits in the emerging markets. This opportunity is expected to push sales to more than 1 billion[60] light vehicles worldwide between 2010 and 2020. That would be the highest growth in a span of 10-years throughout history.

Globally auto industry is showing positive growth after recovering from the economic crisis of 2009. In 2012, the industry grew by 5.2%. The BRIC countries are expected to grow at a much faster rate in this sector than the western countries in the near future. Globally Asia is the largest market for the sale of passenger vehicles, which is majorly driven by the PRC and India. Motor vehicles have a major share in total global exports across all sectors. All the sub-sectors have shown a modest growth rate (7%-10%) in the last 12 years (Figure 1.79).

Figure 1.79: **Contribution to Global Exports and Exports Growth, 2001–13, by Sub-Segment**



Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/.

58 Source: Standard & Poor - The Global Auto Industry Shifts Its Focus To Overseas And Emerging Markets
59 Source: Standard & Poor - The Global Auto Industry Shifts Its Focus To Overseas And Emerging Markets
60 Source: Standard & Poor - The Global Auto Industry Shifts Its Focus To Overseas And Emerging Markets

India Scenario

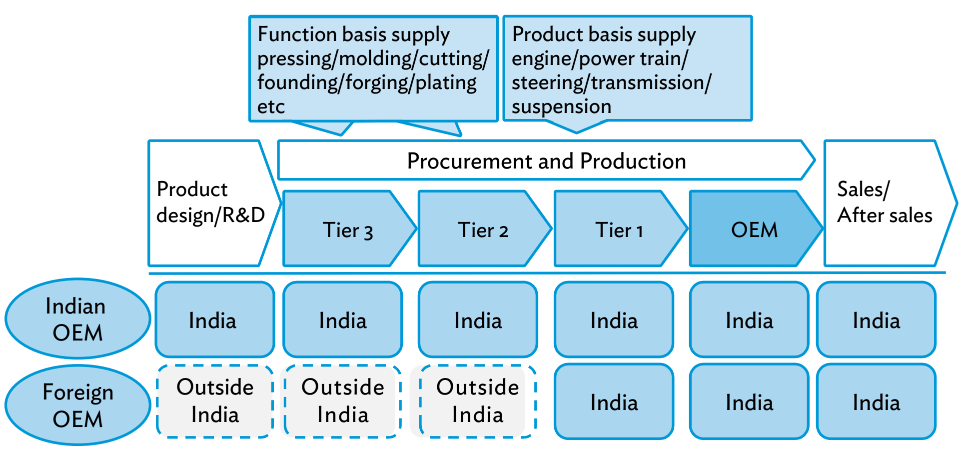
Auto sector's basic value chain is - R&D, Procurement and Production and Sales. Currently, for most of the countries, R&D is integrated with the global value chain and is yet to shift to India at a large scale. However, companies do have their procurement and production and sales part of the value chain in India.

The production part of this sector is a bit complicated. Automobiles comprise of a large number of components which can be defined by layers. Usually it is defined in 4 layers – OEM (assembler)/ Tier 1 /Tier 2/Tier3. OEM assembles main components and Tier 1 supplies main components to OEM including engine/power train/ steering/ transmission/ suspension. Downstream suppliers (Tier 2/Tier3) provide components to upstream suppliers and their role is usually defined based on each function (pressing /moulding /cutting /founding /forging /plating)

In Indian OEMs (e.g. Tata/Mahindra/Ashok Leyland/Hindustan motors) all the functions starting from Tier 3 to assembly is mostly competed in India (In certain cases components are imported but mostly these companies use domestic products) (Figure 1.80).

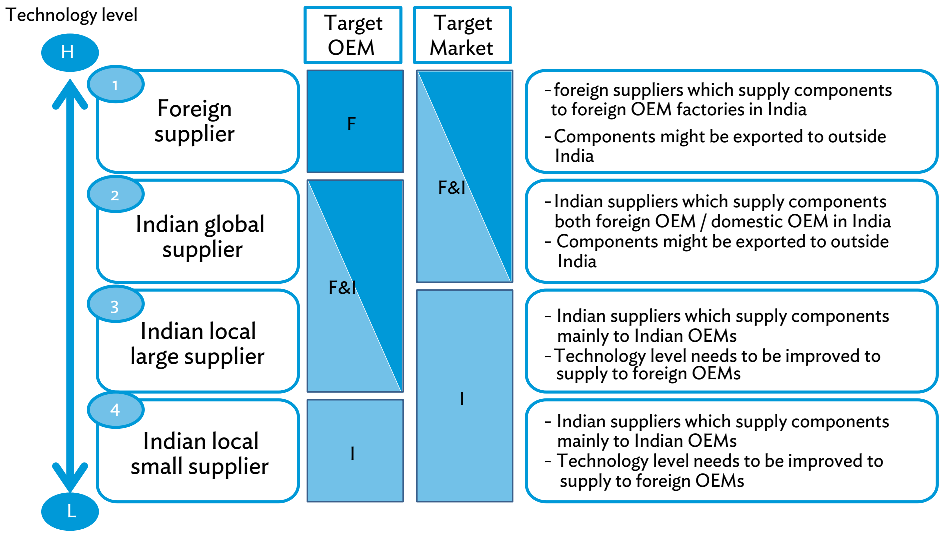
For example, Japanese OEMs have their Tier-1 suppliers in India who supply components from factories adjacent to OEM's assembly base. On the other hand, Tier-2 and Tier-3 suppliers have yet not been set up in India. In most of the cases, they are producing components outside India – for example Japan or Thailand. The components produced outside India are shipped to tier-1 suppliers in India.

Figure 1.80: **Presence of India Across the Value Chain of OEM Manufacturing**



Source: Study team analysis.

Figure 1.81: **Types of Suppliers by OEMs**



Source: Study team analysis.

In case of Indian suppliers, there are various types of suppliers based on the type of OEMs (since requirement standards are different for Indian local OEM and foreign OEM as seen in Figure 1.81).

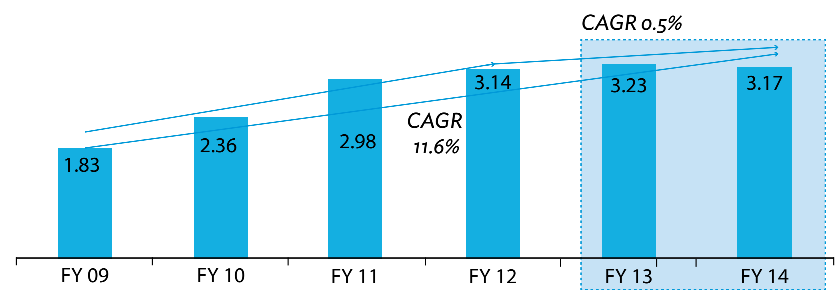
Foreign Supplier - Currently foreign OEMs are supplied mainly from foreign OEMs. These suppliers concentrate on the local market, but export components. (e.g., Yorozu/Kokusan denki)

Indian Global Supplier - Certain well skilled local suppliers supply components to global OEMs as well as local OEMs. They might also export components. (e.g., Amtek/Bharat)

Indian local large supplier/ Indian local small supplier – These players do not focus on exports. They supply components to Indian OEMs. Their capacity needs to be enhanced in order to be included in the value chain of global OEMs. As of now, the quality standards of these suppliers are generally not acceptable for global OEMs.

Production of Indian automobile industry has been growing rapidly for the last several years. Production of passenger vehicles grew rapidly at a CAGR of 19.5% between FY 09 and FY12, as shown in the graph below. In contrast with the rapid growth up to FY12, growth of production has damped in the past two years due to economic down turn. Between FY12 and FY14, CAGR was only 0.5 % (Figure 1.82).

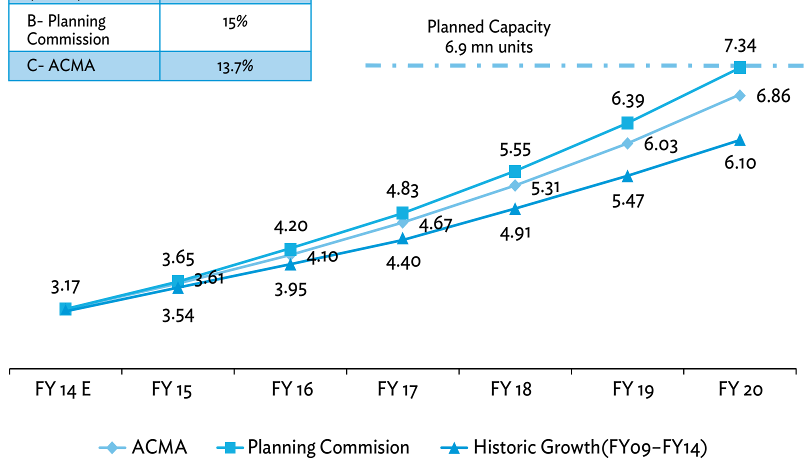
Figure 1.82: **Past Trends in Production of Passenger Vehicle (in million units)**



Source: Study team analysis.

Figure 1.83: **Projection of Passenger Vehicle Production (in million units) 2014–2020**

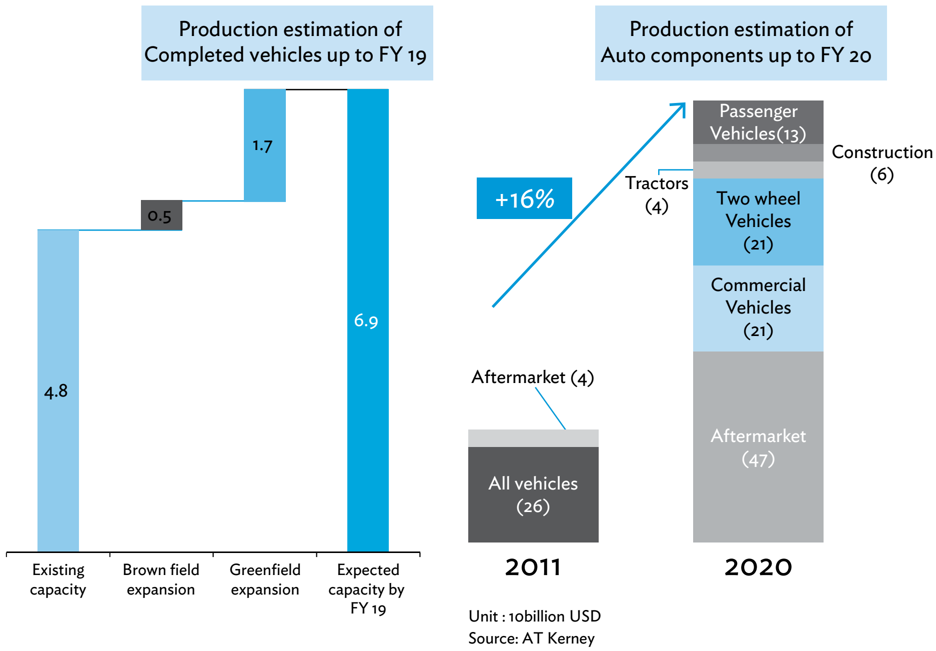
Growth Scenario	Growth rate Considered
A-FY09-14 (Actual)	11.5%
B- Planning Commission	15%
C- ACMA	13.7%



Source: ACMA, Planning commission, Study team analysis.

Although currently, auto industry is experiencing a down trend and stagnation, the number of vehicle production is expected to grow up until 2020. There are various scenarios and growth forecasts, but a stable growth CAGR of 11.5 to 15% can be seen from various sources. By following the scenario of ACMA where we see a growth rate of 13.7% up to 2020, total production volume will reach 6.9 million units, more than double the current number (Figure 1.83).

Figure 1.84: **Estimation of Production Growth in Auto and Auto Components Sector**



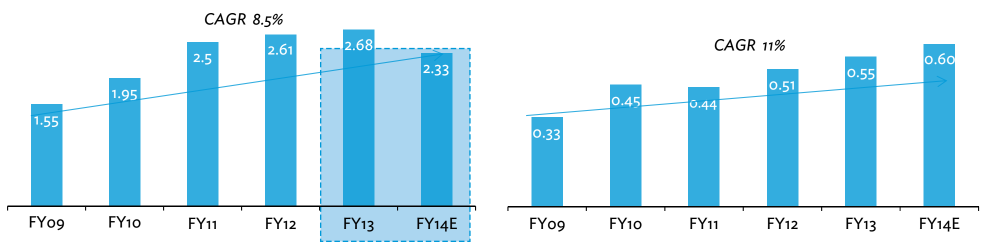
Source: Study team analysis.

Production will increase both due to expansion of existing factory and investment in new green field factory. The graph below shows the source of incremental production capacity and a major share of the increased production is expected to be contributed by greenfield industries.

In parallel with auto industry's growth, growth of auto component industry is also expected. In 2020, of the total auto component industry production value, around 40% is expected to be contributed by passenger vehicle, 20% by commercial vehicle, and 20% by two wheeler vehicles (Figure 1.84).

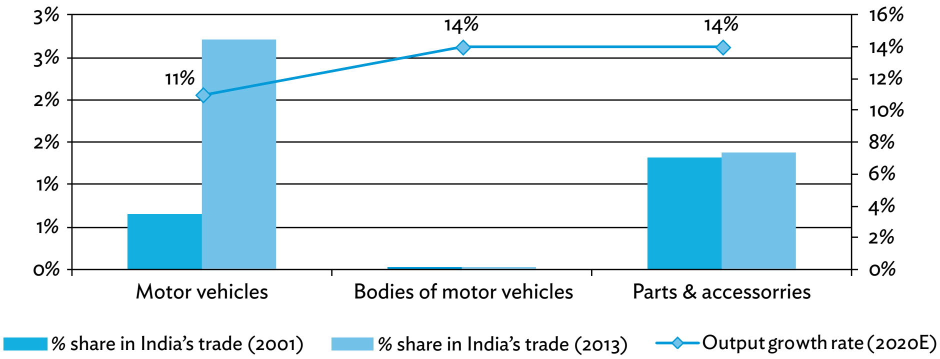
Export market is moving in a different manner than domestic sales – it is growing up rapidly but the number and trend is not subject to economic down trend in India. Upon comparing domestic sales and export sales, export market is experiencing greater growth rate though domestic sales has larger volume compared export market. Also, when the CAGR of Figure 1.85 (entire market growth – CAGR 11.6% between FY 09 and 14) is compared to export market CAGR the number is almost the same and thus it can be concluded that the export market has grown up in parallel with entire market. Since export market volume is subject to

Figure 1.85: **India's Domestic and Exports Sale**



Source: Various automobile company annual reports, Study team analysis.

Figure 1.86: **Contribution to India's Exports, 2001-13; Expected Output Growth Rate 2020, by Sub-Segment**



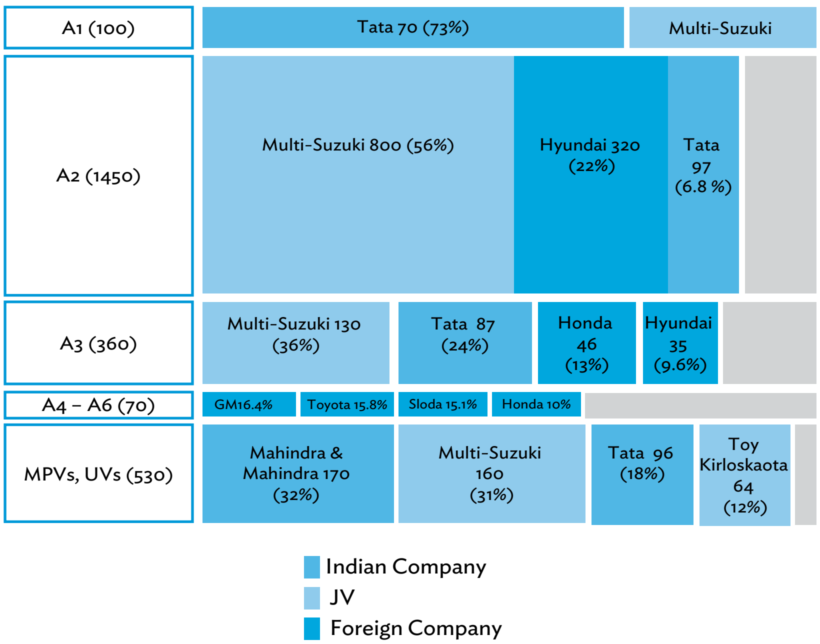
Source: http://www.intracen.org/itc/market-info-tools/trade-statistics/, ACMA.

global demand, one can expect that the volume will experience continuous growth due to continuous growth of demands especially in emerging counties of Middle East, Africa and Asia.

Auto and auto components constitute a small share in India's total trade (exports) across sectors. However, the sector has seen significant growth in the share in last 4 years. All the sub-sectors of this sector are expected to grow at a rate more than 10% by 2020 (Figure 1.86). So, all the sub-sectors of this sector has huge potential yet to be tapped into.

The auto components sector is expected to grow at a CAGR of 16% up to 2020, which is greater than the rate of growth of the entire auto sector. If India can experience growth throughout the value chain from parts to OEM that will definitely boost the growth of the entire auto industry. Another dimension is type of cars – the figure below shows the type of vehicles and share by companies. One of the characteristics of Indian market is that smaller

Figure 1.87: **Type of Vehicles and Share by Manufacturers**



Source: Study team analysis.

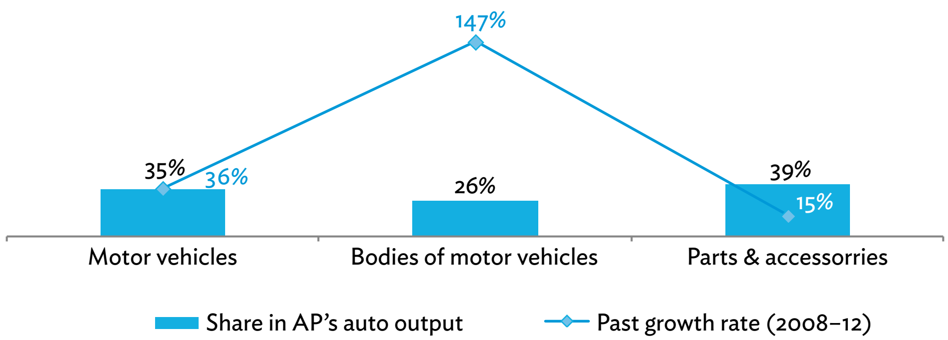
size cars have bigger share in the market. India has potential to become a global hub for export of smaller size vehicles. This segment is also expected to grow up rapidly in the future (Figure 1.87).

State Scenario

Historically, contribution of Andhra Pradesh to the national auto and auto components output has been negligible. Across all the segments i.e. passenger vehicles, two and three wheelers, commercial vehicles and auto components the investment in the state is trivial and the state does not have any significant investments planned in the near future. All the sub-sectors have shown high growth rates. Bodies of motor vehicles have shown a very high growth rate over 145% in the last four years (Figure 1.88). Auto and auto components is a high potential sector and highly unexplored sector for the state.

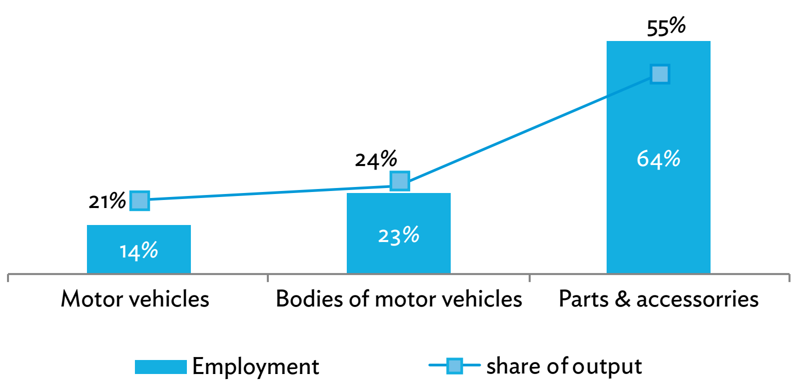
Motor vehicles and bodies of motor vehicles contribute to >70% of the output of the auto and auto components sector in the state of Andhra Pradesh. Though auto parts and accessories have higher GVA share its output growth rate has been lower than the other sub-sectors. Motor vehicles drives the output of the sector through a productivity of more than three times the other sub-sectors. Tamil Nadu is approximately five times more productive in the major sub-sector of motor vehicles. Improving productivity in all the sub-sectors will help to drive the output and GVA of the sector further (Figures 1.89 and 1.90).

Figure 1.88: **Share in Andhra Pradesh's Auto and Auto Components Output (2011-12) and Growth Rate (2008-12), by Sector**



Source: ASI 2008-12.

Figure 1.89: **Comparison of Productivity in Shortlisted Sub-sectors with Competing States**

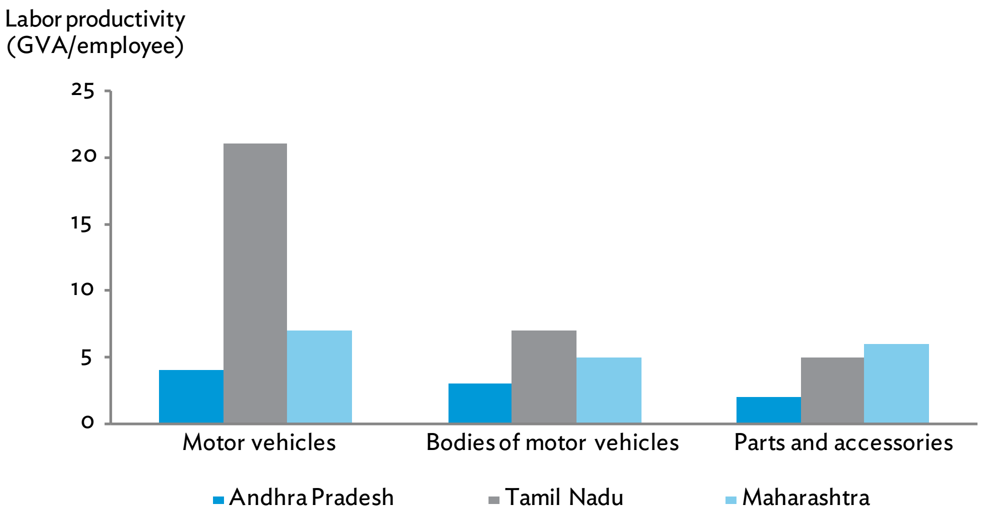


Source: ASI 2008-12.

Key growth drivers for the sector

In order to attract more investment in a longer term, the region needs to achieve future growth and expected to remain its unique position as investment destination

Figure 1.90: **Comparison of Andhra Pradesh's Productivity in Automobile and Automobile Components, by Sub-Segment**



Source: ASI 2008-12.

India's automobile industry is expected to achieve continuous growth. India's economic growth is believed to continue and industry growth will be sustained with strong backbone of domestic purchasing power. One of characteristics of Indian auto industry is concentration on smaller size (compact) vehicles. India can be a global hub for compact vehicle production.

In order to survive in the competition and to achieve sustainable growth, VCIC region needs to attract investment in auto industry. Identifying growth drivers is especially important to achieve growth in this region.

Key drivers of growth: Shorter Term

Infrastructure improvement for OEMs

VCIC region has strong potential in India since this region harnesses sea port and there is a characteristic of proximity to market abroad- considering the competition with other investment clusters in India, key success factor for this region is to keep attracting export-oriented OEMs. From OEM perspective, this region has competitiveness not only because of geological location but also because of cost competitiveness when compared with ASEAN region. Keep attracting export-oriented OEMs to this region with improved investment climate will lead to continuous growth of this region as a hub of vehicle export.

Already several OEMs are investing in this region including Nissan, Hyundai and they are building up factories with their own investment with the support of state government in terms of land provision, and electricity supply. Basically their operation is stable due to this well managed infrastructure within industrial park. Meanwhile, infrastructure for vehicle export is not necessarily well managed.

Since most of the OEMs are focusing on export from this region, improvement of export oriented infrastructure including connecting road construction, port evacuation capacity increase will surely ensure future increase of OEM's investment into this region. Otherwise export oriented OEMs might look for another location and investment to this region might decrease.

Tax/permit process improvement for export

Indian's tax system is complicated and most of foreign players are suffering from the complicated system which is lack of consistency. Sometimes they are imposed of tax which they did not expect and this is working as a barrier to promote export business in this region. In addition, CST (Central State Tax) which is imposed when crossing the state borders is also working as obstacle to develop their business across state borders.

Infrastructure improvement for Tier-2/Tier-3 suppliers

For foreign suppliers, currently investment scope is limited and value chain is not completed within India/VCIC region – only Tier 1 suppliers are investing in the region and investment of downstream layers have not almost happened yet. Most of Tier-2 and Tier-3 foreign suppliers are delivering their work from home country or ASEAN countries (e.g. Thailand). If this investment happens by foreign Tier-2 and/or Tier-3 players, we can expect technology transfer from foreign players to Indian local downstream players as well as pure increase in investment in this region.

In order to increase the investment of suppliers, bottlenecks which they are facing needs to be removed. One of the bottlenecks they are facing now is lack of reliable utility (especially electricity). Therefore, supply of reliable utility infrastructure could be one of the ways to improve the situation. Development of industrial park could be one of the easiest ways to supply reliable utility infrastructure.

Longer Term

Capacity development of suppliers and achievement of industrial growth as export oriented industry

As described in previous section, currently there are suppliers which are lack of technologies/ skills (these are included in the categories of "India local large supplier" and "India local small supplier"). These companies cannot supply components to foreign OEMs since they cannot meet requirements of foreign OEMs. It is important to fulfil the gaps of skills and technologies and bottom up entire level of supplier industry in this region. If these suppliers can be grew up enough to export components from this region, this could also be advantageous for this cluster since they harness inherent cost competitiveness and there is a possibility this region grows up as regional hub of auto suppliers.

In order to further push forward growth of supplier's industry, there are ways which government can take – including MSME protection policy and infrastructure improvement for suppliers (for production and export).

Enhancement of R&D functions and growth as an R&D hub

One of key characteristics auto industry is experiencing these days is that industry is going to more digital side. Consumers are shifting to combine mobility with communication. Therefore, automobiles tend to be combines communication devices. Also, gasoline engine vehicle is gradually shifting to EVs – there is an advantage of less emission – and new technology is expected to be applied to more number of vehicles. Considering this situation, enhancement of R&D function could be one of key driver for continuous growth. VCIC includes IT/electricity cluster and there might be synergies expected between auto sector and these sectors for R&D function enhancement. In order to promote and enhance R&D capability, government's investment into such function and development of R&D oriented industrial hubs could be effective.

Appendix 2: Data tables for industry selection

Table 1.33: **Global-Level Analysis**

Global level analysis					
Sub-sectors	NIC code (3-digt)	Growth in trade (%)	% of global trade (2001)	% of global trade (2013)	Shift in % global trade (2001-13)
Food Processing					
Meat processing	101	9%	0.67%	0.67%	0.00%
Marine processing	102	8%	0.94%	0.84%	-0.10%
Fruit and vegetables	103	10%	1.16%	1.22%	0.06%
Vegetable and animal oils and fats	104	15%	0.31%	0.54%	0.23%
Dairy products	105	10%	0.48%	0.49%	0.01%
Grain mill, starches and starch Product	106	12%	0.98%	1.32%	0.34%
Other food products	107	11%	1.23%	1.44%	0.21%
Animal feeds	108	12%	0.34%	0.44%	0.10%
Textiles					
Spinning, weaving and finishing of textiles	131	5%	0.59%	0.38%	-0.21%
Other textiles	139	5%	1.35%	0.80%	-0.56%
Wearing apparel, except fur apparel	141	7%	1.99%	1.47%	-0.52%
Manufacture of articles of fur	142	10%	0.07%	0.07%	0.00%
Manufacture of knitted and crocheted apparel	143	8%	1.58%	1.41%	-0.18%
Chemicals & Petrochemicals					
Coke oven products	191	13%	0.59%	0.91%	0.32%
Refined petroleum products	192	15%	9.20%	16.09%	6.88%
Basic chemicals, fertilizer and nitrogen compounds, plastics and synthetic rubber in primary forms	201	10%	3.19%	3.42%	0.24%
Other chemical products	202	9%	2.49%	2.50%	0.01%
Man-made fibers	203	14%	0.01%	0.01%	0.00%
Plastics products	222	10%	3.04%	3.18%	0.14%
Pharmaceuticals					
Pharmaceuticals	210	13%	2%	3%	0.80%
Metallurgy					
Basic iron and steel	241	11%	3.30%	3.85%	0.55%
Basic precious and other non-ferrous metals	242	10%	2.00%	2.23%	0.22%
Casting of metals	243	8%	0.80%	0.70%	-0.10%

continued on next page

Table 1.33 *continued*

Global level analysis					
Sub-sectors	**NIC code (3-digt)**	**Growth in trade (%)**	**% of global trade (2001)**	**% of global trade (2013)**	**Shift in % global trade (2001-13)**
Electronics					
Electronic components	261	7%	0.73%	0.53%	-0.20%
Computers and peripheral equipment	262	8%	3.64%	2.98%	-0.67%
Communication equipment	263	8%	4.12%	3.69%	-0.43%
Consumer electronics	264	3%	1.21%	0.59%	-0.61%
Measuring, testing, navigating and control equipment; watches and clocks	265	8%	0.69%	0.61%	-0.08%
Irradiation, electro-medical and electrotherapeutic equipment	266	9%	1.64%	1.64%	0.00%
Optical instruments and equipment	267	12%	1%	1%	0.24%
Magnetic and optical media	268	-13%	0.38%	0.03%	-0.36%
Automobiles					
Motor vehicles	291	7%	6.53%	5.00%	-1.53%
Bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	292	10%	0%	0%	0.01%
Parts and accessories for motor vehicles	293	9%	2.37%	2.18%	-0.18%

Source: INTRACEN.

The overall growth rate of global exports between 2001 and 2013 was measured to be 9.4%. It was observed that out of 3 sub-sectors, only 19 sub-sectors exhibited a growth rate higher than the overall growth rate in exports for all sectors. Most of the sub-sectors under chemicals and petrochemicals, pharmaceuticals, Metallurgy and food processing showcased higher than average growth rates in the last decade. Textiles and Electronics, however, showed a weak growth rate in exports across most of the sub-sectors (Table 1.33). In terms of shift towards increasing their share in the global exports, only 16 sub-sectors showed a positive trend of increasing their share in the global exports. Combining these 2 parameters, we observed that 16 sub-sectors emerge with an increasing share in the global exports, with a growth rate higher than the global average, indicating that these sub-sectors have the potential to be the winners in the future, within a short and medium term time frame. Food processing, chemicals and petrochemicals, pharmaceuticals and Metallurgy emerge as top sectors on the global arena.

The analysis of data in the Indian context was done and the summary of output is being showcased through the Table 1.34:

Table 1.34: **Country-Level Analysis**

Sub-sectors	Growth rate exports (2001-13)	India's exports share (2001)	India's exports share (2013)	Change in exports share (2001-13)	Growth rate in imports (2001-13)	% of India's imports (2001)	% of India's imports (2013)	Shift in % of India's imports (2001-13)	Future growth rate (2020)
Food Processing									
Meat processing	27%	0.63%	1.42%	0.79%	24%	0.00%	0.00%	0.00%	9%
Marine processing	12%	2.83%	1.41%	-1.42%	15%	0.02%	0.01%	-0.01%	4%
Fruit and vegetables	13%	1.93%	1.05%	-0.89%	15%	1.66%	0.97%	-0.68%	6%
Vegetable and animal oils	14%	0.44%	0.29%	-0.15%	17%	2.96%	2.11%	-0.85%	5%
Dairy products	21%	0.16%	0.22%	0.05%	16%	0.01%	0.01%	0.00%	8%
Grain mill, starches and starch Product	21%	2.88%	3.83%	0.95%	23%	0.07%	0.09%	0.02%	10%
Other food products	11%	3.13%	1.48%	-1.65%	19%	0.36%	0.31%	-0.05%	10%
Animal feeds	19%	1.03%	1.10%	0.07%	18%	0.08%	0.06%	-0.02%	10%
Textiles									
Spinning, weaving and finishing of textiles	15%	4.85%	3.36%	-1.49%	5%	0.85%	0.16%	-0.69%	8%
Other textiles	10%	4.21%	1.79%	-2.42%	12%	1.50%	0.61%	-0.89%	12%
Wearing apparel, except fur apparel	10%	9.88%	4.00%	-5.88%	17%	0.19%	0.14%	-0.05%	10%
Articles of fur	6%	0.00%	0.00%	0.00%	13%	0.00%	0.00%	0.00%	10%
Knitted and crocheted apparel	12%	4.18%	2.14%	-2.04%	20%	0.16%	0.16%	0.00%	10%
Chemicals & Petrochemicals									
Coke oven products	12%	0.13%	0.07%	-0.06%	24%	2.27%	3.40%	1.13%	10%
Refined petroleum products	34%	4.77%	20.60%	15.83%	23%	28.86%	36.13%	7.27%	10%
Basic chemicals	19%	4.30%	4.41%	0.11%	19%	6.54%	6.01%	-0.52%	9%
Other chemical products	17%	2.87%	2.53%	-0.33%	18%	1.80%	1.46%	-0.34%	13%
Man-made fibres	14%	1.04%	0.65%	-0.39%	17%	0.18%	0.13%	-0.05%	10%

continued on next page

Table 1.34 *continued*

Sub-sectors	Growth rate exports (2001-13)	India's exports share (2001)	India's exports share (2013)	Change in exports share (2001-13)	Growth rate in imports (2001-13)	% of India's imports (2001)	% of India's imports (2013)	Shift in % of India's imports (2001-13)	Future growth rate (2020)
Plastics products	19%	1.79%	1.85%	0.06%	25%	1.42%	2.14%	0.73%	10%
Pharmaceuticals									
Pharma	22%	2.39%	3.49%	1.10%	21%	0.32%	0.36%	0.03%	15.5%
Metallurgy									
Basic iron and steel	20%	4.46%	5.21%	0.75%	21%	2.75%	2.98%	0.23%	11%
Basic precious and other non-ferrous metals	23%	1.21%	1.93%	0.72%	20%	1.83%	1.81%	-0.03%	
Casting of metals	13%	0.78%	0.42%	-0.36%	23%	0.27%	0.34%	0.07%	
Electronics									
Electronic components	15%	0.15%	0.10%	-0.05%	19%	0.22%	0.19%	-0.03%	21%
Computers and peripherals	13%	0.17%	0.09%	-0.07%	19%	0.82%	0.71%	-0.11%	22%
Communication equipment	34%	0.29%	1.23%	0.95%	28%	1.50%	3.23%	1.73%	32%
Consumer electronics	3%	0.71%	0.14%	-0.57%	10%	1.04%	0.36%	-0.67%	14%
Measuring, equipment	16%	0.20%	0.16%	-0.04%	17%	0.29%	0.21%	-0.08%	19%
Irradiation, electro-medical and electro-therapeutic equipment	17%	0.49%	0.43%	-0.06%	16%	1.65%	1.10%	-0.55%	19%
Optical instruments	20%	0.10%	0.11%	0.01%	17%	0.28%	0.19%	-0.08%	19%
Magnetic and optical media	10%	0.02%	0.01%	-0.01%	4%	0.09%	0.02%	-0.08%	19%
Automobiles									
Motor vehicles	33%	0.65%	2.71%	2.05%	25%	0.06%	0.09%	0.03%	11%
Bodies for motor vehicles	24%	0.01%	0.02%	0.01%	38%	0.01%	0.03%	0.02%	14%
Parts and accessories for motor vehicles	19%	1.32%	1.37%	0.05%	27%	0.43%	0.85%	0.42%	14%

Source: INTRACEN.

The analyses show that India had an average growth rate of 18.5% in terms of trade across all sectors between 2001 and 2013. Of the 34 sub-sectors, 15 had grown at a higher growth rate than India's average during the same period. The same 15 sub-sectors had also shown increase in their share in the totals exports basket from India. Chemicals and petrochemicals (15.22% gain), automobiles (2.11% gain), and pharmaceuticals (1.1%) were the major gainers on overall export share basis, while textiles (11.83% decrease) and food processing (2.24% decrease) have decreased their overall share in the total exports basket from India during 2001-13.

We also analyzed the share of the 34 sub-sectors in AP's total employment generated in the organized industrial sector. The below data table captures the share of employment for each of the identified sub-sectors within their parent sector (2-digit level classification as per NIC), share in AP's total employment for all sectors (organized), output share within parent sector, output share at AP level, wage share within parent sector, wage share at AP level and the growth in wages between 2009 and 2012 (Table 1.35).

Table 1.35: **Share of Employment of Identified Sub-sectors Along with Wage Trend in Andhra Pradesh**

	Share in sector's employ-ment	Share in employ-ment	Share in sector's wages	Share in total wages	Growth in wages between 2009 and 2012	Share in sector's output	Share in total output	Growth in output between 2009 and 2012
Food Processing								
Meat processing	1%	0.2%	1%	0.1%	10%	1%	0.3%	4%
Marine processing	5%	0.8%	4%	0.5%	12%	4%	0.8%	28%
Fruit and vegetables	6%	1.1%	4%	0.5%	19%	2%	0.4%	19%
Vegetable and animal oils	9%	1.6%	11%	1.3%	18%	27%	5.5%	23%
Dairy products	8%	1.4%	15%	1.7%	3%	11%	2.1%	34%
Grain mill, starches and starch Product	45%	7.7%	34%	4.0%	17%	40%	8.2%	24%
Other food products	23%	3.9%	27%	3.1%	13%	10%	2.0%	26%
Animal feeds	3%	0.5%	4%	0.5%	10%	5%	1.0%	55%
		17.2%		11.9%			20.2%	
Textiles								
Spinning, weaving and finishing of textiles	63%	4.9%	65%	3.5%	11%	84%	2.9%	27%
Other textiles	19%	1.5%	18%	1.0%	23%	9%	0.3%	35%
Wearing apparel, except fur apparel	16%	1.2%	15%	0.8%	7%	5%	0.2%	4%
Articles of fur			0%	0.0%		0%	0.0%	
Knitted and crocheted apparel	2%	0.2%	3%	0.1%	33%	2%	0.1%	356%
		7.9%		5.4%			3.5%	

continued on next page

Table 1.35 *continued*

	Share in sector's employ-ment	Share in employ-ment	Share in sector's wages	Share in total wages	Growth in wages between 2009 and 2012	Share in sector's output	Share in total output	Growth in output between 2009 and 2012
Chemicals & Petrochemicals								
Coke oven products	1%	0.1%	1%	0.1%	3%	1%	0.1%	-38%
Refined petroleum products	7%	0.4%	20%	1.7%	15%	55%	9.9%	6%
Basic chemicals, fertilizer and nitrogen compounds, plastics and synthetic rubber in primary forms	33%	1.7%	37%	3.1%	8%	27%	4.9%	8%
Other chemical products	22%	1.1%	23%	1.9%	18%	9%	1.6%	35%
Man-made fibers	1%	0.0%	0%	0.0%	-13%	0%	0.0%	3%
Plastics products	36%	1.9%	18%	1.5%	8%	8%	1.5%	19%
		5.3%		8.3%			18.1%	
Pharmaceuticals								
Pharmaceuticals	100%	6.4%	100%	10.8%	16%	100%	7.7%	25%
		6.4%		10.8%			7.7%	
Metallurgy								
Basic iron and steel	68%	3.2%	89%	11.5%	2%	85%	10.2%	24%
Basic precious and other non-ferrous metals	8%	0.4%	4%	0.5%	0%	5%	0.6%	10%
Casting of metals	23%	1.1%	8%	1.0%	6%	10%	1.2%	84%
		4.6%		13.0%			12.0%	
Electronics								
Electronic components	64%	0.9%	80%	3.0%	-10%	34%	0.6%	33%
Computers and peripherals	2%	0.0%	2%	0.1%	-7%	1%	0.0%	46%
Communication equipment	19%	0.3%	11%	0.4%	11%	35%	0.6%	32%
Consumer electronics	3%	0.0%	1%	0.0%		14%	0.3%	
Measuring, equipment	7%	0.1%	6%	0.2%	1%	4%	0.1%	-19%
Irradiation, electro-medical and electro-therapeutic equipment	2%	0.0%	1%	0.0%	28%	8%	0.2%	-42%
Optical instruments	2%	0.0%	1%	0.0%	-13%	4%	0.1%	-44%

continued on next page

Table 1.35 *continued*

	Share in sector's employ-ment	Share in employ-ment	Share in sector's wages	Share in total wages	Growth in wages between 2009 and 2012	Share in sector's output	Share in total output	Growth in output between 2009 and 2012
Magnetic and optical media	0%	0.0%	0%	0.0%		0%	0.0%	
		1.5%		3.8%			1.8%	
Automobiles								
Motor vehicles	14%	0.1%	28%	0.4%	10%	35%	0.2%	36%
Bodies for motor vehicles	23%	0.2%	16%	0.2%	37%	26%	0.2%	147%
Parts and accessories for motor vehicles	64%	0.6%	55%	0.7%	15%	39%	0.3%	15%
		1.0%		1.3%			0.7%	

Source: ASI 2010-11.

The analysis shows that while the contribution of identified sectors (all 34 sub-sectors included) to AP's total output is 64.1%, the share of these sectors in employment in the state is only 43.8%. Food processing sector accounts for 17.2% of the employment (organized) in the state, followed by textiles (7.9%) and pharmaceuticals (6.4%).

Table 1.36 shows the supply and demand parameters used for identification of target sectors.

Table 1.36. Supply and Demand Side Parameters Used for Identification of Target Sectors

	AT INDIA LEVEL							
Units	INR *crore*	INR *crore*	'000 US$	'000 US$	In %	In %	INR *lakh*	INR *lakh*
Manufacturing sector	FDI analysis	IEM - Investment	Imports - Volume	Exports- Volume	Imports - Growth	Exports - Growth	Output	Investment
No. of years/ period	Apr '00 to July'13	Jan'08 to Aug'13	Median (2008-12)	Median (2008-12)	Avg. 2001-12	Avg. 2001-12	2010-11	till 2010-11
Food Processing	12,220	107,625	11,331,644	19,353,860	94.97	29.53	54,372,015	22,397,425
Beverages	-	-	277,836	167,089	57.09	27.28	3,861,561	2,530,689
Tobacco	-	-	31,239	878,687	36.47	17.41	2,659,033	755,105
Textiles	5,875	165,073	3,559,465	26,076,170	19.41	18.63	34,853,544	19,880,543
Leather	555	1,238	874,692	4,110,585	26.43	9.84	3,126,391	1,337,947
Paper and paper products	4,110	33,149	1,887,452	784,176	17.93	17.02	5,960,453	4,536,077
Printing & Media	1,408	-	545,016	217,612	11.99	19.06	2,995,460	1,729,024
Chemical & Petrochemical	47,774	613,478	37,986,548	58,564,341	21.59	23.99	112,948,441	44,689,438
Pharmaceuticals	59,599	71,869	1,223,985	6,096,125	24.47	22.65	13,572,797	8,509,306

continued on next page

Table 1.36 *continued*

AT INDIA LEVEL								
Units	INR *crore*	INR *crore*	'000 US$	'000 US$	In %	In %	INR *lakh*	INR *lakh*
Manufacturing sector	FDI analysis	IEM - Investment	Imports - Volume	Exports- Volume	Imports - Growth	Exports - Growth	Output	Investment
No. of years/ period	Apr '00 to July'13	Jan'08 to Aug'13	Median (2008-12)	Median (2008-12)	Avg. 2001-12	Avg. 2001-12	2010-11	till 2010-11
Rubber	6,038	26,257	2,712,597	1,675,357	27.85	21.86	5,724,811	2,526,755
Glass	2,122	11,111	783,025	490,114	21.46	10.38	1,169,332	1,087,336
Non-metallic mineral	14,849	416,229	8,955,585	8,426,949	33.06	18.07	13,447,316	12,504,363
Metallurgical industry	35,904	1,483,340	21,005,556	19,869,075	25.23	47.75	64,794,410	46,780,581
Fabricated metal products	331	9,422	28,553,248	8,166,315	63.79	42.12	15,497,458	7,480,582
Electronics	60,005	-	23,397,956	7,070,994	21.25	20.83	10,872,089	3,948,819
Electrical machinery	19,676	2,979,040	7,435,491	4,665,348	24.35	22.62	19,839,509	7,565,138
Machinery	19,238	100,593	-	-	-	-	22,218,452	9,529,211
Auto & auto components	42,746	82,195	3,951,602	9,285,872	33.50	28.78	30,044,070	13,211,434
Transport equipment	1,698	-	7,247,404	5,735,023	46.98	56.10	10,940,271	4,212,156
Furniture and wood	433	2,979	3,605,275	897,604	20.58	28.49	2,778,991	1,339,603
Gems & Jewellery	1,969	-	68,629,982	32,598,057	23.20	19.88	7,727,286	2,009,652
Sports goods	-	-	116,121	122,600	24.60	10.85	90,909	23,643
Toys	-	-	187,942	35,240	25.50	12.62	90,909	23,643
Medical Equipment	3,477	2,496	-	-	-	-	454,546	118,215
Other manufacturing	-	-	402,433	807,974	45.95	110.12	727,274	189,144
IT & Financial services	-	-	-	-	-	-	-	-

	AT INDIA LEVEL					AT STATE LEVEL	
Units	'000 *crore*	Number	INR *lakh*	INR *lakh*	INR *lakh*	INR million	INR million
Manufacturing sector	Investment	M&A analysis	Fixed Capital	Employment	NVA	Investment - AP and TN	Investment- AP and TN
No. of years/ period	Upcoming		2010-11	2010-11	2010-11	Beg till date	Upcoming
Food Processing	50	169	10,128,769	1,533,781	4,745,219	100,868	121,011
Beverages	4	39	1,941,742	127,816	775,928	19,953	9,293
Tobacco	-	4	260,784	412,422	898,246	700	-
Textiles	6	245	12,577,690	2,323,820	5,172,029	162,741	86,485

continued on next page

Table 1.36 *continued*

AT INDIA LEVEL						AT STATE LEVEL	
Units	'000 *crore*	Number	INR *lakh*	INR *lakh*	INR *lakh*	INR million	INR million
Manufacturing sector	Investment	M&A analysis	Fixed Capital	Employment	NVA	Investment - AP and TN	Investment- AP and TN
No. of years/ period	Upcoming		2010-11	2010-11	2010-11	Beg till date	Upcoming
Leather	2	14	628,586	292,657	459,686	23,697	10,740
Paper and paper products	2	27	3,535,209	249,019	869,755	86,701	89,598
Printing & Media	15	58	1,347,126	158,990	764,753	-	-
Chemical & Petrochemical	768	394	30,808,163	1,066,828	15,615,794	238,544	1,690,574
Pharmaceuticals	24	188	5,591,706	470,138	3,917,035	130,838	53,087
Rubber	35	37	1,742,087	189,382	1,081,170	1,398	-
Glass	-	-	873,992	74,020	274,523	34,560	108,200
Non-metallic mineral	284	106	10,050,903	851,230	3,157,016	256,390	297,647
Metallurgical industry	1,150	210	34,847,595	1,011,699	8,409,009	265,928	885,421
Fabricated metal products	183	96	4,524,488	666,663	3,211,307	-	-
Electronics	98	92	2,305,770	229,208	1,922,880	119,897	338,229
Electrical machinery	15	107	4,013,378	506,628	3,349,589	18,994	6,500
Machinery	10	158	5,183,131	677,982	4,565,055	137,982	121,800
Auto & auto components	65	114	9,779,408	715,550	3,845,185	341,659	259,032
Transport equipment	49	31	2,388,505	260,756	2,228,415	21,239	7,000
Furniture and wood	3	6	707,233	138,546	350,654	-	-
Gems & Jewellery	4	50	674,758	192,074	706,552	12,033	-
Sports goods	-	-	7,938	2,260	8,312	-	-
Toys	-	-	7,938	2,260	8,312	-	-
Medical Equipment	-	-	39,692	11,298	41,562	-	-
Other manufacturing	-	-	63,507	18,078	66,499	-	-
IT & Financial services	211	-	-	-	-	167,218	551,176

continued on next page

Table 1.36 *continued*

	AT STATE LEVEL				AT CORRIDOR LEVEL		
Units	INR *lakh*	INR *lakh*	INR *lakh*	INR *lakh*	INR million	INR million	INR *crore*
Manufacturing sector	Output	Fixed Capital	Employment	NVA	Investment	Investment	Output
No. of years/ period	2010-11	2010-11	2010-11	2010-11	Beg till date	Upcoming	2010-11
Food Processing	10,757,105	2,132,132	370,143	701,259	112,369	50,016	3,819,892
Beverages	700,168	317,089	27,701	109,289	6,548	4,959	84,706
Tobacco	919,982	68,223	265,612	327,860	700	-	471,329
Textiles	8,846,204	3,515,128	733,705	1,276,445	78,364	26,395	726,991
Leather	986,494	198,007	130,634	102,488	11,303	8,540	32,061
Paper and paper products	1,429,689	1,079,111	68,533	267,701	6,387	31,196	246,971
Printing & Media	609,153	262,071	44,980	165,211	-	-	20,252
Chemical & Petrochemical	11,445,811	2,908,566	226,742	991,702	106,818	748,030	3,712,454
Pharmaceuticals	2,821,663	1,331,750	103,368	601,657	54,147	7,959	154,673
Rubber	802,053	271,621	40,931	139,526	290	-	25,243
Glass	274,146	242,157	16,189	66,134	2,825	67,200	49,731
Non-metallic mineral	3,152,683	2,784,807	186,177	760,540	134,619	220,087	571,904
Metallurgical industry	7,864,814	3,377,807	115,491	1,064,828	130,813	691,031	1,867,272
Fabricated metal products	4,214,140	866,223	185,514	979,468			267,562
Electronics	1,895,287	298,695	52,811	288,167	60,388	9,936	74,341
Electrical machinery	3,596,151	826,626	109,315	531,217	5,810	1,500	283,582
Machinery	3,842,076	788,474	127,928	875,434	50,634	17,650	67,864
Auto & auto components	8,635,649	3,150,942	216,510	1,466,495	76,526	125,350	41,660
Transport equipment	1,053,101	182,628	29,670	359,908	5,466	2,500	64,848
Furniture and wood	361,897	78,876	18,724	2,680	-	-	37,440
Gems & Jewellery	844,888	73,551	24,409	92,027	93	-	
Sports goods	9,940	865	287	1,083	-	-	-
Toys	9,940	865	287	1,083	-	-	-
Medical Equipment	49,699	4,327	1,436	5,413	-	-	-
Other manufacturing	79,519	6,922	2,297	8,661	-	-	-
IT & Financial services		-	-	-	75,453	329,999	-

Appendix 3: Global FDI analysis

Foreign Direct Investment (FDI) is of growing importance to global economic growth. This is especially important for developing and emerging market countries. Foreign direct investment has many advantages for both the investor and the recipient. One of the primary benefits is that it allows free movement of funds to businesses that has the best prospects for growth and provides for the best returns for investments with the least risk. FDI trends can help us correlate the perspective of global investors on a particular industry and its attractiveness.

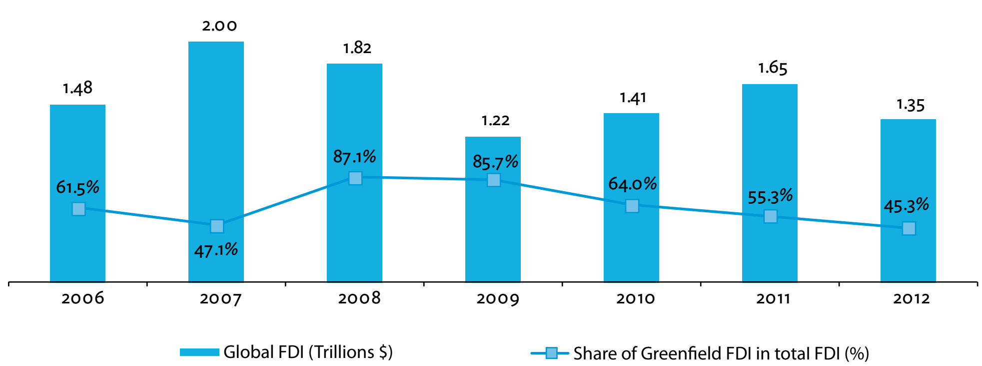
FDI outlook

Current trends in global FDI suggest that FDI inflows fell by 18% in 2012, down from a revised US$1.65 trillion in 2011 to US$1.35 trillion in 2012. The post crisis FDI recovery that started in 2010 and 2011 has currently stalled with global FDI falling to below the pre-crisis level (Figure 1.91). UNCTAD's World Investment Review 2013 takes a view that FDI recovery will now take longer than expected as significant risks persist, including structural weaknesses in the global financial system, weaker growth in the European Union (EU) and significant policy uncertainty in areas crucial for investor confidence.

In addition, Greenfield FDI that can generate industries organically is of high importance from VCIC's perspective. Between 2009 and 2012, the share of Greenfield FDI in overall FDI fell from 85% to 45%. However, these conditions are likely to improve in longer term and the role of FDI in developing VCIC can't be overlooked.

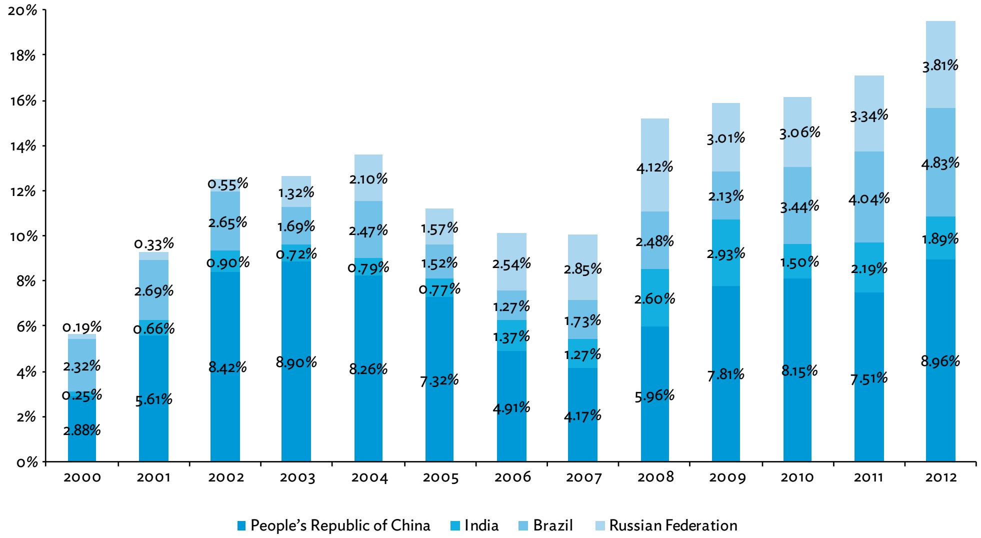
In fact, FDI flow trends in India are looking positive. While the share has been minimal till now in comparison to other BRIC economies, India's share has been growing at over 18% CAGR, which is only second to the PRC (28.3%) (Figure 1.92)

Figure 1.91: **Share of Greenfield FDI in Total Global FDI**



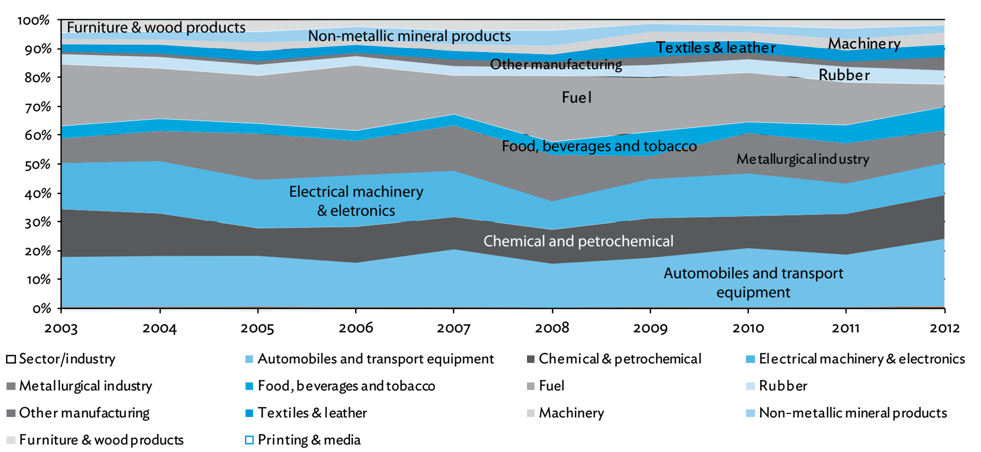
Source: UNCTAD (World Investment Report 2013) Study team analysis.

Figure 1.92: **Share of Global FDI Flows into BRIC Economies**



Source: UNCTAD (http://unctad.org/en/Pages/DIAE/World%20Investment%20Report/Annex-Tables.aspx) Study team analysis.

Figure 1.93: **Sectoral Shares in Greenfield FDI Projects**



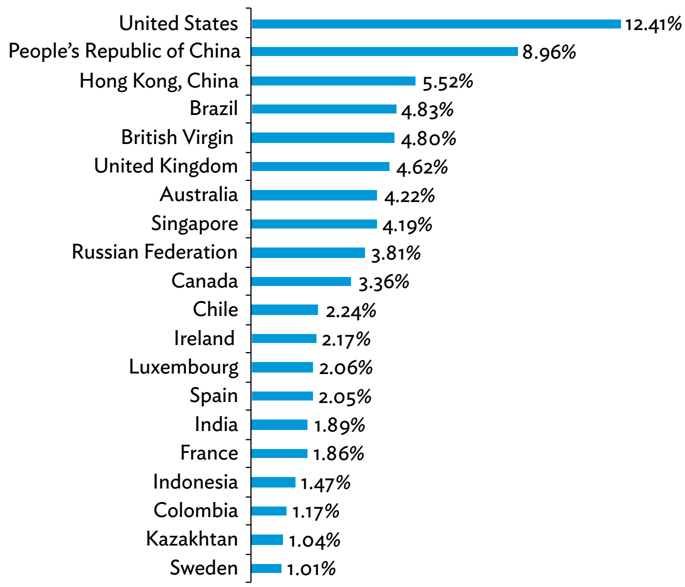
Source: UNCTAD (http://unctad.org/en/Pages/DIAE/World%20Investment%20Report/Annex-Tables.aspx) Study team analysis.

In terms of sectoral composition of FDI in Greenfield projects, the shares of sectors have remained consistent over the past 10 years, with automobile & transport equipment, chemical & petrochemical, electrical machinery, electronics, metallurgical industry, food processing, beverages & tobacco receiving the highest shares of FDI (Figure 1.93).

Key FDI players

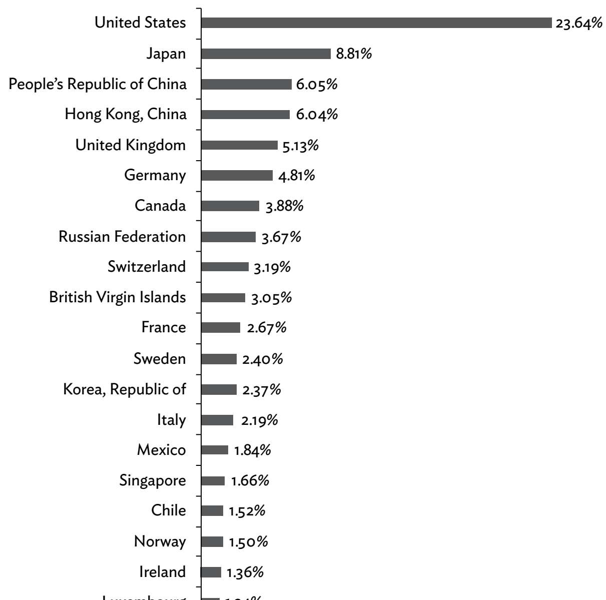
FDI flows are quite concentrated in nature with 75% and 87% of inflows and outflows dominated by top 20 recipients and investor economies respectively (Figure 1.94). While most of the top recipients are also among the top investors, economies like Japan, Germany, Korea, Mexico & Norway have taken a dominant role of being an investor. Among the dominant investors, Japan has the highest share of FDI investments globally (Figure 1.95).

Figure 1.94: **Top Global FDI Recipients**



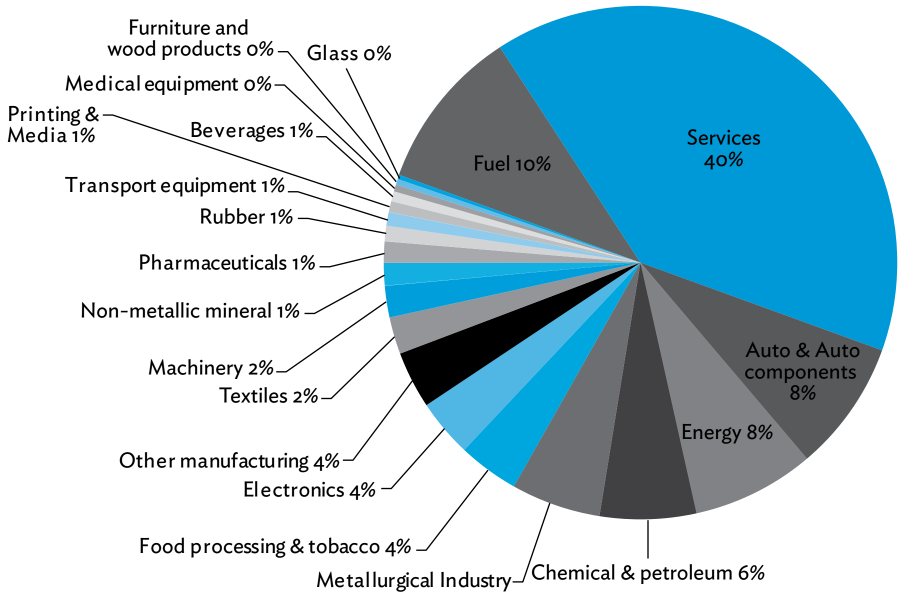
Source: UNCTAD (http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx) Study team analysis.

Figure 1.95: **Top 20 FDI Investors**



Source: UNCTAD (http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx) Study team analysis.

Figure 1.96: **FDI Investments, by Sector**



Source: Financial Times, FDImarkets.com.

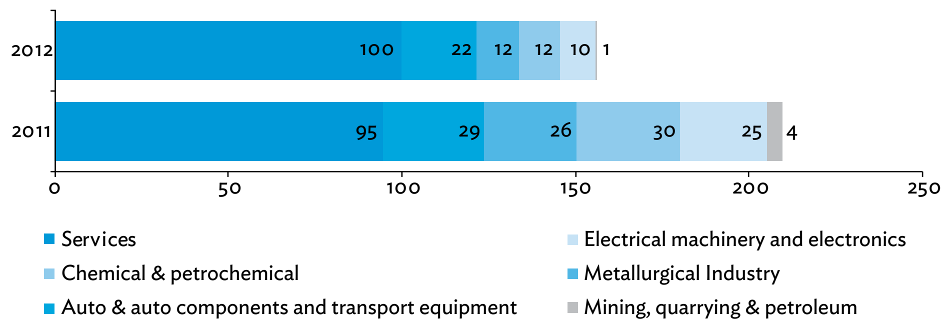
Sectoral FDI overview

Over 90% of FDI investments have been concentrated in 10 sectors, with 40% of this 91% total comprising the services sector only. Within the manufacturing sector, (i) auto and auto components, (ii) chemical and petrochemicals, (iii) metallurgical industry, (iv) food processing and tobacco, (v) electronics, (vi) other manufacturing, and (vii) textiles have been major recipients of FDI (Figure 1.96).

Looking at FDI in greenfield projects in South, Southeast, and East Asia, the services sector seems to be receiving the most attention. In the manufacturing segment, (i) auto and auto components, (ii) transport equipment, (iii) metallurgical industry, (iv) chemicals and petrochemicals, (v) electrical machinery, and (vi) electronics are key sectors attracting FDI (Figure 1.97).

Table 1.37 below depicts top performing sectors globally in terms of FDI and in South, South East and East Asia.

Figure 1.97: **Greenfield FDI Investments, South, South East and East Asia**



Source: World Investment Report 2013

Table 1.37: **Top Performing Sectors Globally in terms of FDI**

Highest Interest

Global FDI	South, South East and East Asia FDI
Services	Services
Fuel & mining	Auto & auto components
Auto & auto components	Transport equipment
Energy	Metallurgical industry
Chemical & petrochemical	Chemical & petrochemical
Metallurgical industry	Electrical machinery
Food processing, beverages & tobacco	Electronics
Electronics	Fuel & mining
Other Manufacturing	
Textiles	
Machinery	
Non-metallic mineral	
Pharmaceuticals	
Rubber	
Transport equipment	
Printing & media	
Beverages	
Medical equipment	
Furniture & wood products	
Glass	

Lowest Interest

Appendix 4: Location Assessment

The eleven clusters identified from the master list of 119 clusters after the stage 1 of the Node analysis and assessment of "good-to-have" factors such as proximity to ports, raw materials and urban centres, further analysis was conducted to understand the comparative advantages of each of the clusters using the following parameters.

- Accessibility to regional trunk roads
- Accessibility to Rail connectivity (< 25 km)
- Availability of skilled manpower (> state average)
- Availability of logistics infra (<100 km)

The outcomes of the analysis are presented in Table 1.38 below.

Table 1.38: **Comparative Advantages of the Clusters Identified**

Location	District	Access to SH and NH (< 50 km)	Rail connectivity (< 25 km)	Availability of skilled manpower (> state average)	Availability of logistics infra (<100 km)
Atchutapuram	Visakhapatnam	✔	✔	✔	✔
Nakkapalli	Visakhapatnam	✔	✔	✔	✔
Bheemunipatnam	Visakhapatnam	✔	✕	✔	✔
Pydi Bhimavaram	Srikakulam	✔	✔	✕	✔
Kakinada	East Godavari	✔	✔	✔	✔
Kankipadu	Krishna	✔	✔	✔	✔
Gannavaram	Krishna	✔	✔	✔	✔
Jaggayyapeta	Krishna	✔	✔	✔	✕
Kopparthy	Kadapa	✔	✔	✕	✕
Yerpedu - Srikalahasti	Chittoor	✔	✔	✔	✕
Sri City	Chittoor	✔	✔	✔	✔

Source: Study team analysis.

Appendix 5: Assumptions under the Business-Induced Scenario

The various sector growth rates assumed for estimating the corridor manufacturing GDP in 2034–35 are summarized in Table 1:39.

Table 1.39: **Assumptions under the Business-Induced Scenario**

Sector	Growth rate assumption	Sources
Food Processing	10.0%	D&B
Textiles	10.0%	Working Group on Textiles for Twelfth Five Year Plan
Metallurgy	7.0%	Draft National steel policy 2012; Indian Minerals Yearbook 2012
Pharmaceuticals	15.5%	Annual report of Department of Pharmaceuticals, 2013
Automobiles	11.0%	ACMA
Chemicals & Petrochemicals	10.0%	Emerging Markets Insight – Chemicals and Petrochemical sector in India, 2013; Annual report of Department of Chemicals and Petro-Chemicals, GoI, 2013;

Source: Study team analysis.

CHAPTER 2

Enabling Competitive Manufacturing through Infrastructure Development

Introduction

Infrastructure is expected to play a critical role in enhancing the competitiveness of the VCIC manufacturing sector. The availability and affordability of adequate infrastructure is a necessary element to enable the development of the industrial sector. The need and criticality of various infrastructure services differ from sector to sector. For some sectors, power plays a key role; for some, road and port connectivity are critical; while for others, the availability of water is the most important input resource. A snapshot of the relative importance of infrastructure components for key sectors is shown in Figure 2.1.

In order to achieve the industrial vision of the corridor, it is essential to have a well-considered and well-planned infrastructure strategy. A multi-pronged approach is needed to address the infrastructure needs of the corridor. Transport, power, and water are the three critical sub-components of the infrastructure strategy. The node-based industrialization strategy proposed for VCIC has been targeted to achieve regional and global competitiveness. Infrastructure development is one of the most important levers to achieve this core objective. As the focus of the corridor will be primarily oriented toward manufacturing, the focus of infrastructure development can be categorized as follows:

Figure 2.1: **Relative Importance of Infrastructure for Industries**

Sectors	Water	Power	Road and Rail connectivity	Ports	Airports
Food processing	High	Medium	High	Medium	Low
Textiles and Apparels	Critical	High	High	Critical	High
Pharmaceuticals	Critical	Critical	High	High	High
Automobiles	High	Critical	Critical	High	Low
Computer, electronics and optical products	Low	Critical	High	Medium	Medium

Low | Medium | High | Critical

Source: Study team analysis.

- **Multi-modal transport infrastructure to enable competitive supply chains.** VCIC will be India's first coastal industrial corridor. Its strategic location in the East Coast Economic Corridor (ECEC) and potential linkages to regional manufacturing hubs bestow tremendous potential for integrating into global value chains and production networks. To leverage these advantages for VCIC's development, it is important to look at multi-modal transport infrastructure not in isolation, but as integral for building competitive supply chains.

  The approach in this study has been to look at the manufacturing nodes, transit gateways (ports and airports), and the hinterland centers in conjunction with each other and linked by strong road and rail networks on which competitive supply chains and efficient logistics services can be designed. Development of inland waterways will be explored at a later stage.

- **Other infrastructure to enable competitive value-added.** The industry and node selection has implicitly factored in resource-linked levers of advantage (e.g., land availability and skilled manpower). These advantages will need to be complemented by other factor inputs that enable competitive value-added like access to and the cost of power and water.

  Access to power and water is more important in emerging economies like India, rather than the pricing itself, as the alternatives to reliable supplies are prohibitively expensive. The approach in this study has been to assess the landscape from the perspective of improving access to these critical resources for industrial use, whether through capacity development, or institutional or regulatory means.

Multi-Modal Transport Infrastructure to Enable Competitive Supply Chains

Background and Context

Manufacturing nodes do not function in isolation, but as part of a supply chain, aligning with domestic or global value networks. Given the paradigm of globalized value chains, the availability and quality of the core transport infrastructure is a critical ingredient on which competitive supply chains can be designed for various industries. Inbound and outbound logistics from the industrial nodes will therefore need to consider capacity and service provision at key infrastructure gateways like ports and airports, as well as road and rail network connectivity between the development of nodes, gateways, and hinterland consumption centers.

The Global Competitiveness Report, 2013–14 by the World Economic Forum considered the quality of infrastructure—including roads, railroads, ports, and air transport infrastructure—as one of the many different components affecting the competitiveness of a country. On a scale of 1 to 7, Table 2.1 shows India's score against competing countries for manufacturing sector investment.

Table 2.1: **Quality of Infrastructure Competitiveness: India vs. Competing Countries**

	India	PRC	Thailand	Rep. of 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

PRC = People's Republic of China.

Source: World Economic Forum. Global Competitiveness Report 2013-14.

India's score against competing countries is especially low for road and port infrastructure. VCIC largely mirrors the difficulties faced by the country, in terms of transport infrastructure, with several issues and challenges ranging from insufficient infrastructure to poor last mile connectivity and cumbersome clearance procedures at key gateways. At the same time, VCIC is also favorably poised in terms of its strategic location and vast potential for growth, anchored around its long coastline.

The focus of this phase of the study has been to understand the current state of capacity and performance of VCIC's multi-modal transport infrastructure, as well as to profile the opportunities, user expectations, issues, and challenges, specifically with respect to supporting manufacturing-aided growth. The recommendations of this section should be seen in complementarity with efforts to improve soft infrastructure to boost supply chain performance, such as enhancing service-level performance for logistics services and improving the ease of doing business.

The outcome of this study should be treated as a diagnostic first step because of the outside-in approach taken for assessment. The study predominantly takes a "business-as-usual" approach in projecting demand for infrastructure and services, and in identifying capacity gaps and bottlenecks. In the next phase of the study, the specific demand from the development of VCIC ("business-induced scenario") will need to supplement the findings of this study to aid corridor master planning.

Objectives of this Study

The objectives of this section are the following:

- profile the current state of multi-modal infrastructure in the influence region, and place it within the development context of VCIC;
- assess the current demand trends in the relevant hinterlands of VCIC, for both quantity and quality of infrastructure stock, especially around the core gateways (ports and airports);

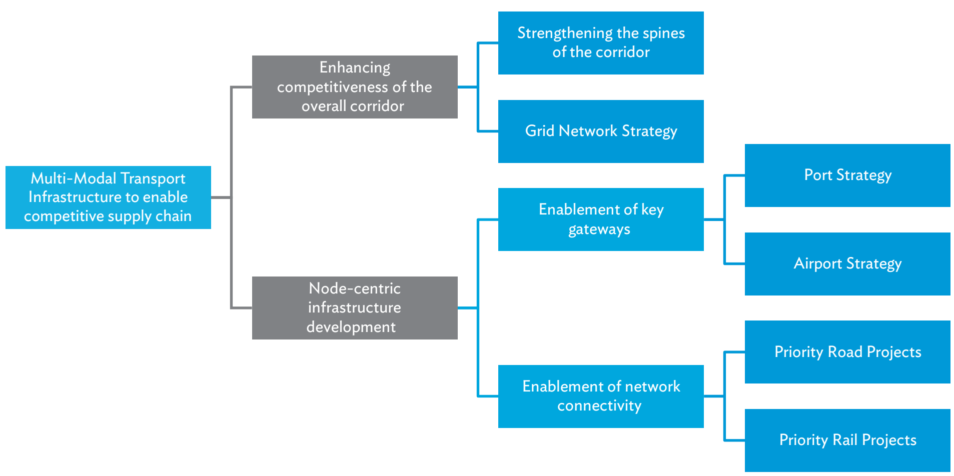
- identify trends in expected user behavior, supported by independent estimates of demand projections where available; draw inferences on opportunities and challenges for the future, supplemented by expected impacts of the development of VCIC;
- based on the above, identify the development imperatives that will need to inform the future infrastructure creation strategy; and
- analyze the current pipeline of infrastructure creation and shortlist projects that are relevant for VCIC; assess the degree of importance and readiness for execution, and identify a time-bound priority execution plan for the immediate-, short-, medium-, and long-term.

General Approach

The study was approached in a series of sequential steps:

- **Profile of transport infrastructure in VCIC.** A detailed literature review was undertaken to collect relevant data. This was supplemented by a detailed set of interactions, stakeholder interviews, and site visits with government agencies and officials, port investors, infrastructure developers, policymakers, and other leading stakeholders. This led to a qualitative and quantitative assessment of the current state of infrastructure development.
- **Two-streamed approach for infrastructure creation.** Based on the above assessment, the study was then divided into two distinct streams as described in Figure 2.2.
    - » **Stream 1: Enhancement of competitiveness of the corridor.** In this stream, infrastructure relevant for enhancement of the overall competitiveness of the corridor was assessed. Since VCIC is a part of the larger ECEC and is being planned around core road and railway networks, the focus of this stream was network integration through the strengthening of spinal and grid networks of both road and rail.

Figure 2.2: **Framework for Assessment**



Source: Study team analysis.

» **Stream 2: Node-centric infrastructure development.** In this stream, a localized node-centric view was adopted for assessing infrastructure stock and quality. A strategy for enablement of key gateways like ports and airports, focused on the nodes, as well as the prioritization of road and rail projects at a localized level was considered.

In both the streams above, the assessment was based on current and visible usage trends, and a pipeline of capacity creation that is already in place. The summary of recommendations was anchored around two key outcomes:

- directional perspectives and strategies for the future creation of capacity, relevant for the next phase of master planning for VCIC; and
- identification and shortlisting of projects at various stages of execution in the current pipeline and prioritization for time-bound implementation.

Infrastructure to Enhance Overall Competitiveness of VCIC

VCIC is a coastal corridor designed around National Highway 5 (NH5) and the Chennai–Kolkata trunk railway line, which form the spines of the corridor. The corridor is also surrounded by several other strategic National Highway routes and other trunk rail routes. The alignments of these road networks are predominantly linear in nature. For the overall competitiveness of the corridor, it is critical that the spines of the corridor are designed for handling heavy transport. At the same time, linking them to arterial roads through radial connectivity at key inter-change points is critical to facilitate cost-efficient linkages between the hinterlands and the corridor.

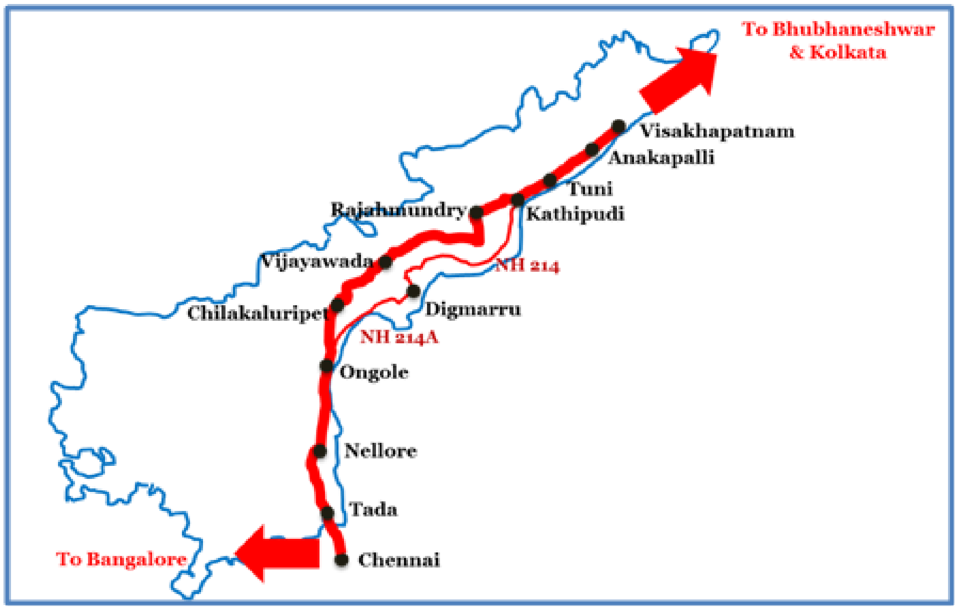
Therefore, as a first step for infrastructure augmentation, a corridor-level assessment is carried for the sufficiency of infrastructure and the key initiatives that are currently under the pipeline. Based on the assessment, certain projects are proposed for the overall enhancement of spinal and grid connectivity in the short-, medium-, and long-term.

Enhancing the Spinal Connectivity Infrastructure for the Corridor

Road Spine

VCIC is anchored around the 800 kilometer (km) segment of NH5 between Chennai and Visakhapatnam. From Chennai, the stretch passes through Tada, Nellore, Ongole, Chillakaluripet, Vijayawada, Rajahmundry, Kathipudi, Tuni, and Anakapalli before reaching Visakhapatnam (Figure 2.3). While almost two-thirds of this stretch is close to the coast, NH5 branches inland between Ongole and Kathipudi.

Figure 2.3: **VCIC Spine: Chennai–Visakhapatnam Segment of NH5**



Source: Consultations with State level road agencies, Study team analysis.

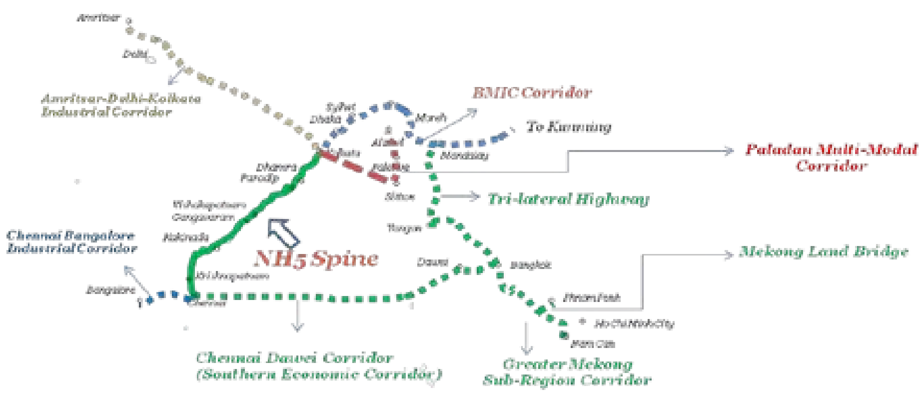
<u>Need for Strengthening the Spine</u>

Designing a strong spine is critical from the perspective of the overall competitiveness of VCIC. Academic evidence (Ghani 2012) has found strong positive effects of the Golden Quadrilateral network on manufacturing plants in proximity to the network, even without any guided planning. In a node-centric manufacturing strategy under VCIC, the spill-over effects are expected to be even wider.

VCIC is part of the larger ECEC stretching from Chennai to Kolkata and anchored around the entire stretch of NH5. The road is strategically linked at both ends to other industrial corridors, like the Chennai–Bangalore Industrial Corridor (CBIC) and the Amritsar–Kolkata Industrial Corridor (AKIC). The highway will also form an important component of major regional road connectivity networks with Southeast Asia, as shown in Figure 2.4, as well as facilitate multi-modal transport between the ports of the corridor and the regional networks. Effective integration into such multi-modal networks will demand a strong backbone.

As part of the National Highway Development Programme's (NHDP) Phase 1, the entire stretch of NH5 was expanded to four lanes. While this phase has facilitated a smoother flow of vehicular movement, there may be a need for further augmentation. The expected increase in freight traffic through the ports of the VCIC region, as well as the location of nodes close to the spine, suggests a further increase in capacity.

Figure 2.4: **NH5—Spine of the East Coast Corridor**



Source: Study team analysis.

(i) 6-Laning the NH5 corridor

The Chennai–Visakhapatnam segment of the National Highway Authorities India (NHAI) has already been shortlisted as a high-density corridor for 6-laning under Phase V of the NHDP. Seven projects have been proposed and are under various stages of implementation to achieve this objective (Table 2.2). They are recommended for immediate prioritization and execution.

Table 2.2: **Projects for 6-Laning of NH5 Spine under Consideration**

S. No.	NH5 segment for six-laning	Length (km)	Criticality	Readiness of the Project					Executing Agency	Comments and Key Issues
				1	2	3	4	5		
1	Chennai–Tada	43.4	Critical						NHAI	Being executed under BOT. 80% construction of the project is completed, with 10km of urban length in Chennai remaining. This 10-km stretch needs to be acquired by NHIA.
2	Tada–Nellore Bypass	128.0	Critical						NHAI	A feasibility study needs to be finalized to identify procurement model,

continued on next page

Table 2.2 *continued*

S. No.	NH5 segment for six-laning	Length (km)	Criticality	Readiness of the Project					Executing Agency	Comments and Key Issues
				1	2	3	4	5		
3	Nellore–Chillakalluripet	183.5	Critical						NHAI	BOT project delayed due to land acquisition; around 134 km of the total work has been completed. The complete project is expected to be delayed to July 2015, pending resolution.
4	Chillakalluripet–Vijayawada	82.5	Critical						NHAI	Being executed under BOT. Around 66 km of the stretch is completed. However, around 15 km in Chilakaluripet town is delayed due to land acquisition.
5	Vijayawada–Gundugolanu	103.6	Critical						NHAI	Being executed under BOT. Land acquisition completed. Project expected to be completed in 3 years.
6	Gundugolanu–Rajahmundry	120.7	Critical						NHAI	Project has been awarded, but implementation yet to be commenced
7	Rajahmundry–Anakapalli–Visakhapatnam	201.1	Critical						NHAI	Implementation Model has to be decided

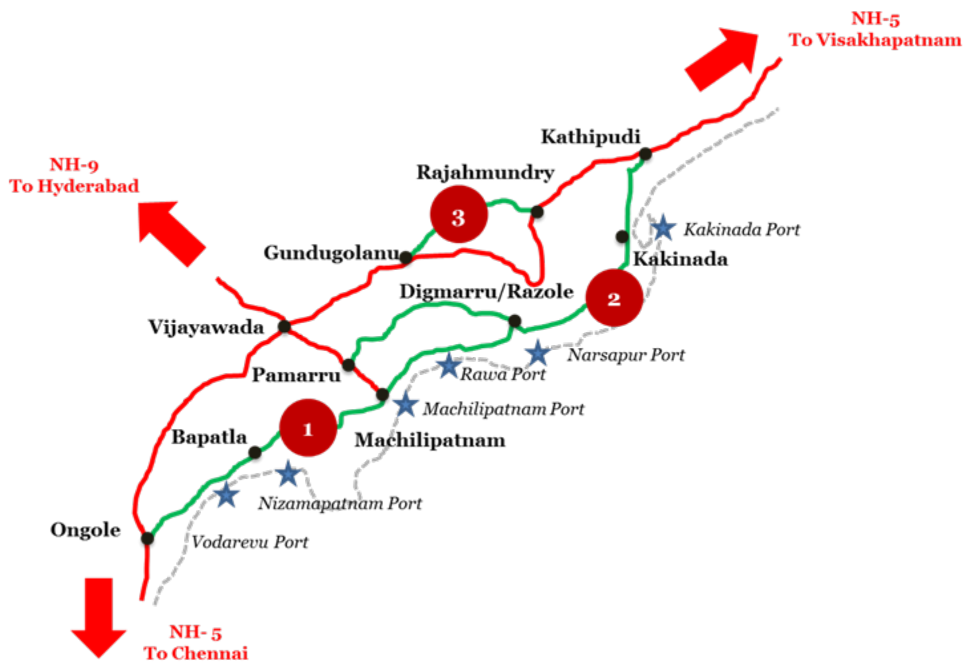
Source: Consultations with Central and State level road agencies (NHAI, APRDC, T,R&B), Study team analysis.

(ii) Parallel Access at Crucial Segments (NH214, NH214A, and SH 103)

The spinal road of NH5 will facilitate direct connectivity for most of the VCIC coastline. However, between Ongole and Kathipudi, the road branches inland. This region is home to the central port cluster anchored around Machilipatnam and Kakinada, as well as the offshore take-off points from the Krishna Godavari basin.

This region may also see a large amount of traffic movement from three nodes (Gannavaram–Kankipadu, Visakhapatnam, and Kakinada), and hinterland movement from three operational ports (Gangavaram, Visakhpatnam, and Kakinada). Therefore, parallel access roads close to the NH5 spine in this region may be required to augment capacity to handle this demand (Figure 2.5). Three important connectivity projects are proposed (Table 2.3):

Figure 2.5: **VCIC Spine—Alternate Access Routes close to the Central VCIC Region**



Source: Consultations with central and state level road agencies (NHAI, APRDC, T,R&B), Study team analysis.

a) NH214 connects Ongole through Bapatla and Machilipatnam to Digmarru, close to the proposed port of Narsapur. The condition of NH214A is very poor in several stretches, requiring urgent attention. In the immediate-term, the road will need to be converted to a high-quality, 2-lane highway with paved shoulders. The stretch also has several proposed port locations. In the event that one or more of these locations are developed, additional capacity augmentation to four lanes may be considered.

b) NH214 connects Pamarru to Kathipudi, crossing NH214 close to Digmarru. NH214 is also expected to become increasingly congested in the near future and needs to be strengthened on an urgent basis. Considering its importance for the Kakinada node, and because of its proximity to the operational ports of Kakinada, it is proposed that this stretch be directly upgraded to four lanes.

c) Finally, an alternate shorter stretch falling under State Highway (SH) 103 between Gundugolanu and Rajahmundry on NH5 is also needed, considering the strategic location of the stretch between the three nodes and the connectivity to Hyderabad and other VCIC hinterlands.

Table 2.3: **Alternate Spinal Connectivity Projects**

S. No.	Project	Length (km)	Criticality	Readiness of the Project					Executing Agency	Comments and Key Issues
				1	2	3	4	5		
1	Upgrade of NH214A from Ongole to Digamarru to two lanes with paved shoulders	255	Critical						NHAI	• Upgrade of entire section from single lane to two lanes with paved shoulders in the short-term and 4-laning in the medium-term • Replacement of low-level causeways with high-level bridges is required • Feasibility study needs to be commenced
2	4-laning of stretch from NH214 (Kathipudi to Razole)	128.0	Critical						NHAI	• Feasibility study needs to be commenced
3	• Gundugolanu–Devarapalli–Kovvur • Bridge on Godavari–Rajahmundry near Kovvur	68	Critical						APRDC and NHAI	• The detailed project report (DPR) for the project has been completed. APRDC has submitted a proposal to the GOI for approval of VGF funding. GOI approval is awaited. Meanwhile, NHAI has requested GOAP to hand over this road stretch to NHAI and convert this into a national highway as per communications in July 2014. • 85% of work on the bridge is completed. Total work is expected to be completed by December 2014

Source: Consultations with central and state level road agencies (NHAI, APRDC, T,R&B); Study team analysis.

(iii) Other Spinal Projects being proposed by Government; Projects linked with Petroleum, Chemicals, and Petrochemicals Investment Region (PCPIR)

The plan of the Government of Andhra Pradesh to establish PCPIR includes proposals for one major expressway parallel to the NH5 along the coastline, and a few connecting feeder routes close to the coastline (Figure 2.6).

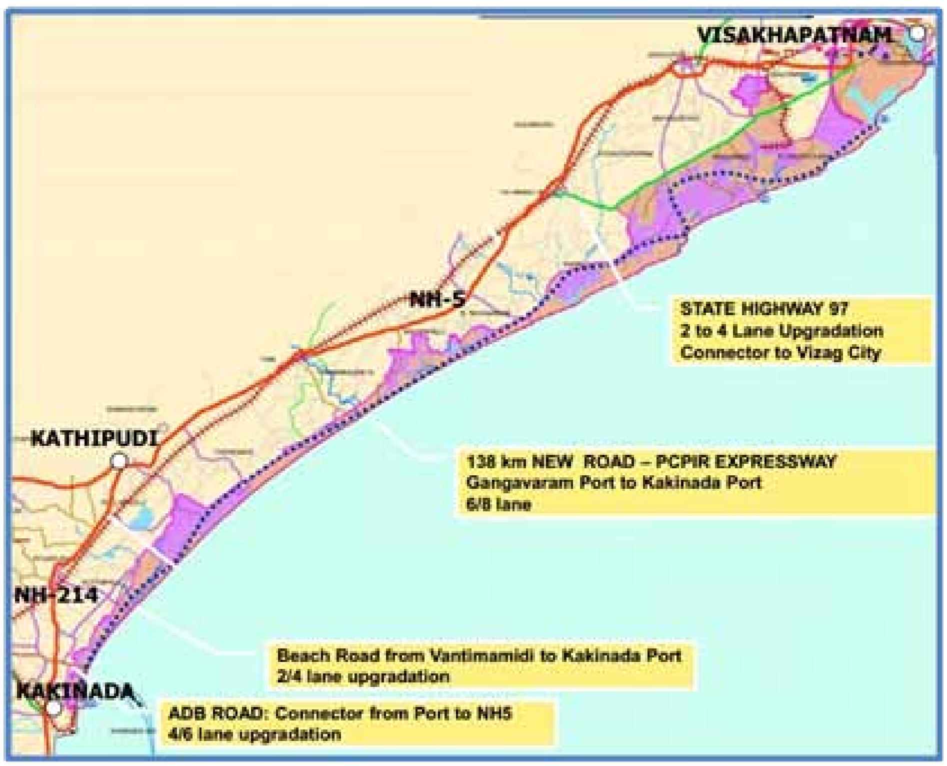
These routes include inter-port connectivity projects (between Gangavaram, Vizag, and Kakinada ports). Therefore, these projects will provide parallel spinal connectivity close to the coastline, and over the long-term provide benefits that go beyond PCPIR itself.

However, given implementation considerations, it is proposed that these projects be taken up as an integral element of the PCPIR project. During implementation, the inter-linkages between PCPIR and VCIC should be considered for infrastructure development.

Railway Spine

The spine of the network is made up of a sub-segment of the Chennai–Kolkata line. This spine falls predominantly under the Vijayawada division of the South Central Railway (Gudur–

Figure 2.6: **Road Projects linked with PCPIR**



Source: Andhra Pradesh PCPIR, Study team analysis.

Duvvada) with small segments falling under the Southern Railway (Chennai–Gudur) and East Coast Railway (Duvvada to Visakhapatnam), respectively.

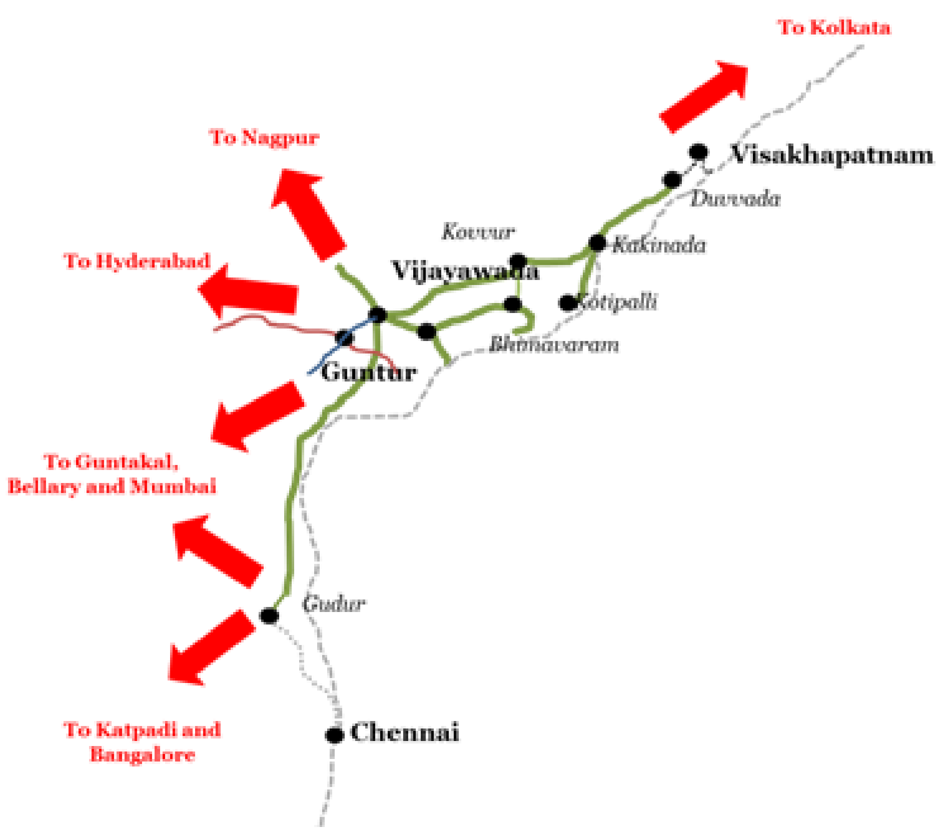
For both passenger and freight traffic, the spinal link is one of the most prominent ones (one of the top seven high-density railway corridors) in the Indian Railway network.

The spine of the network provides onward connectivity to the important hinterland centers of Bangalore, Mumbai, Nagpur, and Kolkata through prominent junctions in the route (Figure 2.7).

__Need for Strengthening the Spine__

The spine is co-terminus with the Vijayawada division of the South Central Railway Zone. The line is one of the busiest in the Indian Railway network. This is determined by the line capacity and utilization (defined in terms of number of trains, both passenger and freight, that can be accommodated in a 24-hour period) of various segments of the line (Table 2.4).

Figure 2.7: **Vijayawada Division of South Central Railway**



Source: Consultations with South Central Railway, Published Pink Book, Study team analysis.

Table 2.4: **Line Capacity and Utilization of the Gudur–Duvvada Trunk Line for VCIC**[a]

S. No.	Section	Chartered Capacity (trains per day)	Effective Capacity (trains per day)	Utilization (trains per day)	% Utilization
1	Gudur–Bitragunta	78	70	65.5	93.6%
2	Bitragunda–Krishna Canal	79	71	67.8	95.5%
3	Krishna Canal–Vijayawada	100	90	87.5	97.2%
4	Vijayawada–Nidadavolu	66	59	50.4	85.4%
5	Nidadavolu–Rajahmundry	73	66	57.3	86.8%
6	Rajahmundry–Samalkot	70	63	61.5	97.0%
7	Samalkot–Duvvada	65	59	47.0	79.8%

[a] South-Central Railway Statistics for Vijayawada Division (2013–14).

Source: South Central Railways.

Capacity utilization in most segments of the line is well above 90%, and with other segments in the 80%–90% range. For the effective running of trains, utilization has to be less than 80%, which is breached in all segments of the line. While the bottleneck capacity is about 60 trains per day for the entire segment, the average capacity is about 68–70 trains per day.

Against this, the Vijayawada division, which is mostly co-terminus with the railway line, handled close to 30 million tons in 2013–14, which translates to approximately 30 rakes a day. This suggests that freight traffic forms roughly half of the line capacity utilization in the entire network.

A manufacturing and port-centric development model for VCIC will increase the number of rail freight trains both along and lateral to the corridor, and therefore effective measures are required for line capacity augmentation. Line capacity augmentation can consider several solutions including increasing the number of lines, rationalization of train speed and number of blocks, and improvements to signaling systems.

i) Number of lines. The entire line is electrified and broad-gauge with double-line configuration. Tripling or quadrupling the entire line may need to be considered. While patch-tripling works have been considered in the past by Indian Railways, doing this across the entire segment will be expensive.

ii) Adjustment of train speed and number of blocks. An important aspect to be considered is the mixed use of this segment between passenger and freight rail. The Chennai–Vijayawada segment is part of the New Delhi–Chennai route, which is already one of the four recognized Group A routes in the country, permitting speeds of up to 160 km per hour. The rest of the line is a Group B route, permitting speeds of up to 130 km per hour. Since several premium passenger trains are expected to run this route, a reduction in train speed or increased number of blocks to de-bottleneck line capacity will need to be imposed only on freight trains, which will have the effect of reducing speed of evacuation.

iii) Advanced signaling systems under mixed use. Implementation of advanced signaling technologies like Automatic Block Signaling (ABS) can also increase the line capacity of the network. However, in mixed traffic situations, the efficacy of ABS is expected to be limited.

Analysis of the current Pink Book suggests that none of the segments have interventions aligned along the above categories. In the absence of sufficient project preparation and given the challenges in implementation, projects in the above categories have not been considered.

Need for a Dedicated Freight Corridor

A long-term solution for the spinal rail network of the VCIC (and for the entire ECEC) may be to separate passenger and freight traffic.

Indian Railways is currently undertaking preliminary studies for two dedicated freight corridor (DFC) projects (Figure 2.8):

Figure 2.8: **Alignment of North-South and East Coast DFCs**

Source: Dedicated Freight Corridor Corporation of India Limited (DFCCIL).

i) North–South DFC, from Delhi to Chennai via Vijayawada, spanning a length of 2173 km

ii) East Coast Corridor from Kharagpur near Kolkata via Visakhapatnam to Vijayawada, spanning a length of 1,100 km

The preliminary studies have not yet been approved. At the time of master planning for VCIC, an extensive demand–supply analysis will need to be undertaken to assess the need and time horizon of a DFC in the future, based on which execution planning will need to be commenced (Table 2.5).

Table 2.5: **Spinal Connectivity Railway Projects for Execution**

S. No.	Project	Length (km)	Criticality	Readiness of the Project					Executing Agency	Comments and Key Issues
				1	2	3	4	5		
1	DPR for North–South DFC from Delhi to Chennai via Vijayawada	2,173	Need to Have						DFCCIL	• Need to commence work on DPR to supplement the preliminary studies
2	DPR for East Coast DFC from Kharagpur to Vijayawada	1,100	Need to Have						DFCCIL	• Need to commence work on DPR to supplement the preliminary studies

Source: DFCCIL.

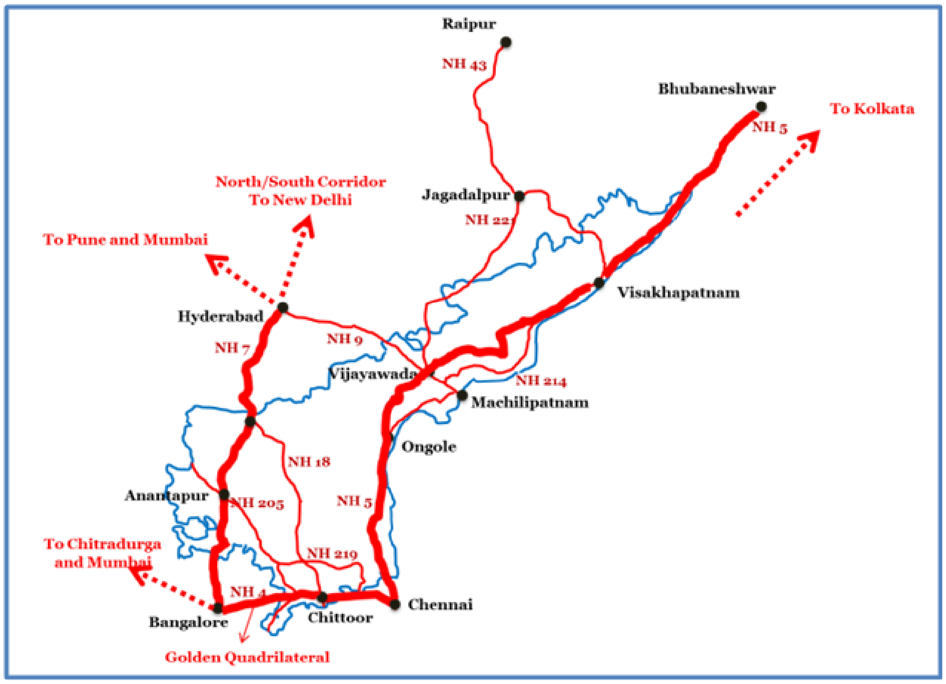
Augmenting the Transport Infrastructure Grid for the Corridor

VCIC Road Network Grid

Besides the spinal road of NH5 and the parallel stretches, VCIC is also bounded by important national highways on two other sides (Figure 2.9):

- NH7 (North–South Corridor of the Golden Quadrilateral network) passes through Anantapur and Kurnool districts to the West, connecting to Hyderabad, Nagpur, and Delhi in the north, and to Bangalore and southern districts in the South.
- NH4 (southern leg of the Golden Quadrilateral network) between Chennai and Bangalore forms the southern boundary of the VCIC region.
- NH9 (Machilipatnam to Pune), passing through Vijayawada and Hyderabad and Solapur, forms the important radial highway network from VCIC to the hinterlands.
- NH18 (Kurnool on NH7) to Chittoor (on NH4) forms a diagonal stretch in the southwestern part of the VCIC network.
- NH205 (Anantapur on NH7) to Chennai via Tirupati forms another diagonal stretch parallel to NH18.
- NH221 and NH43 (between Vijayawada and Raipur) passes through Jagadalpur.

Figure 2.9: **Prominent Road Network around the VCIC Region**



Source: Consultations with central and state level road agencies (NHAI, APRDC, T,R&B), Study team analysis.

Need for cross-connectivity

As seen in Figure 2.9, most of the highways are aligned in a linear direction in the northeast–southwest and north–south directions. Augmenting cross-connectivity between the linear routes to reduce time, cost, and distance for evacuation of cargo from gateways and nodes to the hinterland has been considered. For this purpose, a set of seven road projects are proposed that provide cross-connectivity between the spinal network of NH5 to other arterial highways (Figure 2.10).

- **Southern grid augmentation.** Three road projects are proposed to connect key points on NH5 to NH7 in the southern network, cutting across NH18. One more road project is proposed to connect Tada on NH5 to Kadapa on NH18. The grid is expected to reduce the cost of transport from the southern port cluster to the hinterlands through the arterial road of NH7 and onward to the rest of the hinterlands.
- **Central grid augmentation.** Guntur on NH5 is proposed to directly connect with Bapatla in NH214A. This project, in conjunction with other southern grid projects (Guntur–Kurnool and Guntur–Anantapur), will shorten the distance for the central port cluster.
- **Northern grid augmentation.** One project is proposed to connect Devarapalli on NH5 to Suryapet on NH9, which will reduce the distance of road transport between Visakhapatnam and Hyderabad (both for hinterland and airport connectivity). One

Figure 2.10: **Proposed Road Grid Network for Capacity Augmentation**

Source: Consultations with central and state level road agencies (NHAI, APRDC, T,R&B), Study team analysis.

more project is proposed between Visakhapatnam and Chinturu to reduce the distance from the northern grid to Raipur (Table 2.6a).

VCIC Rail Network Grid

Besides the Vijayawada division of the South Central Railway, five other divisions of the South Central Railway (Guntakal, Guntur, Hyderabad, Secunderabad, and Nanded divisions) form the network connectivity for the corridor. Key interchange points through the Southern, Southwestern, West–Central, and East Coast Railways provide connectivity to distant hinterland centers as shown in the Figure 2.11.

Need for cross-connectivity

The spine of the network (Chennai–Visakhapatnam) is well-connected to the ports of the corridor. However, evacuation to the hinterland from the central spine is bottlenecked through the central inter-change junctions of Guntur and Vijayawada, and to the southern junction at Gudur. Predominantly in the southern network, the triangle formed between the junctions of Renigunta, Guntakal, and Guntur has several gaps that increase the distance between the coast and the hinterland, as well create bottlenecks at the Guntur junction. Similarly, the transport of port cargo from the northern port cluster to the northern hinterlands is constrained by bottleneck capacity at Vijayawada junction. Several projects within the Pink Book are being picked up to relieve this congestion (Figure 2.12).

Table 2.6a: Road Grid Connectivity Projects for Execution

S. No.	Project	Length (km)	Criticality	Executing Agency	Comments and Key Issues
1	Tada to Kadapa through Srikalahasthi and Renigunta	208	Critical	T,R&B Dept. (GoAP)/ NHAI	• SH to NH conversion followed by 4-laning
2	Guntur to Anantapur Road	370	Critical	T,R&B Dept. (GoAP)/ NHAI	• SH to NH conversion followed by 4-laning
3	Krishnapatnam to Nellore to Bellary	460	Critical	T,R&B Dept. (GoAP)	• Upgrading of various stretches of SH57 from the port at Nellore to Yadiki on NH63 for 4-laning • 4-laning of Yadiki–Bellary to Gooty on NH7
4	Guntur to Kurnool	281	Critical	T,R&B Dept (GoAP)/ NHAI	• SH to NH conversion followed by 4-laning
5	Guntur to Bapatla	49	Critical	APRDC	• Upgrading from 2-lane to 4-lane connectivity
6	• Devarapalli to Suryapet via Tallada • Suryapet to Khammam	172 km 61 km	Critical	T,R&B Dept (GoAP)/ NHAI	• Upgrading from 2-lane to 4-lane connectivity for the Devarapalli to Suryapet section • Remaining stretch converted from SH to NH, followed by 4-laning
7	Visakhapatnam to Chinturu	238	Critical	T,R&B Dept (GoAP)/ NHAI	• SH to NH conversion followed by 4-laning

Source: Consultations with Central and State level road agencies (NHAI, APRDC, T,R&B), Study team analysis.

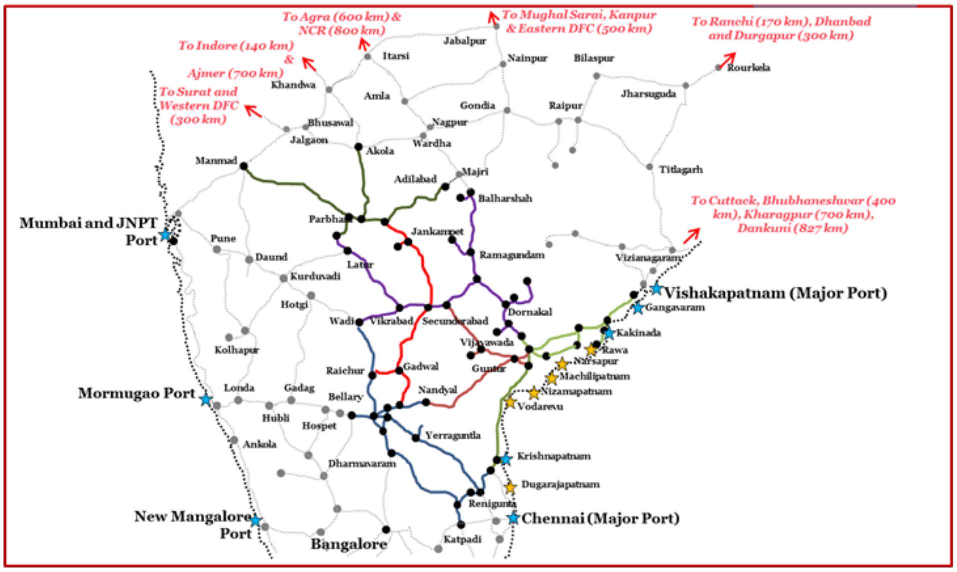
Table 2.6b shows the indicative cost estimates of select priority projects of Government of Andhra Pradesh.

Table 2.6b: Indicative Cost Estimates

Name of the Stretch	Length (in km)	Estimated Project Cost (in INR *crore*)
Atchutapuram–Anakapalle-Yelamanchilli-Gajuwaka	60	540
Tuni -Narasipatnam–Sabbavaram	110	990
Visakhapatnam-Pendruthi-Srungavarapukota-Ananthagiri-Sunkavarimetta-Araku-Orrissa Border	107	1,007
Vizianagaram–Palakonda Road - Haddubhangi	70	719
ADB Road - Kakinada to Rajanagaram	56	504
Kakinada Anchorage Port - Captive port in KSEZ - Kakinada Uppada Beach Road	30	420
Krishnapatnam port to Nellore via Muthukur	25	350
Tada - Srikalahasti	46	414
Renigunta - Cuddapah	135	1,080
Gudur–Rapur–Rajampet–Rayachoti–Kadiri–Hdupur–		
Madakasira–Hiriyur	330	3,181

Source: APRDC.

Figure 2.11: **Railway Grid Network around the VCIC Region**



Source: South Central Railways, Study team analysis.

Figure 2.12: Proposed Railway Grid Network for Capacity Augmentation

Source: Consultations with central and state level rail agencies, Pink Book, Study team analysis.

Table 2.7: **Railway Grid Projects Proposed for Capacity Augmentation**

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project 1	2	3	4	5	Executing Agency	Comments and Key Issues
1	Kadapa–Bangalore	255.4	Critical						MoR and GoAP	• Project sanctioned in 2008-09 • Only 10% of physical progress has been made for and 12% of financial progress
2	Obuluvaripall--Venkatachalam	113	Critical						RVNL	• Project sanctioned in 2006–07 • No progress has been made. Cost sharing planned between Krishnapatnam Port, RVNL, NMDC, and GoAP.
3	Nadikudi–Srikalahasthi	309	Critical						MoR	• Project sanctioned in 2011–12 • No physical progress achieved
4	Prodattur–Cumbum	142	Critical						MoR	• Project sanctioned in 2013–14 • No physical project achieved
5	Nandyal–Yerraguntla	126	Critical						MoR	• Project sanctioned in 1996–97 • 75% progress has been achieved
6	Munirabad–Raichur	246	Critical						MoR	• Project sanctioned in 1997–98 • 75% progress has been achieved
7	Kovvur–Bhadrachalam	151	Critical						MoR	• Project sanctioned in 2012–13 • No physical progress achieved
8	Manuguru–Ramagundam	200	Critical						MoR	• Project sanctioned in 2013–14 • No progress achieved
9	Nizamabad–Jagtial	178	Critical						MoR	• Project sanctioned in 1993–94 • 80% progress achieved

Source: Consultations with central and state level rail agencies, Pink Book, Study team analysis.

Key Conclusions and Recommendations

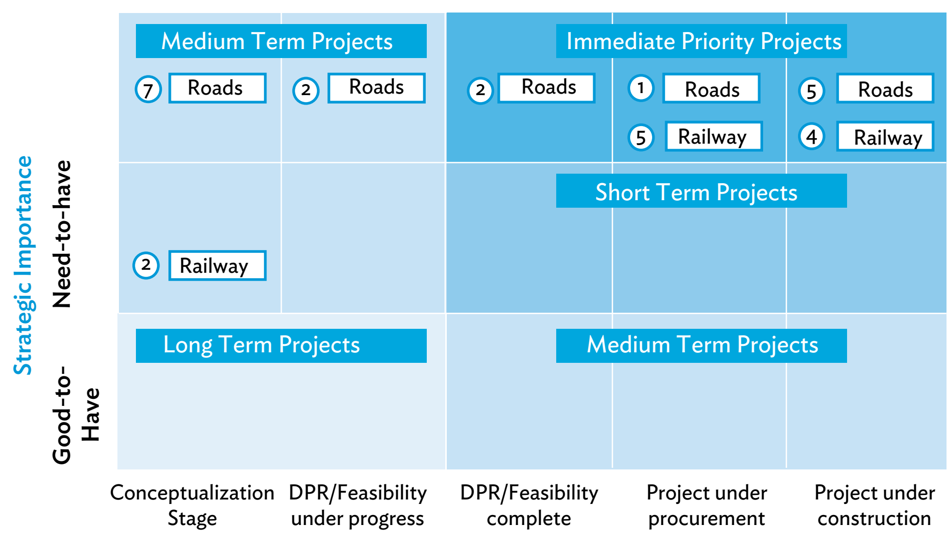
- In total, 28 road and rail projects have been proposed for spinal and road connectivity.
  - » **Spinal connectivity.** Ten road projects and two rail projects DFCs are proposed.
  - » **Grid connectivity.** Seven road projects and nine rail projects (Table 2.7) have been proposed.

- **Criticality and readiness:**
  - » **Criticality.** Twenty six of the 28 projects are judged to be immediately important for VCIC's competitiveness (i.e., critical). The two DFC projects are "need-to-have" projects that will be required in the medium-term.
  - » **Readiness.** While 17 projects are ready for execution, 11 projects are awaiting completion of feasibility studies and detailed project report (DPR).

- **Project prioritization.** Across the two dimensions of criticality and readiness, the following matrix has been generated (Table 2.8):
  - » **Immediate priority projects**
    - o Seventeen projects (eight road and nine rail) that are both critical and ready for execution are recommended for immediate execution. For projects already under procurement and implementation, mission mode monitoring to eliminate bottlenecks is recommended.

  - » **Medium-term projects**
    - o Nine road projects are identified as critical, but not ready in terms of project preparation. Work on a DPR and feasibility reports should commence immediately.

Table 2.8: **Prioritization Matrix for Corridor-Level Projects**



Source: Study team analysis.

- o DPR and feasibility report preparation for the two DFCs should also commence immediately.
- o While the two DFCs are expected to become important to resolve congestion in the trunk lines for cargo movement in the medium-term, VCIC's own development will create additional pressure that may accelerate the need for the DFCs. The timing and magnitude of the expected demand will be estimated during the next phase of the study (Master Planning of the Corridor).

Node-Centric Transport Infrastructure Development

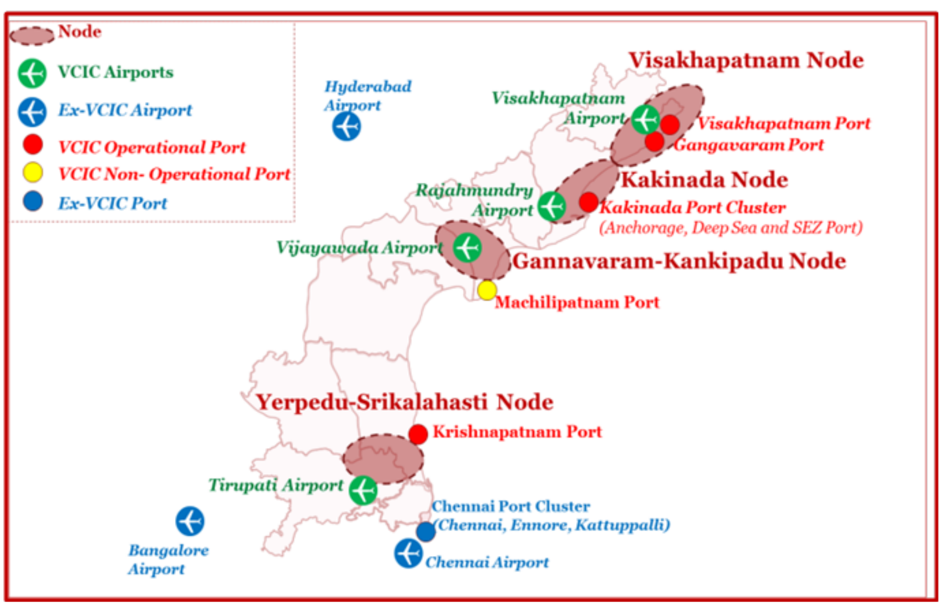
Introduction

As part of the infrastructure strategy for VCIC, four industrial nodes have been identified. Two nodes have been shortlisted closer to the northern coastline, one close to the central region, and one in the southern region. As described earlier, boosting the nodes' competitiveness will involve an integrated approach to connect the nodes, core gateways, and hinterland centers.

Nodes and Gateways

As a first step, each node has been mapped against a core set of gateways proximal to the node. The mapping of the nodes against the core gateways is discussed below (Figure 2.13):

Figure 2.13: **Nodes and Gateways in the VCIC Region**



Source: Consultations with State level government agencies in Andhra Pradesh, Study team analysis.

- Yerpedu–Srikalahasthi node: Krishnapatnam Port cluster and Tirupati Airport
- Gannavaram–Kankipadu node: Machilipatnam Port cluster and Vijayawada Airport
- Kakinada node: Kakinada cluster and Rajahmundry Airport
- Visakhapatnam node: Vizag–Gangavaram Port cluster and Vizag Airport

Gateways within the state of Andhra Pradesh. All the current operational airports and ports in the state of Andhra Pradesh have been represented within the key gateways that have been mapped against the nodes. Considering the importance of the gateways for the nodes, a strategy to enable optimal development of the ports and airports within VCIC is critical. As the next step, connectivity from nodes to the gateways within the selected ports will be assessed.

Gateways outside the state of Andhra Pradesh. Besides the operational ports and airports, other gateways have been considered in proximity to VCIC. For example, three of the top six international airports in India (Hyderabad, Bangalore, and Chennai) are located close to the VCIC region. A dominant portion of VCIC is connected to one or more of the three airports within a distance of 400 km–500 km. The Chennai port cluster is also expected to serve the interests of VCIC in the short-term. Therefore, these gateways are considered for network connectivity projects.

Key Hinterland Centers

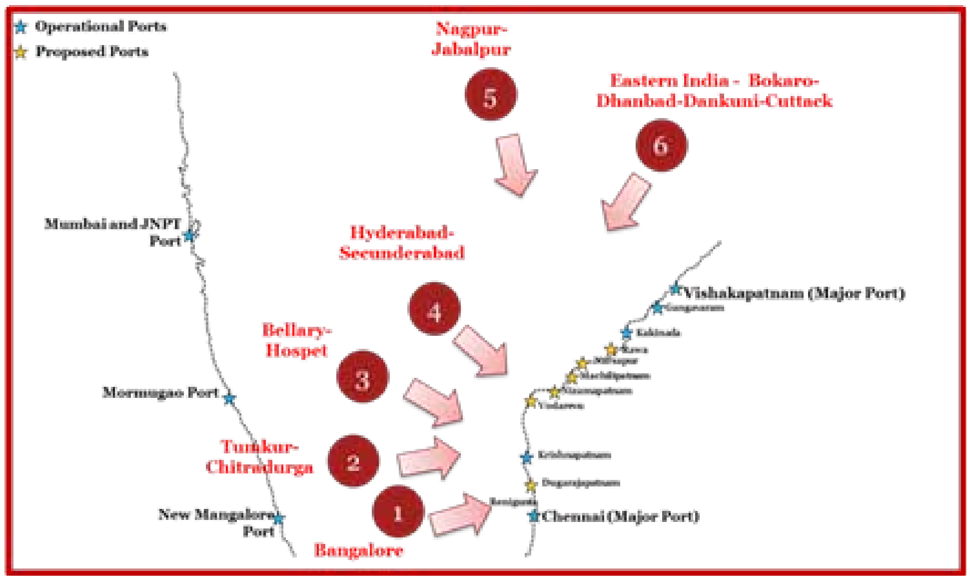
VCIC is surrounded by several cargo hinterland centers that will serve as both source and distribution centers for domestic cargoes, or as transit centers for onward movement. Two distinct requirements for connectivity to the hinterlands may arise:

Node-to-hinterland connectivity. While gateway connectivity can enable logistics anchored around trade, strengthening middle-mile connectivity between nodes and selected hinterland source and distribution centers can improve domestic sourcing and distribution for manufacturing industries within VCIC.

Hinterland-to-gateway connectivity. Several sources of industrial production located outside VCIC may generate demand for cargo throughput through ports in VCIC. Facilitation of this throughput through VCIC gateways via better connectivity may bestow scale advantages to the corridor by (i) helping accelerate cargo agglomeration in VCIC and balancing the export–import mix, and development of shipping services, container capacity, and logistics infrastructure; and (ii) reducing unit costs of logistics infrastructure and services by increasing utilization of both fixed infrastructure and fleets of trucks and railway rakes (e.g., through bi-directional movement).

For this purpose, a shortlist of six strategic regions has been proposed as benchmark hinterland centers. These centers have been chosen based on their strategic locations, as well as the specific development context of the industries (Figure 2.14). They are as follows:

Figure 2.14: **Important Hinterland Centers for the VCIC Region**



Source: Study team analysis.

1) Three regions in the state of Karnataka: Bangalore, Tumkur–Chitradurga, and Bellary–Hospet
   - These regions are expected to attract large amounts of investment in the near future due to their status as existing industrial centers, as well as by being a part of the proposed Chennai–Bangalore Industrial Corridor (CBIC) and Bangalore–Mumbai Economic Corridor (BMEC).
   - These centers lack viable western coastline port options due to technical limitations. Therefore, convenient and cost-effective connectivity to the eastern coastline can increase the competitiveness of VCIC ports.

2) Two regions in central India: Hyderabad and the Nagpur–Jabalpur belt
   - These regions are important production and consumption centers, in addition to being situated at equal distance from the eastern and western coastlines. Both centers are further connected to the North–South corridor through NH7 and can serve as cargo agglomeration centers for north and central India.
   - Providing direct connectivity to these cities can help pull cargo directly from the hinterlands in competition with the western coastline.

3) Connectivity to eastern India: the Bokaro–Dhanbad–Dankuni arc
   - As a segment of the ECEC and because of the comparative technical advantages of the ports in the state, industrial areas in the eastern belt become important candidate cargo centers for VCIC ports.

Focus of Discussion. The next section of the report discusses the node-centric infrastructure development strategy in two stages:

- enabling key gateways through a development strategy for ports and airports, and
- expanding network connectivity between nodes, gateways, and hinterland centers.

Enablement of Key Gateways: Port Development Strategy

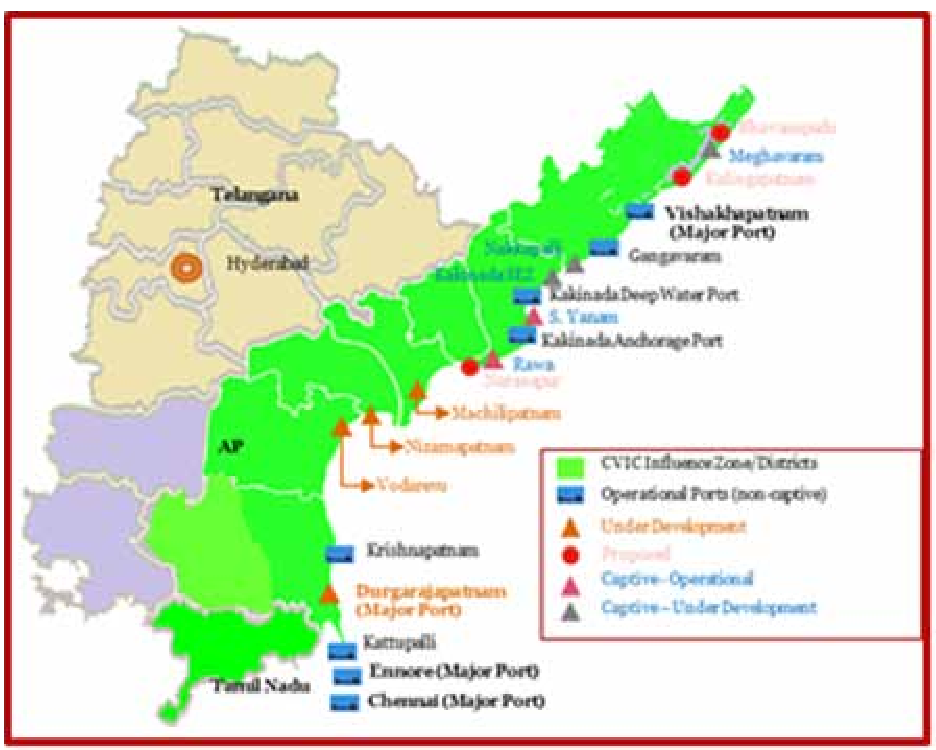
Introduction

VCIC: India's first coastal corridor

The corridor's coastline is about 800 km long and is currently served by the operational ports of Visakhapatnam, Gangavaram, Kakinada Deep Water, and Krishnapatnam in the state of Andhra Pradesh; and by the Chennai port cluster (Chennai, Ennore, and Kattupalli) in the state of Tamil Nadu (Figure 2.15).

Besides the above ports, the Government of Andhra Pradesh has proposed several other candidate locations for greenfield port development.

Figure 2.15: **VCIC Coastline**



Source: Indian Ports Association, Department of Ports, GoAP, Study team analysis.

The VCIC coastline has several advantages:

- sea-side advantages, including deep draughts and protected shore-fronts at many of the identified port locations;
- the natural alignment of the coastline offers competitiveness in handling cargo arriving from or destined for the eastern hemisphere;
- shore-front and land-side advantages in several greenfield locations that are relatively unobstructed by urban sprawl, and the ability to expand to become large ports; and
- spinal connectivity along the coastline in the form of the southeastern leg of the Golden Quadrilateral network (in the form of NH5), and the Kolkata–Chennai railway route, which is already operating as an electrified double-line trunk route.

Need for a port-centric development strategy

> VCIC will be India's first coastal industrial corridor, and will aim to leverage its nautical advantage in the industrialization strategy.

Eleven districts in Andhra Pradesh fall in the influence zone, which represent almost 80% of the state's area, and are expected to become home to industrial nodes providing a renewed thrust to domestic and export-oriented manufacturing. This will, in turn, create demand for both inbound and outbound logistics through the port networks.

The central government and state governments in the region have identified several initiatives to rejuvenate the manufacturing sector, including investments in national manufacturing investment zones, in alignment with the National Manufacturing Policy. This is expected to create demand for shipping and logistics of raw materials and manufactured goods through the coastline.

India's "Act East Policy" was initiated in 1991 to establish closer ties with East Asian economies to realize Indian aspirations of becoming a global economic superpower. The corridor's coastline is naturally suited for tighter integration with East Asia and Southeast Asia economies in terms of participating in global manufacturing supply chains, which have hitherto largely bypassed the sub-continent. The ports of the coastline are expected to play an important part in this process.

Further, special investment regions like PCPIR and the ones near Kakinada–Srikakulam will create demand for commodity-specific port infrastructure. Additionally, other industrial corridors like CBIC and BMEC will create cargo opportunities in the secondary hinterland. However, there is huge potential for improvement in cargo throughput as detailed in the section below. A port-led economic development strategy could result in the corridor emerging as the node integrating India into global manufacturing supply chains.

Nodes and Port Clusters

The coastline can be logically divided into three clusters of port locations, each will serve one or more of the industrial nodes selected for VCIC (Figure 2.16).

Figure 2.16: **Port Clusters in the VCIC region**

Source: Study team analysis.

The Visakhapatnam industrial node is expected to be directly served by the northen cluster.

The northern cluster is comprised of the ports of Visakhapatnam and Gangavaram, which dominate the current throughput in the corridor (mainly for bulk cargo and low-value containerized traffic from proximal centers). While enjoying advantages on the sea-side and due to incumbent traffic, the northern cluster needs to be equipped with better last-mile connectivity and superior logistics infrastructure. Medium-term issues related to available land for expansion and expected urban sprawl need to be resolved as well.

The Gannavaram–Kankipadu and Kakinada nodes are expected to be served by the central cluster.

The central cluster comprises ports around the Krishna Godavari basin, which include the two operational ports at Kakinada. These ports typically have channel, draft, and land-side restrictions, and therefore may not be able to be developed as large port locations. However, they are well-suited to service the captive needs of industrial users. Being centrally located, they are also well-suited for meeting the distribution needs of essential commodities like cement and fertilizers, through creation of multi-purpose berths.

The Yerpedu–Srikalahasthi node is expected to be served by the southern cluster.

The southern cluster of ports is anchored around the currently operational port of Krishnapatnam. The availability of deep drafts, land, and spinal connectivity, and a lack of urban sprawl are key advantages in this cluster, providing bandwidth for expansion. While currently focused on coal cargo for a limited set of users, the cluster is expected to see large containerized movement owing to the development of VCIC and CBIC nodes, as well as from the gradual shift of container traffic from the congested Chennai port to the southern cluster.

Current-State Assessment of VCIC Ports

As part of the analysis phase, a detailed literature review was conducted, which was then supplemented by a list of interactions conducted with port developers, key stakeholders, participants in the cargo supply chain, as well as government officials and policy makers. The focus of this phase was to understand the current state of development of VCIC's port clusters in its entirety, and place their current performance and capacity development plans in context with key external trends and future demand. The strengths and weaknesses of each port cluster and individual port was examined, along with their expected role in supply chains and maritime trade.

Current Commercial Performance

The gateway ports shortlisted against the nodes (Visakhapatnam, Gangavaram, Krishnapatnam, and Kakinada port clusters) represent the entire commercial traffic handled along the Andhra Pradesh coastline. The current traffic performance of VCIC ports, along with the Chennai port cluster, is showcased in Table 2.9.

Table 2.9: Cargo Throughput through VCIC Ports (commissioned or awarded)

S. No.	Port	Status	Developer	2013-14 Traffic (mTPA)	Major Categories of Cargo
Northern Port Cluster (Visakhapatnam Node)					
1	Visakhapatnam	Major Port (Operational)	Visakhapatnam Port Trust	59	Iron Ore, POL, Coal, Fertilizers, Containers
2	Gangavaram	Non-Major Port (PPP Operational)	DVS Raju Group	16	Coal, Project Cargo, Fertilizers
Central Port Cluster (Kakinada and Gannavaram-Kankipadu Nodes)					
3	Kakinada Deep Water	Non-Major Port (PPP Operational)	International Sea Ports Limited	17	Phosphoric Acid, Edible Oil, Steel Billets, Industrial Salt, Coal
4	Kakinada Anchorage	Non-Major Port (Operational)	Department of Ports, Andhra Pradesh	4	Mainly Break Bulk (Fertilizers, FRM , Rice, Soyabean, Edible Oil)
5	Rawa	Private Captive Port (Operational)	Cairn Energy	2	POL
6	Machilipatnam	Non-Major Port (PPP Awarded)	CVR Group	-	Yet to be developed
7	Kakinada SEZ	Private Captive Port (Awarded)	GMR Group	-	Yet to be developed
Southern Port Cluster (Yerpedu-Srikalahasthi Node)					
8	Krishnapatnam	Operational Non-Major Port	CVR Group	23	Coal, Iron Ore, Containers
			Total from VCIC Ports	**121**	
Ex-VCIC Gateways (Chennai Cluster) proximal to VCIC nodes					
9	Chennai	Major Port (Operational)	Chennai Port Trust	52	Containers, POL, Break Bulk
10	Ennore	Major Port (Operational)	Ennore Port Limited	27	Coal, Break Bulk
11	Kattuppalli	Non-Major Port (PPP Operational)	L&T Ports	0	Containers
			Total from proximal Ex-VCIC Gateways	**99**	

PPP: Public Private Partnership; POL: Petroleum, Oil and Lubricants.

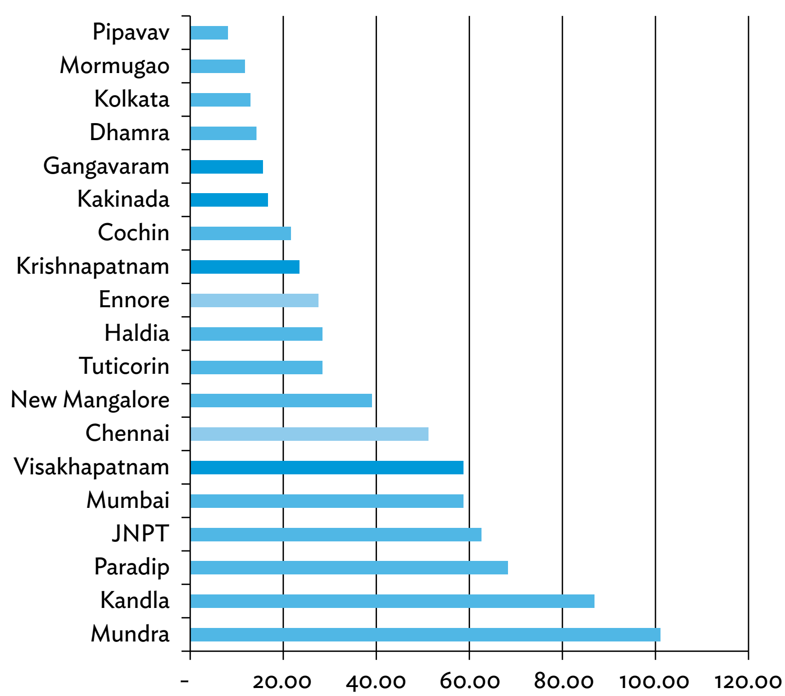
Source: Indian Ports Association, Department of Ports, GoAP, Study team analysis.

Except for Vizag, none of the VCIC ports rank among the top 10 largest ports in the country in terms of traffic. Traffic at Vizag port is also declining and it is losing prominence among Indian ports due to the effects of the economic downturn and the poor state of cargo development along the coastline.

The entire coastline between Chennai and Visakhapatnam handled around 220 million tons of traffic in 2013–14.

Discounting the non-VCIC port cluster of Chennai ports, the port clusters of VCIC represent the entire operational capacity of the state of Andhra Pradesh. These ports handled around 121 million tons of traffic, including six million tons of break bulk and liquid cargo throughput handled through the captive port of Rawa and the Anchorage Port (Figure 2.17).

Figure 2.17: **Commercial Cargo Throughput through Indian Ports, 2013–14 (million tons)**



Source: Indian Ports Association, Department of Ports, GoAP, Study team analysis.

Of the above, the major port of Visakhapatnam alone handled close to 59 million tons of traffic, which represents more than 50% of VCIC's operational traffic, making it the corridor's only port among the 10 largest in the country. However, Vizag port's performance should be seen against its steady decline in its cargo performance. The port's traffic in 2007–08 was almost 65 million tons and it was the second-largest port in the country. Since then, the port has witnessed a steady decline of traffic, both because of the economic downturn and the advent of competing ports. It is now the sixth-largest port in the country.

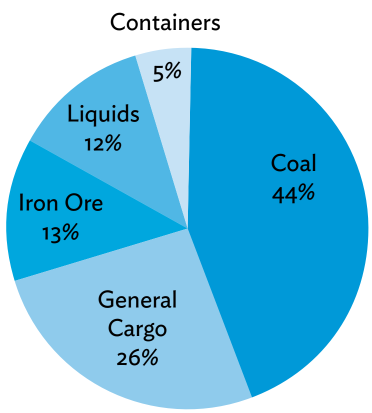
The skewed concentration of cargo toward bulk is an additional indicator of the poor state of cargo development.

Visakhapatnam, Gangavaram, Kakinada Deep Sea Port, and Krishnapatnam represent the operational commercial ports in VCIC handling 115 million tons of traffic in 2013–14.

As illustrated in Figure 2.18, a large proportion of this traffic is driven by bulk cargo. Coal and iron ore together form around 57% of the throughput, with liquids and petroleum, oil, and lube (POL) forming 12%. General Cargo accounts for 26%. Container traffic forms a mere 5% of the overall throughput.

While Visakhapatnam port shows a greater diversity of cargo, the newly developed ports of Gangavaram and Krishnapatnam have an 80% dependence on coal traffic. Kakinada Deep Water Port handles predominantly break-bulk traffic.

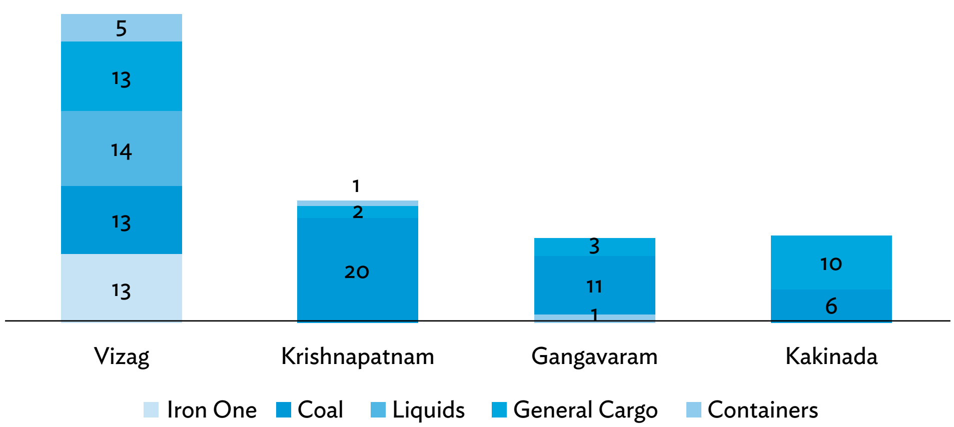
Figure 2.18: **Distribution of Cargo in VCIC ports, 2013–14, by Category of Cargo**



Note: Total cargo = 115 million tons.

Source:Indian Ports Association, Department of Ports, GoAP, Study team analysis.

Figure 2.19: **Distribution of Cargo in VCIC Ports (2013-14), by Port and Category of Cargo**



Note: mTPA: million metric tons per annum.

Source: Indian Ports Association, Department of Ports, GoAP, Study team analysis.

Besides handling more than 50% of the traffic in the region, Vizag handles much of the container throughput in the region at 5 million tons or more than 250,000 TEUs (Figure 2.19).[1] Krishnapatnam is the only other port that handles containers. It handles approximately 1.2 million tons of containers or close to 70,000 TEUs.

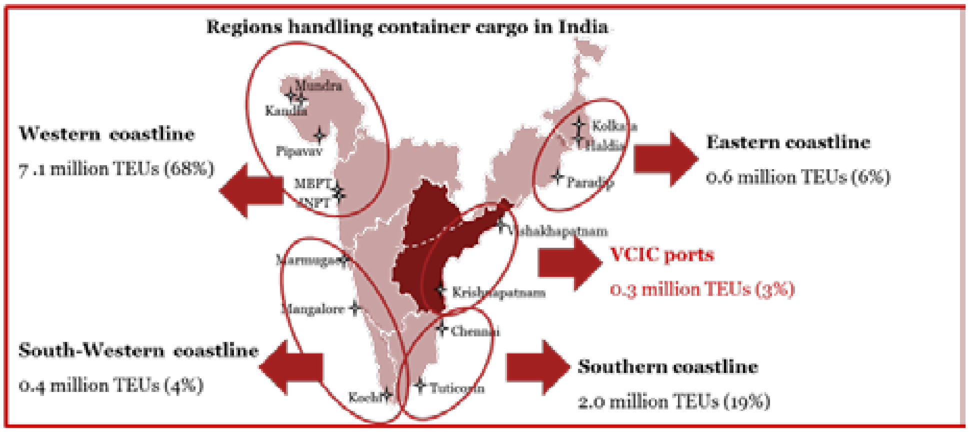
VCIC ports handle a neglibigle fraction of Indian container throughput compared to other port regions.

Manufacturing requires the enablement of logistics centered on containerized movement of inbound and outbound commodities. Therefore, ports enabled for container shipping are the most relevant for this analysis.

In 2013–14, the ports of Krishnapatnam and Visakhapatnam together handled a little over 300,000 TEUs, which forms merely 3% of the 10.5 million TEUs handled around the Indian coastline, indicating the poor level of cargo development (Figure 2.20).

[1] TEU = twenty-foot equivalent units.

Figure 2.20: **Distribution of Container Traffic around the Indian coastline**



Source: Indian Ports Association, Department of Ports, GoAP, Study team analysis.

Figure 2.21: **Origin and Destination patterns of Container Trade in India (2013)**

	N/W Ports	ChPT	Tut	Coc	Viz	K/H
Punjab	5%					
NCR	13%	1%				
Rajasthan	5%					
Gujarat	20%					
MP	2%					
UP	2%					
MH	20%					
AP	1%	3%			2%	
Karnataka	1%	3%		1%	1%	
TN		8%	5%	2%		
Kerala				2%		
East India						5%
Total	**68%**	**15%**	**5%**	**5%**	**3%**	**5%**

Natural Hinterland for AP Ports

Source: Indian Ports Association, Department of Ports, GoAP, Study team analysis.

As illustrated in Figure 2.21, 68% of India's container throughput is concentrated in northwest ports. The Chennai–Tuticorin stretch handles close to 19% of the container traffic. The port of Chennai alone handles around 1.5 million TEUs, which is five times the combined volume of all VCIC ports.

Figure 2.22: **Major Shipping Routes in the Region**

Source: Study team analysis.

The ports in the northwest and in Chennai are able to draw container cargo from the distant hinterlands, including from the natural hinterland of ports in Andhra Pradesh and Karnataka, which are proximal to the VCIC ports.

Current Shipping Activity

The reason for the poor development of container traffic in VCIC ports can be traced to the nature of the container shipping trade. Container lines operate on a hub-and-spoke model. Indian ports predominantly play in the feeder routes, which feed into the international container shipping routes, passing through Singapore, Port Klang, Tanjung Pelepas, and Colombo to the Middle East (Figure 2.22).

> Except for Chennai, none of the ports on the east coast have direct services to the destination ports; these ports host smaller parcel container vessels traveling feeder routes.

At present, the port of Chennai is the dominant container port in the Bay of Bengal, and the only one to have direct shipping calls from the top international lines in the world. All other ports in the region, including Visakhapatnam, Kolkata–Haldia, and Chittagong and Yangon are predominantly serviced by feeder services from smaller operators who have a slot charter arrangement with mainline players. This results in several circular routes servicing several destinations around the coast in a window arrangement, and touching one of the transhipment ports for onward movement. The lack of frequency of services and competition between major lines for cargo originating from the region (since the same feeder operator serves multiple liners) leads to increased shipping costs.

Visakhapatnam Port. The port of Visakhapatnam currently has services operating on the feeder routes, servicing the trans-shipment ports of call with about 6–7 vessel calls per week. The port has regular calls to the ports of Singapore, Klang, and Colombo. The average exchange rate is between 500 TEUs and 750 TEUs per call.

Krishnapatnam Port. The port of Krishnapatnam currently is serviced by two weekly services to Colombo, and limited services to Yangon and Tanjung Pelepas, with a typical exchange of about 250–500 TEUs per call. The port agglomerates a large amount of exports, but a relatively lower level of imports, leading to a large imbalance in container traffic and requiring large-scale repositioning of empty containers.

Vessels serving these smaller ports have an average parcel size of 2,000–3,000 TEUs, compared with 3,000-5,000 TEUS serviced by a port like Chennai. In comparison with the two ports, Chennai port operates close to 30–40 calls per week, along with several weekly direct calls to Europe.

Shipping lines operate services at a port based on various aspects that include certainty of cargo agglomeration, export–import balance, availability of container shipping and logistics ecosystem, and port performance. The volume and frequency of shipping services assigned to the feeder port are also dependent on these factors, which are only partially within the control of the port.

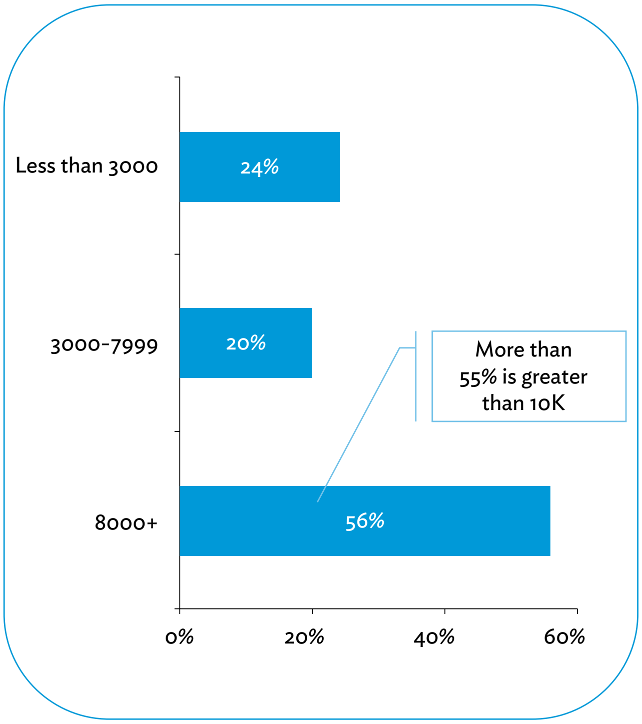
Given the established nature of the shipping ecosystem around the port of Chennai, it is a challenge for these container ports to attract direct services. However, at the same time, the congestion at Chennai port due to evacuation constraints creates windows of opportunities in the near future. However, this will require several interventions, including accelerated agglomeration of cargo from distant hinterland centers and increased connectivity.

Shipping Trends and Development Imperatives for VCIC

Liners are investing in large vessels and therefore require large drafts, which can bring down overall costs of sea-freight.

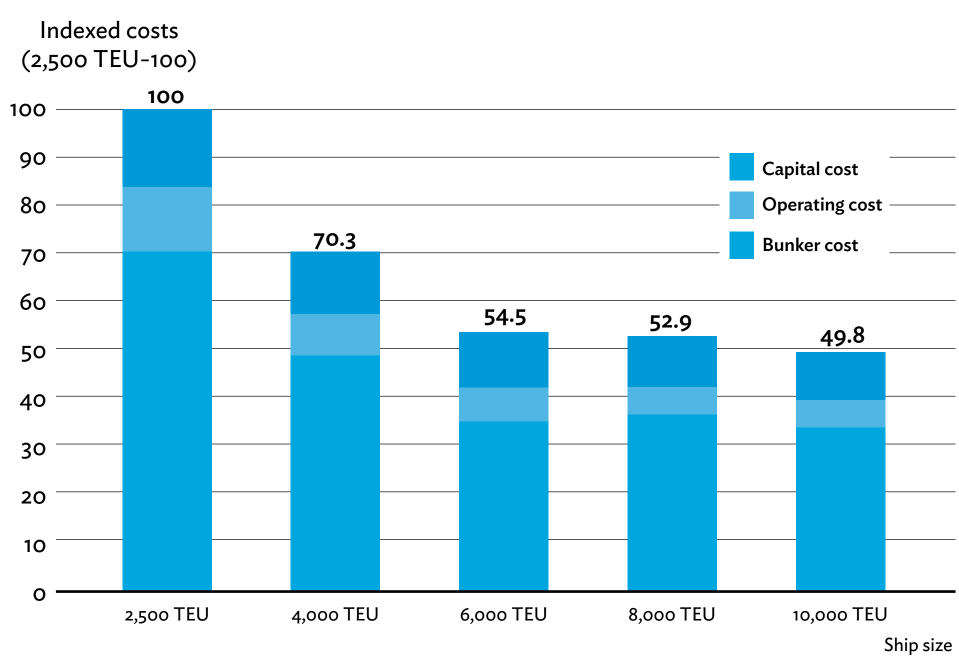
With the intensification of the global container trade, it is found that there is an increasing trend of very large container vessels. It is estimated that major worldwide liners have more than 55% of their order book dedicated to large container vessels of more than 10,000-TEU parcel vessel sizes (Figure 2.23). The slot costs of plying a 10,000-TEU vessel is 10% cheaper than a 6,000-TEU vessel, 30% cheaper than a 4,000-TEU vessel, and almost 50% cheaper than a 2,500-TEU vessel (Figure 2.24).

Figure 2.23: **Orderbook of Container Liners until 2016**



Source: Clark.

Figure 2.24: **Expected Savings in Slot Costs by Plying Larger Vessels**



Source: Drewry Shipping.

While the ports of VCIC may not immediately be affected by this movement toward larger vessels, they will face opportunities arising out of the cascading effect in feeder routes, and the current congestion at ports around the Chennai cluster.

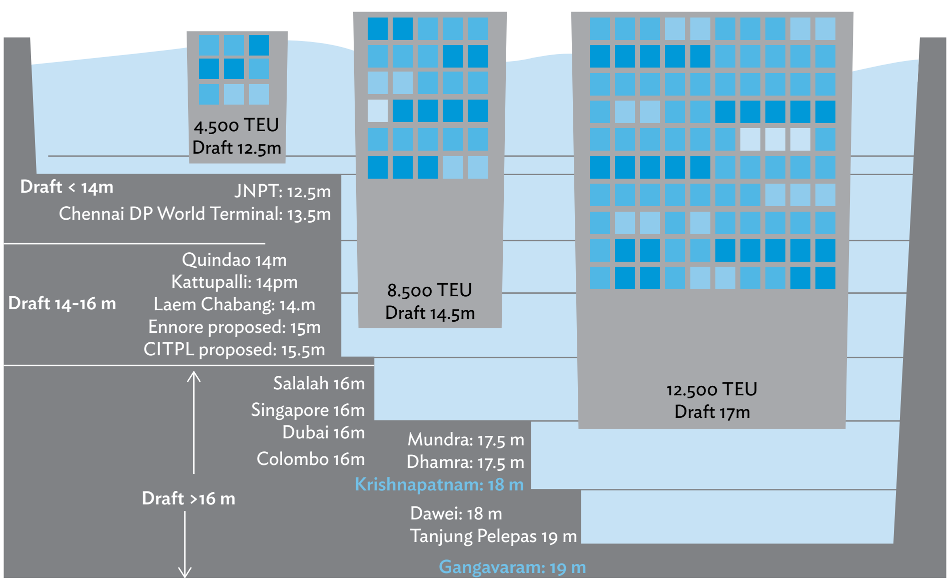
As the mainline routes get populated by the larger vessels, the current mainline vessels of 8,000–10,000 TEUs will become increasingly redundant on these routes.

It is expected that they will be re-deployed on the current feeder routes, or on the smaller direct routes. However, ports like JNPT and Chennai both have draft restrictions that will prevent them from being handled today (Figure 2.25).

While many of the major ports like Chennai have plans to increase their drafts from current levels, the current berth and yard design, as well as evacuation challenges, will prevent efficient evacuation of such cargo through current mechanisms.

Such developments may break the current trends in container shipping, such that the vessels calling at dominant ports like Chennai may gradually shift to technically better equipped ports like Krishnapatnam.

Figure 2.25: **Drafts of Ports in India**



Source: Indian Ports Association, Department of Ports, GoAP, Study team analysis.

VCIC ports will need to prepare for the opportunities resulting from trends in shipping usages, as well as from congestion in proximal ports.

Direct calls from shipping lines will bestow several advantages for VCIC region:

- increased destination and competitive choices for liners and savings in voyage times, resulting in direct savings in costs;
- increased utilization of port capacity and logistics infrastructure for larger cargo volume, reducing the unit costs for logistics infrastructure; and
- reduced fleet utilization costs for road and rail movement, through a better balance of exports and imports, by avoiding expensive repositioning and empty rake movement.

For this to happen, sufficient cargo agglomeration and better supply chain connectivity will be necessary.

While ports like Krishnapatnam have natural advantages in terms of deep drafts and the ability to expand, for the reasons enumerated above, these are "good-to-have" but not sufficient conditions to become a major hub for container shipping. In order to increase traffic and become competitive for direct calls, it is essential to overcome the challenges being faced by operating ports in the region, essentially due to stickiness in the port choices of container liners. Liners have established centers of operations in their current ports. Alternate ports face several supply chain challenges in shifting this behavior, some of which are enumerated below:

- **Need to tap into industrial cargo in the hinterlands.** The lack of value-added industrial cargo in the immediate hinterlands acts as a hurdle to attracting container liners from dedicated routes to these alternate ports. Therefore, there is a need to tap into opportunities in the interior hinterlands to provide a jump-start to achieve greater cargo agglomeration. As part of the VCIC's network connectivity strategy, connecting the gateways to key hinterland centers and last-mile connectivity has been proposed in order to enable this transformation.
- **Correcting the imbalance in exports and imports.** Further, the majority of the operational ports in VCIC (ex-Chennai) experience a trade imbalance with imports dominating over exports, thereby reducing cost competitiveness. With an increase in industrialization in the region through development of the corridor, container cargo on both sides is expected to increase substantially, thereby reducing the trade imbalance.
- **Need for supporting logistics infrastructure.** Development of ports will also need to be supported by an integrated supply chain. Currently, the majority of the alternate ports do not have sufficient logistics and storage facilities. Stakeholder consultations have revealed for example, insufficient cold storage facilities at Visakhapatnam port to cater to the growing pharmaceutical industry. In order to enable port-centric manufacturing development, there is a need to integrate various related aspects including connectivity, infrastructure for supply chain, storage and distribution services, and industrial development of the hinterland, with a focus toward lowering the total cost of logistics.

Cluster-Wise Assessment of Port Capacity and Performance

The current state of performance of VCIC and the development imperatives will need to be tested against the current supply–demand state of the infrastructure stock and the performances of individual operational port clusters.

Northern Port Cluster (serving Visakhapatnam Node)

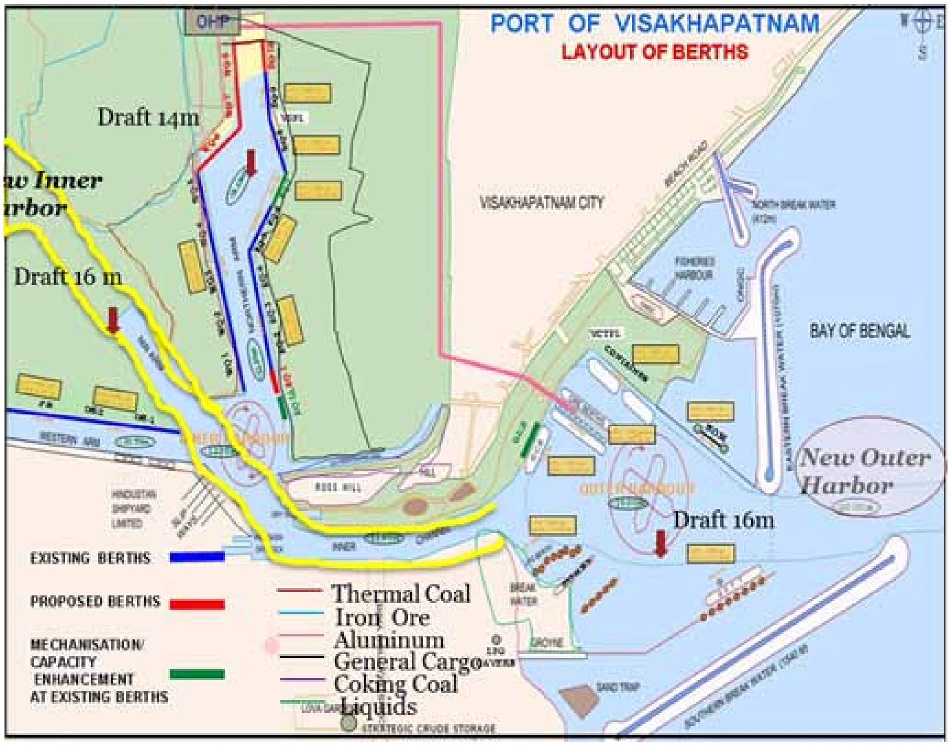
The northern port cluster comprises the ports of Visakhapatnam and Gangavaram. The two ports are divided by a short distance of 40 km on either side of Dolphin's Nose hill. The port cluster is the busiest in the VCIC region, handling large amounts of coal, POL, iron ore, and general cargo. Visakhapatnam is the only port north of Krishnapatnam that is capable of handling containers. The major technical features of the cluster and their ability to develop in the future is discussed below.

Visakhapatnam Port

Layout and Port Configuration

The port of Visakhapatnam is a major port on the northern tip of Andhra Pradesh. It has a large protected harbor infrastructure, divided into an outer and inner harbor (Figure 2.26).

Figure 2.26: **Port of Visakhapatnam Layout**



Source: Visakhapatnam Port.

Table 2.10: **Harbor Facilities at Vizag Port**

Feature	Inner Harbor	Outer Harbor
Water Spread (Hectares)	100	200
Berths	18	6
Max. Draft (m)	11	17
Max. length (m)	PANAMAX	280
Max. Beam (m.)	32.50	48

Source: Study team analysis.

Inner Harbor

- As indicated in Table 2.10, the inner harbor is made up of three segments: east, west, and northwest. There are nine quays in the eastern arm, six in the western arm, and three in the northwestern arm, adding up to 18 berths.
- All berths can accommodate a maximum size of Panamax vessels. Of the 18 berths, 15 are multi-purpose facilities. There are also one fertilizer berth and two oil refinery berths.
- The configuration of the port, as well as the material handling requirements of various commodities, makes the inner harbor suitable only for bulk cargo. Capacity augmentation plans and channel deepening works in this segment will be suited for bulk handling only.

Outer Harbor

- The outer harbor has large deep draft facilities and long berths, which are suited for hosting large vessels (cape-size bulk, very large crude carriers, and large container vessels).
- At present, the outer harbor has the facilities to handle iron ore, coal, liquids, and general cargo, and a container terminal managed by Visakha Container Terminal Private Limited (VCT), which is operating the facility on a public–private partnership (PPP) basis.

Capacity and Services for Container Handling

- The container terminal has access to a channel depth of 16.5 meters (m), with a berth-alongside depth of 15 m. The length of the berth is currently about 450 m (sufficient for about 0.5 million TEUs), which is expandable by another 395 m (bringing the capacity up to 1.5 million TEUs).
- Currently, the terminal operates four Panamax rail-mounted quay cranes, six rubber-tired gantry cranes, six reach stackers, and one mobile crane. There is a back-up area of 19 hectares, expandable by an equivalent amount. There are 2,500 TEU slots on the ground, and 192 reefer points.
- There is an average of one ship call per day, including a weekly call to the People's Republic of China by a Maersk 4,700-TEU vessel.
- The on-dock rail receives only a few rakes a week; these turnaround in about two hours, which points to a good level of performance. The average dwell time for containers is about 3 days both inbound and outbound, which are well within expected timeframes.

However, this can be ascribed to a low level of utilization at present. Future demand may bring in congestion that may affect performance.

- Interactions with developers reveal that the port also handles about 65,000 TEUs from Kolkata. Re-positioning of empties his been a challenge. The incidence of cabotage law prevents direct coastal re-positioning through merchant liners.
- The terminal is currently accessible by a two-lane limited access road, which can be expanded to four lanes. However, the two-lane road has shops alongside of it and a fair amount of foot traffic.

Considerations for Expansion

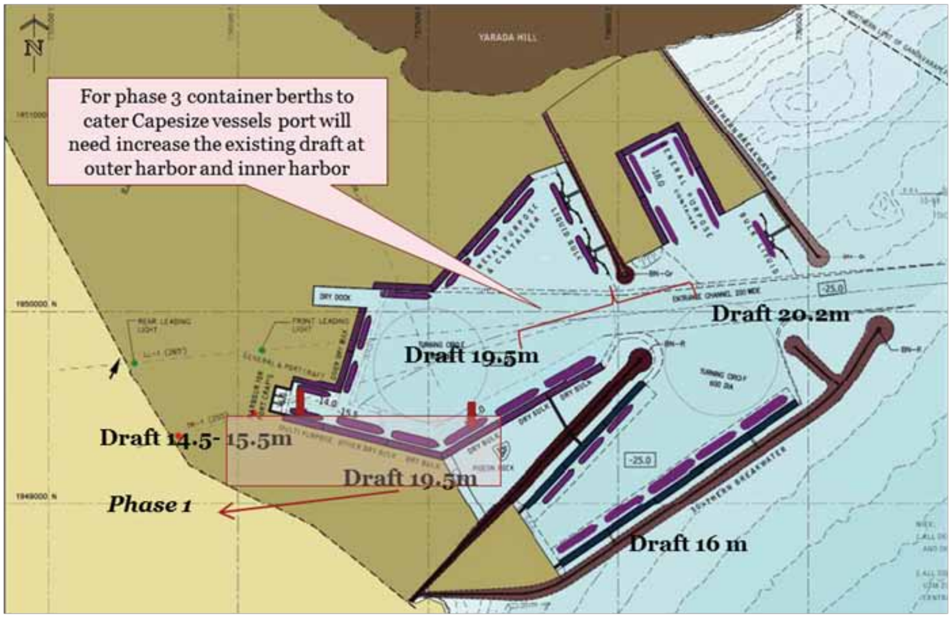
- VCT has sufficient space to manage expansion once they move the on-dock rail to the back of the yard and introduce a new gate away from the berths. This can take capacity up to 1.5 million TEUs (or more than four times the current traffic).

- However, expanding beyond this capacity is likely to be a challenge, primarily because of land availability issues. There is a proposal to relocate the existing fishing harbor north of the outer harbor for this purpose, but the feasibility of this should be studied.

Gangavaram Port

Gangavaram Port is currently a bulk cargo port, located to the south of Visakhapatnam Port (Figure 2.27). It is located six nautical miles south of Vizag Port, but at a distance of 40 km from the main port.

Figure 2.27: **Gangavaram Port Layout**



Source: Gangavaram Port.

Port Features

- The developer has a 50-year concession under a build-own-operate-transfer arrangement, it is a special purpose vehicle and the Andhra Pradesh government has an equity position. The terminal has a total area of 1,800 hectares.
- Given the maximum draft of 18.5 m, and overall length of 290 m, the maximum size ship they can accommodate is a 200,000-ton super Capesize vessel.
- The port currently has five berths, all for handling bulk and multi-purpose cargo. There is no container handling at present.
    - » **Berth 1** handles multi-purpose cargo with a berth draft of 14 m, originally used for project cargo but now being used to handle bulk with grabs.
    - » **Berths 2 and 3** are multipurpose berths with 16 m draft handling bulk cargo using mobile cranes and one quay crane. These berths handle fertilizer cargo as bulk for bagging at berth.
    - » **Berth 4** has a draft of 18.5 m. It was designed to load iron ore for export, which has been under-performing owing to the restrictions on iron ore exports.
    - » **Berth 5** has a similar draft of 18.5 m and is used for unloading coal, which accounts for most of the current traffic volume. The handled coal moves through conveyor to a coal storage yard. In addition, about four million tons are moved by a long conveyor to a nearby steel plant.

Expansion Plans

- Phase 2 plans consist of further development of coal capacity through an additional berth (Berth 6) of similar capacity as Berth 5. Three additional berths (Berths 7, 8, and 9) are being considered for multi-purpose handling of Panamax vessels.
- The coal is unloaded using automated gantry cranes with 65-ton grabs operating on a 45-second cycle.
- Phase 2 capacity with nine berths is estimated to be 35 million tons.

Container Terminal Development

- The port has a master-planned capacity for containers in Phase 3. However, owing to the extensive bulk movements, container capacity development is likely to be challenging.
- The port is likely to become more competitive than Visakhapatnam for bulk handling, owing to the availability of deep draft capacity.

Intra-Port Dynamics and Implications for Container Capacity Development

- The likely specialization of Gangavaram would be as a bulk port due to its superior technical features and the conflicts involved in handling bulk and container vessels in proximity. Therefore, it is important for Visakhapatnam to optimize its capacity for handling containers.
- Apart from the likely development of VCT in the next phase, a new container terminal in the vicinity of the outer harbor may need to be planned for. There is also need for a privately operated distribution center that would be located behind the terminal. Both of these developments would conflict with current plans for expansion of the bulk handling activity in the port, which needs to be addressed.

- The actual need for an additional container terminal is expected to arise in the next 10–12 years. However, the port will need to consider this important requirement at the time of master planning and avoid investment in capacity that can crowd out container capacity investment.
- The biggest constraint for this will be a lack of available land. Solutions may involve releasing current outer harbor capacity for containers, expansion into the nearby fishing harbor, or using a satellite port.

Central Port Cluster (serving Kakinada and Gannavaram–Kankipadu clusters)

The central port cluster will consist of ports on either side of the Krishna Godavari basin. At present, the operational ports in this region will include the Kakinada Anchorage Port, Kakinada Deep Water Port, and the captive port of Rawa. Rawa port is meant for light movement of POL for captive purposes, and therefore was not considered in the assessment. Ports in the pipeline include Machilipatnam port, which has been awarded but yet to be commissioned, and Kakinada Special Economic Zone (SEZ) port, which is proposed for captive development (Figure 2.28).

Kakinada Anchorage Port

Figure 2.28: Layout of Kakinada Anchorage Port

Source: Kakinada Anchorage Port.

Port Features:

- The Kakinada Anchorage port is managed by the Department of Ports in Andhra Pradesh and is almost 100 years old.
- The port spans a 2,000-acre area, with two wharves of 100 m (Burmah Shell and Matti Pool wharves), and one of 613 m (New Port Area Wharf). All three berths are currently suited only for manual operations. The cargo handling is currently targeted toward movement of essential commodities like rice, fertilizers, and FRM .

In view of development constraints and congestion at the port, no further expansion plan is considered for the benefit of VCIC.

Kakinada Deep Water Port

Port Features

- Kakinada Deep Water Port is to the north of Anchorage Port (Figure 2.29). It is being developed by a PPP operator on a build-operate-transfer concession. Commercial operations commenced in 1999.

- The port operates as an all-weather port, with a draft of around 12 m. The maximum available channel draft is 14 m.

Figure 2.29: Layout of Kakinada Deep Water Port

Source: Kakinada Deep Water Port.

- Four berths are available for operation— with a cargo berth of 910 m, a multi-purpose berth of 635 m, as well as two berths serving offshore vessels and coast guard vessels. Berths 5 and 6 are currently under construction, neither of them are geared for container movement.
- The port has recently signed up a large liquid natural gas (LNG) terminal project.
- The port may not be able to expand beyond the next phase of the project, considering the technical limitations and plans to handle LNG cargo, which needs to be separated from fertilizers, grains, and other flammable material.

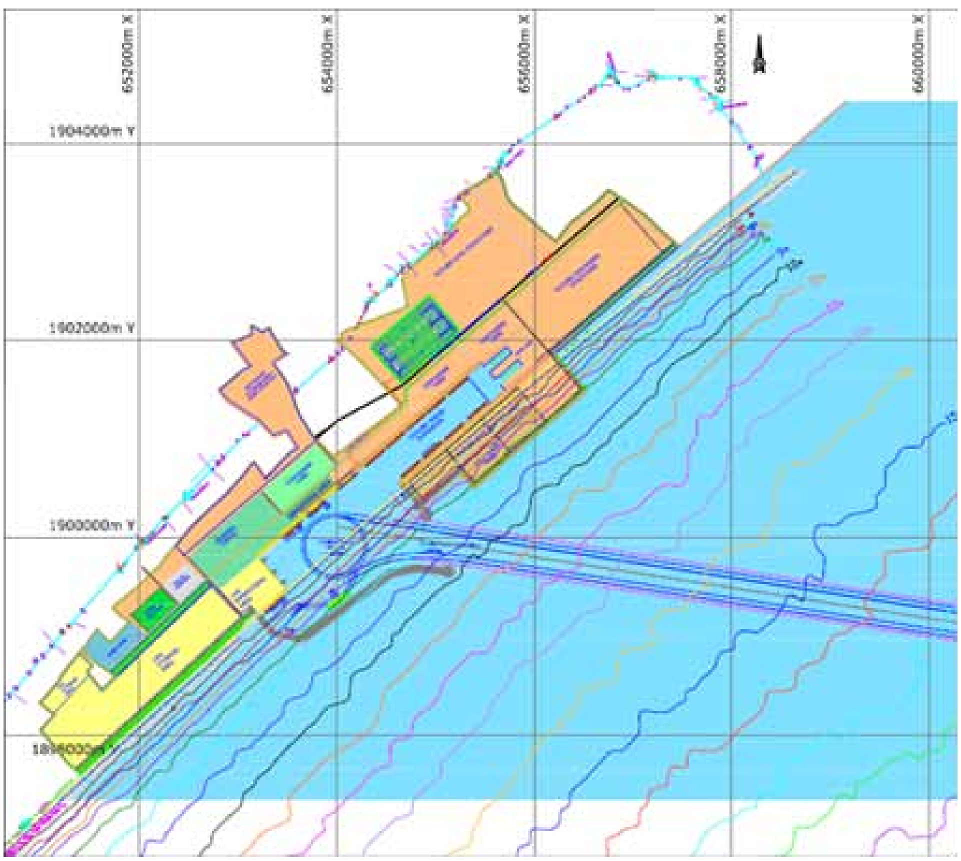
In view of the limited space available for planning and its cargo focus, the port is not considered for further development under VCIC.

Kakinada SEZ Port

Port Features

- The Kakinada SEZ Port is located in the north of the Kakinada region (Figure 2.30). It has been nominated as a captive port to a private developer. It is considered as part of

Figure 2.30: **Layout of Kakinada SEZ Port**



Source: Kakinada SEZ Port.

a large SEZ investment, anchored around heavy manufacturing, petrochemicals, and discrete manufacturing.

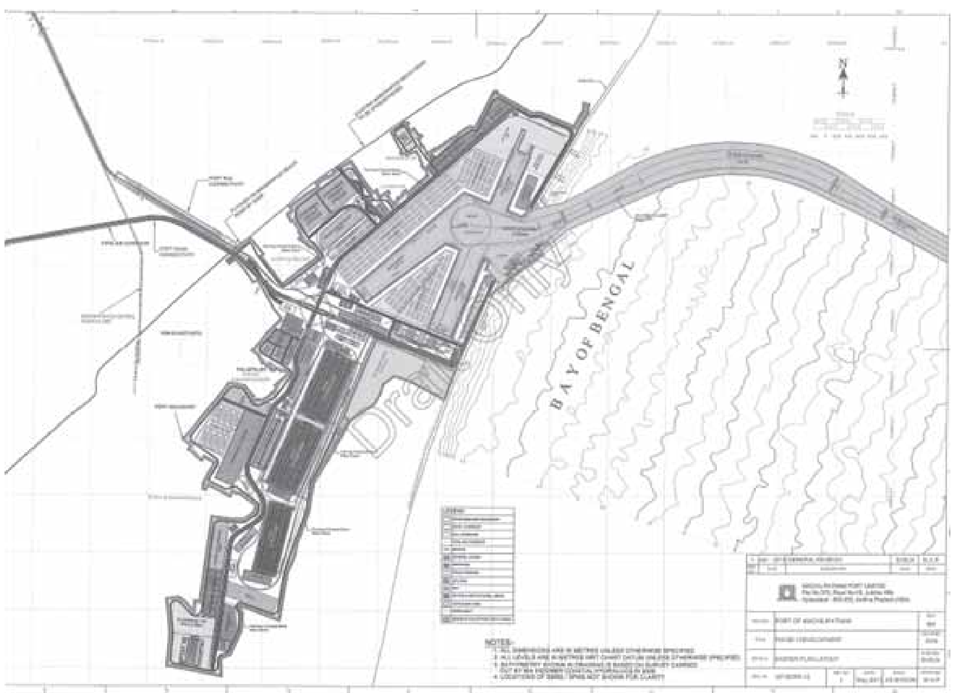
- The port is yet to be developed. Stakeholder interactions suggest that the location enjoys a long waterfront of more than 7 km. The location is, however, in an area with strong littoral drifts, requiring strong breakwater construction.
- This location is not being considered for container port development. The port is also meant for captive consumption for the developer to meet the needs of the SEZ. However, future development of the port may be considered, tying in with the needs of the Kakinada Node development.

Machilipatnam Port

Port Features

- Machilipatnam port is a historical port to the south of the Krishna Godavari basin (Figure 2.31). The port has been awarded to a private developer on a concession, but there is a lack of progress owing to land acquisition issues.

Figure 2.31: **Layout of Machilipatnam Port**



Source: Machilipatnam Port.

- The port is expected to have technical challenges, such as a very shallow beach, and the need for heavy investment, especially around the channels. Subsequent siltation will require a large capital investment in breakwater construction and subsequent maintenance dredging.
- The port has proposed a master plan in which an ultimate handling capability of 14,000-TEU vessels is proposed. In Phase 1, the port is proposed to be designed to handle 7,000-TEU vessels.

Intra-Port Dynamics and Implications for Container Capacity Development

- The central port cluster lacks container capacity and is geared toward handling multi-purpose cargo for the captive needs of industrial users, and for handling bulk and energy cargo.
- Capacity development plans for Machilipatnam port have incorporated large container capacity development. However, the port's plans are stuck at the stage of land acquisition. The plans are also likely to be challenged by the need for large capital investments to overcome technical constraints.
- An alternate location for a container terminal to the north of the Krishna Godavari basin may exist around the Kakinada SEZ port location. While the port has the advantage of a large waterfront and unrestricted back-up area, the port location is not likely to be preferred for agglomeration of container cargo, due to the presence of the Visakhapatnam Port. It will also be constrained by its current categorization as a captive port.
- The requirement of a container-linked port may need to be re-assessed along with the development of the Kakinada and Gannavaram–Kankipadu nodes. In the short-term, both nodes may be served by container traffic from the northern and southern clusters.

Southern Port Cluster (serving Yerpedu-Srikalahasthi clusters)

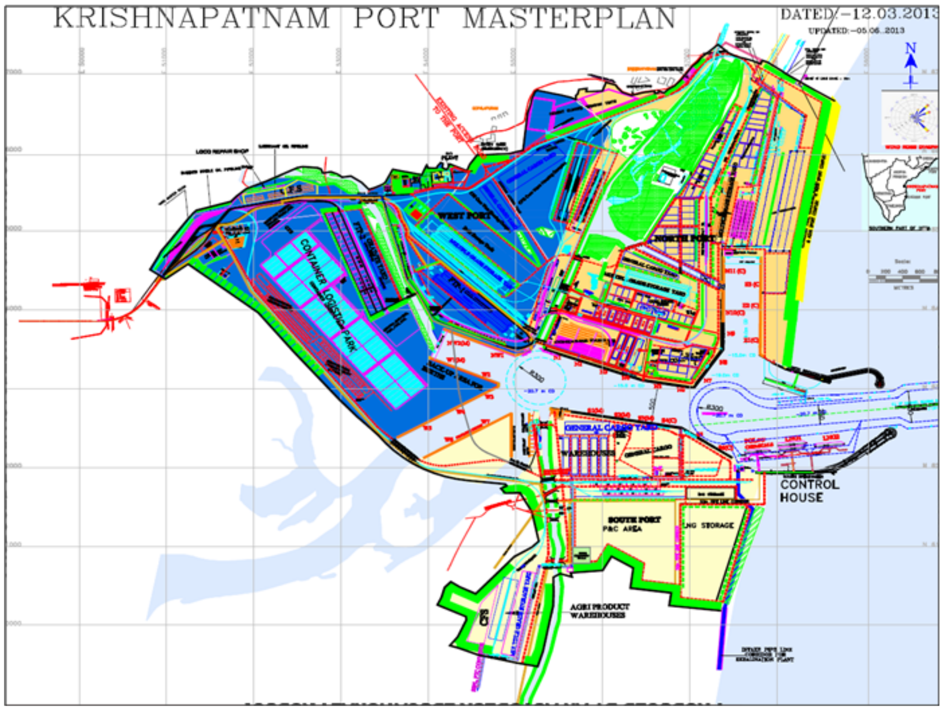
Krishnapatnam Port

At present, the only operational port in the southern cluster is the port of Krishnapatnam, a multi-purpose port with the ability to handle both bulk and container cargo (Figure 2.32).

Port Features

- The port is located 180 km north of Chennai, close to Nellore town and northeast of the Yerpedu–Srikalahasthi node. It is an all-weather port, with a deep channel draft of 18.5m, capable of handling Capesize vessels.
- It has a vast protected waterfront of 12.5 km, with the ability to develop a maximum of 42 berths of 15 m–20 m dredged depth. The approach channel is 6.5 nautical miles long, with a large turning circle of 500 m diameter.
- The port is connected with a double railway line to the Kolkata–Chennai trunk line, which is capable of handling 60 trains a day.
- In the current phase, the port has 10 multi-purpose berths and one container terminal.

Figure 2.32: **Layout of Krishnapatnam Port**



Source: Krishnapatnam Port.

Container Terminal Services

- The terminal has two operational container berths, with a total berth length of 650 m, capable of handling 1.2 million TEUs. The current draft alongside is 13.5 m.
- Four harbor mobile cranes, five quay cranes, and four rubber-tired gantry cranes with 4,600 TEUs of ground slots and five reach stackers capable of handling 38 tons have been installed. The current stacking height of four can be increase to six in the future.
- The port has two weekly services to Colombo, one fortnightly service each to Yangon, and two each to Singapore and the Far East. About 60% of the port's container throughput is trans-shipped via Colombo or Port Klang, and about 40% moves directly on mainline vessels to/from major ports.
- The port is currently handling vessels as large as 4,300 TEUs (Maersk).
- The port is well-positioned to handle container traffic overflows from the port of Chennai. However, considering the skewed export–import balance and the challenges of marketing the port to container liners, exporters, and importers, cargo development remains poor.
- However, this is expected to improve with the increasing agglomeration of cargo traffic northward toward Krishnapatnam.

Capacity Expansion

- At present, the container terminal is being developed in a location that is proximal to bulk cargo handling. A capacity expansion plan to reach an additional 4.8 million TEUs is proposed to take the ultimate capacity to 6.0 million TEU per annum.

Demand–Supply Assessment and Inferences

Demand–Supply Assessment

If the four operational ports in the state of Andhra Pradesh were to develop according to their expansion plans over the next 10 years, baseline traffic in VCIC could be met.

As detailed in Table 2.11, while the current traffic through the operational ports is close to capacity, all four operational ports have immediate DPRs and feasibility plans for an additional augmentation of more than 150 million tons per annum in the near-term. In the long-term, the ultimate planned capacity of the operational ports will be close to 600 million tons per annum. The addition of Machilipatnam port, if it is commissioned as planned, is expected to increase capacity a further 35 million tons in the short-term and 230 million tons in the long-term.

Container and bulk capacity. The capacity projections in the near future are estimated based on the above master plans. If the capacity planned for the four operational ports alone is considered, then the bulk capacity that will be added in the next 10 years will be 480 million tons.

Table 2.11: **Capacity and Utilization of Operational and Awarded Ports**

S. No.	Port	Current Capacity (mTPA)	Current Traffic (mTPA)	DPR Capacity (mTPA)	Ultimate Planned Capacity (mTPA)
Northern Port Cluster (Visakhapatnam Node)					
1	Visakhapatnam	65	59	130	150
2	Gangavaram	18	16	42	200
Central Port Cluster (Kakinada and Gannavaram–Kankipadu Nodes)					
3	Kakinada Deep Water Port	18	17	36	44
4	Machilipatnam	-	-	35	230
Southern Port Cluster (Yerpedu-Srikalahasthi Node)					
5	Krishnapatnam	25	23	75	200
	Total	126	115	283 (Operational) + 35 (Machilipatnam)	594 (Operational) + 230 (Machilipatnam)

Note: mTPA = million tons per annum.

Source: Department of Ports, GoAP, Study team analysis.

The container capacity, considering the capacity augmentation at Visakhapatnam and Krishnapatnam port alone, is expected to be 7.5 million TEUs.

Container and bulk demand assessment

Against this, the baseline incremental demand from past trends is projected for the next 10 years. The demand for bulk and container traffic is projected for the next 10 years under two business-as-usual scenarios based on past growth trends:

- **Scenario 1:** Forecast using India's growth trends (10-year compound annual growth rate /CAGR)
- **Scenario 2:** Forecast using growth trends of the state of Andhra Pradesh (10-year CAGR)

The growth rate of Andhra Pradesh's port cargo is expected to be higher because of its lower base.

Container and bulk demand gap assessment

The demand trends for bulk and containers are again compared for two levels of capacity utilization (Figures 2.33, 2.34):

- **Scenario 1:** 70% utilization of planned capacity
- **Scenario 2**: 100% utilization of planned capacity

Figure 2.33: **Bulk Capacity Projection for the Next 10 years for VCIC Ports**

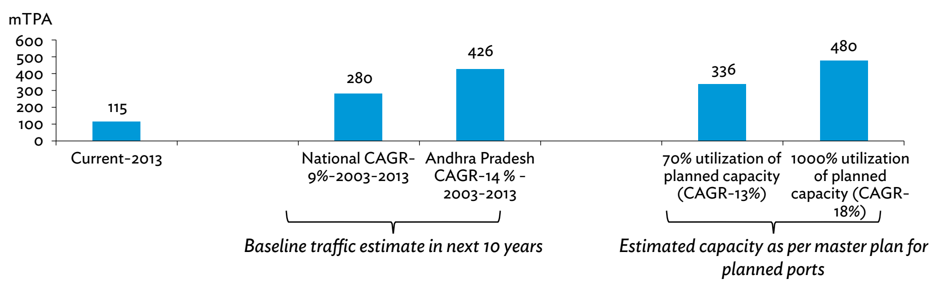
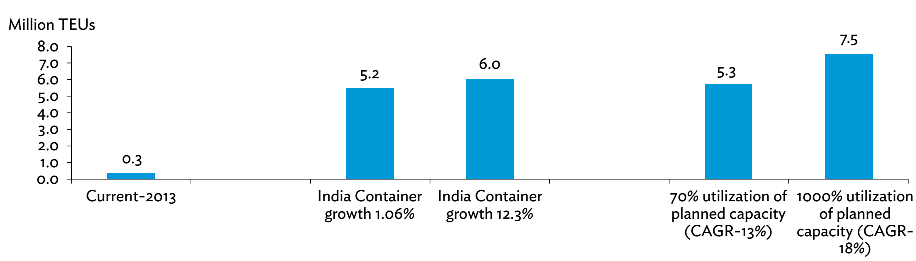


Figure 2.34: **Container Capacity Projection for the Next 10 years for VCIC Ports**



Note: mTPA = million tons per annum, TEU = twenty foot equivalent unit.

Source: Indian Ports Association, Department of Ports, GoAP, Study team analysis.

Key Inferences

- As can be seen from the above projections, the capacity augmentation plans of only the operational ports are expected to be sufficient for both containers and bulk at 100% utilization for the next 10 years of demand.
- The above forecast assumes that all planned capacity will come on stream as expected. It does not consider the further expansion of capacity at other locations.
- Specifically for containers, which are more relevant for VCIC, the following observations are noted:
    - » The current capacity is 1.7 m TEUs (1.2 mTEUs at Krishnapatnam and 0.5 mTEUs at Vizag).
    - » The current terminal can expand capacity to 1.0 mTEU with relative ease. Similarly, Krishnapatnam port has a master plan for 4.8 mTEUs, subject to realization of demand.
    - » Therefore, considering the capacity augmentation at these two ports alone, the capacity that can be brought on stream in the next 10 years is estimated to be 7.5 m TEUs. Even in the optimistic case (12.3% CAGR), the capacity growth may be more than sufficient to handle the demand at 80% utilization.

- The expected augmentation of capacity to 6.0 mTEUs at Krishnapatnam is favorably poised to handle the overflow cargo coming from Chennai port.
- The above projections are based on business-as-usual scenarios, and have not taken care of additional aspects like localized demand–supply scenarios. A more granular view on the port cluster's demand–supply assessment is expected to be undertaken in Phase 2, which will consider the demand created by the development of VCIC nodes.

Summary of Analysis

Focus on container port capacity creation for enabling manufacturing

Considering VCIC's manufacturing-linked development strategy, bi-directional containerized trade with regional economies is critical for integration with global production networks. Despite their inherent advantages, ports of the VCIC region do not feature prominently in the route network of regional container liners, in comparison with established ports like JNPT and Chennai, owing to a lack of incumbent logistics ecosystems and cargo agglomeration. At the same time, trends in global container shipping point to significant opportunities to shift the network model for the benefit of VCIC in the near future.

Intensification of global trade has prompted major shipping lines to begin to invest in larger vessels on both their mainline and feeder routes to benefit from economies of scale. It is expected that container ports of the future will require deep drafts of 16 m–18 m to host larger vessels besides significant back-up area and evacuation capacity to handle the increased throughput volumes, all of which are challenging for congested ports like JNPT and Chennai. Since container trade operates on a hub-and-spoke model, ports lacking the capacity to respond to these trends risk losing their importance in regional route networks.

In contrast, greenfield ports in the VCIC region are better positioned to expand their sea-side, land-side, and evacuation capacities to better respond to these trends and become prominent ports of the regional route network, thereby providing better access and lower cost shipping services to users in the region.

Need for a few mega ports instead of several small ports

Several greenfield ports like Krishnapatnam follow the PPP model and have the technical ability to respond to the above trends through capacity creation to benefit the users of the port.

However, owing to the differences in the time horizons of infrastructure financing and corridor planning, capacity augmentation can run the risk of significantly lagging the manifestation of these trends. In the absence of immediate demand, private port investors may hesitate to invest in large-scale capacity augmentation and often wait to the point of extreme congestion before incremental augmentation of capacity.

Therefore, appropriate signals are necessary from the policymakers to provide greater demand certainty for port capacity creation. Such signals should have the effect of facilitating greater cargo agglomeration at focused locations. As part of VCIC, the proposal to create industrial nodes in proximity to existing operational ports is expected to become an important signal for capacity creation at those ports.

External infrastructure and connectivity can accelerate capacity development

However, the development of VCIC nodes as cargo centers is expected to take time. In order to facilitate capacity creation ahead of demand at the identified ports and to accelerate adoption by shipping liners, it is necessary to increase cargo agglomeration in the short-term. This can be achieved through

(i) focused creation of external infrastructure like last-mile connectivity to a few identified port locations, in order to wean away traffic away from congested neighboring ports (e.g., Krishnapatnam port to wean traffic from Chennai); and

(ii) middle-mile connectivity to the hinterlands outside of VCIC through road and rail links that facilitate the accelerated development of cargo agglomeration.

Key Recommendations

- The port-centric development strategy should align with large-scale, manufacturing-led economic development through the nodes and integrate India into global manufacturing supply chains:
  - Target brownfield development of 2–3 mega container ports close to the nodes (primary candidates are the Vizag–Gangavaram and Krishnapatnam clusters), with the ability to handle large container vessels of 10,000+ TEUs, with necessary supporting multimodal connectivity and supply chain and logistics infrastructure.

  - From a bulk cargo perspective, enable port capacity creation along the coastline by prioritizing movement of energy cargo (e.g., thermal coal, LNG) that will be important for the development of VCIC.

- Rather than focusing on further capacity development, which is best left to market forces, the strategy should aim at accelerating cargo agglomeration in the region and making the ports competitive for direct calls from major container hubs. This can be achieved by
  - focusing on supply-chain efficiency and cargo agglomeration so that the state can lead in containerization trends, with increasing sophistication and value-added through container cargo;
  - ensuring last-mile connectivity to attract cargo from neighboring hinterlands; and
  - delivering efficient middle-mile connectivity to help connect to distant hinterland centers to capture traffic from neighboring and distant hinterlands and east-bound traffic through connectivity projects.

Enablement of Key Gateways: Airport Development Strategy

Airport Landscape in the VCIC Region

Airports. Considering the expanse of VCIC, for the purpose of air connectivity the region can be considered to be co-terminus with the state of Andhra Pradesh. The state currently has seven airports under various stages of development and operations. Six of these are under the management and operational control of the Airports Authority of India (AAI), a public sector undertaking managing a vast majority of the country's airports. The state also has one private airport (Puttaparthi), managed by a private spiritual trust. Visakhapatnam airport, an airport run by AAI, functions as a civil enclave within a naval airport (Figure 2.35).

AAI has undertaken a master planning exercise for a greenfield airport at Ongole and is awaiting clearance from the Ministry of Civil Aviation for further development. It has developed a new terminal at Kadapa, which is awaiting commencement of operations. The state government is also considering other locations for greenfield airports, including Nellore. These plans are to be considered in tandem with the development needs of the new state and are understood to be in the preliminary stage.

Airstrips. The state also has two airstrips—at Bobbili (Vizianagaram District) and Tadepalligudem (West Godavari District)—under the control of the Indian Air Force, but which are effectively defunct.

Airports outside the VCIC region

Besides the airports within VCIC, the region is surrounded by three of the top six international airports in the country (Chennai, Bangalore, and Hyderabad), both in terms of passengers and freight.

Figure 2.35: **Airports in Andhra Pradesh**

Source: Consultations with State government, GoAP.

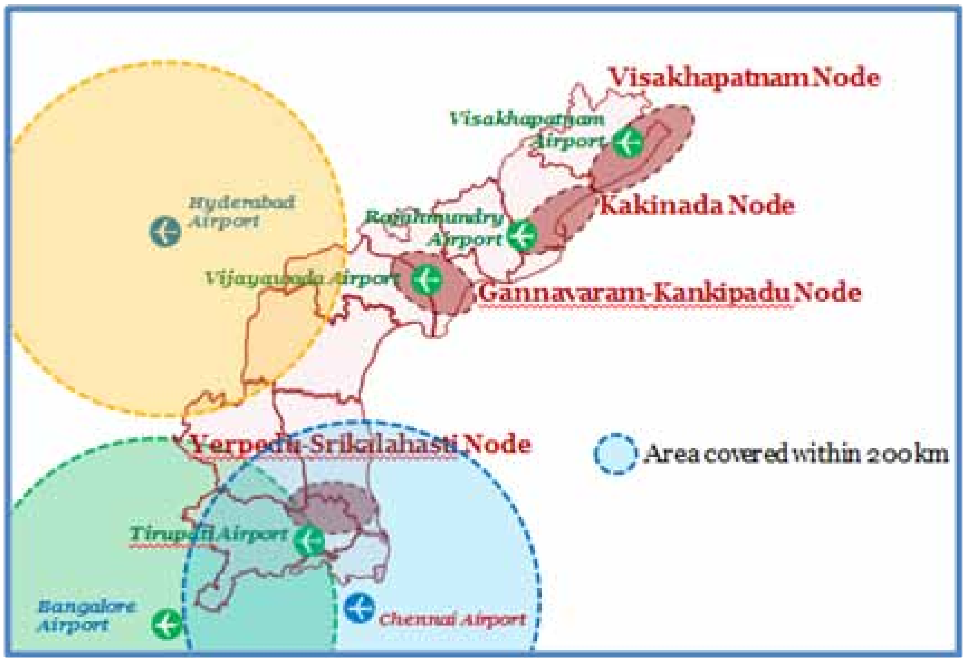
These airports serve several regional and international destinations through scheduled flights, and have well-developed passenger and air cargo infrastructure.

The presence of these airports in proximity to VCIC is important when we consider the influence zones of these airports. As shown in Figures 2.36 and 2.37, southern Andhra Pradesh is within a 200km radius of both Chennai and Bangalore.

As the radius increases to 400 km, almost the entire VCIC, except those areas surrounding Visakhapatnam and Kakinada nodes, is covered by the influence region of one or more of the three major airports. The significance of this observation is highlighted better when we consider that the distance between Tirupati and Vijayawada airports is more than 400 km.

Therefore, any plans for airport development in VCIC should consider the intense competition that will be offered by these established airports. Accounting for the available capacity at these airports as a complement to VCIC would be a prudent strategy.

Figure 2.36: **Area covered within 200km radius from ex-VCIC Airports**



Source: Consultations with State government, GoAP. Study team analysis.

Figure 2.37: **Area covered within 200km radius from ex-VCIC Airports**

Source: Consultations with State government, GoAP. Study team analysis.

Operational Profile of VCIC Airports

> The level of incumbent demand through the VCIC airports is very low, as evidenced by comparison of passenger and freight traffic through leading airports in the state.

Before its division, the erstwhile state of Andhra Pradesh had roughly a 7% share of the Indian population and an 8% share of gross domestic product (GDP). It also accounted for a similar ratio of domestic flights (7.3%). However, after the division of the state into Telangana and residual Andhra Pradesh, the imbalance in air connectivity has become prominent. While the new state of Andhra Pradesh will comprise 60% of the population and 43% of the GDP of the former state, it will only account for 18% of the domestic flights.

As illustrated in Table 2.12, in the financial year ending 2013-14,[2] Visakhapatnam airport handled just over 1 million passengers (about 72,000 international and 940,000 domestic), which makes it the largest airport in the state. However, at an all-India level, the airport ranks 26th in commercial operations. Tirupati airport, the second-largest airport by traffic, handled 272,000 domestic passengers, ranking 44th at an all-India level. Vijayawada is estimated to have handled less than 175,000 passengers and Rajahmundry around 100,000 passengers in the corresponding period, ranking them among airports with the lowest commercial traffic in the country.

Table 2.12: **Passengers and Freight Traffic of Airports in Andhra Pradesh**

Airport	Annual Passenger Traffic (no. of passengers)		% of All-India	All-India Rank	Annual Freight Traffic (metric tons)		% of All-India	All-India Rank
	Domestic	International			Domestic	International		
Visakhapatnam	940,000	72,000	0.6%	26	1,800	0	0.6%	30
Tirupati	272,000	NA	0.1%	44	0	0	NA	NA
Rajahmundry	100,000	NA	<0.1%	>50	0	0	NA	NA
Vijayawada	175,000	NA	<0.1%	>50	0	0	NA	NA
Total Andhra Pradesh	**1,487,000**	**72,000**	**0.9%**	NA	1,800	0	**<0.1%**	NA
Airports for comparison								
Hyderabad	6,210,800	2,443,000	5.1%	6	37,400	49,300	3.8%	6
Delhi	24,195,700	12,681,300	21.8%	1	215,800	389,900	26.5%	2
Mumbai	21,880,700	10,340,700	19.1%	2	181,100	467,600	28.4%	1
All-India	**122,409,143**	**46,617,376**	**100%**	NA	1,443,038	836,083	**100%**	NA

Source: AAI traffic statistics.

2 AAI Traffic statistics.

The combined traffic of the new state of Andhra Pradesh was less than one-fifth of the annual traffic handled at Hyderabad airport, the dominant airport in the erstwhile combined state. This also represented less than 1% of the total passengers handled in the country. Visakhapatnam is the only airport in the state to have registered any air freight traffic in the year. However, despite its customs status, it did not have any international freight traffic. It handled less than 2,000 tons of domestic traffic, which is negligible when compared with leading air cargo airports in the country.

The dominant position of Hyderabad in catering to air travel demand in the state is perhaps explained by the radius of influence of top international airports just outside the VCIC boundary. At a distance of 200 km–400 km, road and rail movement becomes convenient and cost-efficient.

Given the low-level of incumbent demand and high degree of competition from neighboring hubs, airports in the VCIC region have limited operations that are skewed toward domestic movements.

As of 2014, only four airports managed by AAI were operational for commercial traffic, all within the direct influence zone of the VCIC region (Table 2.13). All airports in the state, except one, are designated only for domestic traffic. Visakhapatnam is designated as a "customs airport," but is currently able to offer limited connectivity to Dubai (via Hyderabad) and Singapore by scheduled commercial carriers.

All airports except Visakhapatnam operate during limited hours of the day, and lack direct connectivity to international destinations for passengers and cargo traffic. Since January 2014, Visakhapatnam airport has operated on a 24x7 basis (with runway and air traffic control services available around the clock), allowing for additional utilization of existing capacity for more destinations.

Ongoing brownfield capacity development proposals by AAI are expected to be sufficient to handle traffic growth in the short-term.

As part of its capacity planning exercise in 2012–13,[3] AAI made traffic forecasts for the next 10 years for the four operational airports in the state. As per empirical benchmarks used internationally for airport planning,[4] these annual forecasts have been converted to peak hour capacity required at the airports for the purpose of benchmark analysis. The peak hour requirements for the next 10 years are already met by the current capacity (or capacity under construction) at three of the four airports.

3 Presentation on Airports in Andhra Pradesh provided by AAI to GoAP.

4 Ashford and Wright (1992) prescribe an internationally accepted empirical formula to convert annual passengers to peak hour flow given by the equation Peak Hour Demand = 0.0917 x Peak Day Flow. Peak Day Flow = 1.26 x Average Daily Pax. Average Daily Pax = (1/31) * (1/12) * 1.01 * Annual Passengers.

Table 2.13: **Description of Operational Airports in Andhra Pradesh**

	Rajahmundry	Tirupati	Visakhapatnam	Vijayawada
Location	East Godavari District	Chittoor District	Visakhapatnam District	Krishna District
Ownership structure	Owned & operated by AAI	Owned & operated by AAI	Civil Enclave Airport – Ownership and ATC by Indian Navy	Owned and operated by AAI
			Other airport operations with AAI	
Operations	Domestic airport limited hours	Domestic airport limited hours	Customs airport 24X7 Operations	Domestic airport limited hours
Land area	367 acres	312 acres	350 acres	534 acres
Major carriers as on 2014	Jet Konnect, Spice Jet	Air India, Spice Jet	Indigo, Air India, Spice Jet, Air Costa, Silk Air	Air Costa, Air India, Spice Jet
Terminal details				
Terminal Area	3,900 m^2	1,585 m^2	Domestic: 4,076 m^2 International: 4,550 m^2	850 m^2
No. of Terminals	1	1	2	1
Runway Details				
Length	1,800 m	2,286 m	3,200 m	2,408 m

Source: Consultations with State government, GoAP. AAI. Study team analysis.

As shown in Table 2.14, AAI's own traffic estimates seem to suggest that the current peak hour terminal capacity available at the four airports, with the exception of Vijayawada, is sufficient to cater to the demand until 2022–23. The traffic projections were undertaken based on expected increase in incumbent traffic and may not have considered the development of additional traffic due to the political developments in the state, including the creation of a new capital city at Vijayawada.

Nevertheless, AAI's additional brownfield capacity upgrade plans at each of the four airports represent a multi-fold increase in capacity, which appears to be more than sufficient to handle any surges in traffic that may happen over the next 10 years (Table 2.15).

In addition, AAI has also upgraded the terminal at the presently non-operational airport at Kadapa with an ability to cater to roughly 350,000 annual passengers. It is also proposing a new airport at Ongole with an ability to handle similar volumes of traffic.

Table 2.14: **Forecast of Passenger Traffic in Andhra Pradesh airports**

Year	Visakhapatnam Airport				Rajahmundry Airport			
	AAI Forecast Annual Passengers	Implied Peak Hour Demand	Current PH Terminal Capacity	Implied Utilization	AAI Forecast Annual Passengers	Implied Peak Hour Demand	Current PH Terminal Capacity	Implied Utilization
2014-15	1,207,921	379	700	**54%**	113,862	36	225	**16%**
2015-16	1,303,328	409	700	**58%**	119,555	38	225	**17%**
2016-17	1,406,295	441	700	**63%**	125,533	39	225	**18%**
2017-18	1,517,421	476	700	**68%**	131,809	41	225	**18%**
2018-19	1,607,737	504	700	**72%**	142,354	45	225	**20%**
2019-20	1,703,434	534	700	**76%**	153,742	48	225	**21%**
2020-21	1,804,836	566	700	**81%**	166,042	52	225	**23%**
2021-22	1,912,281	600	700	**86%**	179,325	56	225	**25%**
2022-23	2,026,130	636	700	**91%**	193,671	61	225	**27%**

Year	Tirupati Airport				Vijayawada Airport			
	AAI Forecast Annual Passengers	Implied Peak Hour Demand	Current PH Terminal Capacity	Implied Utilization	AAI Forecast Annual Passengers	Implied Peak Hour Demand	Current PH Terminal Capacity	Implied Utilization
2014-15	346,723	109	300	**36%**	204,076	64	100	**64%**
2015-16	381,395	120	700	**17%**	224,484	70	100	**70%**
2016-17	419,535	132	700	**19%**	246,932	77	100	**77%**
2017-18	461,488	145	700	**21%**	271,625	85	100	**85%**
2018-19	498,407	156	700	**22%**	293,355	92	100	**92%**
2019-20	538,280	169	700	**24%**	316,824	99	100	**99%**
2020-21	581,342	182	700	**26%**	342,170	107	100	**107%**
2021-22	627,850	197	700	**28%**	369,543	116	100	**116%**
2022-23	678,078	213	700	**30%**	399,107	125	100	**125%**

[a] ADB Analysis based on planning benchmarks cited in the previous page.

Source: Consultations with State government, GoAP. AAI. Study team analysis.

Consideration for Future Development Strategies

The low level of incumbent demand is likely to be structural, owing to the dominant position of neighboring airport hubs and competition from multi-modal transport that prevents airline network penetration.

One of the important reasons for the low level of air traffic in the residual state of Andhra Pradesh is the dominant position of Hyderabad airport for air travel in the combined

Table 2.15: **Current and Proposed Terminal and Runway Capacities of Airports in Andhra Pradesh**

	Rajahmundry	Tirupati	Visakhapatnam	Vijayawada
Current Terminal Capacity	• 225 Peak Hour Passengers (PHP) • Expected 2023 utilization: 27%	• 300 PHP (present) and 700 PHP (after 2015) • Expected 2023 utilization: 30%	• 700 PHP • Expected 2023 utilization:91%	• 100 PHP • Expected 2023 utilization: 125%
Proposed Terminal Capacity	• Additional capacity proposed to be developed subject to land availability	• 700 PHP (to be completed by June 2015) • 1400 PHP (owned land) • 2800-3000 PHP (if land can be acquired)	• 1400 PHP (Phase 1) • 2800-3000 PHP (Phase 2)	• 700 PHP (Integrated Terminal) • 1400 PHP (Phase 1, if land can be acquired) • 2800-3000 PHP (Phase 2, if land can be acquired)
Current Runway Capacity	• 1750 x 45 m runway • Capable of handling ATR-72 aircraft	• 2286 x 45 m runway • Capable of handling A-320/321 aircraft	• 3050 x 45 m runway • Capable of handling B-767-400/A-300	• 2286 x 45 m runway • Capable of handling A-320/321 aircraft
Proposed future developments	• 3165 x 45 m runway (if land can be acquired) • Capable of handling B-767-400 aircraft	• 3810 x 45 m runway (if land can be acquired) • Capable of handling B-747-400 aircraft	• 3850 x 45 m runway • Capable of handling B-747-400 aircraft	• 3250 x 45 m runway (if land can be acquired) • Capable of handling Code-D category flights
Cargo Terminal	• Cargo terminal (subject to availability of land)	• Present domestic terminal to be converted to cargo terminal	• Cargo terminal already developed and constructed • Expected to be commissioned soon	• Present domestic terminal to be converted to cargo terminal

Source: Consultations with State government, GoAP. AAI. Study team analysis.

state, and the under-penetration of air travel, when compared with other modes in the rest of the state. Further, the southern region of the state is proximal to two international airports close to Bangalore and Chennai. At such short distances to established hubs, road and rail transport, followed by air lifting, are likely to be the dominant modes for both passengers and cargo.

Such low levels of incumbent demand results in a structural under-penetration of direct airline services. As per the flight schedule of 2014,[5] two of the four airports (Rajahmundry and Tirupati) in the state are connected only to the city of Hyderabad through scheduled flights.

Vijayawada has point-to-point flights only to Hyderabad and Bangalore, and single-hop flights to Coimbatore, Chennai, and Delhi. Visakhapatnam has limited options for point-to-point connectivity to six cities, and single and double-hop flights to two more cities. Where point-to-point or hop-options are available to connect to major metropolitan cities, schedule options are limited, making Hyderabad a preferred lay over location for passengers.

In summary, given the state's current air traffic penetration, and considering the competition from neighboring airport hubs and from other transport modes, it does not seem likely that the incumbent air traffic can support sufficient airline demand aggregation to warrant creation of large airport hubs for the state.

However, specific political and economic development trends in the hinterlands might act as triggers for airline network development, which could warrant specific responses from airport development perspective.

Development of the capital city at Vijayawada might act as a growth catalyst for route development.

The development of a new capital city around Vijayawada might prove to be a catalyst for greater urbanization and industrialization of the region around the Krishna Godavari delta. This may trigger fresh development of airline routes from Vijayawada to regional destinations, making it a potential candidate to become a moderately important airport hub. The implications of capital city development, the need for road and rail connectivity, and their impact on other neighboring airports are outside the scope of this study, but will need to be considered at the time of master planning.

Development of the coastal corridor may trigger long-term demand for business travel and air cargo movement, and may need to be planned through appropriate models.

Several industrial nodes are being proposed as part of the VCIC strategy. There are also important initiatives in the state like PCPIR in the Vizag–Kakinada region, national manufacturing investment zones, and other industrial nodes as part of the Chennai–Bangalore Industrial Corridor (CBIC). Several ports in the state (e.g., Krishnapatnam) are poised to become ports of national importance, carrying large amounts of industrial cargo.

[5] March–October network schedule published by DGCA.

These initiatives are expected to create large-scale employment opportunities and the agglomeration of urban clusters. They will also spawn opportunities for large-scale investment, including through FDI, and the need for physical integration with regional and international destinations through improved air connectivity.

As an example, VCIC is expected to concentrate on electronics as a focus sector, which requires efficient logistics for the safe, reliable, and time-sensitive movement of high-value cargo. It may also create a need for quicker travel for international investors and management personnel to and from these locations that otherwise may not be sufficiently fulfilled by road or rail travel to other airport hubs.

Therefore, the development of small airports, air strips, cargo processing centers, and general aviation facilities closer to the industrial nodes might prove necessary. This should be considered during VCIC master planning.

Illustrative Model 1: Regional airports focused on urbanization and integrated with city development (suitable for new greenfield cities being planned in VCIC)

- In this model, airport planning should be closely correlated with local population growth and increasing urban clusters around fast-growing cities and cities under planned development.
- The airport will need to be supported by connectivity to major domestic and international destinations in the country and the region.
- The cost of land acquisition for greenfield airports should be compared with the option of brownfield development of existing airports. In such planning, a 30-year view may need to be taken in order to secure the land for future airport construction.
- Such airports should be integrated with feeder connectivity through urban transport modes.

Illustrative Model 2: Airport modelled on industrial aerotropolis concept.

- This model may be suited for large industrialization nodes being developed with planned townships.
- The airports may have an equal focus on cargo and passenger traffic anchored around the industrial clusters, and connected directly to important cargo hub airports in the region.
- Multi-modal connectivity and integration with ports, roads, and railways is important.

Summary and Conclusions

The following conclusions can be drawn for VCIC's future airport development strategy:

- The airport development strategy for the VCIC region should carefully consider the very low level of current incumbent passenger and air cargo traffic.
    - » This trend has its roots in competition from neighboring airport hubs, which are well-connected to the cities and competing modes of travel, and leads to a structurally poor state of airline route development from leading airlines.

- » The airports of the region are also functioning with limited operations and with operational bottlenecks.
- » Therefore, it is necessary to consider future airport development in two different time horizons.

- Short- to medium-term
  - » Over the next 10 years, it is expected that the capacity already in place, under construction, or proposed under AAI will be more than sufficient to cater to the growth in incumbent traffic at all four operational airports in VCIC.
  - » Considering the short distance to the neighboring airport hubs (three of the top six international airports in India), facilitating excellent road connectivity to these hubs from the cities and cargo-generating centers of the state is likely to be more capital-efficient in the short-term.
  - » In the short-term, attention may be required to enhance base demand by incentivizing direct airline services to the existing airports in the state from important destinations, including domestic metropolitan cities and regionally important international cities. Such proposals should consider the feasibility of attracting air traffic in the face of multi-modal competition.
  - » This should be supported by service upgrades (e.g., 24x7 operations, night landing facilities, and customs and immigration), and operational de-bottlenecking at current airports.

- Long -term
  - » Beyond 10 years, development of the capital city around the Vijayawada region may be a growth catalyst for airline traffic. This may create the need for developing regional hubs in the city.
  - » These development trends are outside the scope of this study, but will need to be carefully considered before undertaking the master planning for VCIC.
  - » The development of the coastal corridor and additional economic investments in the region may create additional urban and industrial agglomeration, and a need for quicker transit for business travelers and time-sensitive cargo (e.g., electronics).
  - » Therefore, smaller airports under different models may be considered. At the time of master planning, the suitability of different models should be considered for each nodes, taking into account the local context.

Node-Centric Network Development

Introduction

The strategy for network connectivity considers the need to interconnect nodes, gateways, and hinterland centers proximal to VCIC. Besides the gateways and nodes, key hinterland centers have been identified within and outside VCIC that directly provide sourcing and distribution opportunities, or behave as transit nodes for onward movement.

- **Project long-listing.** A long-list of 135 candidate projects (80 roads and 55 railways) was considered based on detailed primary and secondary analysis both at the corridor-level and node-level. These selected projects span both railway and roadway

Table 2.16: **Categorization of Node-Centric Road Projects**

Connectivity Category	Visakhapatnam	Kakinada	Gannavaram–Kankipadu	Yerpedu–Srikalahasti	Total
Node-VCIC Gateway	2	1	1	3	7
Node-Hinterland	3	-	1	2	6
Hinterland-VCIC Gateway	1	3	2	1	7
Node-ex VCIC Gateway	-	-	1	-	1
Intra-Node	2	-	1	1	4
Total	8	4	6	7	25

Source: Study team analysis.

connectivity, and are both greenfield (new capacity creation) and brownfield (existing capacity augmentation) projects.

- **Shortlisting and Categorization**
    - » **Roads.** Out of a total of 80 projects, a shortlist of 50 projects was generated, based on a detailed analysis for relevance to VCIC.
        - o Seventeen of these projects were found to be of relevance to the entire corridor.
        - o Of the remaining 33 projects, eight have been classified as conditional projects, or those that can be developed based on the development of other ports in the region.
        - o The remaining 25 projects were tested for their strategic importance for the nodes across five types of connectivity (Table 2.16).
    - » **Rail.** Out of a total of 55 projects, a shortlist of 34 was generated, based on a detailed analysis for relevance to VCIC.
        - o Eleven of these projects were found to be of relevance to the entire corridor.
        - o Of the remaining 23 projects, two have been classified as conditional projects, or those that can be developed based on the development of other ports in the region.
        - o The remaining 21 projects were tested for their strategic importance for the nodes across five types of connectivity (Table 2.17).

Framework for Prioritization of Projects

A matrix was then developed to assess the prioritization of the projects for implementation over the given time-frame.

- **Assessment of level of criticality.** Each of these projects were then tested for strategic importance to the node and categorized as critical, need to have, or good to have.

Table 2.17: **Categorization of Node-Centric Road Projects**

Connectivity Category	Visakhapatnam	Kakinada	Gannavaram–Kankipadu	Yerpedu–Srikalahasti	Total
Node-VCIC Gateway	-	-	2	2	4
Node-Hinterland	-	-	3	5	8
Hinterland-VCIC Gateway	-	-	2	3	5
Node-ex VCIC Gateway	-	-	-	-	-
Intra-Node	-	2	2	-	4
Total	-	2	9	10	21

Source: Study team analysis.

For example, projects that connect to operational gateways are assessed as critical when compared with projects connecting upcoming gateways. Similarly, projects expected to resolve immediate bottlenecks are proposed as critical when compared with projects that will resolve expected medium-term bottlenecks.

- **Assessment of state of readiness.** The status of project preparation was then assessed on a scale of 1 to 5 (conceptualization->1, feasibility being studied->2, feasibility assessed->3, procurement->4 and implementation->5). Critical and important projects that are in a high state of readiness are proposed for immediate- and short-term execution. Projects with low importance or low states of readiness are proposed for medium- to long-term execution.

Visakhapatnam Node

As mentioned earlier, the node-centric projects have been divided into five categories. NH5 is the only national highway that passes through the district:

- **Node to VCIC gateway**
  - » The Visakhapatnam node is an agglomeration of four major economic clusters: Atchutapuram, Nakkapalli, Bheemunipatnam, and Pydibhimavaram. The major gateways include the international airport at Visakhapatnam, and Visakhapatnam and Gangavaram ports.
  - » Nakkapalli and Pydi Bhimavaram are connected by NH5. However, Atchutapuram SEZ needs to be connected to Gopalapuram–Anakapalle where it then touches NH5. This road project has been proposed.
  - » Additionally, stakeholder consultations revealed that the road from Visakhapatnam port to NH5 needs to be strengthened. Hence, this road project has also been proposed and will connect all the economic clusters to Visakhapatnam port. However, stakeholder consultations revealed no critical constraints in terms of Gangavaram port connectivity.

- **Node to hinterland**
  - » Within Visakhapatnam district, the other major industrial clusters in addition to the proposed economic clusters include Narsipatnam, Yelamanchilli, and Gajuwaka.
  - » Hence, projects have been proposed to connect these clusters. Additionally, other proximal hinterlands includes Orissa. A proposed project connecting Vizianagaram and Haddubhangi via Palakonda road will connect Visakhapatnam node to Orissa.

- **Hinterland to VCIC gateway**
  - » As mentioned earlier, the closest hinterland to Visakhapatnam is Orissa and the east coast. Hence, ports in Visakhapatnam should target cargo from this region.
  - » To enable this, a project has been proposed that starts from the Orissa border; passes through Araku, Sunkavarimetta, Ananthagiri, Srungavarapukota, and Pendruthi; and ends at Visakhapatnam, which is connected to Visakhapatnam port.

- **Node to ex-VCIC gateway**
  - » The key ex-VCIC gateways include Hyderabad, Bengaluru, and Chennai airports. The Hyderabad airport is connected via NH5 until Rajahmundry. Rajahmundry to Devarapalli has been proposed as a new stretch under the Kakinada node. Devarapalli is connected to Suryapet and Hyderabad via NH and hence no new projects required.
  - » The majority of the stretch between Visakhapatnam and Bangalore airport is connected by NH4 and NH5. The stretch between Naidupeta and Tirupati which is connected by SH has been proposed for development under the Yerpedu node projects. Further, Visakhapatnam and Chennai are connected via NH5, which has been proposed for upgradation under the spinal projects list.

- **Intra-node**
  - » Two stretches have been proposed. The Sabbavaram–Kothavalasa stretch will improve connectivity between the Pydibhimmavaram and Atchutapuram–Nakkapalli clusters, and the Prattipadu–Nidadavolu stretch will improve connectivity with the Gannavaram cluster.
  - » Further, the Kakinada node and Visakhapatnam node will also be connected by the PCPIR project that has been proposed as an alternate spinal project.

On all the above aspects, existing rail connectivity is found to be sufficient and no new rail projects are proposed. The detailed list of projects proposed under the Visakhapatnam node is depicted in Figure 2.38. Project details are shown in Table 2.18.

Kakinada Node

- Node to VCIC gateway
  - » Kakinada port and Rajahmundry airport are the two major gateways for the Kakinada node. The Kakinada node and port are connected via the Uppada

Figure 2.38: **Node-Centric Road and Rail Projects—Visakhapatnam**

Source: Consultations with State government, GoAP. Study team analysis.

Table 2.18: **Node-Centric Road Projects–Visakhapatnam**

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project					Executing Agency	Comments and Key Issues
				1	2	3	4	5		
1	Visakhapatnam–Pendruthi–Srungavarapukota–Ananthagiri–Sunkavarimetta–Araku–Orrissa Border	126	Good to have						R&B, GoAP	This project will connect Visakhapatnam with its immediate hinterland (Orrisa).
2	Visakhapatnam Port Connectivity Road under NHDP-II	13	Critical						NHAI	This will improve the connectivity between the node and the VCIC gateway (Visakhapatnam port).
3	Yelamanchilli–Gajuwaka	57	Need to have						APRDC	This project will be an alternate route to connect the two industrial clusters (Atchutapuram and Nakkapalli) and will reduce the distance (by around 6 km) and travel time. They are currently connected via NH5.

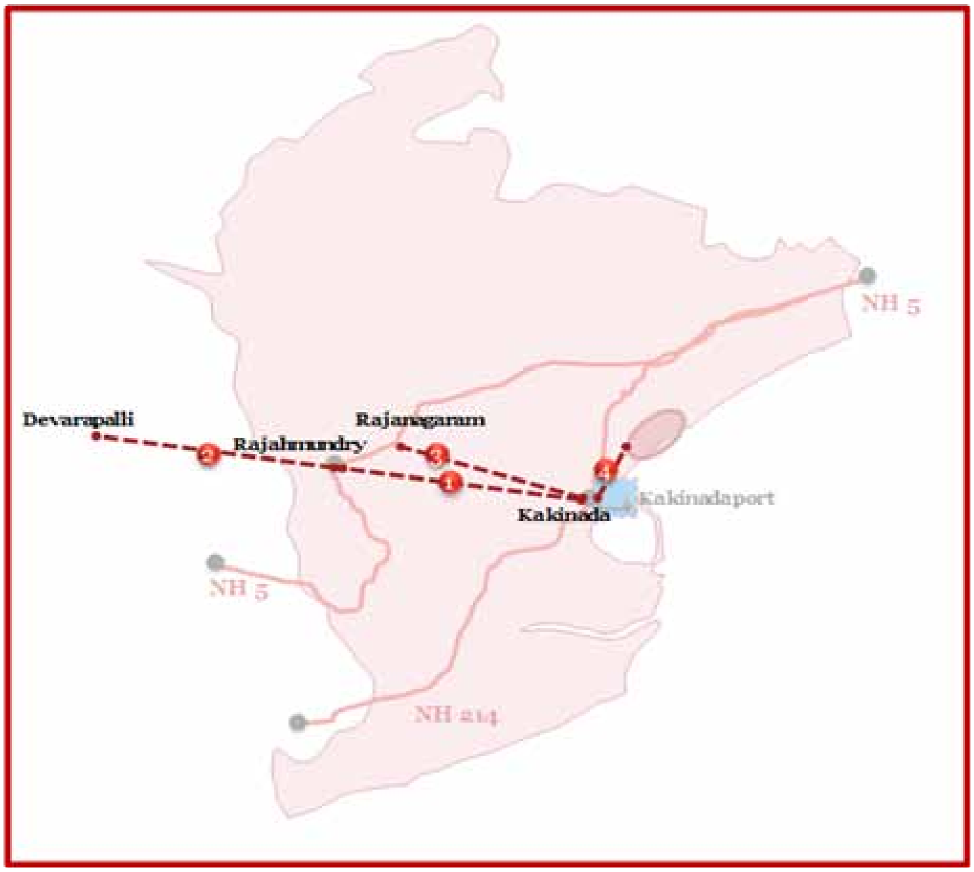
continued on next page

Table 2.18 *continued*

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project 1	2	3	4	5	Executing Agency	Comments and Key Issues
4	Narasipatnam –Tuni	40	Critical						APRDC	Tuni is connected to the Nakkapalli cluster via NH5. This road stretch will connect Nakkapalli cluster with Narasipatnam, which is one of the major towns in Visakhapatnam.
5	Sabbavaram–Kothavalasa	13	Critical						APRDC	The road stretch between Sabbavaram and Kothavalasa will connect Pydibhimmavarm and Atchutapuram–Nakkapalli as Kothavalasa is connected to Pydibhimmavaram via NH5. Thus, improving connectivity between economic clusters in Visakhapatnam.
6	Vizianagaram–Palakonda Road–Haddubhangi	105	Critical						APRDC	Haddubhangi is close to the Andhra Pradesh–Orissa border. Hence, this project will improve connectivity from node to hinterland.
7	Prattipadu–Nidadavolu	24	Need to have						APRDC	Atchutapuram and Gannavaram are connected by NH5 except for the stretch between Nidadavolu and Prattipadu. Hence, upgradation of this stretch will ease connectivity between Gannavaram and Atchutapuram, two nodes under VCIC.
8	Atchutapuram–Anakapalle	15	Critical						APRDC	Atchutapuram and Visakhapatnam port are connected by NH5 across a majority of the stretch. However, the stretch between Atchutapuram and Anakapalle is a 2-lane road and needs widening. Nakappale and Pydi bhimavaram are connected by NH5.

Source: Consultations with Central and State (GoAP) government agencies (NHAI, APRDC, T, R&B), Study team analysis.

Figure 2.39: **Node-Centric Road Projects—Kakinada**



Source: Consultations with Central and State (GoAP) government agencies, Study team analysis.

beach road which is a two-lane road. Stakeholder consultations have revealed that this road is facing congestion and development of this stretch has been proposed in the projects listed below (Figure 2.39, Table 2.19).

» This project coupled with the proposed Kakinada–Rajahmundry stretch will ease connectivity between the node and Rajahmundry airport. Additionally, a captive port has also been proposed at the node, which may be developed in the medium- to long-term and served by this road.

- Node to hinterland
  » The major industrial clusters within Kakinada district include Kakinada and Rajahmundry. The proposed Kakinada–Rajahmundry stretch will ease connectivity with these two industrial regions. Additionally, the other proximal hinterland includes Hyderabad.
  » The proposed project connecting Rajahmundry to Suryapet will improve connectivity between these two regions.

Table 2.19: **Node-Centric Road Projects—Kakinada**

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project					Executing Agency	Comments and Key Issues
				1	2	3	4	5		
1	Kakinada-Rajahmundry (combined with Rajahmundry–evarapalli)	65	Critical						R&B, GoAP	This road stretch will connect Kakinada to Rajahmundry, which are the major economic clusters of the district. This coupled with the Kakinada Uppada beach road project will connect the node to VCIC gateway (Rajahmundry airport).
2	Rajahmundry–Devarapalli (covered)	30	Need to have						R&B, GoAP	This project will connect Rajahmundry to Devarapalli, which in turn is connected to Suryapet and Hyderabad, improving connectivity between the VCIC gateway and hinterland.
3	ADB Road	55	Need to have						APRDC	This project will be an alternate route to connect Kakinada and Rajahmundry. The start and end points of this project are Kakinada and Rajanagaram. Rajanagaram lies on NH5 and is connected to Rajahmundry.
4	Kakinada Anchorage Port–Captive port in KSEZ–Kakinada Uppada Beach Road	25	Need to have						R&B, GoAP	The node in Kakinada is close to Uppada, which is connected via the Uppada beach road to Kakinada port. Hence, upgradation of this road will improve connectivity between node to Kakinada port which is the VCIC gateway

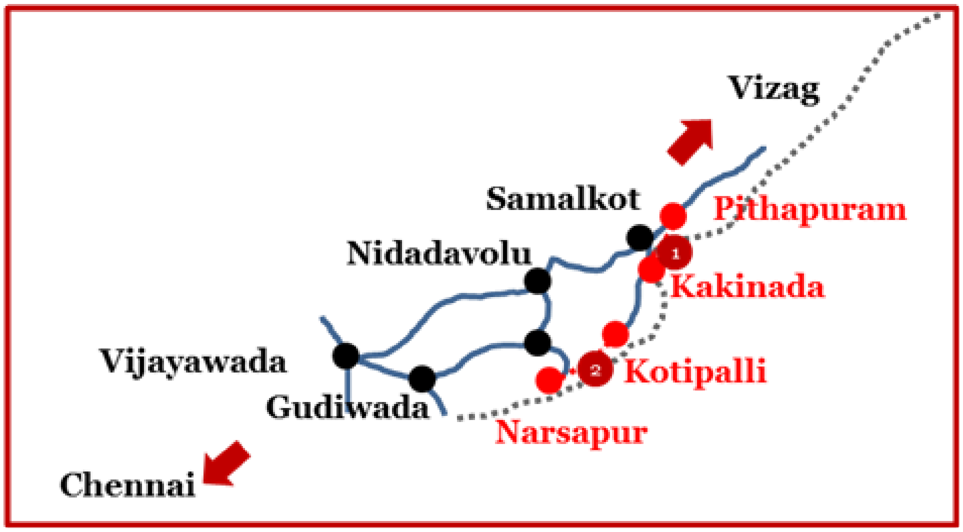
Source: Consultations with Central and State (GoAP) government agencies, Study team analysis.

- Hinterland to VCIC gateway
  - » The closest hinterland to Kakinada is Hyderabad. Hence, ports in Kakinada should aim to attract cargo from this region and other regions in Telangana.
  - » The proposed stretch between Rajahmundry and Suryapet will enable this. Additionally, it also passes through economic clusters in Kovvur and Khammam.

- Node to ex-VCIC gateway
  - » The key ex-VCIC gateways include Hyderabad, Bengaluru, and Chennai airports. Rajahmundry to Devarapalli has been proposed as a new stretch under the Kakinada node. Deverapalli is connected to Suryapet and Hyderabad via NH5. Hence, no new projects are required.
  - » The majority of the stretch between Kakinada and Bangalore airport is connected by NH5 and NH18A. The stretch between Naidupeta and Tirupati, which is connected by SH, has been proposed for development under the Yerpedu node projects.
  - » Further, Rajahmundry and Chennai are connected via NH5, which has been proposed for upgradation under the spinal projects list. Hence, no additional projects have been proposed.

- Intra-node
  - » Kakinada node is well-connected with the Visakhapatam cluster. The PCPIR expressway will further improve connectivity.
  - » Rajahmundry and Gannavaram are well-connected via NH5 except for the stretch from Prattipadu to Nidadavolu, which has been proposed for development under the Visakhapatnam node projects.
  - » Two rail projects connecting the Kakinada port to Pithapuram junction, and another project connecting Narsapur with Kotipalli, are being considered (Figure 2.40, Table 2.20).

Figure 2.40: **Node-Centric Rail Projects—Kakinada**



Source: Consultations with Central and State (GoAP) government agencies, Study team analysis.

Table 2.20: **Node-Centric Rail Projects—Kakinada**

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project 1	2	3	4	5	Executing Agency	Comments and Key Issues
1	New Line Kakinada–Pithapuram	21.5	Need to Have						MoR	• Project for strengthening last-mile connectivity in the port section • Project sanctioned in 2000–01 • No progress has been achieved
2	New Line Kotipalli–Narsapur	57.2	Need to Have						MoR	• Project for strengthening last-mile connectivity in the port section • Project sanctioned in 1999–2000 • No progress has been achieved

Source: Consultations with Central and State (GoAP) government agencies, Study team analysis.

Gannavaram–Kankipadu Node

- Node to VCIC gateway
  - » The key gateways include the Machilipatnam port and the Gannavaram airport. The two stretches proposed between Kankipadu and Gannavaram via Kesarapally and Machilipatnam to Machilipatnam port will improve connectivity with both gateways. Kakinpadu and Machilipatnam are connected by NH9.
  - » Considering the central port cluster of Nizamapatnam, Machilipatnam, and Vodarevu (already awarded or yet to be awarded), PET surveys of two last-mile rail connectivity projects are proposed.

- Node to hinterland
  - » Gudivada is an existing economic cluster in Krishna district. This project connects Gannavaram to an existing cluster. A project has been proposed to connect Gudivada to Gannavaram via the Manikonda road.
  - » Three rail capacity augmentation projects (doubling, tripling, and gauge conversion) are to be considered to ease the congestion from the Guntur–Vijayawada region to Nagpur, Bellary, and Bangalore.

- Hinterland to VCIC gateway
  - » Machilipatnam, Padana, and Nuzivid are the major industrial hubs in Krishna districts. The Machilipatnam port is a key gateway and not very well-connected to these clusters. Hence, two projects have been proposed to improve connectivity. These include Pedana–Nuzvidu–Vissannapeta road and Machilipatnam–NH214 road.

- » Two projects from Guntur are being considered (doubling and electrification) to ease the traffic flow between hinterland centers like Hyderabad to the central port cluster in the future.

- Node to ex-VCIC gateway
    - » The key ex-VCIC gateways include Hyderabad. The proposed nodes are well-connected to Vijayawada, which in turn is connected to Guntur via NH5. To connect Vijayawada to Hyderabad, the stretch between Guntur and Kondamodu lies on SH2. Hence, this stretch has been proposed for development.

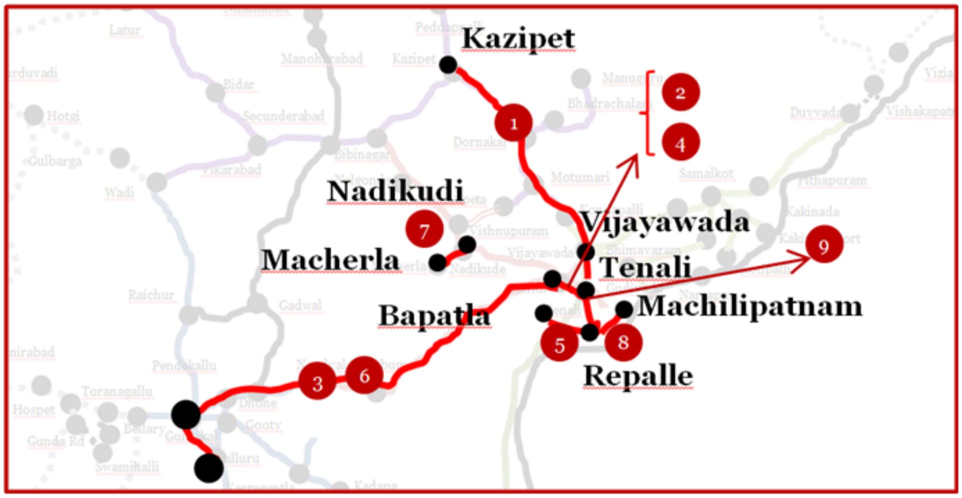
- Intra-node
    - » In addition to Kakipadu and Gannavaram, Thotapalli, which is a village in the Agiripallin mandal, also has land available for development and is a part of the node. Hence, the road stretch between Gannavaram and Thotapalli has been proposed to improve connectivity.
    - » Two PET studies are proposed for accelerated execution between Macherla and Nadikude, and between Tenali and Repalle, considering future congestion in this area.

The projects proposed under the Gannavaram–Kankipadu node are depicted in Figures 2.41 and 2.42, with details provided in Tables 2.21 and 2.22.

Figure 2.41: **Node-Centric Road Projects—Gannavaram–Kankipadu Node**

Source: Consultations with Central and State (GoAP) government agencies, Study team analysis.

Figure 2.42: **Node-Centric Rail Projects—Gannavaram-Kankipadu Node**



Source: Consultations with Central and State (GoAP) government agencies, Study team analysis.

Table 2.21: **Node-Centric Road Projects—Gannavaram–Kankipadu Node**

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project					Executing Agency	Comments and Key Issues
				1	2	3	4	5		
1	NH214A–Machilipatnam	10	Need to have						R&B, GoAP	This project will connect Machilipatnam, which is on NH214A to Machilipatnam port, which is the VCIC gateway.
2	Pedana–Nuzvidu–Vissannapeta Road (PNV 8)	96	Critical						APRDC	Vissannapeta and Nuzivid are major industrial hubs in Krishna (particularly mangoes). This stretch connects these two regions to Gannavarama and Kankipadu cluster, and also to Machilipatnam port.
3	Kondamodu–Guntur (Part of Hyderabad–Guntur road)	70	Need to have						APRDC	Vijayawada and Guntur are connected via NH 5. To connect Vijaywada to Hyderabad, the stretch between Guntur and Kondamodu lies on SH2 and hence this stretch has been proposed for development to connect Vijayawada to Hyderabad.

continued on next page

Table 2.21 *continued*

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project 1	2	3	4	5	Executing Agency	Comments and Key Issues
4	Kankipadu to Gannavaram road via Kesarapally	14	Need to have						R&B, GoAP	Kankipadu and Gannavaram are the two economic clusters in the node. This stretch connects the two clusters. Additionally, it also connects Kakipadu to Gannavaram airport, which is a VCIC gateway.
5	Manikonda Road from Gannavaram to Gudivada	32	Good to have						R&B, GoAP	Gudivada is an existing economic cluster in Krishna district. This project connects Gannavaram to an existing cluster.
6	Gannavaram to Thotapalli	12	Good to have						R&B, GoAP	Thotapalli is a village in the Agiripalli mandal, which is also a part of the node. Hence, this road stretch connects the two proposed economic clusters as a part of VCIC.

APRDC = Andhra Pradesh Road Development Corporation; T, R&B = Transport, Roads and Buildings.

Source: Consultations with Central and State (GoAP) government agencies, Study team analysis.

Table 2.22: **Node-Centric Rail Projects—Gannavaram–Kankipadu Node**

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project 1	2	3	4	5	Executing Agency	Comments and Key Issues
1	Kazipet to Vijayawada (Third Line with OHE)	219	Critical						RVNL	• Project to ease high degree of congestion for hinterland connectivity between Hyderabad and Nagpur • Project sanctioned in 2012–13 • No progress has been achieved
2	Guntur–Tenali (Electrification)	24.4	Good to Have						RVNL	• Project to Provide connectivity to future gateways (Nizamapatnam and Vodarevu) from Hyderabad • Project sanctioned in 2011–12 • No progress has been achieved

continued on next page

Table 2.22 *continued*

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project 1	2	3	4	5	Executing Agency	Comments and Key Issues
3	Gauge Conversion: Guntur–Guntakal and Guntakal–Kalluru (478 km) including Pendekallu–Gooty new line with lifting of Kalluru–Dharmavaram (76 km)	478	Critical						MoR	• High degree of congestion in core hinterland line. • Project progress to be monitored on a mission mode
4	Guntur–Tenali (Doubling)	24.4	Good to Have						MoR	• Project to provide connectivity to future gateways (Nizamapatnam and Vodarevu) from Hyderabad • Feasibility to be assessed
5	PET Survey for a new line between Baptala–Nizampatnam–Repalle	50	Good to Have						MoR	• Connectivity to future gateways (Nizamapatnam and Vodarevu) from Hyderabad • PET survey to be accelerated
6	Guntakal–Guntur Doubling Survey	478	Critical						MoR	• Connectivity to Bellary and Bangalore; high degree of congestion • Survey to be accelerated
7	Preliminary Engineering cum Traffic Survey for doubling between Macherla–Nadikude	23	Need to Have						MoR	• Expected future congestion after commissioning of Nadikudi–Srikalasthi line • PET to be completed
8	Survey for updating of new line between Machhilipatnam and Repalle via Nizampatanm	45	Good to Have						MoR	• Connectivity to future gateways (Nizamapatnam and Machilipatnam) • Survey to be completed
9	Preliminary Engineering cum Traffic Survey for doubling and electrification of Tenali –Repalle	34	Good to Have						MoR	• Connectivity to future gateways (Nizamapatnam and Vodarevu) from Hyderabad • Survey to be completed

MOR = Ministry of Railways, RVNL = Rail Vikas Nigam Limited.

Source: Consultations with Central and State (GoAP) government agencies, Study team analysis.

Yerpedu–Srikalahasthi Node

Road Network

The national highways passing through Chittoor district include NH4, NH219, NH18, and NH 716. Detailed analysis is as illustrated below.

- Node to VCIC gateway
  - » Tirupati airport and Krishnapatnam port are the two major gateways for the Yerpedu–Srikalahasti node. To improve connectivity between the node and the gateways, three projects have been proposed. These include Nellore to Krishnapatnam port, Chowtour to Tirupati airport, and Kandadu–Musalipadu to Tirupati airport.
  - » Two critical rail projects are to be considered for the doubling of the Gudur–Renigunta–Tirupati and Krishnapatnam–Venkatachalam sections.

- Node to hinterland
  - » Chittoor, Tirupati, and Naidupeta are the major industrial clusters in the region. To improve connectivity between the nodes and these clusters, the Tirupati–Naidupeta and Chittoor–Puttur stretches have been proposed. Additionally, the Gudur–Hiriyur stretch will also improve connectivity with the Chitradurga hinterland.
  - » Five rail capacity augmentation projects are proposed to connect to the southern and western hinterlands.

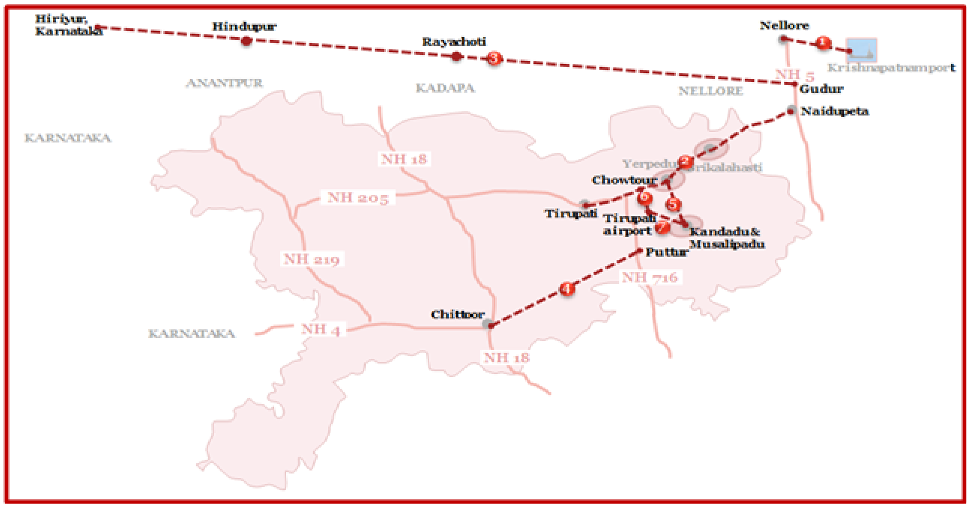
- Hinterland to VCIC gateway
  - » The key hinterlands for Krishnapatnam port include the Tumkur–Chitradurga region and the Chennai region. The stretch between Gudur and Hiriyur, which is well connected to Chitradurga, will enable cargo from Karnataka region. Additionally, this stretch also passes from Rayachuti and Hindupur, which are key economic clusters in the Rayalaseema region.
  - » Three projects are proposed to provide direct access from hinterland centers to VCIC gateways.

- Node to ex-VCIC gateway
  - » The Yerperdu–Srikalahasti node is well–connected to Chennai region via NH5.

- Intra-node
  - » The Tirupati–Naidupeta stretch also connects the Srikalahasti and Yerpedu regions. A Yerpedu to Kandadu and Musalipadu stretch via Papa Naidu Peta road has been proposed to connect the Kandadu and Yerpedu–Srikalahasti regions.

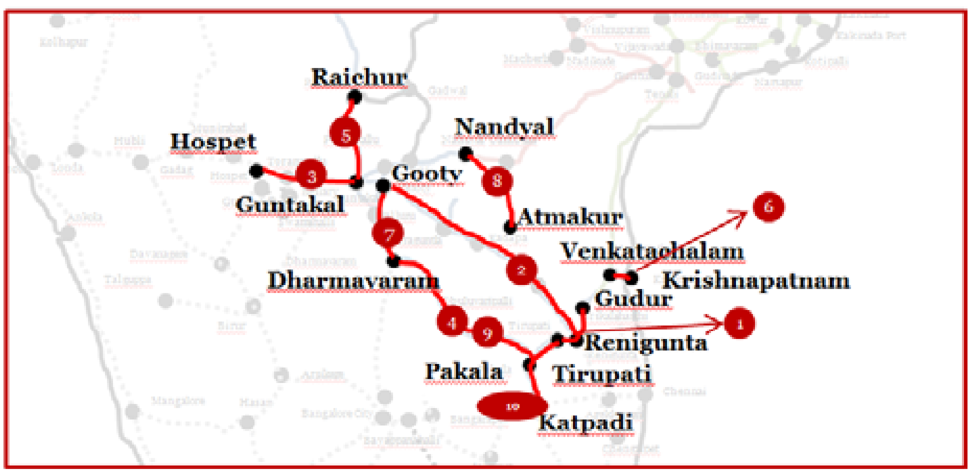
The projects proposed under the Yerpedu–Srikalahasti node are depicted in Figures 2.43 and 2.44, with details provided in Tables 2.23 and 2.24.

Figure 2.43: Node-Centric Road Projects—Yerpedu–Srikalahasti



Source: Consultations with Central and State (GoAP) government agencies, Study team analysis.

Figure 2.44: **Node-Centric Rail Projects—Yerpedu–Srikalahasti**



Source: Consultations with Central and State (GoAP) government agencies. Study team analysis.

Conditional projects

As mentioned earlier, certain projects have been classified as conditional projects, which need not be taken up as part of VCIC. They can be taken up subject to completion of the linking infrastructure projects as part of other project packages (Table 2.25).

Table 2.23: **Node-Centric Road Projects—Yerpedu–Srikalahasti**

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project					Executing Agency	Comments and Key Issues
				1	2	3	4	5		
1	Krishnapatnam port to Nellore	27	Critical						R&B, GoAP	Yerpedu–Srikalahasti node to Krishnapatnam port is connected via NH5 except for two stretches: Naidupeta to Srikalahastia and Nellore to KPT. Nidupeta to Srikalahasti will be covered under the Naidupeta–Tirupati stretch. Hence, Nellore to KPT is proposed.
2	Tirupati–Naidupeta conversion from existing two lanes to four lanes	80	Need to have						R&B, GoAP	This road will help connect Naidupeta to Yerpedu–Srikalahasti and Tirupati.
3	Gudur–Rapur–Rajampet–Rayachoti–Kadiri–Hdupur–Madakasira–Hiriyur	356	Good to have						R&B, GoAP	This stretch will connect Krishnapatnam port to Hindupur and Chitradurga. The stretch from KPT to Nellore has been proposed separately for development, Nellore to Gudur is connected by NH5 and Hiriyur to Chitradurga is connected by NH4
4	Chittoor–Puttur road	65	Critical						APRDC	The stretch provides for an alternate connectivity between Chittoor node and Chittoor, which is the district headquarters
5	Yerpedu to Kandadu and Musalipadu–Papa Naidu Peta Road	11	Need to have						R&B, GoAP	In addition to Yerpedu and Srikalahasti, land is also available in the Kandadu area. Hence, this proposed road stretch will connect the economic clusters in the node.
6	Chowtour to Airport	3	Need to have						R&B, GoAP	This project will connect the Yerpedu and Srikalahasti economic clusters to the airport. Chowtour is on the road proposed between Naidupeta and Tirupati.
7	Kandadu and Musalipadu to Airport via Munagalapallem	15	Good to have						R&B, GoAP	This road stretch will connect the economic cluster to VCIC gateway (Tirupati airport).

Source: Consultations with Central and State (GoAP) government agencies. Study team analysis.

Table 2.24: **Node-Centric Rail Projects—Yerpedu–Srikalahasti**

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project 1	2	3	4	5	Executing Agency	Comments and Key Issues
1	Double Line from Gudur–Renigunta (83 km) and Renigunta–Tirupati (9.34 km)	92	Critical						MoR	• Last-mile connectivity • Project Progress to be monitored
2	Gooty–Renigunta patch doubling	151	Critical						RVNL	• Gateway to Hinterland connectivity • Project Progress to be monitored
3	Doubling of Hospet–Guntakal	115	Need to Have						MoR & RVNL	• Gateway to Hinterland connectivity • Project Progress to be monitored
4	Gauge Conversion of Dharmavaram–Pakala	227	Critical						MoR	• Node to Hinterland connectivity • Project Progress to be monitored
5	Guntakal–Raichur doubling of existing sections: (i) Guntakal–Nancherla 7 and (ii) Kuppagal–Kosigi (by Rlys)	81	Critical						MoR & RNVL	• Node to Hinterland connectivity • Project sanctioned in 2003–04 • Phase I–IV have been commissioned. Phase V, Mantralayam–Raichur excluding Mantralayam Road–Matmarri (11.15 km) bridge portion, is being taken over by SCR and is in progress.
6	Doubling of Krishnapatnam–Vekantachalam	23	Critical						RVNL	• Node to gateway • Project progress to be monitored
7	Preliminary Engineering cum Traffic Survey for doubling between Gooty–Dharmavaram with electrification	91	Need to Have						MoR	• Node to hinterland • Study to be completed

continued on next page

Table 2.24 *continued*

S. No.	New Line Projects	Length (km)	Criticality	Readiness of the Project 1	2	3	4	5	Executing Agency	Comments and Key Issues
8	Reconnaissance Engineering cum Traffic Survey for a new line between Nandyal–Atmakur via Mahanandi	62	Good to Have						MoR	• Hinterland to gateway • Study to be completed
9	PETS for doubling of Tirupati–Katpadi	110	Need to Have						MoR	• Node to hinterland • Study to be completed
10	PETS for doubling of Dharmavaram–Pakala	227	Need to Have						MoR	• Node to hinterland • Study to be completed

Source: Consultations with Central and State (GoAP) government agencies. Study team analysis.

Table 2.25: **List of Conditional Projects**

S. No.	Name of Project	Length (km)	Implementing Agency
1	NH5–Duragrajapatnam port	33	R&B Department, GoAP
2	NH214A–Vadarevu port	10	R&B Department, GoAP
3	NH16–Ramyapatnam port	9	R&B Department, GoAP
4	NH214A–Nizamapatanam port	14	R&B Department, GoAP
5	NH16–Kalingapatnam port	30	R&B Department, GoAP
6	NH16–Meghavaram port	13	R&B Department, GoAP
7	NH16–Bhavnapadu port	16	R&B Department, GoAP
8	NH16–Bhimunipatnam port	6	R&B Department, GoAP
9	Gudur-Dugarajapatnam Rail line	41	MoR
10	Gangavaram Trunk Railway Line to PCPIR Cluster	TBD	MoR

Source: Consultations with Central and State (GoAP) government agencies. Study team analysis.

Summary and Conclusions

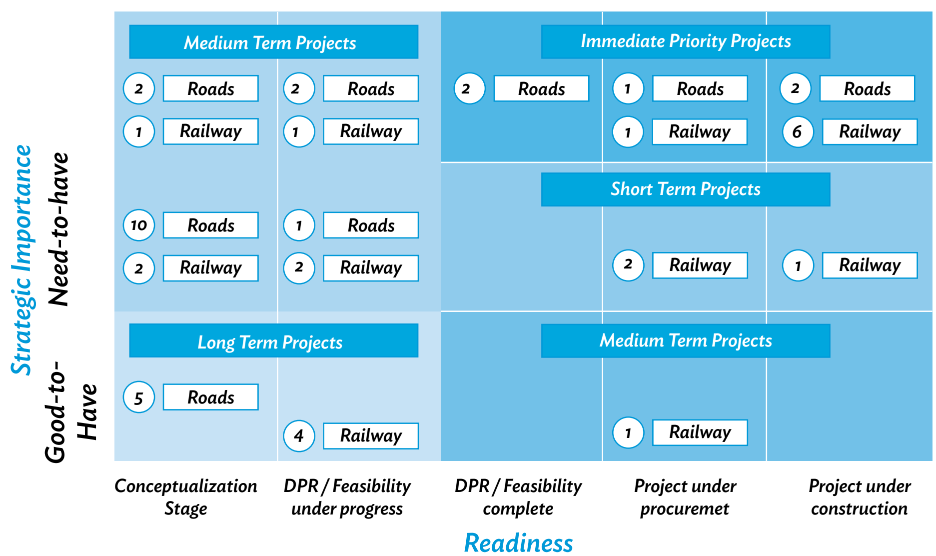
- In total, 46 projects (25 road and 21 rail) are proposed for node-centric network connectivity.
  - **Criticality**
    - Eighteen of the 46 projects (nine road and nine rail) are judged to be critical.

- Eighteen projects (11 road and seven rail) are judged to be “need to have”.
- Ten projects (five road and five rail) are judged to be “good to have”.

» **Readiness**
- Only 16 projects (five road and 11 rail) are ready for execution (Stage 3 or above).
- Fourteen projects (seven road and seven rail) are awaiting completion of feasibility studies and DPR.

» **Project Prioritization** (Figure 2.45)
- **Immediate Priority.** Twelve projects (five road and seven rail) are to be considered for immediate execution. All projects undergoing execution are to be monitored on a mission mode.
- **Short-Term.** Three rail projects are to be considered for short-term execution.
- **Medium-Term.**
  - Accelerated completion of feasibility reports for 21 projects (15 road and six rail) is recommended. Of these, six projects (four road and two rail) are critical.
  - One more rail project is to be considered for medium-term execution.
- **Long-term.** Nine projects (five road and four rail) are to be considered for long-term execution.

Figure 2.45: **Prioritization Matrix for Network Projects**



Source: Study team analysis.

Other Infrastructure to Enable Competitive Value-Added

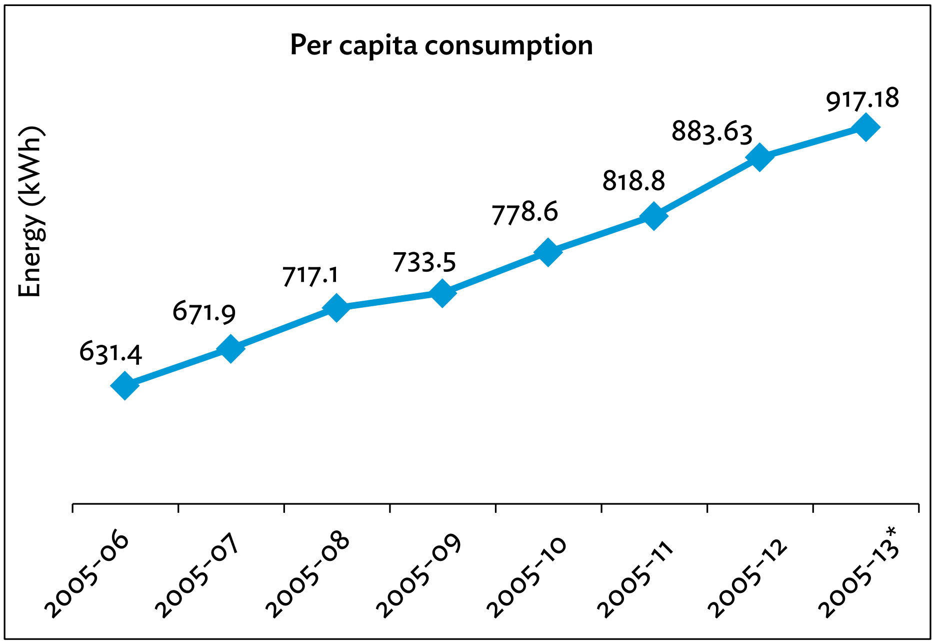
Power Strategy

Indian Scenario

Power is considered a core industry as it facilitates development across various sectors of the Indian economy, such as manufacturing, agriculture, commercial enterprises, and railways. The industrial, domestic, and agricultural sectors are the major consumers of electricity in the country. The annual per capita consumption of electricity increased to 917.2 kWh in FY 2012–13 from 631.4 kWh in FY 2005–06 on a CAGR of 5.5% (Figure 2.46).

Though per capita consumption of electricity has grown and electricity generation in India had registered tremendous growth, the country continues to face peak and energy shortages. The gap in the electricity demand–supply situation is highlighted by the fact that the country experienced a peak deficit of 4.5% and an energy deficit of 4.2% in FY 2013–14.[6]

Figure 2.46: **Per Capita Consumption of Electricity**

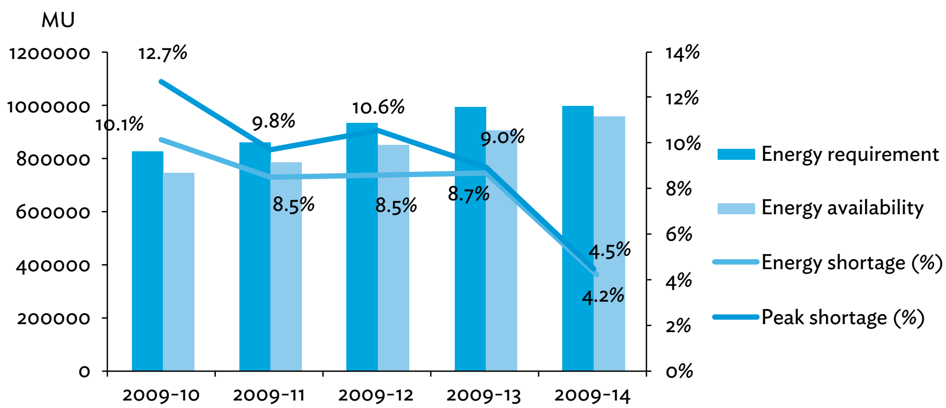


* Provisional

Source: CEA.

[6] CEA, Load Generation Balance Report, 2014-15.

Figure 2.47: **Demand–Supply Scenario for India**



Note: MU: designated million units, gigawatt hour.

Source: MoP Annual Report 2013-14.

Figure 2.47 shows how the peak and energy shortfalls have narrowed in FY 2013–14 from the power supply position in FY 2009–10. Propelled by sustained economic growth and rising income levels, India is poised to face a significant increase in energy demand in the next few decades, which also translates into higher demand for electricity.

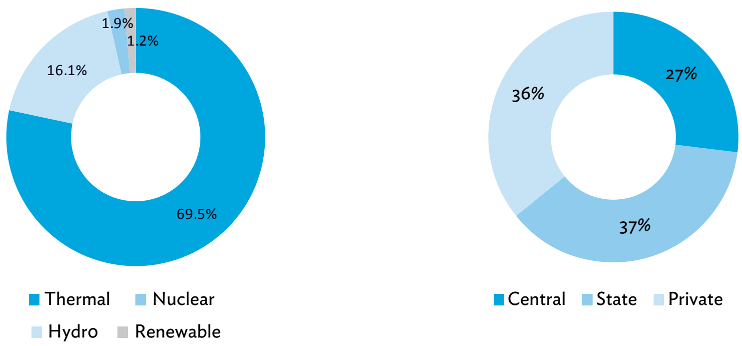
Generation

Power generation in the country has seen massive growth from 1,713 MW in December 1950 to 253,390 MW at the end of August 2014. The present total comprises thermal 176,119 MW; hydro 40,799 MW; nuclear 4,780 MW; and renewables 31,692 MW. The private sector's contribution to installed capacity stands at 35.6%, which has been increasing since enactment of the Electricity Act, 2003, which de-licensed generation. Captive generation capacity in industries having demand of 1 MW and above (as of 2012) has grown to 39,375 MW.

Figure 2.48 shows the breakdown of total installed capacity in terms of energy source and contribution from the central government, state government, and the private sector.

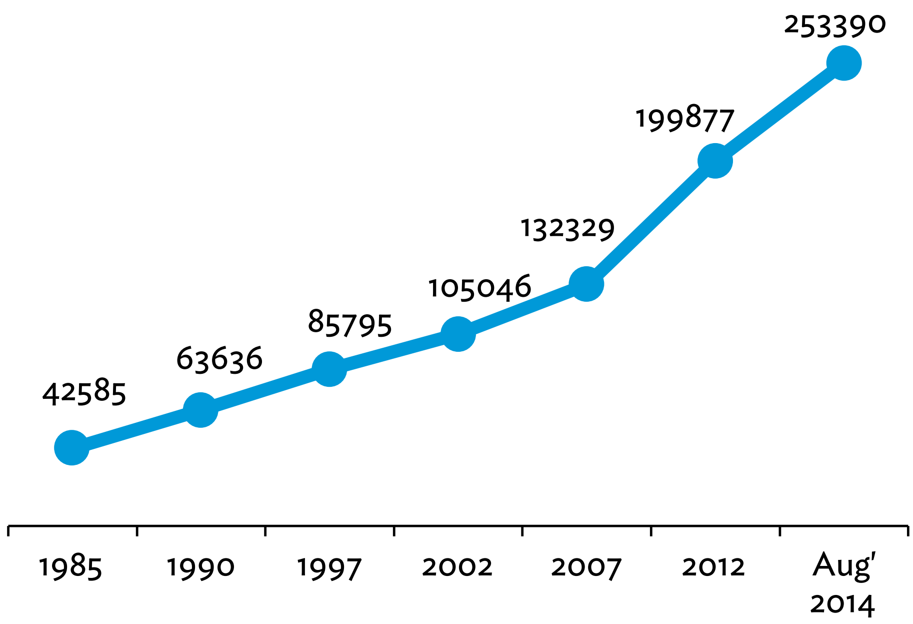
The 11th Five-Year Plan (2007–2012) envisaged a capacity addition of 78,700 MW, while the actual achievement was 54,964 MW, or around 70% of the target. The period saw a quantum leap in the capacity addition, which was more than 2.5 times the capacity addition achieved in either the 9th or 10th plans. The 12th Plan (2012–17) envisages capacity expanding by 88,537 MW. India has already added 20,622.8 MW and 17,825 MW in FY 2012–13 and FY 2013–14, respectively. The cumulative capacity addition through August 2014, during the 12th Plan period has been 46,766 MW, which stands at 52.8% of the target capacity addition (Figure 2.49).

Figure 2.48: **Breakdown of Installed Generation Capacity Contribution, by Energy Source and Sector**



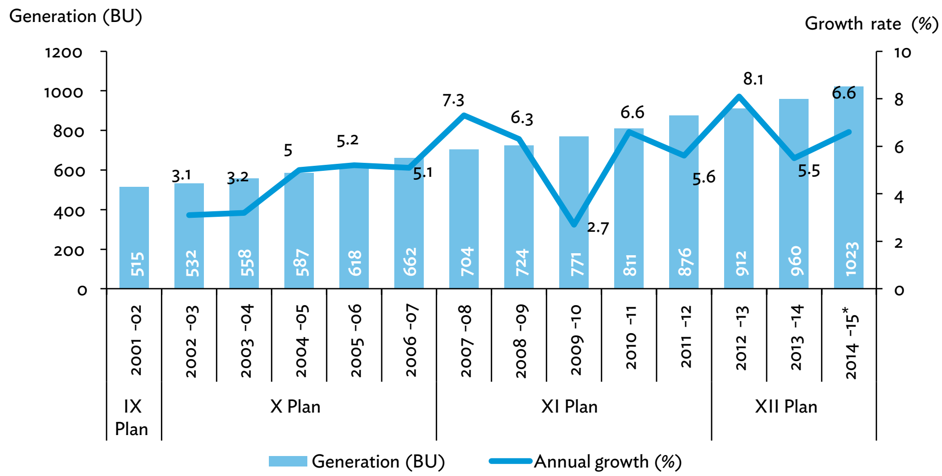
Source: CEA.

Figure 2.49: **Installed Generation Capacity (in megawatts)**



Source: CEA.

Figure 2.50: **Electricity Generation and Growth Rates**



Note: BU = billion units terawatt hour, * Target electricity generation.

Source: CEA.

Since 2001, the country has witnessed a steady increase in total generation on account of new capacity addition as well as improved performances among generation plants. All India electricity generation in FY 2013–14 stands at 960 BU compared to 515 BU in FY 2001–02. The growth rate in generation was 5.5% in FY 2013–14 against 3.1% in FY 2002–03. The generation during August 2014 was 89,901 MU compared to a target of 86,866 MU. Figure 2.50 indicates year-wise generation and growth rates since FY 2001–02.

Considering an energy elasticity of 0.8,[7] India is projected to require around 7% annual growth in electricity supply to sustain annual GDP growth over the next few years. This requires tapping all potential sources to address the deficit and meet demand growth accompanying accelerating economic development, while taking into account long-term sustainability and environmental and social aspects.

Generation mix and key challenges

Among total installed generation capacity, coal contributes the largest share, followed by hydropower at 16%, and gas by 9%. From this, it is evident that coal-fired power plants are the backbone of the installed generation capacity and will remain so in the near future. Coal-based power generation capacity has grown at a faster rate than other generation sources in the last few years. However, in recent years, an inadequate supply of coal and gas has been a major challenge, especially for upcoming power projects. The plant capacity utilization of existing plants has been suboptimal because of the increasing demand–supply gap. The average plant load factor (PLF) has declined from 77.8% in FY 2009–10 to 60% in August

[7] Planning Commission, Government of India.

2014. The drastic reduction in domestic gas production has also hampered gas-based generation, which is clear from the fact that PLF for gas-based plants has come down to 22.5% during April–July 2014.

Some key challenges related to the fuel supply are listed below:

- The domestic coal shortage is being met to some extent through coal imports from other countries, but the price volatility of imported coal is resulting in fluctuating costs of electricity generation.
- The increased dependence on imported coal exposes the economy to volatility in foreign exchange markets as well as to risks of unexpected changes in coal prices by major coal-exporting nations.
- The reduced availability of domestic gas is also a growing concern, which has left significant gas capacity stranded or forced plants to operate at reduced loads. LNG imports increased, providing an alternative, but high generation costs from LNG make continuous use of its unviable.
- The fuel supply shortage is not the only reason for low PLFs, many power plants are being forced to back down as the cash strapped electricity distribution companies (are unable to pay their dues and are opting for load shedding.

Indian coal scenario

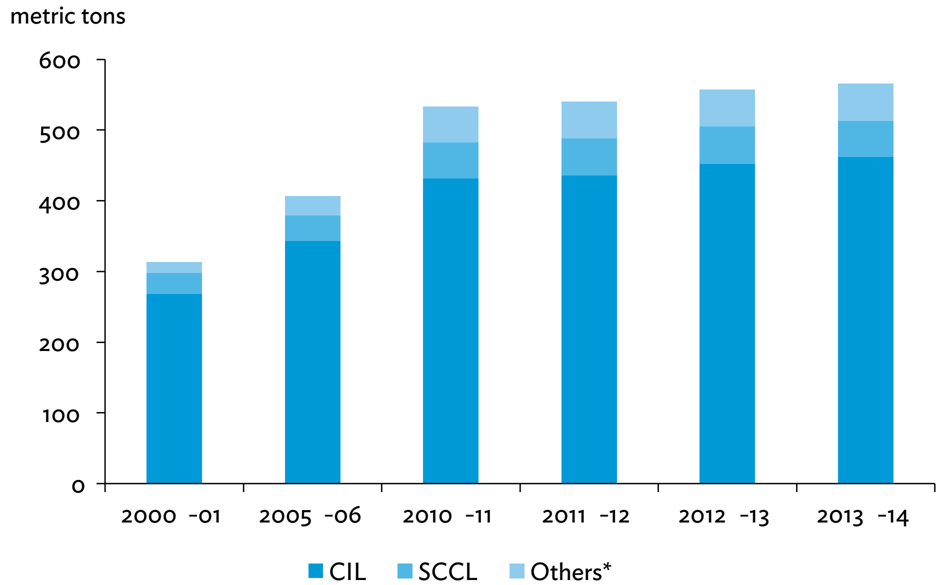
Coal production and imports—An increasing gap

India has the fifth-largest coal reserves in the world at around 286 BT, and is the third-largest coal-producing country. Of the total reserves, nearly 88% are non-coking coal reserves, while tertiary coal reserves account for a meagre 0.5%. The balance is coking coal. Coal deposits are chiefly located in Jharkhand, Odisha, Chhattisgarh, West Bengal, Madhya Pradesh, Andhra Pradesh, and Maharashtra. Indian coal is characterized by a high ash content of up to 45% and low sulphur content. The power sector is the main buyer of coal and accounts for about 74% of all consumption in the country, followed by the iron and steel and cement segments.

Coal India Limited (CIL) is one of the largest coal producers in the world, accounting for 80% of India's coal production. It is tasked with supplying coal to most of the country's power plants. Coal production in FY 2013–14 was 565.64 million tons (provisional) compared to 556.41 million tons during FY 2012–13, reflecting annual growth of 1.7% (Figure 2.51).

The country's demand for coal has grown at a CAGR of more than 7% in the last decade. Currently, the demand has reached beyond 700 MT. The demand is primarily met through a mix of indigenous production and imports. The share of imported coal in total coal consumption has risen from 7% in FY 2002–03 to about 21% in 2013–14. The gap between demand and the availability of coal in India is expected to rise every year. As per the 12th Five-Year Plan (2012–17), the estimated demand for coal will rise to 980 MT by FY 2016–17 and 1,373 MT by FY 2021–22, while the supply of domestic coal is expected to be 795 MT by FY 2016–17 and 1,102 MT by FY 2021–22. In any situation, there is a general consensus that India will face higher coal shortages in the coming years and that it will be met by imports.

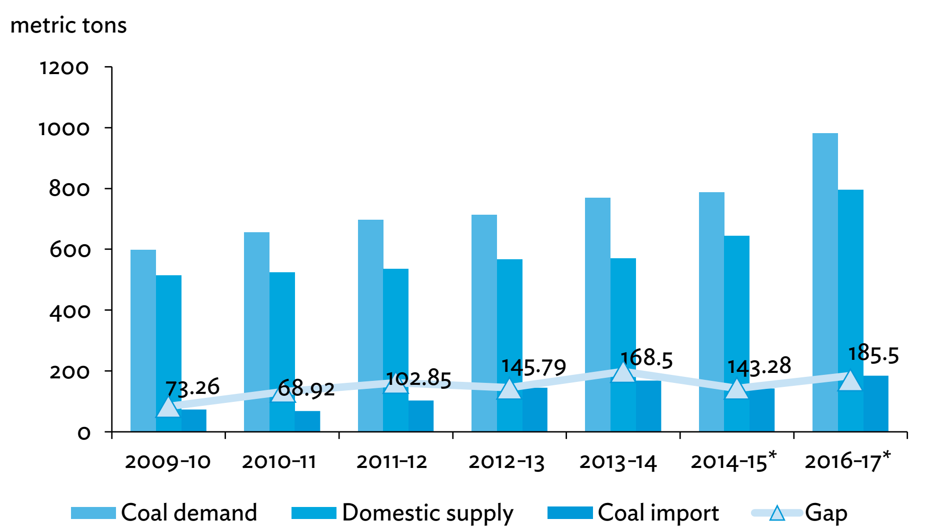
Figure 2.51: **Indian Coal Production**



Note: CIL=Coal India Limited, SCCL= Singareni Collieries Company Limited. Others include Tata Steel (earlier) TISCO, IISCO, DVC, private, captive mines.

Source: Ministry of Coal, CIL, SSCL.

Figure 2.52: **Demand–Supply Scenario for Coal**

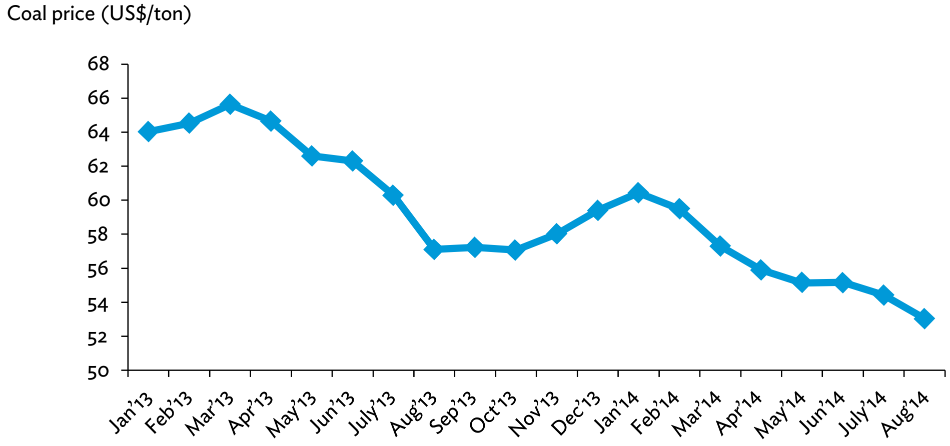


*Projected figures

Source: Annual reports, Ministry of Coal.

Figure 2.52 shows the demand–supply scenario for coal since FY 2009–10. Coal imports are estimated to reach around 185.5 MT in FY 2016–17.

Figure 2.53: **Price Trend for Indonesian Coal—Enviro coal 5000 kcal/kg (gar)**



Source: HBA August 2014.

The major import sources of thermal coal are Indonesia and South Africa. Indonesia contributes about 70% to India's thermal coal imports. The geographical proximity of Indonesia and the suitability of its coal for power generation make it a competitive supplier.

Imported coal price trends—Price volatility a key concern

The growing dependence on overseas sources magnifies the risk to domestic consumers as several external factors such as changes in laws and taxation in exporting countries, global spot price movements, and foreign currency exchange rate variations have had an impact. A number of recent events underline this issue. The Indonesian coal benchmark price regulation adversely affected Indian power companies offering stable electricity tariffs by investing in and controlling upstream coal mining activities. With the projected shortages and consequent increase in imports, global prices for internationally traded coal are likely to rise. As imported coal prices are on average 15%–50% higher than domestic coal prices, the net impact of fuel inflation will be significant and unavoidable. The fluctuations in Indonesian coal prices are presented in Figure 2.53.

The road ahead

Growth in the coal sector has been led by state-owned companies. The change in industry structure has been driven by a number of factors, such as the need to meet increased demand, bring in new technologies and modern mining methods to improve the productivity and sustainability of operations, finance new development, and bring corporate capabilities to exploration and operations. Competition from new players and the profit incentive will help spur better performance and lower costs.

India can, however, take bold steps to improve local energy security by reforming the coal sector. Private participation is an important element of this reform. Presently, commercial mining is undertaken by state-owned companies, while private sector ownership in coal mining is limited to captive use. However, in many ways, the private sector already has a big presence in the development and operation of coal mines, through contract mining, technical services, and beneficiation. The government needs to consider taking the next step to broaden private sector participation as a valid industry participant.

Indian gas scenario

Gas production and imports—An increasing gap

India had proven gas reserves of 42.4 trillion cubic feet (tcf) at the end of 2011. Proven reserves increased from 25 tcf to 29 tcf between 1991 and 2001, but then grew by 50% between 2002 and 2011 on account of exploration success in fields offered under India's New Exploration Licensing Policy (NELP). In 2002, massive gas discoveries were made in the D6 field in the Khrisna Godavari basin (KG-D6) off India's east coast. These were originally estimated to be recoverable reserves of over 6 tcf. About 80% of India's gas production comes from offshore fields, mainly from the west coast. Onshore production is dominated by four states: Assam in the northeast; Gujarat in the west; and Tamil Nadu and Andhra Pradesh in the southeast, which jointly account for close to 90% of production. India is said to have substantial shale gas resources in the order of 250 tcf but has made limited efforts to explore this potential.

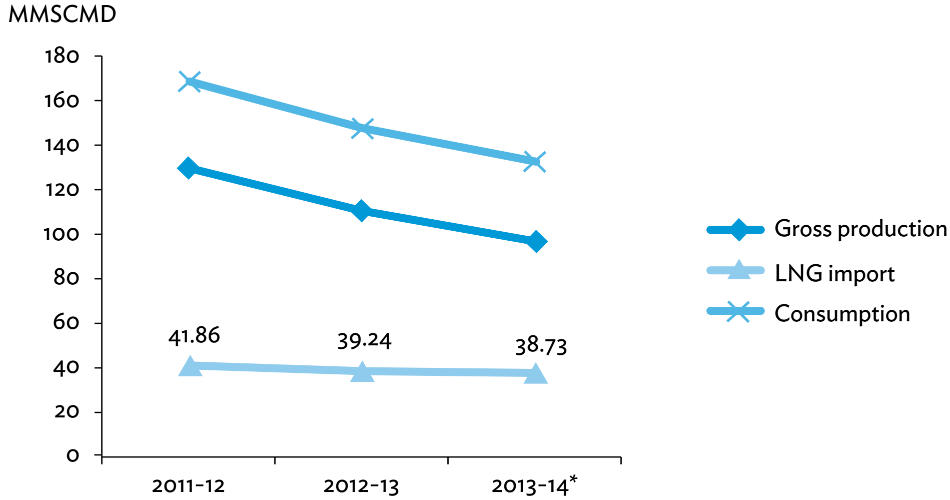
India produced 88.22 million metric standard cubic meters per day (MMSCMD) of natural gas in FY 2005–06. However, gas production in the KG-D6 basin dropped significantly. In March 2012, production was 34 million standard cubic meters per day (MCMD) instead of the projected 80 MCMD. Of the total 128 MCMD produced in March 2012, ONGC contributed 53%, OIL 6%, private producers 41%, and the share of KG-D6 accounted for 26%. Consequently, cumulative domestic supply projections for the 12th Five-Year Plan were revised downward by 27% from 342 BCM to 249 BCM over the entire period.

The average natural gas production in FY 2011–12 was 130 MMSCMD, which was about 9% lower than the previous year, mainly due to lower production from the KG-D6 deep water block. In FY 2012–13, natural gas production stood at 111.3 MMSCMD, compared to projected production of about 117.8 MMSCMD. Natural gas production for FY 2013–14 has been projected to decline to 96.67 MMSCMD against demand of 133.11 MMSCMD (Figure 2.54). India imported 39.24 MMSCMD of LNG in FY 2012–13, which was 27% of total gas demand. Projected LNG imports for FY 2013–14 stand at 38.73 MMSCMD. With declining domestic gas production in recent years, the share of LNG imports is expected to increase significantly.

Gas consumption

In FY 2012–13, the largest share of natural gas use comprised power generation (33.5%), followed by the fertilizers industry (27.9%) and natural gas used for domestic fuel (5.2%). The sector-wise consumption of natural gas is presented in Figure 2.55.

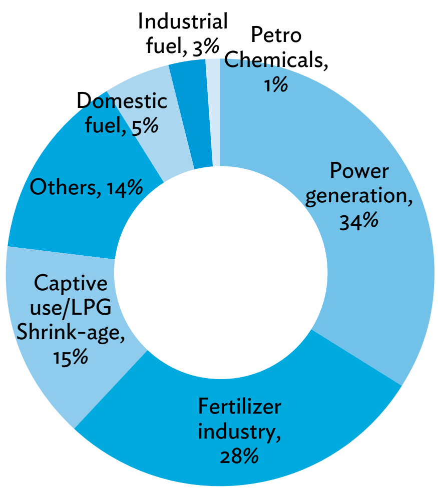
Figure 2.54: **Demand–Supply Scenario for Gas**



Note: MMSCMD = Million Metric Standard Cubic Meter per Day, *Projected numbers, Reliance import figure is not included.

Source: Ministry of Petroleum and Natural Gas.

Figure 2.55: **Consumption of Natural Gas in FY 2012-13, by Sector**



Source: Energy Statistics 2014.

Gas pricing

India's natural gas prices are regulated and set at different levels for gas originating from different producers. The methodologies currently in practice to price domestically produced gas consists broadly of two pricing regimes: one for gas priced under the Administered

Pricing Mechanism (APM) and the other for the non-APM gas, or free market gas. The price of APM gas is set by the government. Following the first gas price discovery process, the price for NELP gas was fixed in 2009 at US$4.2 per million British thermal units (MBtu) in based on an oil-indexed price formula. This price has been due for revision in 2014. In January 2013, the Government of India had notified the new gas pricing guidelines based on a pricing formula suggested by a panel headed by C. Rangarajan. Under this formula, the rates would have doubled to US$8.4 per MBtu. However, the new government has extended the decision on gas price revision to November 2014.

Issues

India is facing scarcity of domestically available natural gas. Its existing gas reserves are being rationed between the power sector and the fertilizers sector. Domestic production of gas was expected to rise following the discovery of gas in the KG-D6 Basin off east coast of India. But expected gas output from the KG-D6 Basin has not been met. Because of inadequate gas supply, the PLF of gas-based power plants has been very low in recent years and the growing demand for natural gas is not likely to be met. Declining gas production may result in increases in costly imported gas.

The two largest gas consumers—the power and fertilizers sectors—are highly price-sensitive as they operate in tightly regulated output markets and fuel is not a pass-through cost. Thus, it is unlikely that they can substitute domestically produced gas with LNG in light of the substantially higher costs, at least in the short-term.

The road ahead

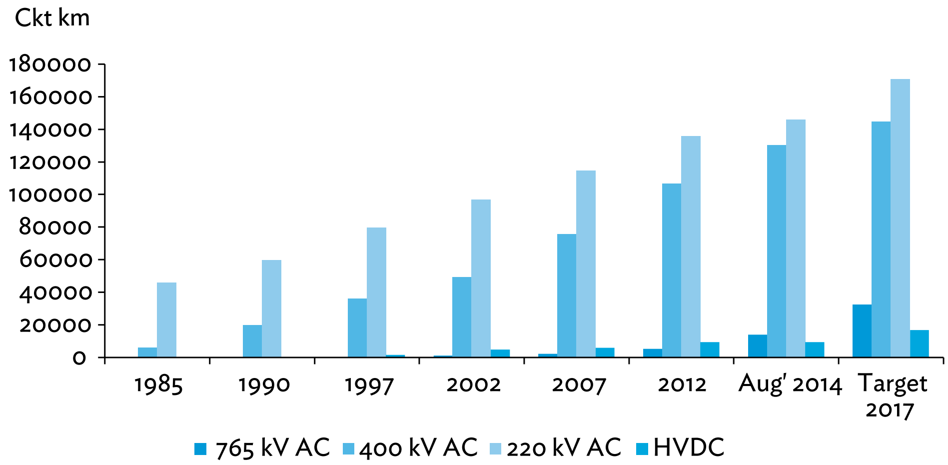
Gas has the potential to play an important role in meeting India's energy demand. However, gas pricing has to be made attractive to ensure timely and sufficient investment in domestic exploration and production, and LNG re-gasification facilities. Shale gas can emerge as an important new source of energy in the country. India has several shale formations that seem to hold shale gas. The shale gas formations are spread over several sedimentary basins such as Cambay, Gondwana, Krishna-Godavari (on-land), and the Cauvery. The Directorate General of Hydrocarbons has initiated steps to identify prospective areas for shale gas exploration.

Transmission

The transmission sector is a key link between electricity generation and the distribution sector. Transmission projects continue to be accorded a high priority in the context of the need to evacuate power from generating stations to load centers, strengthen systems, and augment the National Grid. India's transmission system has come a long way since the basic framework for coordinated planning and development was established and private participation in transmission was allowed through the Electricity Act, 2003. India has since moved toward establishing a nationally synchronized grid to smooth variations in regional demand and supply, and build inter-regional links.

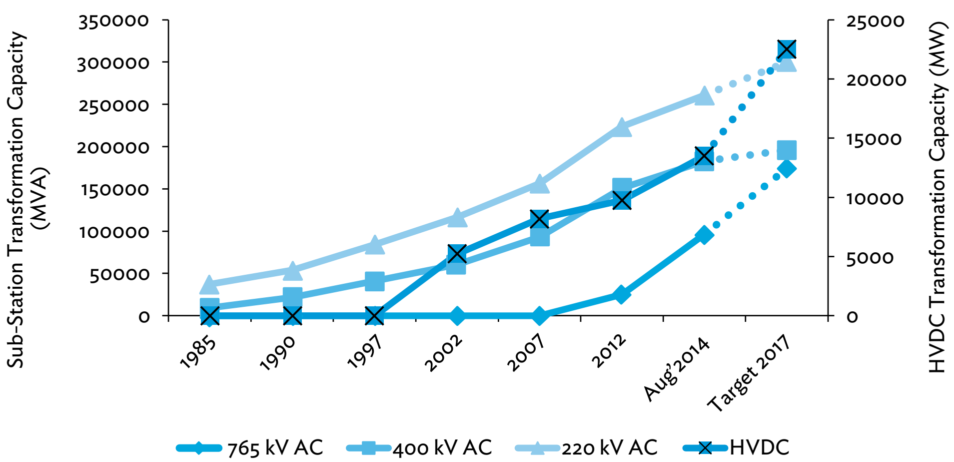
The Power Grid Corporation of India (PGCIL), the central transmission utility, is playing a vital role in the growth of the Indian power sector by developing a robust Integrated National

Figure 2.56: **Growth in Length of Transmission Lines**



Source: CEA.

Figure 2.57: **Growth in Transformation and Transmission Capacity**



Source: CEA.

Grid. Present inter-regional power transfer capacity of the National Grid is about 38,550 MW. The target is to enhance inter-regional capacity to about 65,600 MW by the end of the 12th Five-Year Plan in 2017 (Figure 2.56).

Figure 2.57 shows growth of the transmission sector in terms of transmission line length and transformation and transmission capacity since the end of the Sixth Five-Year Plan through August 2014, and indicates the target for the transmission sector under the Twelfth Five-Year Plan (2012–17).

The Planning Commission estimates power demand of 450 GW and total installed capacity of about 600 GW by 2022. To carry this demand, the national grid's transmission capacity would need to be gradually enhanced to about 150 GW by 2022. The government still dominates the transmission segment, but efforts are under way to attract greater private sector participation.

Key challenges

Despite the installed capacity of over 250 GW, India is able to meet a peak demand of only 137 GW. One of the major reasons for this gap is the lack of a strong transmission network. Transmission infrastructure development did not keep pace with generation capacity growth during the 10th and the 11th Five-Year Plan periods. Many transmission lines in the country are severely overloaded and stressed. The addition of transmission capacity has been impacted by issues and challenges faced by developers at various stages of project implementation.

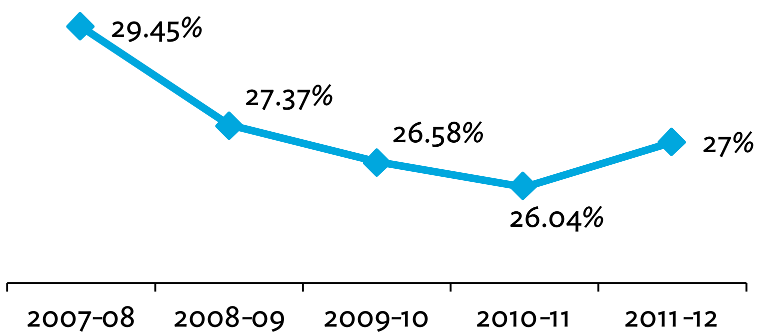
Distribution

Distribution and retail supply is the most critical link in the electricity market, which interfaces with the end customers and provides revenue for the entire value chain. During the pre-reform era (1991), the power sector of India was dominated by the state-owned vertically integrated entities called State Electricity Boards (SEBs), responsible for all three functions: generation, transmission, and distribution of electricity. Initially, the generation segment had been on the agenda of the government in light of the large energy deficit and the need for huge capacity addition. The need to improve the distribution sector was realized during the period of 10th Five-Year Plan (2002–07), with emphasis on steps to reduce the huge aggregate technical and commercial (AT&C) losses, control theft and pilferage, and rationalize tariff structures. Apart from a handful of franchisees and privatized utilities, the distribution sector in India is still largely controlled by state distribution companies.

According to the Power Finance Corporation (PFC), the average AT&C losses in the country were at around 27% in FY 2011–12, which are higher on both technical and commercial heads (Figure 2.58). Higher technical losses are due to old and dilapidated conductors, longer lines serving distant and remote loads, old and inefficient distribution transformers, and incorrect configuration leading to load imbalances. Higher commercial losses are due to stealing of power, poor billing, low collection efficiency, and faulty metering. In the absence of a proper energy accounting and auditing system in place for most of the utilities, the actual figures for AT&C losses could be higher than what gets reported.

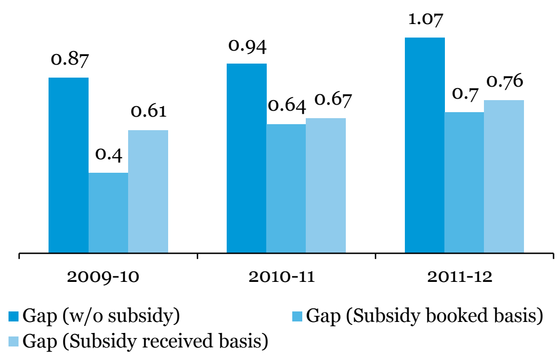
The book losses (on an accrual basis) of all the utilities increased from INR30,430 *crores* in FY 2009–10 to INR51,602 *crores* in FY 2010–11 and to INR62,581 *crores* in FY2011–12. It is projected that the losses will go up to INR1,16,000 *crores* by FY 2014–15 if present loss levels are not significantly reduced. The financial position of distribution utilities has been deteriorating, which is clear from the fact that the revenue gap on each unit of energy sold has increased to INR1.07 per kWh in FY 2011–12 from INR0.87 per kWh in FY 2009–10 (Figure 2.59).

Figure 2.58: **AT&C Losses for India**



Source: PFC report on Performance of the State Power utilities.

Figure 2.59: **Revenue Gap for Distribution Utilities in INR/kWh**



Source: PFC report on Performance of the State Power utilities.

The Government of India has launched the Restructured Accelerated Power Development Programme with a budget of INR51,577 *crores* to realize a financial turnaround in the sector. Its objective is to reduce AT&C losses to 15% in project areas, which are urban areas, towns, and cities with a population of more than 30,000.

The sustainability of other elements like generation, transmission, and equipment manufacturing is dependent on the commercial performance and financial viability of the distribution sector in India. Over the past 15 or so years, a number of states have worked to improve the commercial performance of their state utilities, unbundle state entities, create independent regulatory systems, and put in place measures to control losses and theft. However, progress has been time-consuming and slower than envisaged.

Southern Region Scenario

The country is geographically divided into five regions: northern, eastern, western, north-eastern, and southern (Figure 2.60). All the states and union territories in India fall in one of these regions.

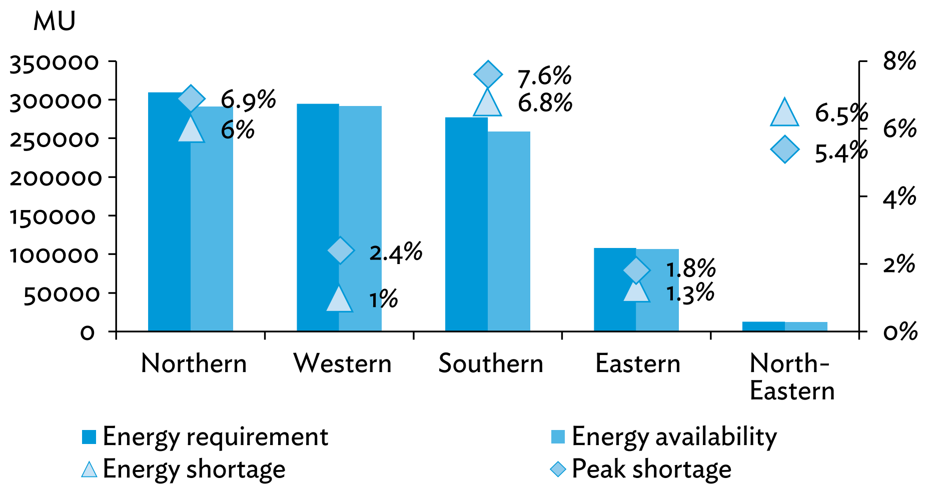
During FY 2013–14, all regions in the country experienced overall energy and peak power shortages of varying magnitudes, although there were short-term surpluses depending on the season or time of day. The region-wise demand–supply position for FY 2013–14 is presented in Figure 2.61.

The southern regional grid consists of four states— Andhra Pradesh, Karnataka, Tamil Nadu, and Kerala—and two union territories—Puducherry and Lakshadweep. As Telangana was separated from Andhra Pradesh in June 2014, it has become the fifth state of the southern grid.

Figure 2.60: **Indian Power Grid**

Source: ADB.

Figure 2.61: **Demand Supply Scenario for FY 2013-14, by Region**



Source: CEA LGBR report.

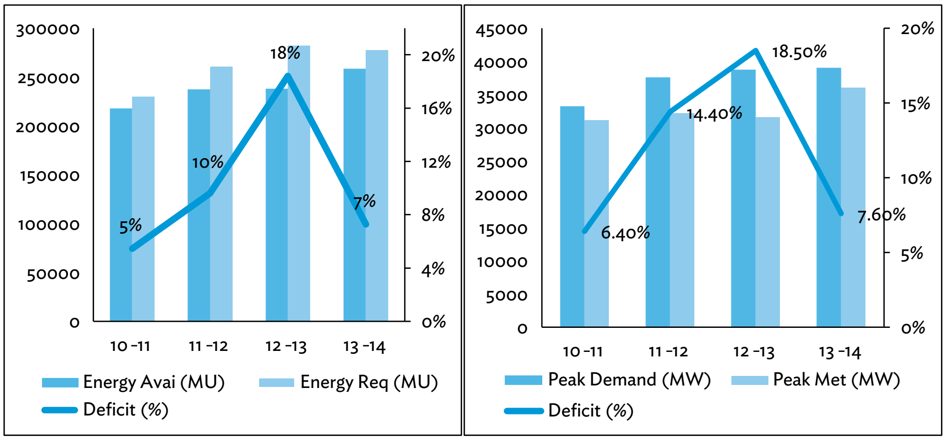
Among all regions, energy shortage and peak shortage were the highest for the southern region in FY 2013–14 at 6.8% and 7.6%, respectively. Historically, energy shortage and peak shortage have been highest for the southern region among all regions. Energy availability for the southern region has failed to keep pace with demand. This is clear from the fact that energy availability has grown at a CAGR of only about 4% compared with demand expanding at a CAGR of 5%.

The year-on-year demand–supply scenario and peak demand and peak met scenario for the southern region are shown in Figure 2.62.

The installed capacity of the southern region stood at 59,787 MW as of August 2014, which was 23.6% of the total installed capacity of the country. The energy supply mix in the southern region has been dominated by thermal energy sources (coal and gas). The share of thermal-based generating capacity is 55.7% of total installed capacity in the southern region. However, thermal power generation plants have been facing fuel supply constraints. Some key issues being faced include:

- supply shortage in domestic coal has often led power plants to operate at reduced loads,
- increasing dependence on imported coal has put strain on procurement and supply chain and end prices, and
- volatility in gas supply has left significant gas generation capacity stranded or operating at very low PLFs.

Figure 2.62: **Demand–Supply Scenario and Peak Demand and Peak Met for Southern Region (YOY)**



YOY = year-on-year.

Source: CEA.

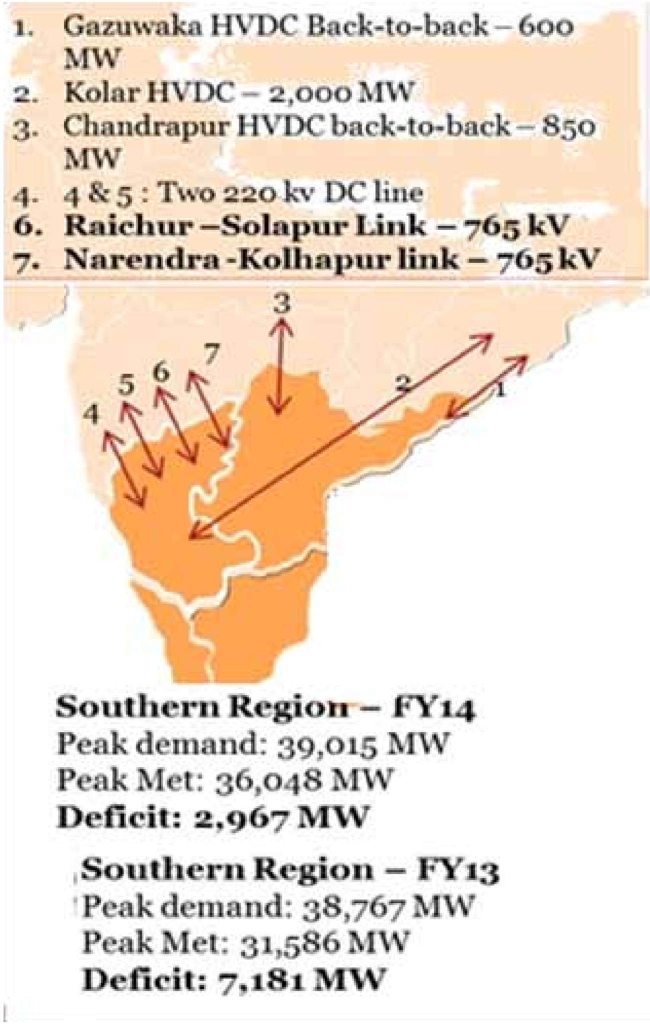
Transmission and grid management are essential functions for smooth evacuation of power from generating stations to the consumers. Grid management, which involves taking care of the overall reliability, security, economy, and efficiency of the power system, is carried out on a regional basis in India.

Initially, only the northern, eastern, western, and northeastern regions were operating in a synchronous manner, which implies that power across these regions can flow seamlessly as per the relative load generation balance. The southern region was interconnected with the rest of India's grid through asynchronous links. This implied that the quantum and direction of power flows between the Southern Grid and the National Grid could be manually controlled. However, with the commissioning of the Raichur–Sholapur 765 KV single circuit transmission line in January 2014, the southern region has been interconnected with the Nation Grid through a synchronous link, thereby achieving the "one nation-one grid-one frequency system." Each of the five regions has a Regional Load Despatch Centre, which is the apex body—as per the Electricity Act, 2003—to ensure integrated operation of the power system in the concerned region.

The present inter-regional transmission capacity is insufficient to meet the growing demand in the southern region (Figure 2.63). To improve this situation, many new inter-regional transmission lines have been made operational.

While the commissioning of new links has enhanced the capacity, the same has failed to keep pace with the growing southern demand. In recent years, the eastern and southern link has become a key gateway as can been seen from the continuous increase in inter-regional flows through this link. Transmission capacity augmentation between southern and eastern regions is helping channelize the surplus energy of the eastern region to address the energy deficit in the southern region.

Figure 2.63: **Transmission Scenario for the Southern Region**



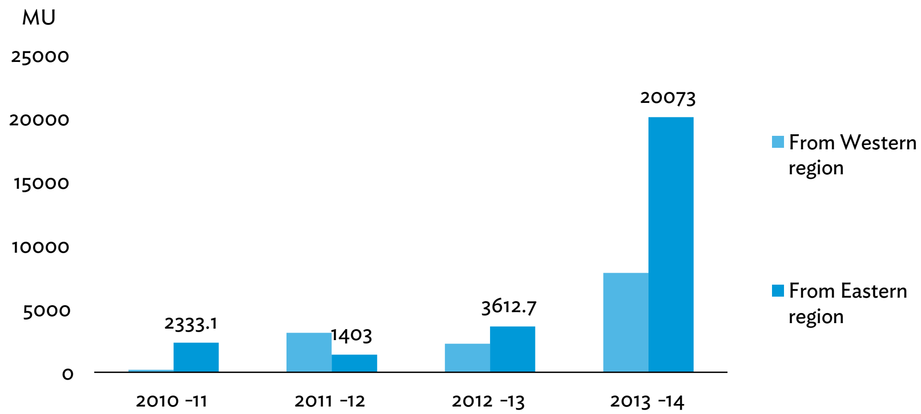
Source: SLDRC, Study team analysis.

As seen in Figure 2.64, 20,073 MU of energy was transferred in FY 2013–14 from the eastern region to the southern region, compared to 1,403 MU and 3,612 MU in FY 2011–12 and FY 2012–13, respectively.

Andhra Pradesh (Undivided) State Scenario

Energy availability in Andhra Pradesh has grown at a CAGR of about 4% since FY 2010–11; however, it has failed to keep pace with the increase in energy demand, which has grown at more than a 5% CAGR over the same period. The energy availability of Andhra Pradesh in FY 2013–14 was 89,036 MU compared to demand of 95,662 MU. The demand supply scenario for Andhra Pradesh since FY 2010–11 is presented in Figure 2.65.

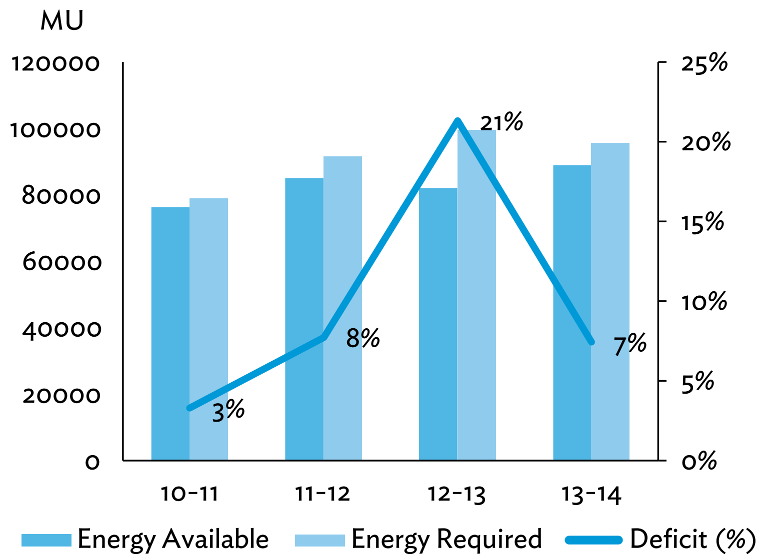
Figure 2.64: **Inter-Regional Energy Exchange to the Southern Region**



Note: MU=gigawatt hour.

Source: CEA LGBR report.

Figure 2.65: **YOY demand supply scenario for undivided, Andhra Pradesh**

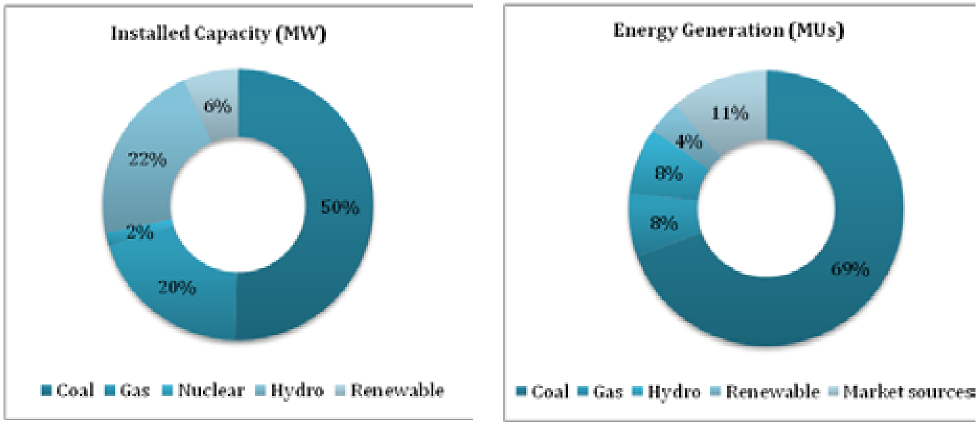


Note: MU=gigawatt hour.

Source: CEA.

The energy deficit of Andhra Pradesh reached 21% in FY 2012–13 from 3% in FY 2010–2012, before falling to 7% in FY 2013–14. However, the decline in the deficit in FY 2013–14 is partly attributed to a decline in industrial output as a result of economic the slowdown. Energy supply constraints in the past have resulted in curtailed supply to industries by imposing load restrictions or power holidays. With the picking-up of economic activity, future demand is expected to increase.

Figure 2.66: **Supply Mix in Installed Capacity and Energy Generation for Andhra Pradesh**



Source: CEA.

The installed generation capacity of undivided Andhra Pradesh was 18,531 MW as of August 2014, which is 31% of the installed capacity of the southern region. The annual per capita consumption of electricity for Andhra Pradesh increased to 1157 kWh in FY 2011–12 from 802 kWh in FY 2006–07, and is higher than the national average of 917.18 kWh in FY 2012–13.

Figure 2.66 shows the breakdown of installed capacity as well as the share of total energy generation of various energy sources.

Supply mix and key challenges

The energy supply mix in Andhra Pradesh is dominated by thermal energy sources (coal and gas). The share of thermal-based generating capacity is 70% of total installed capacity in Andhra Pradesh. However, thermal power generation plants have been facing fuel supply constraints and delays in capacity addition on account of difficulties with land acquisitions and project clearances.

Some of the key issues being faced by electricity sector are summarized below:

Coal

- Out of total installed capacity of 18,531 MW in the state, about 50% of the capacity (9,583 MW) is dependent on coal, with domestic coal being the primary fuel. Domestic coal supply shortages often lead power plants to operate at reduced loads.
- With the coal supply from CIL and its subsidiaries not keeping pace with demand, there is an increasing reliance on imported coal to sustain generation, bringing risks of price and supply volatility.

- The division of the state might lead to operational challenges resulting from competing needs for natural resources like coal.

Gas

- Out of gas-based installed capacity of 3,370 MW, 20% (674 MW) has been severely stranded because of gas availability.
- Volatility in gas supplies has left significant gas generation capacity stranded and plants operating at very low PLFs.
- Generation from these plants have only been limited to meet occasional deficits, but the cost of power generation is a key concern because of the use of either spot gas or RLNG (if available).

Market sources

- Short-term power supplies have only been used in certain situations when there is spare capacity in the inter-regional transmission system.
- Energy availability is a key challenge because of competing demand from industries to meet their energy requirements and purchases by utilities.
- Volatile clearing prices limit utilities' purchases.

Renewables

- The slow pace of annual wind and solar energy capacity addition is a key challenge (750 MW and 164 MW, respectively). The potential for wind (14,500 MW) and solar energy exist in the state, especially in Seemandhra.
- Constraints in evacuation can pose a challenge because of lack of progress in implementation of planned transmission projects to connect the potential areas.

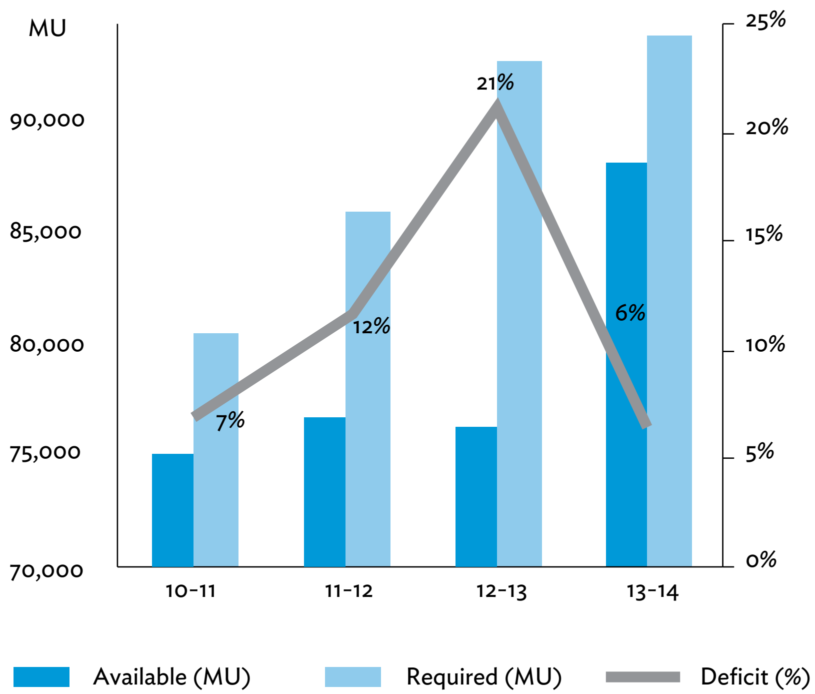
Tamil Nadu State Scenario

Energy availability in Tamil Nadu has grown at a CAGR of about 4%, however, it has failed to keep pace with the increase in energy demand, which has grown at a CAGR more than 5%. The energy availability of Tamil Nadu in FY 2013–14 was at 87,980 MU compared to demand of 93,508 MU. The demand–supply scenario for Tamil Nadu since FY 2010–11 is presented in Figure 2.67. The energy deficit of Tamil Nadu reached 21% in FY 2012–13 from 7% in FY 2010–11, before falling to 6% in FY 2013–14.

The installed generation capacity of Tamil Nadu was 21,193 MW as of August 2014, the highest installed capacity in the southern region with a 35% share of the total. The annual per capita consumption of electricity for Tamil Nadu has increased to 1,277 kWh in FY 2011–12 from 1,080 kWh in FY 2006–07. It is the second-highest in the southern region after Poducherry, and is higher than the national average of 917.18 kWh.

Figure 2.68 shows the breakup of installed capacity as well as share in total energy generation of various energy sources.

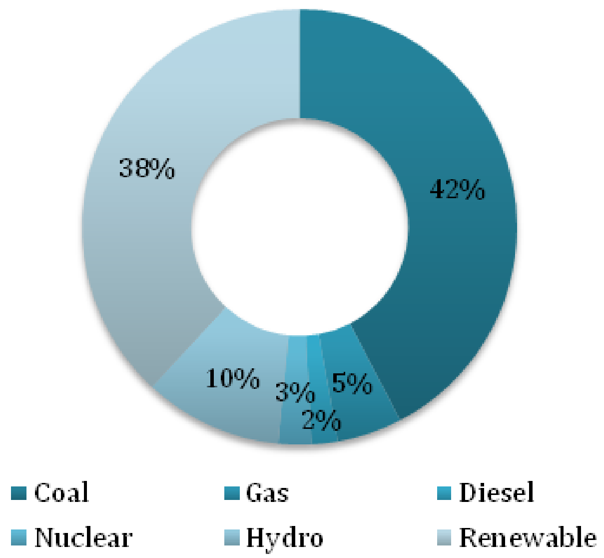
Figure 2.67: **Demand–Supply Energy Scenario for Tamil Nadu (YOY)**



Note: MU=gigawatt hour, YOY = year-on-year.

Source: CEA.

Figure 2.68: **Supply Mix in Installed Capacity**



Source: CEA.

Supply mix and key challenges

The energy supply mix in Tamil Nadu has traditionally been dominated by thermal energy sources (coal and gas). Renewable energy (wind) also contributes. The shares of thermal-based generating capacity and renewable generation capacity stand at 49% and 39% of total installed capacity, respectively. Tamil Nadu is facing similar constraining issues related to the supply of coal as Andhra Pradesh, which is hampering generation.

Some of the other key issues in the electricity sector in Tamil Nadu include:

- wind energy faces challenges in evacuation in addition to having seasonal variability in generation, and
- downstream the state is also facing challenges in distribution with high system losses of about 22%.

Future Power Scenario in VCIC

VCIC area in Andhra Pradesh

VCIC covers nine districts of the newly separated Andhra Pradesh state along the east coast. For energy availability in VCIC to meet future demand, the thrust of new generation capacity addition and transmission system strengthening will be the key. The analysis of various projects, undertaken by the central government and state governments and the private sector, shows that a total of 29 generation projects with around 34,000 MW of generation capacity and 51 transmission projects are coming to Andhra Pradesh over the next 10 years. Table 2.26 presents future phase-wise and energy-source-wise generation capacity in the VCIC area in Andhra Pradesh.

Fuel Mix

An adequate supply of fuel for the upcoming generating power projects is the key to ensure future energy availability in VCIC. Fuel supply tie-ups and availability require close monitoring to avoid any possible slippages of generating capacity. Annual coal requirements for upcoming generation capacity of VCIC in Andhra Pradesh have been estimated at 55.8 MT. Also, around 8.63 MMSCM of gas are required annually for upcoming gas-based power projects of VCIC in Andhra Pradesh. The breakdown for annual fuel requirements is presented in Table 2.27.

Table 2.26: **Upcoming Generation Capacity in VCIC Area of Andhra Pradesh**

Energy Source	Upcoming Generation Capacity (MW)		
	Before FY 17	Post FY 17	Around FY23
Domestic Coal	1,640	-	-
Imported coal	300	-	3,960
Blended coal	6,560	3,960	5,320
Gas	-	8,453	3,000
Hydro	-	-	960
Total	8,500	12,413	13,240

Source: CEA, Study team analysis.

Table 2.27: **Projected Annual Fuel Requirements**

Energy Source	Unit	Annual fuel requirement		
		Plant coming before FY 17	Plants coming post FY 17	Plants coming around FY23
Domestic Coal	MT	26.08	11.2	2.17
Imported coal	MT	8.92	4.8	2.73
Total coal	MT	35	16	4.9
Gas	MMSCM	-	6.37	2.26

Source: CEA, Study team analysis.

Table 2.28: **Summary of Upcoming Generation and Transmission Projects in VCIC Area of Andhra Pradesh**

Fuel	Generation projects		Transmission projects	
	Number	Generating Capacity (MW)	Number	Transmission Capacity (MW)
State utilities	6	8,660	44	12,370
Central utilities	-	-	6	8,200
Private IPPs	23	25,493	1	1,204
Total	29	34,153	51	21,774

Source: CEA, Study team analysis.

The central transmission utility, PGCIL, and Andhra Pradesh state transmission utility, Andhra Pradesh Transmission Company (APTRANSCO), have undertaken development of 51 new transmission lines in VCIC for evacuation of around 21,800 MW power from upcoming power projects. It also includes many transmission lines for strengthening of existing systems. The summary of generation and transmission projects upcoming in VCIC is presented in Table 2.28.

Demand–supply projections

Figure 2.69 shows projected energy availability and energy demand for FY 2017 and FY 2023. Energy availability has been projected considering the existing and upcoming generation capacities of VCIC in Andhra Pradesh.

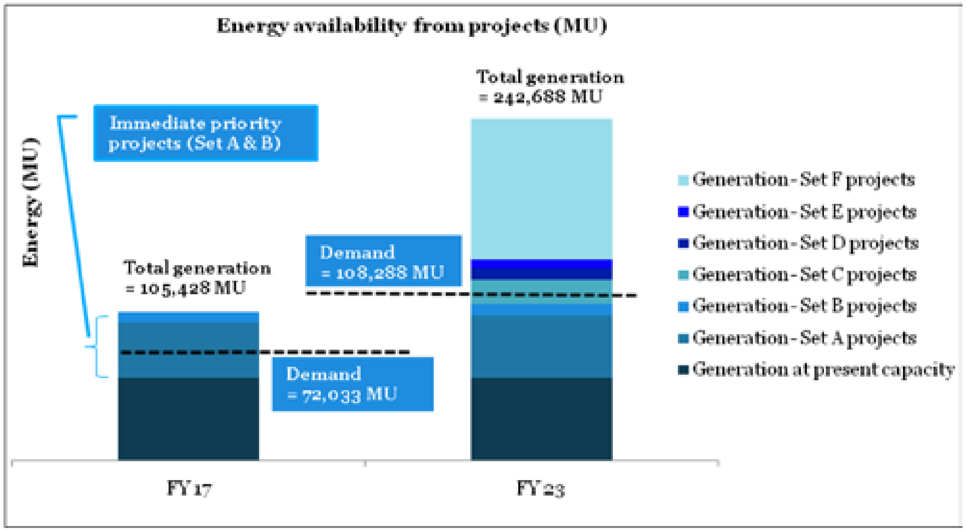
Energy demand as forecast in the 18th Electric Power Survey is 72,033 MU for FY 2017, compared with projected energy availability of 105,428 MU. For FY 2023, energy availability is higher at 242,688 MU against demand of 108,288 MU.

With a stream of generating projects planned, the VCIC areas of Andhra Pradesh will have a power surplus in future.

Project prioritization

All upcoming generation and transmission projects in VCIC are classified as either immediate priority projects, medium-term projects, or long-term project on the basis of analysis of their strategic potential and readiness in terms of project implementation stages.

Figure 2.69: **Projected Energy Availability from Upcoming Generation Projects in VCIC Area of Andhra Pradesh**



Assumptions: Plant load factor (PLF) of 80% and 75% has been assumed for future central independent power projects and state projects based on coal. Considering the uncertainty surrounding gas availability, 50% PLF is taken for gas-based projects, whereas PLF of 30% is assumed for hydro projects.

Source: Study team analysis.

The parameters considered to assess the readiness of generation projects are

(i) conceptualization stage;
(ii) land acquisition, water availability, and environment and forest clearances;
(iii) fuel supply tie-ups;
(iv) financial closure and power supply tie-ups, and signing of power purchase agreement; and
(v) progress of project implementation.

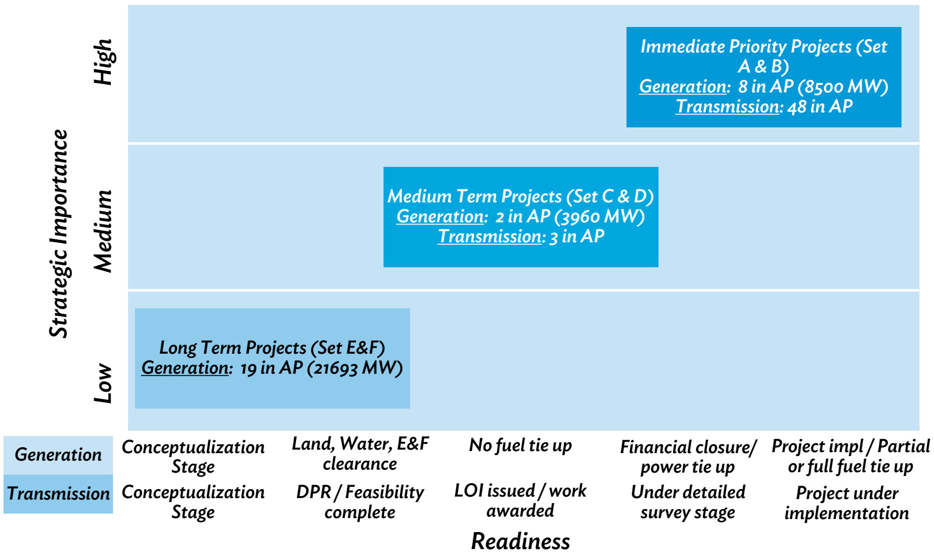
The parameters considered to assess the readiness of transmission projects include

(i) conceptualization stage,
(ii) DPR and feasibility study,
(iii) letter of intent issued and work awarded,
(iv) project under detailed survey stage, and
(v) progress of project implementation.

In order to forecast energy availability among all upcoming generation projects in VCIC, the above parameters are further categorized in the following sets:

Set A: fuel tie up available; implementation underway.

Figure 2.70: **Matrix for Project Prioritization**



Source: Study team analysis.

Set B: partial fuel tie up; implementation underway.

Sets C and D: initial phase of implementation; partial land acquisition.

Sets E and F: planning underway, pending land acquisition and clearance, pending financial closure, no fuel tie up.

Figure 2.70 represents the above sets across two dimensions: strategic importance and readiness of project.

On the basis of above parameters under each set, all upcoming generation and transmission projects are analyzed and categorized into various phases and sets. The summary for the same is presented below.

Generation projects

Immediate priority projects

These projects are at advanced stage of implementation with complete or partial fuel supply tie up. Table 2.29 shows that eight generation projects with a total of 8,500 MW capacities fall under the category of immediate priority projects that are expected to come on stream by 2017. Set A covers six projects with a total capacity of 7,200 MW. These require close monitoring of project implementation for timely completion.

Table 2.29: **Immediate Priority Generation Projects in the VCIC Area of Andhra Pradesh**

Project Developer	Current Status	No. of Projects	Capacity (MW)
State utilities	• Fuel tie up available • Project implementation under progress	1	1,600
IPP	• Fuel tie up available • Project implementation under progress	5	5,600
Total	**SET A**	**6**	**7,200**
State utilities	• Partial fuel tie up • Project implementation under progress	1	600
IPP	• Partial fuel tie up • Project implementation under progress	1	700
Total	**SET B**	**2**	**1,300**

IPP = Independent power producer.

Source: Study team analysis.

Medium-term projects

These projects are at initial stage of implementation with complete and partial fuel supply tie ups and partial land acquisition and project clearances. Table 2.30 shows that two independent power producers (IPPs) with a total of 3,960 MW generation capacity fall under the medium-term category that are expected to come online after 2017. Sets C and D are part of this category that require proper monitoring of project implementation to achieve projected commissioning.

Long-term projects

These projects are either at the planning stage or very initial stage of implementation with pending fuel supply tie ups, land acquisition, and project clearances. Table 2.31 shows generation projects in Sets E and F with total generation capacities of 21,700 MW fall under the long-term category of projects that are expected to come online around 2023.

Transmission projects

Immediate priority projects

These projects are at advanced stage of implementation with good progress in tower erection and conductor stringing (Table 2.32). Transmission projects that are facing controlled challenges in project management are also covered under immediate priority because of their expected commissioning before 2017.

Table 2.30: **Medium-Term Generation Projects in the VCIC Area of Andhra Pradesh**

Project Developer	Current Status	No. of Projects	Capacity (MW)
IPP	• Fuel tie up available • Project implementation under initial stages	1	1,320
Total	**SET C**	**1**	**1,320**
IPP	• Partial land acquisition and clearances	1	2,640
Total	**SET D**	**1**	**2,640**

IPP = Independent power producer.

Source: Study team analysis.

Table 2.31: **Long-Term Generation Projects in the VCIC Area of Andhra Pradesh**

Project Developer	Current Status	No. of Projects	Capacity (MW)
State utilities	• Fuel tie up available • Project implementation under conceptualization	1	960
IPP	• Available fuel tie up • Project implementation under conceptualization	1	768
Total	**SET E**	**2**	**1,728**
State utilities	• Partial or no fuel tie up • Pending land acquisition and clearance • Pending FC • No clarity of offtake	2	4,800
IPP	• Partial or no fuel tie up • Pending land acquisition and clearance • Pending FC • No clarity of offtake	15	15,165
Total	**SET F**	**19**	**19,965**

IPP = Independent power producer.

Source: Study team analysis.

Out of 51 upcoming transmission projects, 48 are immediate priority to be commissioned by 2017. This represents transmission lines associated with generation capacity of around 19,700 MW as well as lines for transmission system strengthening. This category covers 42 transmission projects undertaken by state utility APTRANSCO and six projects of PGCIL. These projects require close monitoring of project implementation for timely completion.

Table 2.32: **Immediate Priority Transmission Projects in the VCIC Area of Andhra Pradesh**

Project Developer	Current Status	No. of Projects	Capacity of Associated Generation Project (MW)
State utilities	• Project implementation under advanced stage	29	2,120
Central utilities	• Project implementation under advanced stage	4	6,880
Total	**SET A**	**33**	**9,000**
State utilities	• Challenges in project management • Delays in tender process	8	4,480
Central utilities	• Challenges in project management • Delay due to RoW, forest clearance, etc.	2	1,320
Total	**SET B**	**10**	**5,800**
State utilities	• Scheme to be formulated	5	4,960
Total	**SET C**	**5**	**4,960**

Source: Study team analysis.

Table 2.33: **Medium-Term Transmission Projects in the VCIC Area of Andhra Pradesh**

Project Developer	Current Status	No. of Projects	Capacity of Associated Generation Project (MW)
State utilities	• Scheme to be formulated	2	810
Private utilities	• Bidding process to be taken up	1	1,204
Total	**SET D**	**3**	**2,014**

Source: Study team analysis.

Medium-term projects

These projects are at initial stage of bid process or planning and they are likely to be commissioned after FY 2017. This category covers three transmission projects that represent lines associated with generation capacity of around 2,014 MW as well as lines for transmission system strengthening (Table 2.33).

VCIC area in Tamil Nadu

VCIC area covers two districts of Tamil Nadu along the east coast: Chennai and Tiruvallur. To drive increased energy availability in the VCIC area of Tamil Nadu to meet future demand, generation capacity addition and transmission system strengthening are needed. The analysis of various projects undertaken by the central government and state governments, and the private sector show that 12 generation projects with around 6,600 MW of generation

Table 2.34: **Upcoming Generation Capacity in the VCIC Area of Tamil Nadu**

Energy Source	Upcoming Generation Capacity (MW)		
	Before FY 17	Post FY 17	Around FY23
Domestic Coal	1,000	-	450
Blended coal	2,020	1,746	1,460
Total	**3,020**	**1,746**	**1,910**

Source: CEA, Study team analysis.

Table 2.35: **Projected Annual Fuel Requirements**

Energy Source	Unit	Annual Fuel Requirements		
		Plant coming before FY 17	Plants coming post FY 17	Plants coming around FY23
Domestic Coal	MT	10.27	4.9	6.23
Imported coal	MT	2.43	2.1	1.77
Total coal	**MT**	**12.7**	**7**	**8**

Source: Study team analysis.

capacity are planned in the VCIC area in the next 10 years. Table 2.34 presents phase-wise and energy-source-wise generation capacity upcoming in the VCIC area.

Fuel Mix

An adequate supply of fuel to the upcoming generating power projects is the key to ensure future energy availability in VCIC. Therefore, fuel supply tie-ups require close monitoring to avoid any possible slippages of generating capacity. Considering the upcoming generation capacity in the VCIC area of Tamil Nadu, it is estimated that 27.7 MT of coal is required annually (Table 2.35).

The central transmission utility, PGCIL, and the state transmission utility, Tamil Nadu State Transmission Company (TNTRANSCO), have undertaken development of 16 new transmission lines in VCIC for evacuation of around 4,800 MW power from upcoming power projects. This also includes many transmission lines for the strengthening of the existing system. The summary of generation and transmission projects upcoming in VCIC is presented in Table 2.36.

Project prioritization

All upcoming generation and transmission projects in VCIC are classified as either immediate priority projects, medium-term projects, or long-term project on the basis of analysis of their strategic potential and readiness in terms of project implementation stages. In order to project energy availability from all upcoming generation projects in VCIC, they are further categorized into sets A, B, C, D, and E.

Table 2.36: Summary of Upcoming Generation and Transmission Projects in the VCIC Area of Tamil Nadu

Fuel	Generation projects		Transmission projects	
	Number	Generating Capacity (MW)	Number	Transmission Capacity (MW)
State utilities	6	4,640	16	4,766
Central utilities	2	1,000	-	-
Private IPPs	4	1,036	-	-
Total	**12**	**6,676**	**16**	**4,766**

Source: CEA, Study team analysis.

Table 2.37: Immediate Priority Generation Projects in the VCIC area of Tamil Nadu

Project Developer	Current Status	No. of Projects	Capacity (MW)
State utilities	• Fuel tie up available • Project implementation under progress	2	1,200
Central utilities	• Fuel tie up available • Project implementation under progress	2	1,000
IPP	• Fuel tie up available • Project implementation under progress	1	160
Total	**SET A**	**5**	**23,60**
State utilities	• Pending fuel tie up • Project implementation under progress	1	660
Total	**SET B**	**1**	**660**

Source: Study team analysis.

Generation projects

Immediate priority projects

These projects are at an advanced stage of implementation with complete or partial fuel supply tie up. Six generation projects with a total of 3,020 MW of generation capacity fall under the category of immediate priority projects expected to come on stream by 2017. Set A covers five projects with a total capacity of 2,360 MW that require close monitoring of project implementation for timely completion (Table 2.37).

Medium-term projects

These projects are at their initial stage of implementation with complete or partial fuel supply tie up, and partial land acquisition and project clearances. Two independent power producers one state project with a total of 1,746 MW of generating capacity fall under the

Table 2.38: **Medium-Term Generation Projects in the VCIC Area of Tamil Nadu**

Project Developer	Current Status	No. of Projects	Capacity (MW)
IPP	• Fuel tie up available • Project implementation under initial stages	1	126
Total	**SET C**	**1**	**126**
State utilities	• Partial land acquisition and clearances • Pending fuel tie up	1	1,320
IPP	• Partial land acquisition and clearances • Pending fuel tie up	1	300
Total	**SET D**	**2**	**1,620**

Source: Study team analysis.

Table 2.39: **Long-Term Generation Projects in the VCIC Area of Tamil Nadu**

Project Developer	Current Status	No. of Projects	Capacity (MW)
State utilities	• No fuel tie up • Partial land acquisition and clearance • Pending FC • No clarity of offtake	2	1460
IPP	• No fuel tie up • Partial land acquisition and clearance • Pending FC • No clarity of offtake	1	450
Total	**SET E**	**3**	**1,910**

Source: Study team analysis.

medium-term category that are expected to come online after 2017. Sets C and D are part of this category that requires proper monitoring of project implementation (Table 2.38).

Long-term projects

These projects are either at the planning stage or very initial stages of implementation with pending fuel supply tie ups, land acquisitions, and project clearances. Three generation projects with a total of 1,910 MW of generation capacity fall under the long-term category that are expected to come online around 2023 (Table 2.39).

Transmission projects

Immediate priority projects

These projects are at an advanced stage of implementation with progress made in tower erection and conductor stringing (Table 2.40). Transmission projects facing challenges in

Table 2.40: **Immediate Priority Transmission Projects in the VCIC Area of Tamil Nadu**

Project Developer	Current Status	No. of Projects	Capacity of Associated Generation Project (MW)
State utilities	• Project implementation under advanced stage	9	4,766
Total	**SET A**	**9**	**4,766**
State utilities	• Challenges in project management • Delays in tender process	7	-
Total	**SET B**	**7**	**-**

Source: Study team analysis.

project management are also covered under the immediate priority category because of their expected commissioning before 2017.

All 16 upcoming transmission projects will be undertaken by the state utility, TNTRANSCO. This represents transmission lines associated with a total generation capacity of around 4,700 MW as well as lines for transmission system strengthening. These projects require close monitoring of project implementation for timely completion.

Import of power from other regions (Gateway to the southern grid)

VCIC is located in the southern grid of India as shown in Figure 2.71, which means that VCIC will be a gateway to the Southern Grid, facilitating the transmission of surplus power from the eastern region. Commissioning of the eastern and southern links with 2,600 MW total capacity has led to a 4.5 times increase in power flowing from the eastern region. For FY 2013–14, the total power flow to the southern region stands at 20,073 MW. In July 2014, there were power exports of 1,919 MW from the Eastern Grid to the Southern Grid.

The installation of new inter-regional transmission lines will improve the connectivity of the southern grid with rest of India's grids:

(i) 765 kV Sholapur–Raichur (2nd circuit)
(ii) 765 kV Kolhapur–Narendra (Kudgi) GIS
(iii) 765 kV Wardha–Hyderabad
(iv) Angul–Srikakulam PP–Vemgiri Polling point

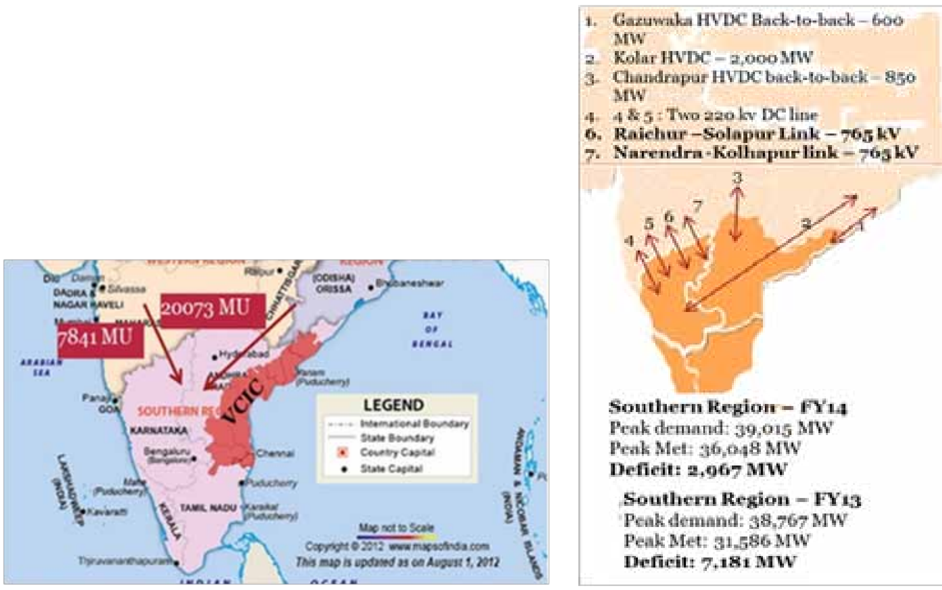
This will further augment the connectivity of the southern and eastern grids, thus, enabling the flow of surplus generation capacity to the southern region.

Water Strategy

Overview–Andhra Pradesh

Andhra Pradesh State Water Policy was formulated by the Irrigation & CAD Department of the Government of Andhra Pradesh in 2008. The total water resources (surface water and

Figure 2.71: **VCIC—Gateway to the Southern Grid**



Source: Maps of India, SRLDC, Study team analysis.

groundwater) of Andhra Pradesh are estimated to be about 108 BCM (about 78 BCM from surface water, primarily from the Godavari and Krishna rivers), of which nearly 65 BCM are currently utilized (0.6 BCM for drinking, 64 BCM for irrigation, 0.3 BCM for industry, and 0.3 BCM for power generation) (Figure 2.72).

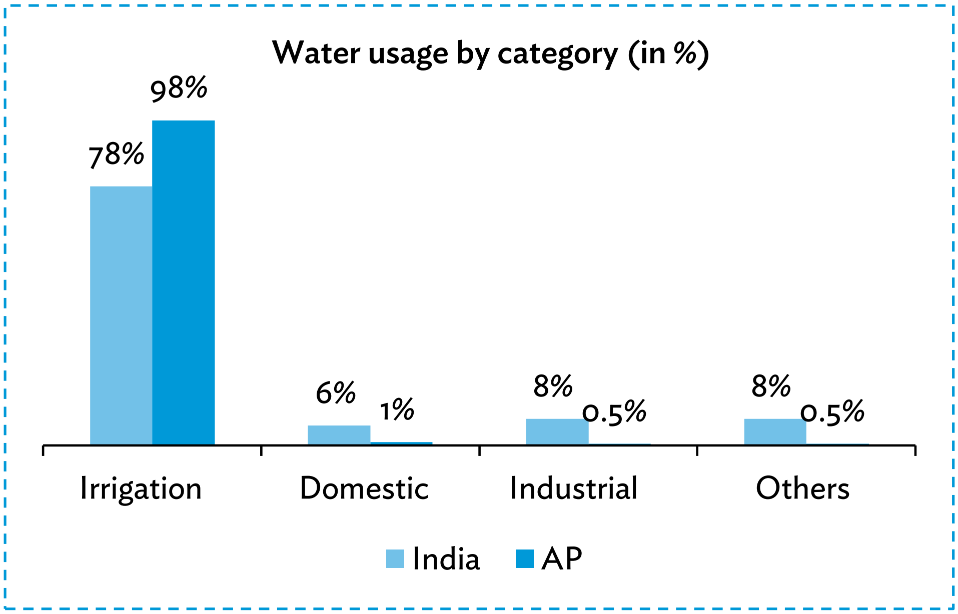
As per Andhra Pradesh's water policy, priority is given to the allocation and supply of water for domestic and irrigation purposes.

At the national level, around 78% of water is consumed by irrigation, 6% by domestic users, and around 8% by industries. However, in the state of Andhra Pradesh, 98% of water is consumed by irrigation and less than 1% each for domestic uses and industries, which signifies the importance of agriculture in the state.

Further, the per capita water supply in class I cities in the state of Andhra Pradesh is lower when compared to competing states in the country. In Andhra Pradesh, 78% of Class I cities get less than 100 liters per capita per day (lpcd) of water compared to 24% in Karnataka, 5% in Gujarat, and 22% in Maharashtra. On average in India, 36% of the class I cities get less than 100 lpcd of water and 46% of the cities get water between 100 lpcd and 200 lpcd.

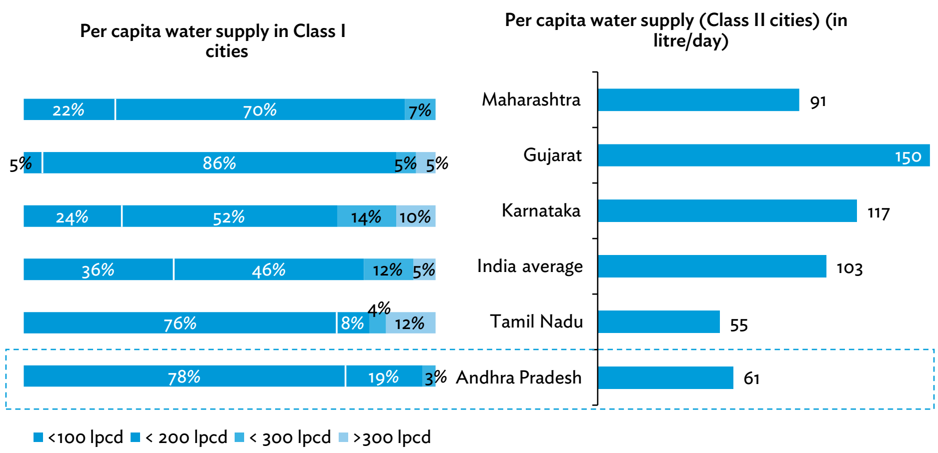
Among class II cities, the per capita water supply is lower in Andhra Pradesh at 61 lpcd compared to the national average of 103 lpcd (Figure 2.73).

Figure 2.72: Water Usage by Category—India vs. AP



Source: Ministry of Water Resources, Andhra Pradesh State Water Policy.

Figure 2.73: Per Capita Water Supply in Class I and Class II Cities



Source: Indiastat.

Industrial water scenario around industrial nodes

Surface water

Andhra Pradesh is a riverine state with 40 major, medium, and minor rivers. Of these, three are major interstate rivers. The Godavari, Krishna, and Pennar rivers flow through the heart of the state. Besides these, five interstate rivers north of Godavari flow through Orissa and Andhra Pradesh, and four rivers south of Pennar flow through Andhra Pradesh and Tamil Nadu. Apart from the above 12 rivers, 28 medium and minor rivers flow within Andhra Pradesh.

The total reservoir capacity of the state (major and minor irrigation projects) is around 16.5 BCM (580 TMC), the major ones being Nagarjunasagar, Somasila, and Kandaleru, which together account for around 80% of the total reservoir capacity.

Groundwater

The State is divided into 40 drainage basins and 81 sub-basins of major and minor rivers. These 81 sub-basins are further divided into 1,229 groundwater micro-basins, between 100 km^2 and 300 km^2 in size, based on local drainage, geomorphology, and hydrogeology.

Groundwater meets around 85% of domestic water needs in rural areas, 30% of urban needs, and around 50% of industrial demand. Over 80% of the mandals in the state of Andhra Pradesh fall in the safe category. Parts of West Godavari, Krishna, Prakasam, Cuddappah, and Chittoor districts have over exploited regions.

Industrial water scenario of the corridor

The total reservoir capacity (major irrigation projects) of the corridor is around 15 BCM, the major reservoirs being Nagarjunasagar, Somasila, and Kandaleru, which are in Guntur and Nellore districts. The majority of the regions that are a part of the corridor fall in the safe zone, except parts of Prakasam, Kadapa and Chittoor districts (Table 2.41).

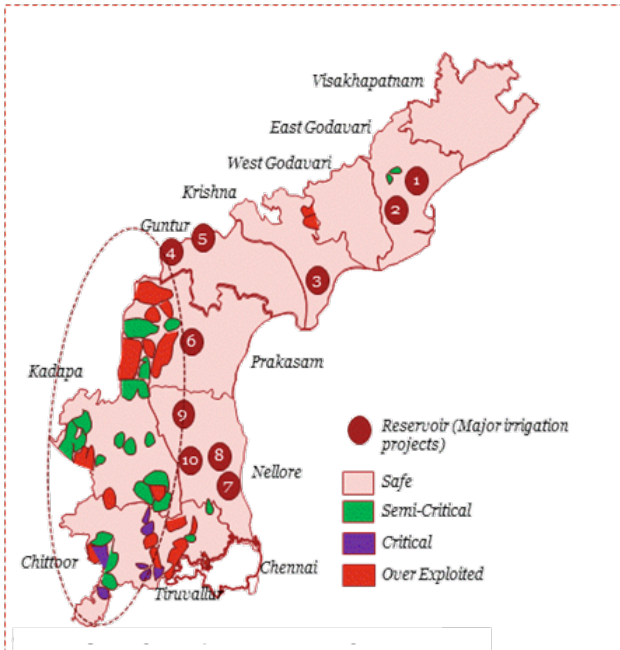
Figure 2.74 illustrates that districts closer to the coast have higher surface and groundwater availability; however the westward districts have limited supply of both sources of water.

Table 2.41: **VCIC Reservoirs**

	Name of Reservoir	Capacity (TMC)
1	Yeleru	24
2	Sir Arthur Cotton	3
3	Prakasam Barrage	3
4	Pulichintala	46
5	Nagarjunasagar	312
6	Gundlakamma	4
7	Somasila	78
8	Kandaleru	68
9	Kanigiri	6
10	Survepalli	2
	Total (TMC)	**546**
	Total (in BCM)	**15**

Source: Irrigation department.

Figure 2.74: **Industrial Water Scenario**



Source: Irrigation department, State Ground Water Department.

Projected water demand

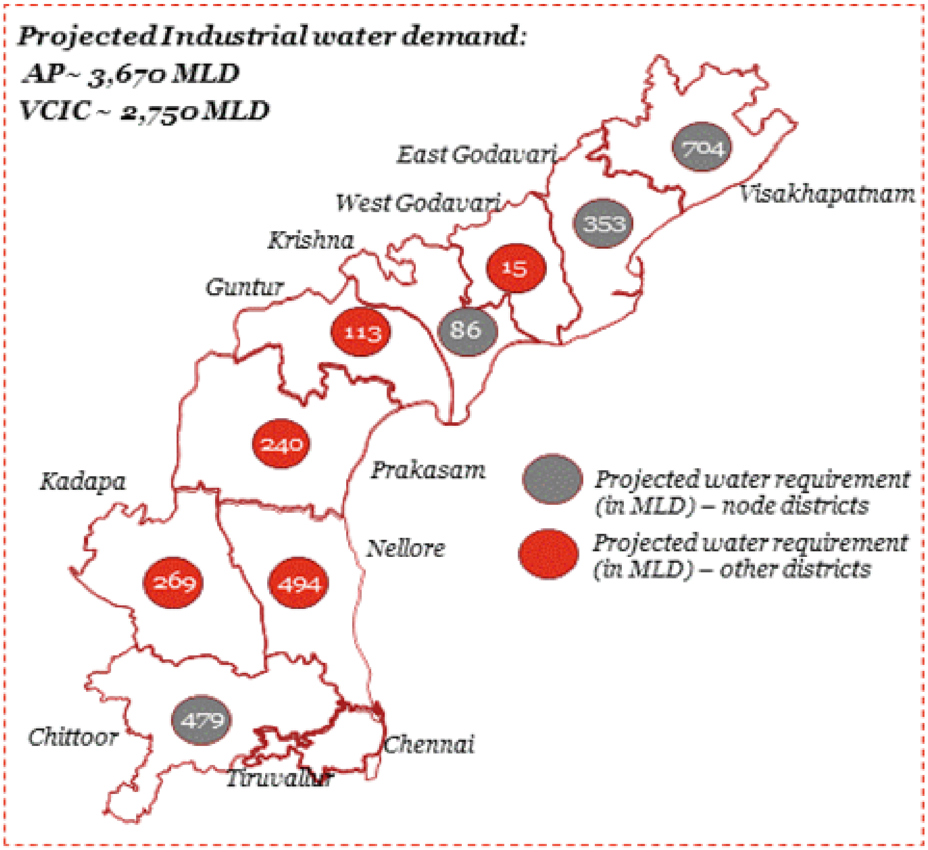
Over the next 10 years, around three-fourths of Andhra Pradesh's projected industrial water demand will come from the corridor districts.

The state of Andhra Pradesh has over 140 industrial parks and estates spread across 100,000 acres. Further, around 18 parks are in the planning stage with a proposed development area of over 18,000 acres. Over the next 10 years (2015–25), the industrial water demand from industrial parks and other private industries is expected to be around 3,700 MLD (47 TMC) (Figure 2.75).[8]

Of the total industrial water requirement in the state, around 2,750 MLD is the requirement of corridor districts, which accounts for around three-fourths of the state's demand.

8 APIIC (Assumed water consumption of 7.50 KLD per acre. Water demand of major industries like power plants and steel plants is not included. Mega projects like VCIC, CBIC, and ITIR are not considered.)

Figure 2.75: **Projected Industrial Water Demand**



Source: APIIC.

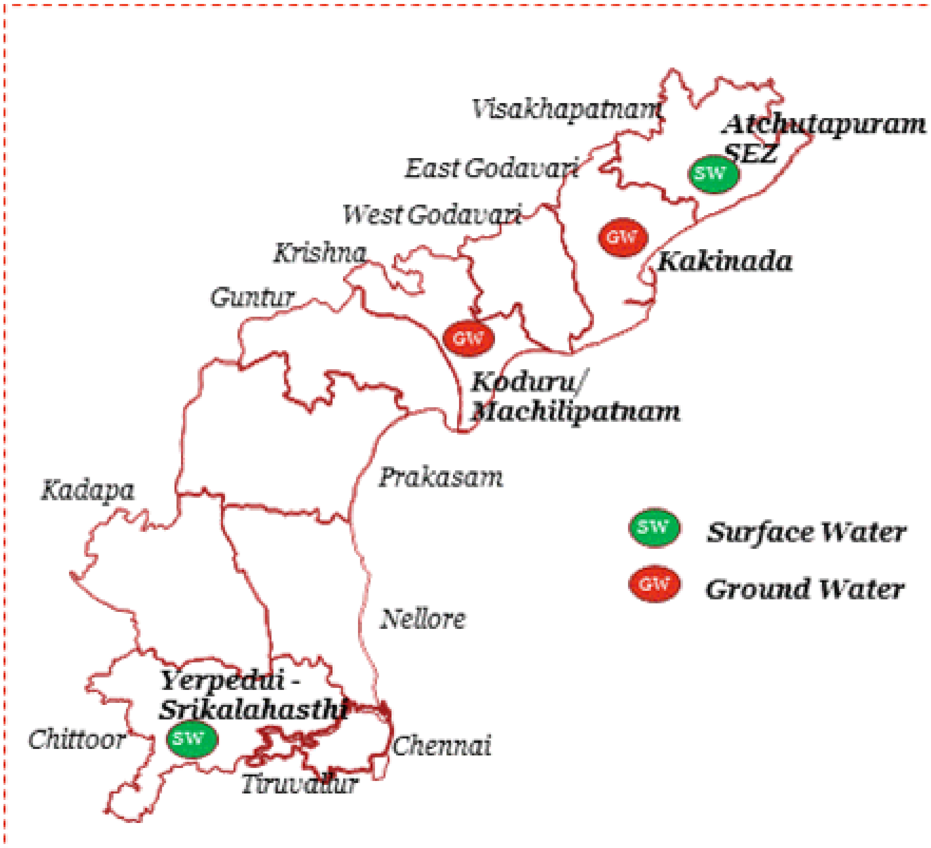
Among the corridor districts, the four nodal districts of Visakhapatnam, East Godavari, Krishna, and Chittoor together account for around 60% of VCIC's water demand.

Need for industrial water supply projects

Two shortlisted nodes are currently dependent on groundwater for industrial uses; therefore, plans are needed for industrial water supply projects.

A closer look at the consumption patterns of the shortlisted nodes reveals that two of the four are dependent on groundwater, which is not a reliable source in the long-term because of dependency on rainfall (Figure 2.76).

Figure 2.76: **Sources of Water in VCIC nodes**



Source: Stakeholder consultations.

Industries in Kakinada and Koduru–Machilipatnam are significantly dependent on groundwater. Further, the quality of groundwater in Koduru–Machilipatnam is poor and hence not suitable for use by all types of industries.

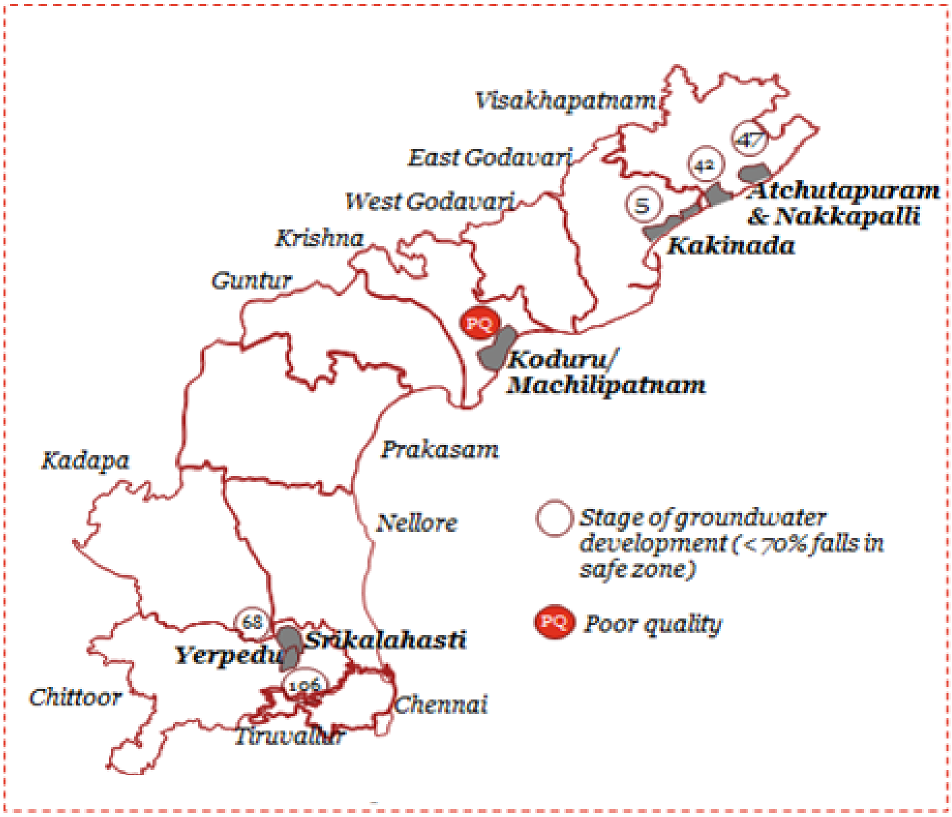
Though industries around the Atchutapuram SEZ in Visakhapatnam and Yerpedu–Srikalahasti in Chittoor are using surface water, the availability is uncertain, unreliable, and heavily dependent on rainfall.

Strategic interventions

New reservoirs and desalination projects

As depicted in Figure 2.77, groundwater development ranges from as low as 5% in Kakinada to as high as 106% in Yerpedu. The majority of these regions do not have reliable sources of surface water.

Figure 2.77: **Stage of Groundwater Development in VCIC Nodes**



Source: State Ground Water Department.

Hence, in order to increase the reliability and availability of industrial water in the state of Andhra Pradesh, the following steps need to be taken:

- identify the need for new reservoir or desalination projects in areas with poor water availability through surface water, and
- develop reservoirs at key industrial nodes.

Water recycling

While water recycling in our focus industries has high potential, in practice it is insignificant.

Water recycling is one of the key strategic interventions that would help reduce demand for industrial water in the region. Currently, the percentage of water recycling in the corridor

Table 2.42: **Benchmarks of Recycle Ratios in Japan**

S. No.	Sector Activity	Recycle Ratio (%)
1	Food Processing	29.8
2	Textiles and Apparels	48.3
3	Chemicals and Petrochemicals	86.0
4	Metallurgical industry	88.5
5	Electronics	65.0
6	Electrical machinery	41.4
7	Auto and auto components	43.0
8	Machinery	89.5
9	Other manufacturing	57.0

Source: Japanese Industrial Census (2011).

region is negligible. The industrial water tariff plays a key role in the promotion of recycling. Industrial water tariffs in the corridor are in the range of INR8 to INR40 based on the source of water; however, the cost of water treatment and recycling is around INR35. Hence, it is essential for fresh water tariffs to be higher than the cost incurred in recycling.

The industries in the corridor could target to achieve the recycle ratios of industries in Japan. Sector-wise recycling percentages are shown in Table 2.42.

Water use efficiency

Shortlisted industry sectors are water-intensive; therefore, water use efficiency is key to being more productive.

As shown in Figure 2.78, India's water productivity is around US$8 per cubic meter of water used, which is lower than countries like Sweden and the Republic Korea whose industrial water productivity is 10 times that of India.

As shown in Table 2.43, the majority of the sectors shortlisted under VCIC like metallurgy, chemicals and petrochemicals, and textiles are water-intensive.

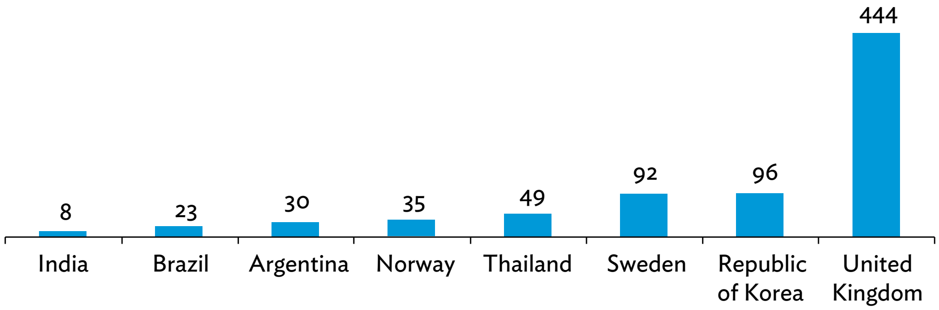
Hence, necessary steps need to be taken to improve industrial water productivity.

Industrial water tariffs

Current pricing is one of the hurdles to promoting recycling and water use efficiency.

Current industrial water tariffs range from as low as INR2 per kiloliter to as high as INR40 per kiloliter depending on the source of water. The water tariffs, source-wise, are detailed in the Table 2.44.

Figure 2.78: **Industrial Water Productivity Benchmarks (US$ per cubic meter)**



Source: Planning Commission 2010 and Narishmhan (2008) cited in Water in India, Situation and Prospects (UNICEF 2013).

Table 2.43: **Water Consumption Benchmarks, by Sector**

	Metallurgy	Petrochemicals	Textiles	Pharmaceuticals
Water consumption (kl/tonne)	82.5	17	200	25

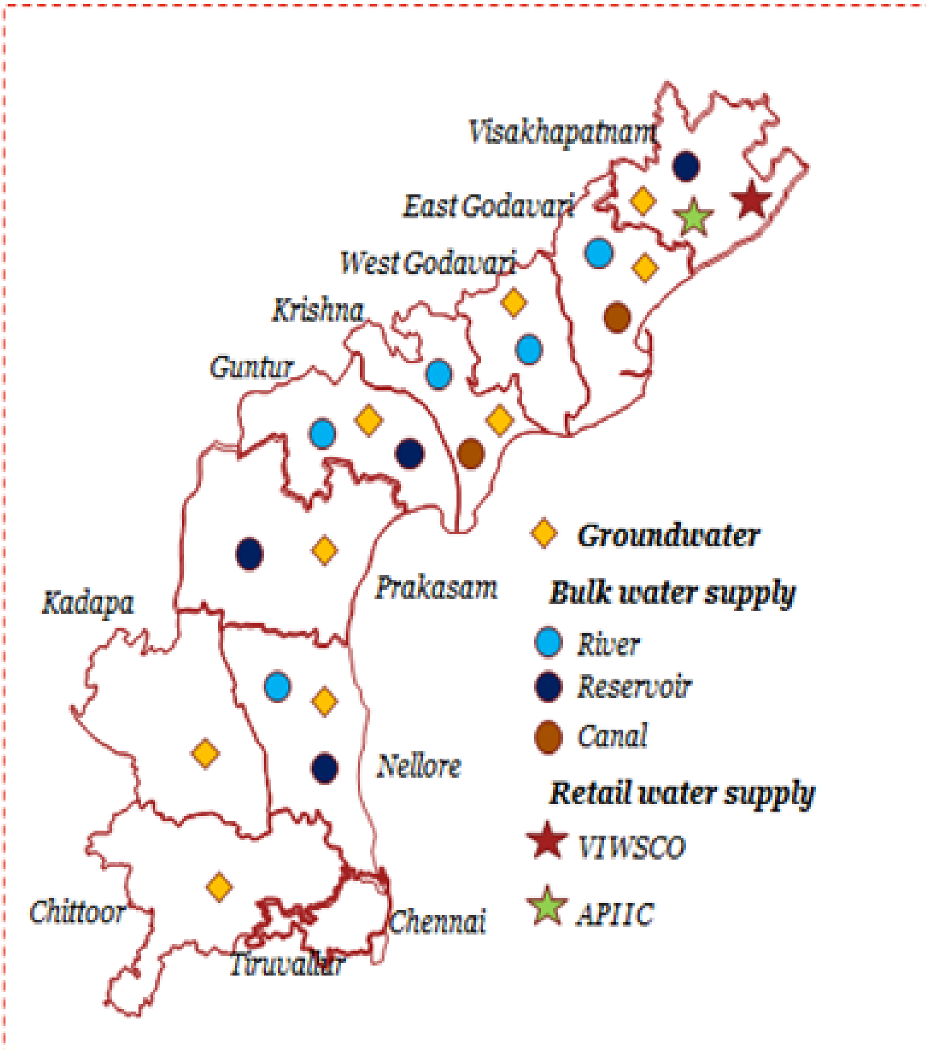
Source: Study team analysis.

Table 2.44: **Water Tariffs by Source**

Water source	Rate (INR per kl)
Surface water	
Bulk water– irrigation departments	
River water	1.5
Reservoir	3.0
Canal	4.5
Retail water	
VIWSCO	20.0
APIIC	40.0
Groundwater	7-8*

Source: Consultations with GoAP.

Figure 2.79: **Sources of Industrial Water, by District**



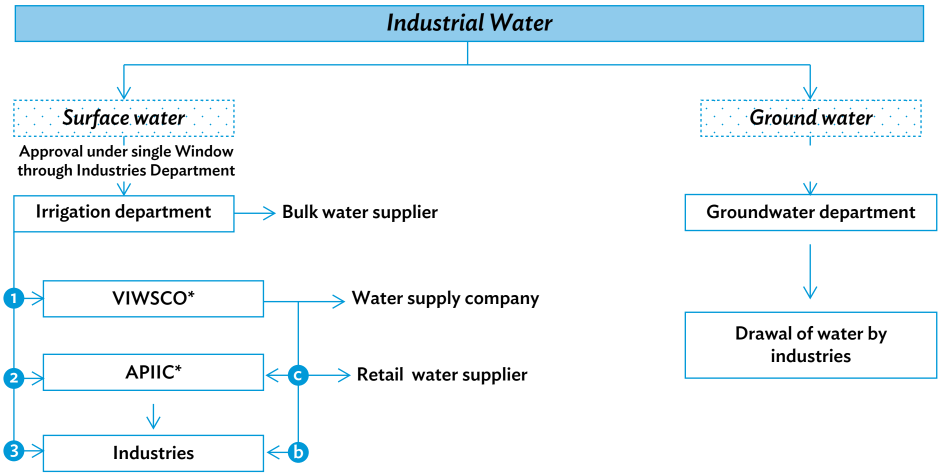
Source: Irrigation department, APIIC, Study team analysis.

As can be seen in Figure 2.79, the majority of districts have multiple industrial water sources leading to different industrial water tariffs within a district, which is one of the hurdles to promoting water recycling and water use efficiency. Further, the water tariffs in the state have not been revised since 2002.

Industrial water planning and management

No dedicated agency exists for industrial water planning and management. Irrigation and groundwater departments manage the industrial water supply in the state of Andhra Pradesh.

Figure 2.80: **Institutional Structure of Industrial Water in Andhra Pradesh**



VIWSCO- Visakhapatnam Industrial Water Supply Company; #APIIC-Andhra Pradesh Industrial Infrastructure Corporation

Source: Consultations with GoAP.

The institutional structure of industrial water in the state of Andhra Pradesh is depicted in Figure 2.80.

Approval for industrial water comes from an industries department under a Single Window scheme for both surface water and groundwater. Approval for surface water is given by an irrigation department. For groundwater, approval comes from the State Groundwater Department of the Government of Andhra Pradesh.

For surface water, an irrigation department is the bulk water supplier and is responsible for water transmission for irrigation and domestic and industrial purposes. An irrigation department supplies water to APIIC in cases of industrial parks and to individual industries in cases of private industries located outside industrial parks. The state of Andhra Pradesh does not have a dedicated agency for industrial water planning and management.

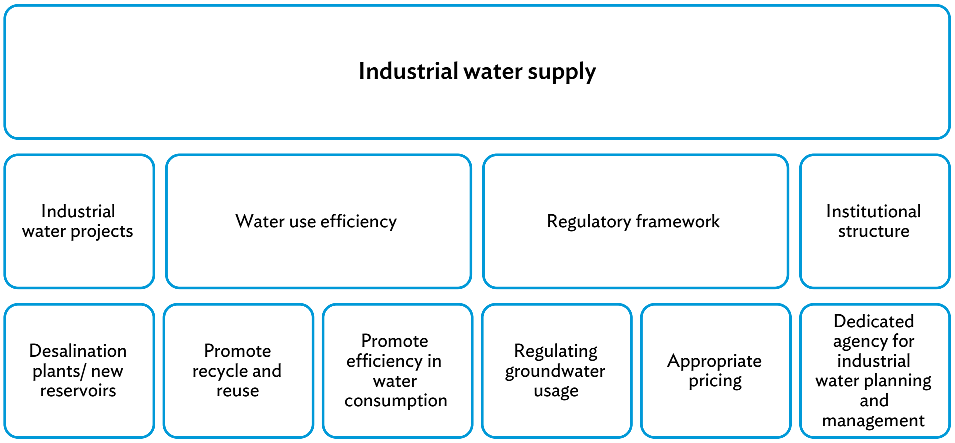
The only exception is in Visakhapatnam, where the department supplies water to the Visakhapatnam Industrial Water Supply Company (VIWSCO). In turn, VIWSCO supplies water to APIIC, private industrial parks, and individual companies.

Among all the APIIC parks in the state, industries in Visakhapatnam are the only ones use surface water for industrial purposes. Across the majority of the other industrial parks in the state, groundwater is the major source.

3.2.5 Conclusion

To summarize, there is a need to resolve the issues in the industrial water segment and provide a long-term planning perspective. The key interventions required by the state government in this sector are shown in Figure 2.81.

Figure 2.81: **Key Interventions in Management of the Industrial Water Supply**



Source: Study team analysis.

Appendix 2.1

Power

Figure 2.82: **Upcoming Generation Projects in Andhra Pradesh**

REF. NO.	PROJECTS	FUEL
	ANDHRA PRADESH STATE	
	Immediate Priority Projects	
2	Rayalseema IV	Coal
23	Sri Damodaram Sanjeevaiah TPP	Blended Coal
24	Pynampuram TPP	Blended Coal
25	Thamminapatnam TPP-I	Blended Coal
26	Thamminapatnam TPP-II	Blended Coal
27	Simhapuri Energy Pvt Lts Ph-II	Imported coal
33	Bhavanpadu TPP	Blended Coal
34	Vizag TPP	Coal
	Medium Term Projects	
28	Muthukur Mandal I	Blended Coal
35	Komarada TPP	Blended Coal
	Long Term Projects	
3	Gautami CCPP	Gas
4	Jegurupadu expansion	Gas
5	Konaseema II	Gas
6	Biccavolu II	Gas
7	Pow eravara	Gas
8	Kakinada I	Gas
9	Kakinada II	Gas
10	Rajahmundry II	Gas
11	Rajahmundry II	Gas

REF. NO.	PROJECTS	FUEL
	ANDHRA PRADESH STATE	
12	Samalkot II	Gas
13	Polavaram	Hydro
14	Rajanagaram Gas	Gas
17	Kondapalli III	Gas
18	Dr. NTTPS V	Gas
29	Muthukur Mandal II	Blended Coal
30	Krishnapatnam UMPP	Imported Coal
31	Vodarevu UMPP	Blended Coal
37	Vijjesw aram III	Gas
38	Panduranga I	Gas
	TELANGANA STATE	
1	Adilabad	Coal
15	Sattupally	Coal
16	Kothagudem VII	Coal
19	Pashamlaram	Gas
20	Low er Jurala	Hydro
21	Nagarjuna Sagar Tail	Hydro
22	Pulichintala	Hydro
32	Karim Nagar CCGP	Gas
36	Kakatiya II	Coal

Source: Study team compilation.

Immediate priority generation projects in the VCIC area of Andhra Pradesh

Table 2.45: **Immediate Priority Generation Projects in the VCIC area of Andhra Pradesh**

Sr.	Project	Fuel	Capacity (MW)	District	Ownership	Expected COD
SET A						
1	Sri Damodaram Sanjeevaiah TPP	Blended Coal	1,600	Nellore	APGENCO	FY 15
2	Vizag TPP	Coal	1,040	Visakhapatnam	IPP	FY 15
3	Pynampuram TPP	Blended Coal	1,320	Nellore	IPP	FY 15
4	Bhavanpadu TPP	Blended Coal	2,640	Srikakulam	IPP	Ph-1 in Dec 15, Ph-2 in Dec 16
5	Thamminapatnam TPP-I	Blended Coal	300	Nellore	IPP	Near completion
6	Simhapuri Energy Pvt Lts Ph-II	Imported coal	300	Nellore	IPP	Partly commissioned
Total	**SET A**		**7,200**			
SET B						
7	Rayalseema IV	Coal	600	Cuddapah	APGENCO	Dec 15
8	Thamminapatnam TPP-II	Blended Coal	700	Nellore	IPP	Mar 15
Total	**SET B**		**1,300**			
Total Capacity (SET A+B)			**8,500**			

Source: CEA.

Medium-term generation projects in the VCIC area of Andhra Pradesh

Table 2.46: **Medium-Term Generation Projects in the VCIC Area of Andhra Pradesh**

Sr.	Project	Fuel	Capacity (MW)	District	Ownership	Expected COD
SET C						
1	Komarada TPP	Blended Coal	2,640	Vizianagaram	IPP	Post FY17
Total	SET C		2,640			
SET D						
2	Muthukur Mandal I	Blended Coal	1,320	Nellore	IPP	Post FY17
Total	**SET D**		**1,320**			
Total Capacity (SET C+D)			**3,960**			

Source: CEA.

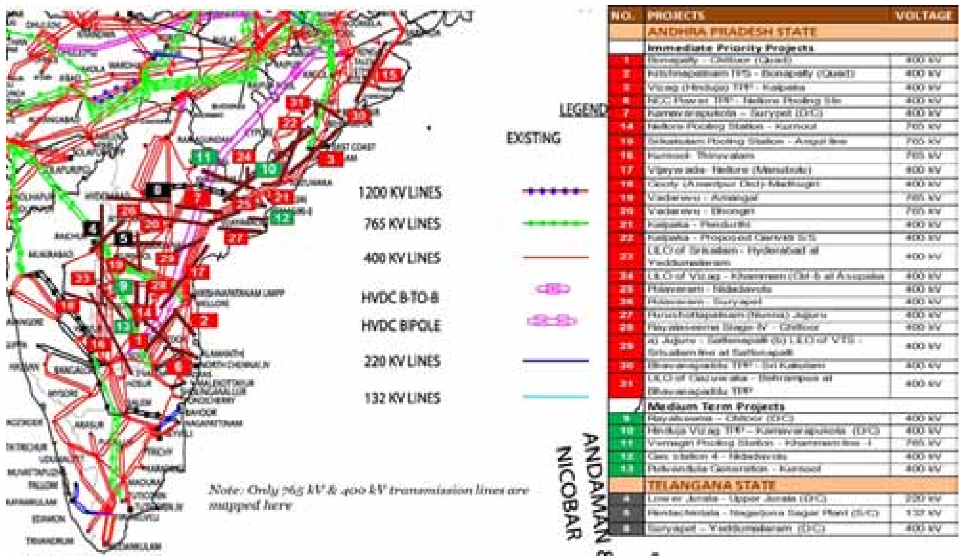
Long-term generation projects in the VCIC area of Andhra Pradesh

Table 2.47: **Long-Term Generation Projects in the VCIC Area of Andhra Pradesh**

Sr.	Project	Fuel	Capacity (MW)	District	Ownership	Expected COD
SET E						
1	Polavaram	Hydro	960	East Godavari	APGENCO	Remote future
2	Rajahmundry II	Gas*	768	East Godavari	IPP	Unlikely before FY17
Total	**SET E**		**1,728**			
SET F						
1	Vodarevu UMPP	Blended Coal	4,000	Prakasam	APGENCO	Remote future
2	Dr. NTTPS V	Gas*	800	Krishna	APGENCO	Remote future
3	Krishnapatnam UMPP	Imported Coal	3,960	Nellore	IPP	Stalled
4	Vijjeswaram III	Gas*	700	West Godavari	IPP	Post FY17
5	Jegurupadu expansion	Gas*	800	East Godavari	IPP	Post FY17
6	Konaseema II	Gas*	820	East Godavari	IPP	Post FY17
7	Biccavolu II	Gas*	225	East Godavari	IPP	Post FY17
8	Poweravara	Gas*	440	East Godavari	IPP	Post FY17
9	Kakinada I	Gas*	350	East Godavari	IPP	Post FY17
10	Gautami CCPP	Gas*	800	East Godavari	IPP	Post FY17
11	Rajahmundry II	Gas*	436	East Godavari	IPP	Unlikely before FY17
12	Samalkot II	Gas*	2,262	East Godavari	IPP	Unlikely before FY17
13	Rajanagaram Gas	Gas*	1,200	East Godavari	IPP	Remote future
14	Kakinada II	Gas*	1,000	East Godavari	IPP	Remote future
15	Kondapalli III	Gas*	742	Krishna	IPP	Unlikely before FY17
16	Panduranga I	Gas*	110	West Godavari	IPP	Unlikely before FY17
17	Muthukur Mandal II	Blended Coal	1,320	Nellore	IPP	Remote future
Total	**SET F**		**19,965**			
Total capacity (SET E+F)			**21,693**			

Source: CEA.

Figure 2.83: **Upcoming Transmission Projects in Andhra Pradesh**



Source: Study team compilation.

Immediate priority transmission projects in the VCIC area of Andhra Pradesh

Table 2.48: **Immediate Priority Transmission Projects in the VCIC Area of Andhra Pradesh**

Sr. No.	Project	Voltage level (kV)	Circuit type	Length (Ckt Km)	Capacity of associated generation project (MW)	Ownership
1	Nellore Pooling Station–Kurnool	765	D/C	602	5,560	PGCIL
2	Kurnoo–Thiruvalam	765	D/C	748	-	PGCIL
3	Srikakulam Pooling Station - Angul line	765	D/C	550	1,320	PGCIL
4	NCC Power TPP–Nellore Pooling Station	400	D/C	50	1,320	PGCIL
5	Gooty–Madhugiri	400	D/C	418	-	PGCIL
6	Vijaywada–Nellore (Manubolu)	400	D/C	686	-	PGCIL
7	Vadarevu–Amangal	765	S/C	240	4,000	APTRANSCO
8	Vadarevu–Bhongiri	765	S/C	275		APTRANSCO
9	Purushottapatnam (Nunna) Jujjuru	400	D/C	112	-	APTRANSCO

continued on next page

Table 2.48 *continued*

Sr. No.	Project	Voltage level (kV)	Circuit type	Length (Ckt Km)	Capacity of associated generation project (MW)	Ownership
10	Vizag (Hinduja) TPP–Kalpaka (By Hinduja)	400	D/C	15	1,040	APTRANSCO
11	Kamavarapukota–Surypet	400	D/C	424		APTRANSCO
12	Hinduja Vizag TPP–Kamavarapukota	400	D/C	600		APTRANSCO
13	Polavaram–Suryapet	400	D/C	390		APTRANSCO
14	Jujjuru–Sattenapalli LILO of VTS–Srisailam line at Sattenapalli	400	D/C	134	-	APTRANSCO
15	Bonapally–Chittoor (Quad)	400	D/C	194	1,600	APTRANSCO
16	Krishnapatnam TPS–Bonapally (Quad)	400	D/C	182		APTRANSCO
17	Rayalseema–Chitoor	400	D/C	420	600	APTRANSCO
18	LILO of Srisailam–Hyderabad at Yeddumailaram	400	D/C	312	-	APTRANSCO
19	LILO of Vizag–Khammam (Ckt-I) at Asupaka	400	D/C	34	-	APTRANSCO
20	Kalpaka–Pendurthi	400	D/C	50	-	APTRANSCO
21	Kalpaka–Proposed Garividi S/S	400	D/C	300	-	APTRANSCO
22	Polavaram–Nidadavolu	400	D/C	120	960	APTRANSCO
23	Bhavanapaddu TPP - Sri Kakulam	400	D/C	-	2,640	APTRANSCO
24	LILO of Gazuwaka–Behrampue at Bhavanapaddu TPP	400	D/C	-		APTRANSCO
25	Rayalaseema Stage-IV–Chittoor	400	D/C	420	600	APTRANSCO
26	Manublu–Sullurpeta	220	D/C	136	-	APTRANSCO
27	Muddanur-Anantapur (3rd line)	220	S/C on D/C	100	-	APTRANSCO
28	Palamaneru–Madanapalli	220	S/C	50	-	APTRANSCO
29	Peddapuram–laggampet-LI	220	S/C	15	-	APTRANSCO
30	Pendurthy–Vizianagaram	220	D/C	88	-	APTRANSCO
31	Pulichintala–Piduguralla	220	S/C	35	-	APTRANSCO

continued on next page

Table 2.48 *continued*

Sr. No.	Project	Voltage level (kV)	Circuit type	Length (Ckt Km)	Capacity of associated generation project (MW)	Ownership
32	Pulivendula–Hindupur	220	D/C	250	-	APTRANSCO
33	RTPP–Kondapuram	220	S/C on D/C	15	-	APTRANSCO
34	Thimmapuram–Yellanur	220	D/C	8	-	APTRANSCO
35	Yellanur–Gaddamvaripalli	220	D/C	5	-	APTRANSCO
36	Achutapuram(Brandix)–Koruprolu	220	S/C	40	-	APTRANSCO
37	Appannadorapalem–Bobbili	220	D/C	163	-	APTRANSCO
38	Chittoor 400 kV S–Mananapalli	220	D/C	130	-	APTRANSCO
39	Gaddamvaripalli–Goddumari	220	D/C	9	-	APTRANSCO
40	Garividi–Bobbili	220	D/C	75	-	APTRANSCO
41	Gooty–Adoni	220	S/C on D/C	32	-	APTRANSCO
42	Gooty–Adoni (2nd Ckt.)	220	S/C	32	-	APTRANSCO
43	Jangampalli–Mulkapalli	220	S/C	6	-	APTRANSCO
44	Kalyandurg–Anantapur	220	S/C	61	-	APTRANSCO
45	Koruprolu–Narsipatnam LI	220	S/C	35	-	APTRANSCO
46	LILO of Pulivendula–Hindupur(Ckt I) at Kadiri	220	D/C	50	-	APTRANSCO
47	Gas station–Tanuku	220	S/C	45	-	APTRANSCO
48	Pulichintala HEP–Chillakallu	132	D/C	-	120	APTRANSCO
Capacity of associated generation project (MW)					**19,760**	

Source: CEA.

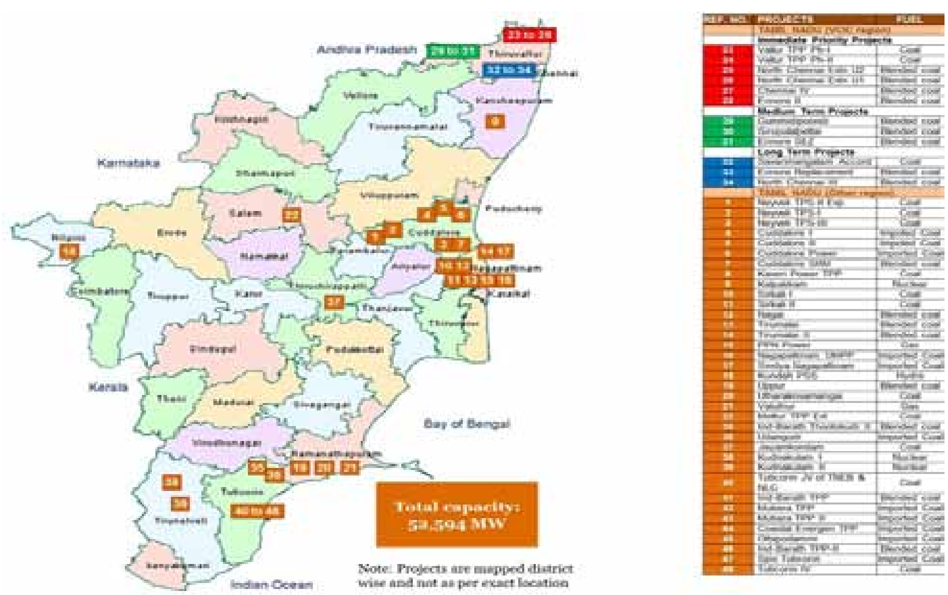
Medium term transmission projects in the VCIC area of Andhra Pradesh

Table 2.49: **Medium-Term Transmission Projects in the VCIC Area of Andhra Pradesh**

Sr. No.	Project	Voltage level (kV)	Circuit type	Length (Ckt Km)	Capacity of associated generation project (MW)	Ownership
1	Vemagiri Pooling Station–Khammam line -I	765	D/C	455	1204	Vemgiri Trans System Ltd.
2	Gas station 4–Nidadavolu	400	D/C	60	810	APTRANSCO
3	Pulivendula Generation– Kurnool	400	D/C	350	-	APTRANSCO
Capacity of associated generation project (MW)					**2,014**	

Source: CEA.

Figure 2.84: **Upcoming Generation Projects in Tamil Nadu**



Source: Study team compilation.

Immediate priority generation projects in the VCIC area of Tamil Nadu

Table 2.50: **Immediate Priority Generation Projects in the VCIC Area of Tamil Nadu**

Sr. No.	Project	Fuel	Capacity (MW)	District	Ownership	Expected COD
SET A						
1	Vallur TPP Ph-I	Coal	500	Thiruvallur	NTPC JV	Feb 13
2	Vallur TPP Ph-II	Coal	500	Thiruvallur	NTPC JV	Feb 14
3	North Chennai Extn U2	Blended Coal	600	Thiruvallur	TANGEDCO	Apr 13
4	North Chennai Extn U1	Blended Coal	600	Thiruvallur	TANGEDCO	Sep 13
5	Chennai IV	Blended Coal	160	Thiruvallur	IPP	Mar 15
Total	**SET A**		**23,60**			
SET B						
7	Ennore II TPP	Blended Coal	660	Thiruvallur	TANGEDCO	May 15
Total	**SET B**		**660**			
Total Capacity (SET A+B)			**3,020**			

Source: CEA.

Medium-term generation projects in the VCIC area of Tamil Nadu

Table 2.51: **Medium-Term Generation Projects in the VCIC Area of Tamil Nadu**

Sr. No.	Project	Fuel	Capacity (MW)	District	Ownership	Expected COD
SET C						
1	Gummidipoondi TPP	Blended Coal	126	Thiruvallur	IPP	Post FY17
Total	**SET C**		**126**			
SET D						
2	Ennore SEZ	Blended Coal	1320	Thiruvallur	TANGEDCO	Post FY17
3	Sirupulalpettai TPP	Blended Coal	300	Thiruvallur	IPP	Post FY17
Total	**SET D**		**1620**			
Total Capacity (SET C+D)			**1746**			

Source: CEA.

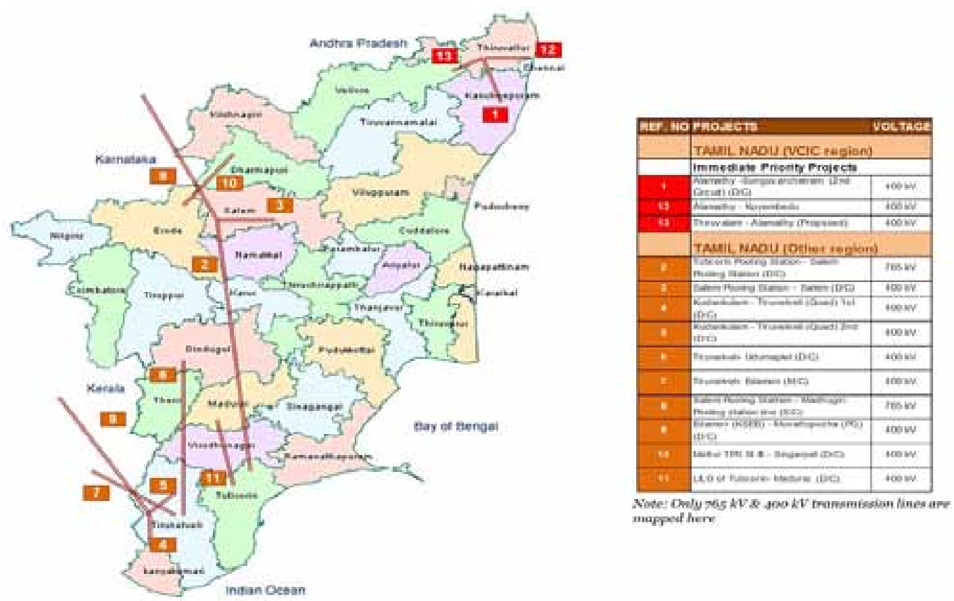
Long-term generation projects in the VCIC area of Tamil Nadu

Table 2.52: Long-Term Generation Projects in the VCIC Area of Tamil Nadu

Sr. No.	Project	Fuel	Capacity (MW)	District	Ownership	Expected COD
SET E						
1	Ennore replacement	Blended Coal	660	Thiruvallur	TANGEDCO	Remote future
2	North Chennai III	Blended Coal	800	Thiruvallur	TANGEDCO	Remote future
3	Savarimangalam Accord	Coal	450	Thiruvallur	IPP	Remote future
Total	**SET E**		**1,910**			

Source: CEA.

Figure 2.85: Upcoming Transmission Projects in Tamil Nadu



Source: Study team compilation.

Immediate priority transmission projects in the VCIC area of Tamil Nadu

Table 2.53: **Immediate Priority Transmission Projects in the VCIC Area of Tamil Nadu**

Sr. No.	Project	Voltage level (kV)	Circuit type	Length (Ckt Km)	Capacity of associated generation project (MW)	Ownership
1	Alamathy–Sunguvarchatram (2nd Circuit)	400	D/C	-	1,200	TNTRANSCO
2	Alamathy–Koyembedu	400	D/C	-	3,566	TNTRANSCO
3	Thiruvalam–Alamathy (Propsoed)	400	D/C	150		TNTRANSCO
4	Arasur 400 kV S/S–Karamadai 230 kV S/S	220	S/C	39	-	TNTRANSCO
5	Avadi-Ayappakkam line	220	S/C	3	-	TNTRANSCO
6	Basin Bridge–TNEB HQ (UG Cable)	220	S/C	23	-	TNTRANSCO
7	Kadapperi–Guindy (UG Cable)	220	S/C	14	-	TNTRANSCO
8	Kalivanthapattu–Kadapperi	220	S/C	34	-	TNTRANSCO
9	Koladi - PH Road	220	D/C	23	-	TNTRANSCO
10	LILO of Siruseri–Tharamani at Sholinganallur	220	D/C	2	-	TNTRANSCO
11	LILO of Sriperumbudur–Koyambedu at Guindy	220	D/C UG Cable	18	-	TNTRANSCO
12	LILO of Tonidapet–Mylapore at TNEB HQ	220	D/C UG Cable	1	-	TNTRANSCO
13	Mylapore–Tharamani	220	D/C UG Cable	25	-	TNTRANSCO
14	PH Road–Koyambedu	220	D/C UG Cable	6	-	TNTRANSCO
15	Sholinganallur–KITS	220	D/C	1	-	TNTRANSCO
16	Sriperumbudur–Korattur (Changing of conductor)	220	S/C	20	-	TNTRANSCO
Capacity of associated generation project (MW)					**4,766**	

Source: CEA.

Appendix 2.2

Projects Identified by APTRANSCO

APTRANSCO proposed the following 220 and 132 kV sub-stations (SS), lines and augmentation of existing Power Transformer capacity, and augmentation of line conductor capacity for first phase Nodes.

NODE I

Cluster location: Pydibhimavaram / Srikakulam District:

- APTRANSCO conducted studies for 220/132 kV substation (SS) at Pydibhimavaram and administrative approval was accorded for Rs. 75 Cr. It caters to the loads of local upcoming industries. This SS can cater to the expected upcoming industrial loads of VCIC cluster.
- The SS will be provided with 3 no. 160 Mega Volt Amp (MVA) Power Transformers (PTRS) to meet the ultimate load of the cluster and other industrial loads.
- Land of 20 Acres is required near Pydibhimavaram. APTRANSCO will purchase land from farmers if the Government land is not available. Land cost for 20 Acres is about Rs.75.00 Lakhs.
- The SS is fed from upcoming 400 kV SS Garividi (Maradam) Vizianagaram Dist.
- The works of Garividi SS and Lines are started.
- To take direct 33 kV loads on the upcoming 220 kV SS Pydibhimavaram it is proposed to provide 33 kV feeders at the SS.
- This SS will be connected to 132 kV SS Ranastalam.
- Thus the loads of the cluster will be met from the two sub-stations.
- 220 kV Pydibhimavaram line from Garividi. - Garividi line from 400 kV SS to Kalapaka.
- 132 kV Ranastalam SS from200 kV SS Garivid.

Further augmentation of Power Transformer capacity is required in this area at 132 kV SS Ranastalam i.e existing 31.5 MVA PTR will be replaced with 50 MVA PTR. At 132 kV Chilakapalem SS also PTR 31.5 MVA will be replaced with 50 MVA PTR.

Cluster location:Bhimunipatnam/Visakhapatnam District.

- APTRANSCO conducting studies for 132 kV substations at Kapuluppada (Bhimunipatnam), Ozone Valley (Madurawada). These sub-stations cater to the loads of local upcoming industries and IT SEZ. This SS can cater to the expected upcoming industrial loads of VCIC cluster.
- The SS will be provided with 2 no., of 80 MVA PTRS each to meet the ultimate load of the cluster and other industrial loads.
- These sub-stations will be fed from 220 kV SS Dairy Farm and 132 kV SS Anandapuram SS.
- These two sub-stations will get main source from 220 kV SS Pendurthy and from 400 kV kalapaka, Gajuwaka, Upper Sileru.

- These two substations shall be preferred with Gas Insulated SS (Maintenance free and UG XLPE cable line) as the area prone to cyclones and Over Head lines are not preferable.

Further augmentation of Power Transformer capacity is required in this area at 220 kV SS Dairy Farm and at 132 kV SS Anandapuram, i.e. existing 31.5 MVA PTR will be replaced with 50 MVA PTR. With this certain load feeding by 220 kV SS Dairy Farm in the areas of Bhimunipatnam will be relieved, the relieved capacity will be utilised at the cluster.

Cluster location: a) Achutapuram / Visakhapatnam District.

- APTRANSCO conducting studies for 132kV substations at Achutapuram. This SS can cater to the expected upcoming industrial Loads of VCIC cluster.
- The SS will be provided with 2 no. 80 MVA PTRS each to meet the ultimate load of the cluster and other loads.
- This sub-station will be fed from 220 kV SS Brandix.
- This sub-station will get main source from 220 kV SS Brandix, Brandix will get from 400 kV kalapaka.

Cluster location: b) Achutapuram / Visakhapatnam District.

- APTRANSCO sanctioned 132 kV SS at Narsingabilly with 2X80 MVA PTR capacity connecting between 132 kV SS Koruprolu and Brandix.
- This sub-station will cater to the cluster loads in addition to the system requirement load.
- This will have redundancy of power source from two sub-stations.

Cluster location: Nakkapally / Visakhapatnam District.

- APTRANSCO conducted studies for 132 kV substations at Nakkapally to cater to the expected upcoming industrial loads of VCIC cluster.
- The SS will be provided with 2 no. 80 MVA PTRS each to meet the ultimate load of the cluster.
- These sub-stations will be fed from 132 kV Payakaraopeta and Koruprolu 132 kV SS and in future from 220 kV upcoming SS at Koruprolu with a strong source.

Further augmentation of Power Transformer capacity is required in this area at 132 kV SS VSEZ, Kasimkota, Koruprolu, i.e. existing 31.5 MVA PTR will be replaced with 50 MVA PTR. This augmentation of PTR capacity will cater to the loads of VCIC cluster loads also.

Node II:

Cluster location: Yerpedu / Chittoor District

- APTRANSCO will conduct studies for 220/132/33 kV substation at Yerpedu to meet the loads of the cluster.

- The SS will be provided with 3 no. 160 MVA PTRS to meet the ultimate load of the cluster.
- Land of 20 Acres is required near Yerpedu. APTRANCO will purchase land from farmers if the Government land is not available. Land cost for 20 Acres is about Rs. 75.00 lakhs.
- The SS is fed from 400 kV SS Manubolu and RTPP through Rajampet SS.

Table 2.54: **Projects Identified by R & B**

Shelf of Road Projects Identified for Development as Part of VCIC with Loan Assistance of Asian Development Bank (ADB)							
S. No.	**Name of the road**	**Length (km)**	**Existing Lane**	**Proposed Improvement**	**Estimated Project Cost (Rs.in Cr.)**	**Dept.**	**Remarks**
NODE : VISAKHAPATNAM & CLUSTER : PYDI BHIMAVARM							
1	Srikakulam - Calingapatnam	33	BT - Double Lane	Two Lane with paved shoulders	215.00	(R&B) Corenet	The road connects the Cluster with Calingapatnam Port.
2	Tekkali - Bhavanapadu	22	BT - Single Lane	Two Lane with paved shoulders	143.00	(R&B) MDR	The road connects the cluster to Bhavapadu Port.
3	Kotabommali - Bhavanapadu	30	BT - Single Lane	Two Lane with paved shoulders	195.00	(R&B) MDR	The road provides alternate route to connect cluster to Bhavanapadu Port.
4	Santhabommali - Meghavaram	22	BT - Single Lane	Two Lane with paved shoulders	143.00	(R&B) MDR	The road connects the cluster to Meghavaram Port.
5	Amudalavalasa - Srikakulam	15	BT - Two Lane	Four Lane	135.00	(R&B) Corenet	This road will facilitate connectivity between the Cluster and near by major Railway Station.
NODE : VISAKHAPATNAM & CLUSTER : BHEEMUNIPATNAM							
1	Bheemunipatnam - Thagarapuvalasa	9	BT-Two Lane	Four Lane	81.00	(R&B) MDR	The road provides connectivity to National Highway from Bheemunipatnam Cluster and also connects PydiBhimavaram Cluster.
2	Bheemunipatnam - Anandapuram (via) Doratota	10	BT-Two Lane	Four Lane	90.00	(R&B) Corenet	The road provides connectivity to National Highway from Cluster.
3	Visakhapatnam Port to Bheemili (via) Beach Road	32	Two/Four Lane	Not Required	0.00	(R&B)/ GVMC	The road connects important Vizag Port to the Cluster.
NODE : VISAKHAPATNAM & CLUSTER : ACHUTAPURAM							
1	Achutapuram - Anakapalli	20	BT - Single Lane	Two Lane with paved shoulders	130.00	(R&B) MDR	The road provides connectivity from Cluster to National Highway.

continued on next page

Table 2.54 *continued*

Shelf of Road Projects Identified for Development as Part of VCIC with Loan Assistance of Asian Development Bank (ADB)							
S. No.	**Name of the road**	**Length (km)**	**Existing Lane**	**Proposed Improvement**	**Estimated Project Cost (Rs.in Cr.)**	**Dept.**	**Remarks**
2	Gajuwaka - Gangavaram port	17	BT - Four Lane	Not Required	0.00	NH	The road provides connectivity to Gangavaram Port from the Cluster through National Highway.
3	Sheelanagar - Vizag Port (via) Port main road	18	BT - Two/ Four Lane	Four Lane	45.00	NHAI/ GVMC	The road connects Vizag Port with Gangavaram port. This road improves connectivity between Cluster and two ports.
NODE : VISAKHAPATNAM & CLUSTER : NAKKAPALLI							
1	Nakkapalli - Narsipatnam	35	BT - Single Lane	Two Lane with paved shoulders	228.00	(R&B) MDR	The road connects Cluster to urban centre.
NODE : YERPEDU – SRIKALAHASTI							
1	Renigunta - Naidupeta	56	BT - Two Lane with PS	Four Lane	0.00	(R&B) NH	Yerpedu and Srikalahasti Clusters are located on this Nationa Highway. This NH connects Tirupati on one side and NH16 on the other side. The road required to be developed to four lane by GoI
2	Yerpedu - Chennur	65	BT - Two Lane	Four Lane	0.00	(R&B) NH	This road connects NH 16 through Mannavaram Industrial Area. The road required to be developed to four lane by GoI
3	Renigunta - Papanayudupet - Srikalahasti(RPK Road)	42	BT - Single Lane	Two Lane with paved shoulders	273.00	(R&B) MDR	The road connects two Clusters through Airport and industrial belt.
4	Yerpedu to RPK Road	10	BT - Single Lane	Two Lane with paved shoulders	65.00	(R&B) MDR	The road connects cluster to important industrial belt Gajulamandyam.
5	Tada - Srikalahasti Road	46	BT - Two Lane	Four Lane	414.00	(R&B) Corenet	This road connects Cluster to National Highway 16 and Sri City (SEZ) thereby connects Chennai.
6	Krishnapatnam port - Nellore via Muthukur	25	BT - Two/ Four Lane	Four Lane	350.00	(R&B) Corenet	This road connects NH 16 to Krishnapatnam Port.
		507			**2507.00**		
	Length of Total Roads identified: **507 km**						
	Length of roads already improved: **49 km**						
	Length of roads to be improved by NH: **121 km**						
	Length of roads to be improved under ADB assistance : **337 km**						

CHAPTER 3

Institutional and Regulatory Framework

Ease of Doing Business in India

Well designed regulations and implementation mechanisms are critical for realizing the full economic potential of any industrial corridor. Experience from established industrial–economic corridors highlight the importance of

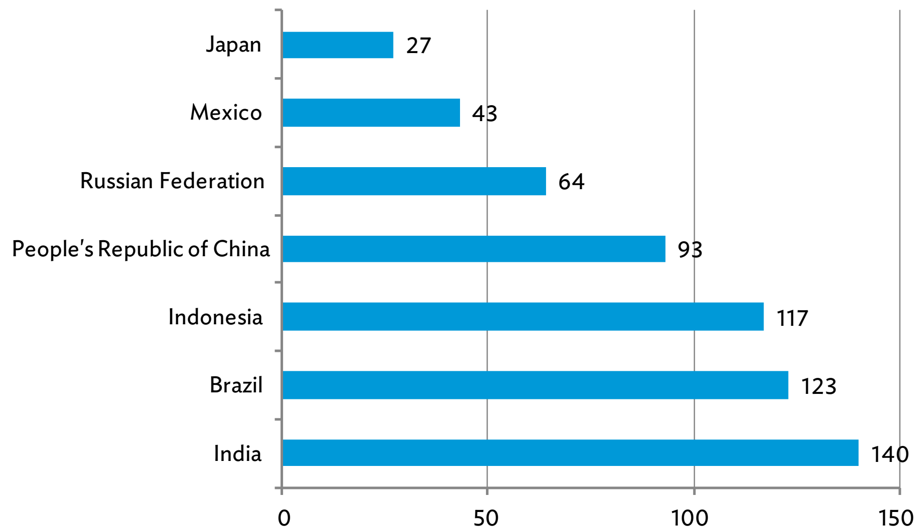
(i) simplifying regulatory compliance requirements and making the compliance process more transparent and objective,
(ii) providing a uniform regulatory compliance experience to current and potential investors irrespective of their location along the corridor and the consequent changes in jurisdiction, and
(iii) adopting suitable institutional mechanisms for coordination across multiple regulatory organizations to minimize regulatory interfaces for investors.

In India, regulatory requirements are quite complex, with the power to administer individual regulations being vested with multiple agencies and organizations at the central, state, and local government levels. Thus, a suitable institutional framework is needed for ensuring a coordinated approach.

The World Bank's Doing Business[1] ranked India 140th among 189 countries in the 2014 Ease of Doing Business rankings (Figure 3.1). For comparison, Singapore was ranked first and the United States (US) was ranked seventh, while other leading Asian economies were ranked as follows: the Republic of Korea (5), Malaysia (20), Japan (27), and Thailand (28). India trailed all other members of the so-called BRIC group of countries (Brazil, Russia, India, and the People's Republic of China). India placed among the top 50 economies in only two parameters of the Ease of Doing Business rankings: Getting Credit and Protecting Investors (Figure 3.2). For other parameters—such as Enforcing Contracts, Starting a Business, and Dealing with Construction Permits—India was among the least responsive countries on the list.

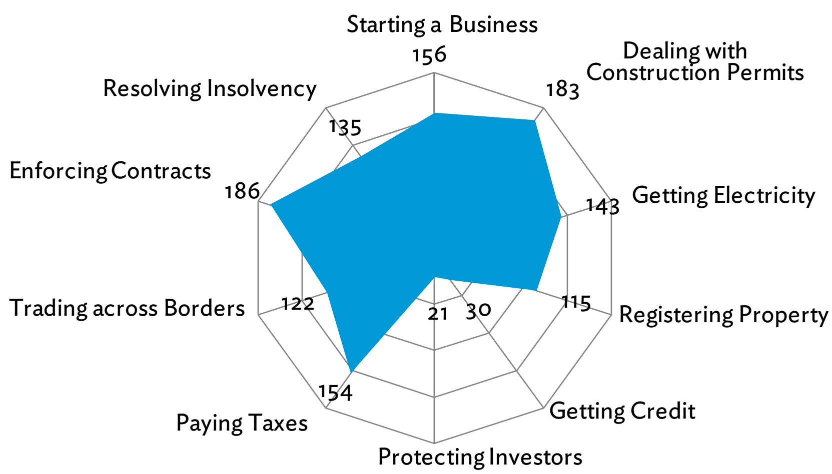
[1] World Bank. 2015. *Doing Business 2015*. www.doingbusiness.org/data/exploreeconomies/india/. Rankings for 2014 were adjusted for data corrections.

Figure 3.1: **Ease of Doing Business Rankings, 2014**



Note: Reflects revision in 2014 rankings.
Source: World Bank's Doing Business 2015.

Figure 3.2: **India's Ranking in Doing Business 2014, by Parameter**



Note: Reflects revision in 2014 rankings.
Source: World Bank's Doing Business 2015.

Improving India's standing in the World Bank's Ease of Doing Business rankings is a prerequisite for the success of any Indian industrial–economic corridor. Furthermore, it is imperative to address both the institutional and regulatory aspects of corridor development.

This chapter begins with a discussion on streamlining the institutional and regulatory framework in the VCIC. This involves a comprehensive framework for the planning, development, and management of industrial areas, urban industrial complexes, and investment regions. The discussion then moves to streamlining the business regulatory framework, which involves fostering a favorable investment climate and ensuring the smooth functioning of logistics in the VCIC.

Streamlining the Institutional Framework

Planning and Development of Industrial Areas

Over the last 10–15 years, the planning and development of industrial areas has progressed from building industrial estates with basic infrastructure to creating and servicing large-scale, complex developments. As in many other domains, the arrival of global companies, technology, and capital have opened up new possibilities and raised expectations regarding the planning, design, construction, and management of new industrial developments. To meet these expectations substantial improvements may be needed in the relevant legal and institutional arrangements.

Challenges in Planning and Development

One of the primary challenges of facilitating new industrial development is acquiring and managing the land needed. The issues and strategies related to land management are discussed in Chapter 4: Urbanization and Land Management Framework. The relevant takeaway from this discussion is the need to have enabling laws and effective institutional arrangements to facilitate land management. This requires the introduction of mechanisms such as land pooling and the revamping of land acquisition to make it more equitable.

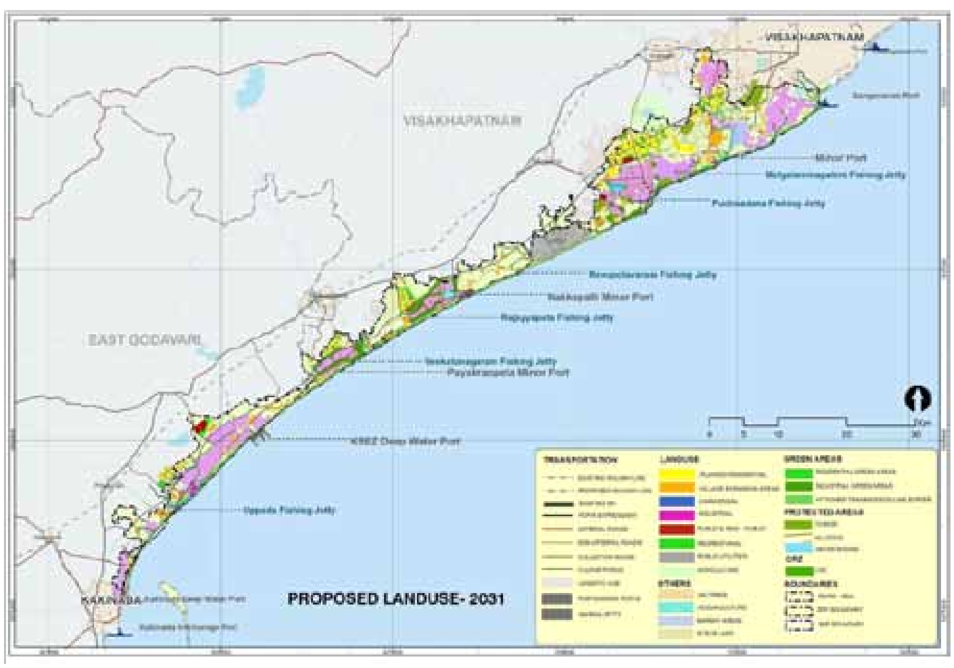
Large industrial complexes are emerging as a major element in the industrial development strategy. These include formats like the Petroleum, Chemicals, and Petrochemicals Investment Region (PCPIR); National Investment and Manufacturing Zone (NIMZ); and Special Investment Region (SIR). These require comprehensive physical planning in large areas covering anything from 20 square kilometers (km^2), such as an NIMZ, to hundreds of square kilometers, such as the Visakhapatnam–Kakinada PCPIR and Dholera SIR, which both cover more than 600 km^2. At such a scale, these complexes need to accommodate not just industries, but also a large variety of activities to support them, including large-scale utilities (e.g., power, water, wastewater, and effluent treatment), logistics, commercial facilities, hotels, offices, convention centers, workforce housing, recreational facilities, and social infrastructure. Planning for such large-scale development requires appropriate legal mandates and institutional capacities.

Existing Legal and Institutional Framework

Andhra Pradesh Industrial Infrastructure Corporation (APIIC) assembles land for industrial estates and areas primarily through land acquisition and the use of available government land. There is no dedicated legal provision for land acquisition by industries.[2] The planning of industrial estates and industrial areas is typically done by APIIC.

The Andhra Pradesh Urban Areas (Development) Act, 1975 has a provision for creating Special Development Authorities (SDAs), which has been used to create the SDA for the Visakhapatnam–Kakinada PCPIR. Under other provisions of this act, the SDA can prepare Development Plans within its jurisdiction, including a land use plan and zoning regulations. This has also been done in the case of the Visakhapatnam–Kakinada PCPIR. A very elaborate planning exercise has been carried out for the 600 km^2 jurisdiction of the PCPIR with the help of external planning consultants. The Development Plan sets forth land use zoning, plans for macro-level infrastructure, and projects for development of the region. However, the implementation of the Development Plan requires land acquisition, layout plan approvals, and building approvals by the SDA (Figure 3.3).

Figure 3.3: **Proposed Land Use Plan for Visakhapatnam–Kakinada PCPIR**



PCPIR = Petroleum, Chemicals, and Petrochemicals Investment Region.
Source: Study team compilation.

[2] Tamil Nadu has the Tamil Nadu Acquisition of Land for Industrial Purposes Act, 1997. The Karnataka Industrial Areas Development Act, 1966 has a chapter on land acquisition with special provisions for expediting the acquisition process. The Maharashtra Industrial Development Act, 1962 has similar provisions and, in fact, seems more evolved, with additional provisions for consultations with local bodies and dealing with compensation issues.

The Andhra Pradesh Town Planning Act, 1920 includes the requisite provisions for the preparation and implementation of Town Planning Schemes. A detailed study has been done by the Centre for Good Governance in Hyderabad,[3] which strongly recommended the reintroduction of Town Planning Schemes in Andhra Pradesh.

Based on available information, it seems possible to use the Andhra Pradesh Urban Areas (Development) Act, 1975 in combination with the Andhra Pradesh Town Planning Act, 1920 for the planning and development of large-scale industrial areas in VCIC.

The existing framework for the Industrial Area Local Authority (IALA) has no provisions for planning and development, and is therefore discussed in the subsequent section on Governing and Managing Industrial Areas.

Emerging Models of Planning and Development

Emerging models of industrial areas

Integrated Urban-Industrial Complexes and SIRs illustrate the direction in which planning and development of industrial areas and regions are headed in India. These mechanisms, along with examples, are detailed in Appendix 3.1.

Good planning and development is only half the job. Effective governance and management of industrial areas is an equally large challenge, and a sound institutional framework plays a critical role in ensuring good governance. Studies carried out in existing industrial areas show that service delivery and infrastructure maintenance have a major impact on the productivity of industries.[4]

Challenges in governing and managing industrial areas

Industrial areas present infrastructure management needs that are quite different from those of nearby local bodies, either urban or rural. The local body in whose jurisdiction the industrial area is located usually lacks the capacity to respond to these needs. This is understandable considering that new industrial areas tend to be located in rural areas or the peripheries of urban areas. This capacity issue has been recognized by many states which have responded by creating constitutional enclaves for the industrial area, exempting them from the local body's jurisdiction for specific functions and enabling them to be managed by more appropriate institutional entities.

3 Centre for Good Governance. 2010. *Managing Urban Growth Using the Town Planning Schemes in Andhra Pradesh*. Hyderabad.

4 B.R. Balachandran. Studies on Amritsar–Kolkata Industrial Corridor (unpublished).

However, taking the industrial area out of the local body's jurisdiction is not enough. A new institutional mechanism needs the capacity to maintain the infrastructure and deliver services in a reliable and competitive manner.

Existing Legal and Institutional Framework

Industrial Area Local Authority

The Government of Andhra Pradesh had been cognizant of the issues related to the management of industrial areas for decades. In 1994, the government amended several acts to create the Industrial Area Local Authority (IALA) system to give local authority status to the APIIC in the industrial areas it creates. This was done to remedy the situation in which local bodies—despite collecting revenues like property taxes, building approval fees, and transfer duties—were unable to provide services to industrial areas. The amended acts included (i) Section 147 of the Andhra Pradesh Panchayati Raj Act, 1994; (ii) Section 389-B of the Andhra Pradesh Municipalities Act, 1965; and (iii) Section 679-F of the Hyderabad Municipal Corporation Act, 1955.

Following these amendments, the Municipal Affairs and Urban Development Department and the Panchayati Raj and Rural Development Department notified the APIIC Industrial Areas falling under Municipalities, Municipal Corporations, and Gram Panchayats, and directed APIIC to exercise the statutory powers of local bodies in these Industrial Areas (e.g., assessment, levy, demand and collection of property and advertisement taxes, sanction of building permits, removal of encroachments, and management and maintenance of civic services), subject to the condition that APIIC must remit 35%–50% of the taxes and other revenues collected to the local bodies concerned. APIIC nominates its officials to serve as the Executive Authority under the relevant acts to perform the statutory functions of the local bodies within the Industrial Areas. More than 200 Industrial Areas (phase-wise), Housing Complexes, Mini-Industrial Estates, and Commercial Complexes are functioning as IALAs.

Industrial Areas Service Societies

To promote local self-governance, the system evolved further with the introduction of Industrial Areas Service Societies (IASSs), which involve the tax-paying community of industrialists and other users in the management and maintenance of these areas. The IASSs registered under the Andhra Pradesh (Telangana Area) Public Societies Registration Act 1350F; the Societies Registration Act, 1860; and the Andhra Pradesh Societies Registration Act, 2001 have been nominated by APIIC as nodal agencies to assist in the collection of property taxes and maintenance of civic services. The managing committee of an IASS consists of office bearers (e.g., chairman, secretary, joint secretary, and treasurer), other elected members, and ex-officio members (e.g., Zonal Manager or Dy. Zonal Manager of APIIC, District Industries Center officials, Andhra Pradesh Pollution Control Board, Parent Local Body, and AP Transco).

Revenues

The revenues accruing to the IALAs and IASSs include

- property tax (65% retained, 35% to local body),
- building permit fee (90% retained, 10% to local body),
- fee for installation of plant and machinery (90% retained, 10% to local body),
- duty on transfer of property (100% retained),
- mutation fee (100% retained),
- advertisement tax (100% retained), and
- encroachment fee (100% retained).

Opportunities for Further Improvement

Based on a preliminary assessment, there seem to be opportunities for improvement in the IALA system. The existing model is based on the functioning of local bodies. New industrial developments may utilize facilities management companies to run services. A more diverse revenue base, including various types of user charges, should also be considered. In addition, the management of integrated developments like Sri City may require a different sort of management capacity since a diverse range of land uses are involved.[5]

Emerging Models of Governance and Management

Regional Development Authority

Appendix 3.1 describes the Regional Development Authority (RDA) created under the SIR Act of Gujarat. The act empowers the RDA not just to plan and develop the Industrial Areas and Investment Regions, but also to operate and maintain the infrastructure, levying the necessary taxes, fees, and charges. The act also allows the RDA to enter into agreements with the government or private sector entities for infrastructure maintenance and service delivery.

Jamshedpur Utilities and Services Company

The TATA Group website describes Jamshedpur Utilities and Services Company (JUSCO) as India's only comprehensive urban infrastructure service provider. In 2004, the Town Services Division of Tata Steel was spun off as a separate company. JUSCO's areas of operations include the following:

- engineering procurement and construction (e.g., planning, development, and maintenance of township infrastructure),
- power services division (e.g., operation and maintenance of power infrastructure and distribution of power), and

---

[5] There has been at least one instance where IALA areas were merged back into the local body (Greater Hyderabad Municipal Corporation) because the IALA was unable to provide civic services satisfactorily to the non-industrial developments in their jurisdiction. Available at http://timesofindia.indiatimes.com/city/hyderabad/GHMC-to-take-over-14-IALA-areas/articleshow/7363718.cms

- integrated township management (e.g., providing civic and municipal services in an integrated manner in a full-fledged municipal area).

Since its creation, JUSCO has been winning contracts, awards, and accolades. JUSCO has been maintaining Jamshedpur's water requirements, waste disposal, sewers, power, health services, roads, and parks, among other services, to the satisfaction of the city's 700,000 citizens living in an area of 64 km^2. According to JUSCO's website, the municipal water and sanitation market is estimated at INR100,000 million and is growing at the rate of 6%–8% per year. Similarly, the industrial sector market is estimated to be worth between INR100,000 million and INR120,000 million, and growing at 5%–7% per year.[6] This observation points to the opportunity for JUSCO-like companies to offer facilities management services to developments like Sri City and Mahindra World City.

Comprehensive Framework for New Industrial Areas, Urban-Industrial Complexes, and Investment Regions

Andhra Pradesh already has a legal and institutional framework in place for the planning, development, and management of industrial areas. However, it is not bound together in a cohesive and synergistic manner. The situation was quite similar in Gujarat before the SIR Act. One of the achievements of the SIR Act has been its effective leveraging of the existing legal and institutional framework. This includes the Gujarat Town Planning and Urban Development Act, 1976; the Gujarat Infrastructure Development Act, 1999; and others. Therefore, it should be a goal to design a comprehensive legal and institutional framework for managing the planned industrialization and urbanization of Andhra Pradesh along the lines of, if not more advanced than, the SIR system of Gujarat.

Essential Features of a Comprehensive Framework

Aspects of a comprehensive legal and institutional framework for the planning, development, and management of new industrial areas, urban-industrial complexes, and investment regions are detailed in the following paragraphs.

Institutional structure

The new legislation should mandate the establishment of (or designate an existing entity as) the Apex Authority for decision-making in the establishment of new industrial areas, urban-industrial complexes, and investment regions. It should also mandate the establishment of (or designate existing entities as) local authorities for each industrial area. The act should provide for flexibility in engaging government and private entities for performing specific roles of planning, development, and management through the delegation of power or other contractual arrangements as appropriate.

---

6 G. Kamath. 2010. The Business of Urbanity. January. Available at http://www.tata.co.in/company/articlesinside/r4XuV0EAk5Q=/TLYVr3YPkMU

Planning and development

The comprehensive legislation should have a detailed section on the planning and development of new industrial areas, urban-industrial complexes, and investment regions. This section should cover the following:

- Macro-level planning of investment regions and urban-industrial complexes
  - » Development Plans (land use plans)
  - » Infrastructure plans
  - » Project formulation for trunk infrastructure

- Micro-level planning of industrial and urban areas
  - » Industrial layouts
  - » Urban design plans
  - » Land pooling or other land assembly mechanisms
  - » Detailed infrastructure design
  - » Project formulation for area-level infrastructure

Governance and management

The new legislation should address the governance and management of new industrial areas, urban-industrial complexes, and investment regions:

- **Governance.** Creating a governance system for new industrial areas, urban-industrial complexes, and investment regions involves striking a meaningful trade-off between the imperatives of efficient service delivery for industrial development and the constitutional mandate of democratic self-governance. The IALA experience and experiences in other parts of the country indicate that a professional management is needed. Such professional management, as in the case of JUSCO in Jamshedpur, will eventually drive utilities management excellence in the rest of the country. Therefore, the new legislation should empower the institutional entities created or designated under its mandate to create governance enclaves that foster such excellence. The powers and responsibilities of the new or designated entities should include
  - » planning and development,[7]
  - » tax collection,[8]
  - » provision of utility services,
  - » user charges for utilities,[9]
  - » Single Window for building approvals and other compliances,
  - » administrative services for registration,
  - » fees and charges for approvals and administrative services,
  - » start-up facilitation for industries,
  - » compliance monitoring and punitive action where required, and
  - » removal of encroachments.

---

7 According to the 73rd and 74th Constitutional Amendments, planning is a function of a democratically elected body. However, there is adequate precedent for the delegation of this power to a statutory local authority that is not democratically elected.

8 Taxes can be levied only by a democratically elected body. However, the task of collection can be delegated to a local authority, as in the case of IALA.

9 Service provisions against user charges can be made by a statutory local authority that is not democratically elected.

- **Infrastructure maintenance and service delivery.** It is anticipated that new industrial areas, urban-industrial complexes, and investment regions will require extensive infrastructure networks both for the industrial and non-industrial developments. It is imperative that the new law empowers the Apex Authority and local authorities to engage in various agreements with utility service providers.[10]
- **Setting up new industries.** The new legislation should specify the approval system for setting up new industries, industrial parks, SEZs, and NIMZs. In the SIR Act, this power rests with the Apex Authority. The Government of Andhra Pradesh can decide on a similarly centralized system. Alternately, a decentralized method of facilitation can be considered and calibrated to the size and complexity of the project.

Leveraging existing legal and institutional frameworks

The key features of the proposed new legislation have been discussed above. There are two options for drafting these sections:

- **Cross-reference existing legislation, invoking the provisions therein.** The advantage of this option is the leveraging of existing institutional capacities. The disadvantage is that many provisions required for future developments may not be present in existing legislation.
- **Define planning and implementation mechanisms in the new legislation.** The advantage of this option is that new concepts, mechanisms, and institutional formats can be introduced to modernize the process of planning, developing, and managing the new industrial areas, urban-industrial complexes, and investment regions. However, the challenge is to conceptualize an approach in a reasonably short period of time and operationalize the new mechanisms from scratch.

Streamlining the Business Regulatory Framework

In addition to issues of land availability and infrastructure development, which have been addressed in other parts of this report, there are two key regulatory dimensions that also need to be addressed:

(i) **Investment climate.** A favorable investment climate refers to the ease of securing requisite clearances, licenses, and approvals from the relevant government agencies for setting up businesses, as well as renewals during the normal course of business operations.

(ii) **Streamlining logistics.** Logistics both at the intra- and inter-state levels should be streamlined through harmonized tax policies and inspection procedures.

---

[10] Agreement formats for infrastructure development and service delivery could include Build, own, operate (BOO), Build, own, transfer (BOT), Build, own, operate, transfer (BOOT), Build, own, lease, transfer (BOLT), Engineering, procurement and construction (EPC) contracts, management contracts, and other contracts with all elements of asset lease, ownership, pricing of service delivery, among others.

(iii) The following sections highlight key findings related to these two key dimensions based on a review of the existing business regulatory framework and analysis of feedback from concerned stakeholders (e.g., entrepreneurs, industry associations, government officials).

Investment Climate

Making the investment climate conducive for the establishment and operation of industrial undertakings involves simplifying processes, reducing timeframes, and ensuring greater transparency in seeking the clearances and compliances required to set up new units and expand existing units, and operate a business in its normal course. The focus of the current study is on clearances and compliances associated with state and local government departments and agencies. Clearances and compliances associated with central government agencies—such as the Ministry of Corporate Affairs (name availability, director identification number), Central Board of Direct Taxes (Permanent Account Number), and Department of Industrial Policy and Promotion (Industrial Entrepreneur Memoranda)—have not been assessed as part of the current exercise. This review comprised interactions with concerned stakeholders—including entrepreneurs, industry association representatives, and officials of state departments and agencies that grant clearances and monitor compliance—to validate feedback and generate proposed recommendations.

Key Issues and Recommendations

Key issues related to the ease of securing clearances and ensuring compliance, both prior to and after the commencement of operations, are presented in Table 3.1, along with recommendations for (i) changes in policy or the institutional framework, or (ii) process simplification.

Ease of Logistics

Logistics, in the context of industrial–economic corridors, refers to

(i) intra-state movement of inputs and outputs across separate administrative jurisdictions such as districts,
(ii) inter-state movement of goods, and
(iii) movement of goods across international borders.

Table 3.1: **Securing Clearances and Ensuring Compliance: Key Issues, Recommendations, and Proposed Solutions**

	Key Issues	Recommendations and Proposed Solutions
Policy Institutional Framework	***Prior to commencement***	
	• The existing role of the Single Window mechanism in many states is limited, with applicants having to make multiple visits to the concerned competent authorities.	• The roles of the appropriate committees under the Single Window system need to be clearly defined by the competent authorities. • The role and capacities of the Single Window nodal agency need to be augmented and all interactions with applicants should ideally be restricted to the nodal agency, other than technical inspections by the competent authority(s), wherever applicable.
	• Complete set of clearances required for establishing unit not covered under the Single Window system	• Need for coverage of all clearances requiring one-time registration and approval under the Single Window system (See Appendix 3.3 for details)
	• Industrial units setting up operations in industrial parks and estates are required to separately secure individual clearances, even though some of these clearances have already been secured by the park developer for the industrial park overall. For example, Consent for Establishment (CFE) and Consent for Operation (CFO) under the Water Act are to be obtained by park occupants, even though the same is issued to the occupants based on the common wastewater treatment facilities set up by the park developer and already approved by the State Pollution Control Board.	• Industrial units are to be exempt from securing specific clearances that have been secured by the park developer. For example, CFE and CFO under the Water Act are to be issued to park occupants via self-certification, based on CFE and CFO issued to the park developer by the State Pollution Control Board for the wastewater treatment facility.
	• Non-polluting industries, as per classification of the respective State Pollution Control Board, are still required to secure CFE and CFO under the Water Act and the Air Act.	• As has been implemented in some states, for example, in Andhra Pradesh where it is applicable only to small and medium-sized enterprises, application receipt for CFE and CFO can be construed as clearance for all units (irrespective of scale of operations) in industries under the Green category as notified by the Central Pollution Control Board vide notification F. No. B-29012/1/2012/ESS-1526 dated 4 June 2012.
	• Limited empowerment and financial and technical capacities of the state-level nodal agency inhibit the ability to deliver its mandate effectively.	• Society structure under the Societies Registration Act, 1860 may be adopted for state-level nodal agency (e.g., Gujarat and Karnataka) to enable adequate financial and administrative autonomy. • Governing board of the nodal agency to have senior-level state administrative functionaries to ensure support from key departments.

continued on next page

Table 3.1 *continued*

	Key Issues	Recommendations and Proposed Solutions
Policy Institutional Framework		• Flexibility to engage skilled resources on contractual basis for providing escort services to strategic investors and monitoring IT-enabled systems
	• Absence of a single point of contact with a point of presence at the Industrial Park for obtaining approvals for setting up and expansion of industrial units in industrial parks and estates	• Special committees for designated industrial parks and estates comprising officials with adequate empowerment drawn from all concerned government agencies to give approvals for setting up units in industrial parks and estates
	Post-commencement of operations (normal course of business)	
	• Inadequate support from municipality in upkeep of supporting urban infrastructure within industrial parks and areas (e.g., roads, street lights) as well as inadequate municipal service delivery levels	• Local government regulations to include provisions for facilitating the granting of local authority status to all park developers, including private sector developers (e.g., Andhra Pradesh Industrial Infrastructure Corporation/APIIC) • Empowerment of park developer to exercise statutory powers of a local body in notified industrial areas, with revenue sharing arrangement with concerned local body (See Appendix 3.4 for details.)
	• Multiplicity of inspections (even by officials from the same department like Labour), with absence of a mechanism for ensuring coordination • Absence of checklists and information to be furnished as part of inspections	• Constitution of a state-level committee with officials from concerned government agencies with requisite empowerment to ensure coordination for joint inspections, wherever applicable, with pre-defined checklists
Process Simplifications	***Prior to commencement***	
	• Multiple information requests by concerned government agencies as part of Single Window clearance processing, mostly close to expiry of processing time limits and often not relevant, result in delays in application processing.	• Introduction of pre-scrutiny meeting as part of Single Window system at time of application submission to reduce processing time after application acceptance: o Detailed checklist beyond which no information can be requested o Information requests to be made only once within 1 week of receipt of application, like in Rajasthan, or else it is concluded that no information is required
	• Sequential processing in case of dependencies on clearances, resulting in delays in processing; for example, processing for approval of building plan is initiated after receipt of factory plan approval, Consent for establishment (CFE) from state Pollution Control Board (PCB), No-objection certificate (NoC) from Fire Services.	• Conditional approval issued by the respective competent authority, subject to clearance by other concerned agencies • Nodal agency to collate such inter-dependent approvals and place before respective committee for issue of requisite clearance

continued on next page

Table 3.1 *continued*

	Key Issues	Recommendations and Proposed Solutions
Process Simplifications	• Delays in securing clearances where no follow-up inspections are required as per applicable regulation (e.g., registration for professional tax)	• Introduction of spot approvals for identified clearances not requiring follow-up inspection at the time of pre-scrutiny, which can form the basis for subsequent registration
	• Limited transparency for investors on status of processing	• Provision for investors to track application status through IT-enabled system, with text message or email generation at each status change like in case of Gujarat
	• Absence of real-time tracking of application status by concerned district and state level committees	• Introduction of IT-enabled system with dashboards for respective committees to monitor clearances by respective agencies, like in case of Gujarat
	Post-commencement of operations (normal course of business)	
	• Requirement for same set of information by multiple government agencies at different points in time • Additional administrative burden for entrepreneurs	• Deployment of IT-enabled application for capturing all application-related information, with single point data submission by applicant; IT system generates custom reports and application forms for the competent authorities based on their individual requirements • Provision of online repository of information, with relevant information to be made available to respective government agency based on requirements, like in cases of Rajasthan and Haryana, for labor-law-related renewals
	• Delays in inspections on account of shortage of staff within respective government agency	• Empanelment of reputed third party service providers, wherever permissible as part of underlying regulations, for registration renewal, like in the case of Punjab, for boilerplate registration renewal
	• Delays in incentive disbursement	• Operationalization of online systems through which industries can apply for sanctions of specific incentives and track the same, like in the case of Gujarat

Source: Study team analysis.

Regulations governing the movement of goods across international borders primarily fall under the jurisdiction of central government agencies like customs authorities, drug control authorities, and quality certification inspection agencies, which have not been assessed as part of the current exercise.

Key Issues and Recommendations

Based on a review of applicable regulations governing the intra- and inter-state movement of goods, and feedback from entrepreneurs, we have identified the following key issues and associated recommendations in Table 3.2.

Table 3.2: **Key Issues and Recommendations on Movement of Goods**

	Key Issues	Recommendations and Solutions
Policy Institutional Framework	***Intra-state movement of goods***	
Policy Institutional Framework	• Multiplicity of state-level regulating and enforcement agencies with each being responsible for supervising the movement of goods in line with their applicable regulations (See Appendix 3.5 for details.) • Leads to transit delays due to detention at multiple check-posts and inspections by multiple regulators	• The creation of integrated check-posts at borders from among the check-posts of state enforcement agencies, like in Andhra Pradesh, which has established ICPs involving multiple state governments, is needed. This should be accompanied by the requisite institutional mechanisms to ensure coordination among the respective enforcement agencies at the state-level (See Appendix 3.6 for details of the institutional framework adopted in Canada for facilitating the movement of goods.) • This is expected to (i) result in a significant reduction in vehicle clearance times and (ii) save carriers from harassment in moving from one authority's check-post to another.
Policy Institutional Framework	***Inter-state movement of goods***	
Policy Institutional Framework	• Individual state check posts at borders between 2 states within close proximity to each other lead to multiple inspections focusing on same information and / or documents, resulting in delays and user inconvenience • Absence of uniformity in the levy of an entry tax on goods across states is resulting in trade flow distortions. For example, Andhra Pradesh has abolished the entry tax on goods, whereas an entry tax is still applicable in neighboring states like Tamil Nadu, Madhya Pradesh, and Odisha. • Entry tax rates on goods vary across states, including goods- and area-based tax exemptions.	• Exporting and importing states check-posts that are located within a couple of kilometers of each other should be integrated, with institutional mechanisms in place for capturing and sharing data of mutual interest. This would also ensure joint manning and common inspection by both states at the border, thus reducing stoppage time and improving user experience. • Rationalization of state VAT and entry tax structures across participating states, including goods- and area-based tax exemptions • With the unified tax regime in the form of a goods and service tax (GST) expected to be enforced shortly, states need to strengthen their preparedness and work together to put in place an enabling policy, legal, institutional, and operational framework to minimize rate and structural differences.
Policy Institutional Framework	• Differential state value-added tax (VAT) rates for the same commodity distort trade flows on account of price differentials. For example, food grains such as rice and pulses attract a 6% tax in Andhra Pradesh as compared to zero tax in Tamil Nadu, Karnataka, and Maharashtra; and bread is taxed at 5% in Andhra Pradesh while it is exempt in Tamil Nadu.	

continued on next page

Table 3.2 *continued*

	Key Issues	Recommendations and Solutions
Process Simplification	***Inter-state movement of goods***	
	• Participating states have their own set of forms and processes with no uniformity, resulting in the dealer spending substantial time and effort complying with regulations. For example, for road permits, Andhra Pradesh requires Form X or 600, Odisha requires VAT 402/402 A, and Madhya Pradesh requires Forms 49 and 50.	• Adoption of uniform processes and procedures, in terms of common waybill format and common platform for generating waybills, with respect to the movement of goods in the corridor • Expected to lead to a reduction in compliance costs for traders and ensure higher revenues by curbing tax evasion through the sharing of inter-state trade-related data
	• E-road permit systems across state are not integrated with each other, thus limiting the scope for the seamless sharing of inter-state trade-related data between states.	

Source: Study team analysis.

Corridor Management: Cross-Cutting Issues

There are two types of regulatory issues that need to be addressed as part of corridor management, those which are specific to a particular state (e.g., Single Window system) and those which involve more than one state (e.g., transit across state borders).

For state-specific issues, it is proposed that a minimum baseline level of service delivery be incorporated as a pre-condition for participation in the Corridor Development initiative. In return, the Government of India's Corridor Development Authority may support the state government with suitable financial and technical support to achieve minimal regulatory compliance standards. A representative list of priority actions to be implemented by the state governments is given below.

(i) **Improving investment climate** through the establishment of
- institutional structures empowered to accord clearances and approvals through a Single Window system prior to business commencement (e.g., ventures in industrial areas);
- IT-enabled systems that ensure (a) tracking of time required for government departments to give requisite clearances, (b) updates to entrepreneurs on status of new business application, and (c) tracking of time required to apply incentives as per applicable policies and regulations;
- joint inspections based on pre-defined checklists and with provisions for entrepreneurs to furnish the requisite information through IT-enabled systems;
- delegation of powers providing urban services in industrial areas to respective developers through changes to requisite regulations; and
- institutional mechanisms to address grievances of investors.

(ii) **Facilitating ease of logistics** through
- the harmonization of tax rates and policies providing goods- and area-based tax exemptions to ensure uniformity across participating states;

- the establishment of integrated check-posts involving multiple state government departments, instead of separate departmental check posts at the inter-state borders,
- joint manning and common inspections at inter-state borders by officials from concerned state governments; and
- setting up institutional mechanisms to address the grievances of entrepreneurs.

In addition, for all issues involving more than one state, a suitable institutional mechanism is needed with representatives from concerned departments and agencies of the involved state governments. This body can be mandated to (i) identify priority actions to be taken by respective agencies and departments, (ii) monitor progress of implementation on a periodic basis, and (iii) redress the grievances of industrial units that require multi-state coordination.

The Corridor Management Authority proposed by the Department of Industrial Policy and Promotion (DIPP) needs to play a key role in facilitating the institutional mechanisms for addressing inter-state issues listed above. Additional roles for the Corridor Management Authority could include

- planning industrial corridors and associated capital investments, while ensuring institutional funding from lenders and multi-lateral funding agencies, among others;
- developing consensus on projects to be undertaken as part of the corridor in each of the participating states, including infrastructure development for last-mile connectivity, development of greenfield ports, and expansion of existing ports, among others;
- capital budgeting for identified projects for each of the corridors;
- project management with a focus on timely implementation of identified projects through coordination with the central and state governments to remove any bottlenecks;
- establishing a mechanism for resolving the grievances of investors and entrepreneurs; and
- managing toolkits and information-sharing to ensure the replication of best practices across individual corridors.

Appendix 3.1: Emerging Models of Planning and Development

Emerging models

Two emerging models are described in this Appendix for the purpose of illustrating the direction in which planning and development of industrial areas and regions is headed.

Integrated Urban-Industrial Complexes

One genre of industrial areas that is emerging in many parts of India, modeled on international counterparts, is an integrated development model that includes industrial, commercial, and residential development along with supporting infrastructure for each type of land use. Two examples are very briefly described here: Sri City and Mahindra World City.

Sri City

Located at Satyavedu on the border of Chittoor District and Nellore District, Sri City is an integrated development consisting of a special economic zone (SEZ), domestic tariff zone (DTZ), and a free trade and warehousing zone (FTWZ). According to publicly available information, the SEZ covers 6,000 acres and the total development covers over 100 square kilometers (km^2), or about 25,000 acres. The proposed development (much of it already in implementation) includes high quality infrastructure to support a wide range of industries (e.g., roads, power, telecommunications, water, sewerage, and other utilities),

Figure 3.4: **Master Plan for Sri City**

Source: Study team compilation.

logistics, residential development (e.g., workforce housing, apartments, and high-end villas), commercial development (e.g., offices, shopping, and hotels), recreational centers (e.g., parks, gardens, and golf course), social infrastructure (e.g., schools, higher education, health centers, and hospitals), and facilities for safety and security (Figure 4).

Mahindra World City

Mahindra World City is a joint venture of TIDCO and Mahindra Lifespace Developers Limited set on 1,500 acres in Chengalpattu Taluk of Kancheepuram District at an estimated project cost of about INR350 *crores*. This industrial complex also includes SEZs for information and communication technology, auto and apparel, housing, and social infrastructure. A total of 47 leading multinational and Indian companies are operating in this park, providing employment for about 30,000 persons. The project is situated next to a railway line connecting to Chennai, with regular suburban train service to the city. The railway station is built and maintained by MHC. The infrastructure is high quality and the overall environment is very pleasant. Interestingly, the land outside Mahindra World City is developing in a complementary manner with shops and restaurants, among other attractions (Figure 3.5).

Figure 3.5: **Mahindra World City Layout Plan and Modern Railway Station**

Source: Study team compilation.

Both examples above were the result of effective partnership between government and the private sector, the latter playing the lead role in planning and development, and both have been successful in attracting investments from leading national and global industries. These examples can provide a template for future industrial development. Although industrial areas meant for hazardous industries would need a different arrangement, with the non-industrial areas being located at a safe distance and connected by a convenient transportation system.

There are two essential elements that need to be taken into consideration:

- **Comprehensive and integrated physical planning and design.** The quality of the environment achieved in such projects has been possible only because of the holistic nature of planning and design, which combines the skills of industrial area planning and infrastructure planning with urban planning, urban design, and landscape design.

- **The role of a master developer.** The planning, development, and management of such integrated complexes are emerging as specialized domains of expertise. It is in the interest of governments to promote the growth of private sector enterprises capable of fostering these domains of expertise and delivering services in an entrepreneurial and competitive manner.

Investment regions (SIR in Gujarat)

As mentioned above, an emerging genre of new development involves the planning and development of large investment regions covering hundreds of square kilometres. One of the most recent and interesting formats is the SIR in Gujarat. In 2009, the Government of Gujarat enacted the Gujarat Special Investment Region Act to provide for (i) the establishment, operation, regulation, and management of large Investment Regions and Industrial Areas in the State of Gujarat; (ii) their development as global hubs of economic activity supported by world class infrastructure, premium civic amenities, centers of excellence and proactive policy framework; (iii) and the establishment of an organizational structure with this purpose. Under the act, the Gujarat Infrastructure Development Board (GIDB) was designated as the SIR Apex Authority. The act provides for Industrial Areas (50–100 km^2) and Investment Regions (more than 100 km^2) to be delineated and declared as SIRs. For each SIR, the legislation creates a governance enclave under a Regional Development Authority (RDA), with all RDA members nominated by the state government.

Planning and development of the SIR

The RDA has the following major functions:

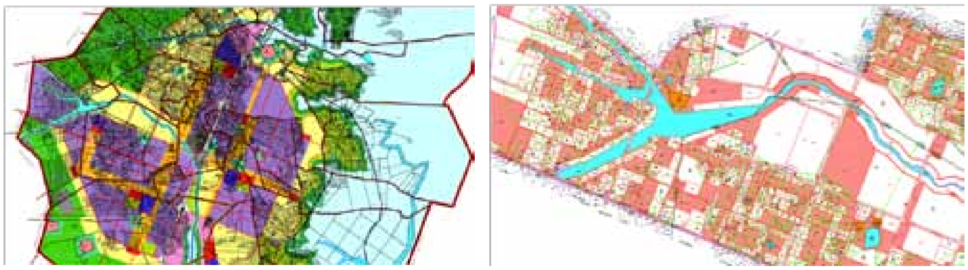
- undertake planned development, regulation, and management of the SIR and its periphery;
- prepare and implement the Development Plan (land use planning at macro level) and Town Planning Schemes (land pooling at micro level) for the SIR area;
  - » The SIR Act specifies that the provisions of the Gujarat Town Planning and Urban Development Act, 1976 shall, *mutatis mutandis*, apply with respect to the Development Plans and Town Planning Scheme, thus effectively bringing the entire urban planning and urban development process under the SIR Act.
  - » Approval of Development Plans and Town Planning Schemes is to be done by the Apex Authority (GIDB).
- provide for civic amenities in the SIR and levy fees and charges for the same.

The use of land pooling through Town Planning Schemes ensures that the original land owners retain up to 50% of their land holding, if they so desire, and enables them to participate in and benefit from the development of the SIR (Figure 3.6).

Setting up Units and Amenities in the SIR

The Apex Authority (GIDB) is designated as the single point of contact for starting an economic activity or setting up a unit, amenity, or infrastructure in the SIR. The RDA's role in this regard is to provide land and services upon approval by the Apex Authority. The units and amenities of SEZs in the SIR are governed under the SEZ Act. The SEZ Developer has to conform to the proposals of the SIR Development Plan.

Figure 3.6: **Dholera SIR Development Plan and Town Planning Scheme**



Dholera SIR Development Plan (about 600 km^2 developable out of a total of 900 km^2)

Dholera SIR Town Planning Scheme (about 6,600 hectares)

Source: Study team compilation.

Infrastructure Projects

The act contains several provisions to enable infrastructure development. The state government may set up or designate agencies, including companies, and assign to them powers and functions relating to project development and implementation. For the development of infrastructure and amenities in the SIR, the RDA may transfer its assets to a government company or a private entity where there is a concession agreement. Such assets may include land granted by the state government, its agencies, or a local authority. The RDA may enter into agreement with a developer for any project or development in the SIR. An interesting provision for encouraging participation of land owners is that a person or entity with enough land in the SIR may propose integrated area development therein.

Administration and development of SIR the periphery

The state government may declare up to three kilometers of the outer area adjoining the SIR to be the periphery of the SIR. On declaration, the RDA of the SIR shall also be the RDA for the periphery and the powers and functions of the RDA and the Apex Authority shall extend to it. The RDA may then prepare a separate Development Plan to regulate the periphery. This provision ensures that haphazard development can be prevented.

Advantages of the SIR system

The SIR system builds on an urban development system of Development Plans and Town Planning Schemes that has been operating fairly successfully in Gujarat for many decades, especially in the last two decades. It also builds on an equally successful system of facilitating infrastructure development through public–private partnerships under GIDB. Another key advantage is that the SIR system subsumes the urban development function for new industrial areas or regions under the GIDB and GIDC. The SIR system leverages existing institutional capacity in the state by utilizing the available resources of serving and retired town planners in the government. Other handy resources available are the consultants in the private sector who have experience preparing Development Plans and Town Planning Schemes in Gujarat's cities.

Appendix 3.2

Table 3.3: **Regulations Assessed for Streamlining the Investment Climate**

Nature of Clearance	Applicable Acts, Rules, and Regulations
Environment and Pollution	• Water (Prevention and Control of Pollution) Act, 1974; Andhra Pradesh Water (Prevention and Control of Pollution) Rules, 1976 • Air (Prevention and Control of Pollution) Act, 1981; Andhra Pradesh Air (Prevention and Control of Pollution) Rules, 1982 • Environment Protection Act, 1986; Hazardous Wastes (Management, Handling, and Transboundary Movement) Rules, 2009; Plastic Waste (Management and Handling) Rules, 2011
Safety	• Indian Boilers Act, 1923; Indian Boiler Regulations, 1950; Andhra Pradesh Boilers Rules, 1967 • Andhra Pradesh Fire Service Act, 1999; Andhra Pradesh Fire and Emergency Operations and Levy of Fee Rules, 2006 • Indian Explosive Act 1884; Explosives Rules, 1983
Taxation	• Central Sales Tax Act, 1956; Central Sales Tax Rules, 1957 • Andhra Pradesh Value Added Tax Act, 2005; Andhra Pradesh Value Added Tax Rules, 2005 • Andhra Pradesh Tax on Professions, Trades, Callings, and Employments Act, 1987; Andhra Pradesh Tax on Professions, Trades, Callings, and Employments Rules, 1987
Land and Building	• Andhra Pradesh (Andhra Area) Town Planning Act, 1920 • Andhra Pradesh Urban Areas (Development) Act, 1975 • Andhra Pradesh Municipalities Act, 1965 • Andhra Pradesh Municipal Corporations Act, 1994 • Visakhapatnam Municipal Corporation Act, 1979 • Vijayawada Municipal Corporation Act, 1981 • Andhra Pradesh Building Rules, 2012 • Andhra Pradesh Panchayat Raj Act, 1994; Andhra Pradesh Gram Panchayat Land Development (Layout and Building) Rules, 2002 • Andhra Pradesh Agricultural Land (Conversion for Non-Agricultural Purposes) Act, 2006; Andhra Pradesh Agricultural Land (Conversion for Non-Agricultural Purposes) Rules, 2006 • APIIC Industrial Parks Allotment Regulations, 2012
Electricity	• Indian Electricity Act, 2003; Indian Electricity Rules, 1956 • Central Electricity Authority Regulations (Measures Relating to Safety and Electrical Supply), 2010
Labor and Employment	• Factories Act, 1948; Andhra Pradesh Factory Rules, 1950 • Contract Labor (Regulation and Abolition) (Andhra Pradesh Amendment) Act, 2003; Andhra Pradesh Contract Labor (Regulation and Abolition) Rules, 1971 • The Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979 • The Andhra Pradesh Shops and Establishments Act, 1988; Andhra Pradesh Shops and Establishments Rules, 1990

continued on next page

Table 3.3 *continued*

Nature of Clearance	Applicable Acts, Rules, and Regulations
	• Payment of Bonus Act, 1965; Payment of Bonus Rules, 1975 • Payment of Gratuity Act, 1972; Payment of Gratuity Rules, 1973 • Payment of Wages Act, 1936 • Minimum Wages Act, 1948; Minimum Wage Rules, 1950 • Industrial Dispute Act, 1947 • Industrial Employment (Standing Orders) Act, 1946; Industrial Employment Central Rules, 1946 • Apprentices Act, 1961; Apprentices Rules, 1992 • Maternity Benefit Act, 1961; Maternity Benefit Rules, 1966
Sector-specific	• Drugs and Cosmetics Act, 1940; Drugs and Cosmetics Rules, 1945 • Andhra Pradesh Excise Act, 1968; Andhra Pradesh Excise Rules; Andhra Pradesh Distillery Rules, 1970 • Andhra Pradesh Petroleum Products (Licensing and Regulation of Supplies) Order, 1980

Source: Study team analysis.

Appendix 3.3: List of Clearances to be Considered for Inclusion in the Single Window Framework at the State Level

Pre-establishment stage:

- approval for conversion of land from agriculture to non-agriculture use as required
- approval for allocation of land in state-owned industrial parks and estates as per regulations of state government agencies
- approval of factory plan as required under the Factories Act, 1946
- approval for building plan
- approval for feasibility and grant of power connection as required under the Electricity Act, 2003
- approval of electrical drawings prior to issue of power connection under the Central Electricity Authority (Measures Relating to Safety and Electric Supply) Regulations, 2010
- approval for water supply connection
- consent for establishment (CFE) as required under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981
- no-objection certificate from fire services
- registration of firms as required under the Indian Partnership Act, 1932
- registration for value-added tax (VAT)
- registration for central sales tax (CST) as required under the Central Sales Tax Act, 1956

- license for manufacture of bulk drugs; formulations; cosmetics; and ayurvedic, homeo, siddha, or unani drugs as may be applicable
- license for establishment of distillery as may be required
- registration for manufacturers and recyclers of plastic bags as required under Plastic Waste (Management and Handling) Rules, 2011
- Registration for units handling hazardous waste as required under Hazardous Wastes (Management, Handling, and Transboundary Movement) Rules, 2009

Approvals at the pre-operation stage:[11]

- approval for factory license as required under the Factories Act, 1946
- consent for operation (CFO) as required under the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981
- issue of Occupancy Certificate under Fire Services Regulations
- boiler registration as required under the Boilers Act, 1923
- registration for shops and establishments as required
- registration for engaging contractual labor as required under Contract Labor (Regulation and Abolition) Regulations
- registration for deploying inter-state migrant workers as required under the Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979
- registration for professional tax under applicable state regulations
- license for import and storage of petroleum, diesel, or naptha as may be required
- license for possession and use of rectified or denatured spirits as may be required

Appendix 3.4: Case Study on Grant of Status of Local Area Authority to Park Developer in Andhra Pradesh

Industrial areas have been typically neglected by local bodies in terms of maintaining civic services, leading to poor roads and other infrastructural facilities. In order to address this problem, Andhra Pradesh Industrial Infrastructure Corporation Ltd. (APIIC), an undertaking of the Government of Andhra Pradesh, was vested with the status of a local authority for industrial areas through amendments to the following acts:

- u/s 147 of the Andhra Pradesh Panchayat Raj Act, 1994;
- u/s 389B of the Andhra Pradesh Municipalities Act, 1965; and
- u/s 679-F of Hyderabad Municipal Corporation Act, 1955.

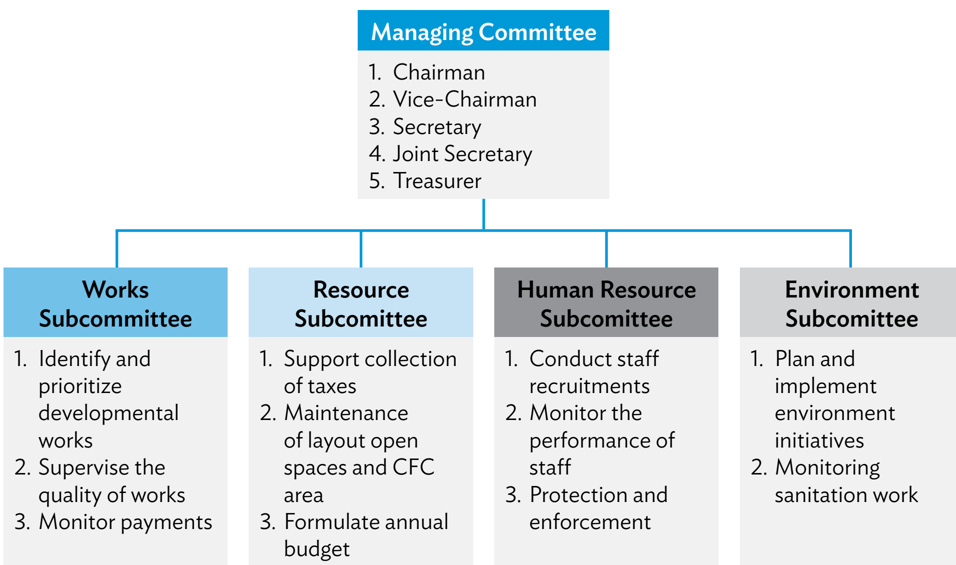
Based on the above, the departments associated with local governments—Municipal Administration and Urban Development, and Panchayati Raj and Rural Development—have notified APIIC industrial areas that fall under the jurisdiction of municipalities, municipal corporations, and Gram Panchayats where APIIC is empowered to exercise certain statutory powers and functions such as assessment, levy, demand, and collection of property tax; sanction of building permits; removal of encroachments; and management and maintenance of civic services. APIIC shares a part of its revenue (35%–50%) with the concerned local body, with the balance utilized for industrial estate maintenance or augmenting amenities.

[11] Pre-operation is defined as the stage prior to or just after commencement of operations.

For this purpose, APIIC has established Industrial Area Local Authorities (IALAs), with executive authority under the relevant acts, to exercise the above powers and functions, effective 1 October 1994, in around 264 industrial areas.

Furthermore, there exists a concept of self-governance in some of the notified APIIC-IALA industrial areas wherein the entrepreneurs have formed service societies. These service societies act as advisory bodies or nodal agencies (similar to the councils in the local bodies) to assist in the collection of property taxes and maintenance of civic services like power, water, and sewerage. A service society elects a managing committee consisting of five office bearers with a three-year term. Subcommittees are formed that are headed by one of the office bearers. The commissioner or executive officer acts as the convener in each of the subcommittees. The structure of a service society, with the key functions of subcommittees, is depicted in Figure 3.7.

Figure 3.7: **Structure of the Service Society**



Source: Study team analysis.

During field visits, interactions with entrepreneurs confirmed that the establishment of IALAs has led to improved delivery of urban services and other civic amenities like roads and street lights in industrial areas. IALAs are also actively involved in developing environmentally friendly and efficient management of industrial parks. Successes include

- controlling illegal discharges of wastes, emissions, and effluents;
- solid waste management;
- constructing plantation and buffer zones; and
- establishing storm water drainage and water harvesting.

Appendix 3.5

Table 3.4: **Applicable Regulations Governing Intra- and Inter-State Movement of Goods**

Type of Compliance	Applicable Act or Policy	Regulatory Administering Agency
Intra-State Movement of Goods		
• Monitoring essential commodities, weights and measures, and food adulteration.	• Essential Commodities Act • Prevention of Food Adulteration Act • Weights and Measures Act	District Supply Office and State Civil Supplies Department
• Monitoring and enforcement of road permits and waybills for intra-state movement of goods	• Value-Added Tax Act	State Commercial Taxes Department
• Monitoring and enforcement of provisions relating to motor vehicles (e.g., checking if vehicles have paid road taxes, if drivers are carrying proper documents and conforming to loading and dimension norms)	• Motor Vehicle Act • Motor Vehicles Taxation Act	State Transport Department and Regional Transport Office
Inter-State Movement of Goods		
• Enforcement of provisions relating to inter-state sales (including delivery of statutory forms like C and F)	• Central Sales Tax Act	State Commercial Taxes Department (tax is levied by the central government and administered by state government)
• Monitoring and enforcement of road permits and waybills for inter-state movement of goods	• Value Added Tax Act	State Commercial Taxes Department
• Levy and collection of taxes on the import of scheduled goods in the state	• Act for Tax on Entry of Goods into Local Area	State Commercial Taxes Department
• Regulating transit of timber and other forest produce	• Indian Forests Act	State Department of Environment and Forest
• Monitoring and enforcement of provisions relating to inter-state movement of vehicles	• Motor Vehicles Act • Motor Vehicles Taxation Act	Regional Transport Office and State Transport Department
• Monitoring the movement of excisable goods (e.g., liquor)	• State Excise Act	State Excise Department
• Monitoring of mineral transportation from the states	• Mines and Minerals (Development and Regulation) Act	State Department of Mines and Geology

Source: Study team analysis.

Appendix 3.6: Case Study on Asia-Pacific Gateway and Corridor Initiative in Canada

The Asia-Pacific Gateway and Corridor Initiative is an integrated set of investment and policy measures focused on trade with the Asia-Pacific region. Its mission is to establish Canada's Asia-Pacific Gateway and Corridor as a best-in-class transportation network facilitating global supply chains between North America and Asia.

Within this framework, in 2009, three Canadian provinces—Alberta, British Columbia, and, Saskatchewan—which fall under the Asia Pacific Gateway and Corridor Initiative, entered into the New West Partnership to create Canada's largest, barrier-free, interprovincial market.

New West Partnership[12]

The New West Partnership builds on trade, investment, and labor mobility within the provinces and focuses on four key areas key of economic growth: (i) trade, (ii) international cooperation, (iii) innovation, and (iv) procurement. The provinces have entered into separate agreements for cooperation in each of the above areas.

As part of the institutional framework, the trade agreement provides for the establishment of a ministerial committee. Each province appoints a cabinet-level minister to the committee who is authorized to act on behalf of their respective government in matters pertaining to the trade agreement. The committee members are also responsible for ensuring coordination and implementation of the provisions of the agreement.

For the other three agreements, steering committees comprising members at the level of assistant deputy minister ensure coordination and provide strategic leadership for joint initiatives in international cooperation, innovation, and procurement.

As per the terms of the partnership, the participating governments have also agreed to establish a secretariat headed by an administrator who is responsible for the objective and impartial dispute resolution processes and procedures of the New West Partnership Trade Agreement (NWPTA). Additionally, the administrator provides coordination, administrative, and technical support to the three governments as required for the overall implementation of the NWPTA.

The key objectives of the agreements are summarized in Table 3.5.

---

[12] http://www.newwestpartnership.ca

Table 3.5: **Key Objectives of New West Partnership**

Trade Agreement	• The agreement ensures that the provinces do not restrict or impair inter-state trade, investment, and labor mobility. • The agreement reconciles provinces' existing standards and regulations that govern trade, investment, and labor mobility, with agreement to not establish new standards or regulations that operate to restrict or impair the same. • Any worker certified for an occupation by a regulatory authority of one province will be recognized as qualified to practice that occupation by the other participating provinces. • There is a provision for penalty of up to CAD5 million if any participating province is found to be non-compliant with their obligations under the agreement.
International Cooperation Agreement	• Provinces will identify international markets of common interest where co-located offices can be pursued; develop and participate in collaborative international trade and investment initiatives of common interest; develop common messaging when jointly targeting and engaging foreign governments and industries; and jointly engage Government of Canada agencies to support federal and partner government commercial interests.
Innovation Agreement	• The provincial governments will collectively support and build capacity for innovation by sharing non-confidential information, evaluations, and analysis on innovation activities; and identifying opportunities to jointly collaborate with industry, governments, and other stakeholders on innovative activities.
Procurement Agreement	• The provincial governments will establish interprovincial procurement arrangements and ensure the standardization of procurement practices and template documents, where appropriate.

Source: Study team analysis.

The benefits of the economic partnership include

- streamlined existing regulations prevailing across the provinces;
- unhindered access of supplies to procurement in all three provinces;
- enhanced labor mobility across the region, thereby creating a broader pool of qualified workers; and
- seamless registration for businesses across the region.

Integration of Multiple Port Authorities within the Corridor

British Columbia previously had three independent ports in geographic proximity to one another in the lower mainland region: Fraser River, North Fraser, and Vancouver. The Government of Canada integrated these three ports into one port authority in June 2007 to enhance investment opportunities in the region. This action facilitated greater coordination in terms of (i) ensuring less waiting and turnaround times, (ii) developing specializations among the respective ports, and (iii) enhancing Canada's competitiveness in global trade by maximizing port efficiencies and optimizing port planning.

Appendix 3.7: Trade Facilitation

International cargo can only be handled at locations notified under the Customs Act, 1962 by the Central Board of Excise and Customs (CBEC); where the customs area has been earmarked under Section 8 of the Customs Act, 1962; and where the imported goods or the export goods can be stored prior to their clearance. The handling of imports and exports at a customs location can commence only after the requisite notifications are issued under Sections 7 and 8 of the Customs Act, 1962. India has over 90 ports (12 major ports and more than 80 non-major ports), 155 container freight stations (CFSs), 100 inland container depots (ICDs), and 36 air cargo complexes notified under the Customs Act, 1962.

While the importer or exporter can clear goods from the gateway port or airport where the goods have arrived or are being shipped from, the customs regime also provides options with regard to the location from where the statutory formalities can be fulfilled.

The importer or exporter can exercise his choice with regard to the location based on factors such as

- proximity to manufacturing, processing, warehouse, or office location;
- connectivity (e.g., road and rail links, coastal shipping facilities);
- availability of logistic services;
- efficiency of operations at the customs location;
- availability of handling facilities or any special requirements (e.g., reefer containers) keeping in view the nature of the goods; and
- presence of the regulatory agencies at the location.

Imports

The importer has the following options for clearance of imported cargo to manage supply chain and logistics:

Clearance of goods from the first port or airport of landing. The importer can choose to clear the cargo from the port or airport of landing. The cargo can be removed from the customs station only after payment of customs duties. After clearance, the importer may choose to transport the cargo to his premises in the international container or shift the cargo to trucks or domestic containers for onward transportation.

Clearance of goods from a CFS. CFSs act as satellite facilities of the ports, primarily to deal congestion at the ports. The stuffing and de-stuffing of containers, aggregation and segregation of cargo, and physical inspection of goods (where required) is normally carried out in a CFS. The customs functions relating to processing a manifest and import or export declarations are performed in the custom office of the parent port to which the CFS is attached. A CFS is connected to the parent port electronically for seamless functioning of the customs automation system. The shifting of cargo from a port to a CFS is done in international containers.

The Government of India is planning to encourage the setting up of airfreight stations to cater to similar traffic from air cargo complexes.

Clearance of goods from an ICD. The goods can be moved to a notified ICD in the international container from the port or airport of landing for trans-shipment, if they are so manifested. The carrier is responsible for fulfilling the conditions of trans-shipment. The customs clearance formalities have to be complied with by the importer at the ICD including the payment of customs duties.

Clearance of goods from the first port of landing or from the ICD to a public or private bonded warehouse. The importers can exercise the option of moving the goods from the port or airport of landing to a warehouse bonded under the Customs Act, 1962. However, a prerequisite in this case is the availability of space in a public or a private bonded warehouse duly licensed by the customs. The bonded warehouse could also belong to the importer. In such cases, customs duties are to be paid only at the time of clearance of the cargo from the bonded warehouse and not at the gateway location.

Cargo Clearance

The regulatory component of the clearance process consists broadly of three parts: (i) checking the documents, (ii) physical examination of cargo, and (iii) compliance with the requirements of other government agencies. However, due to application of the Risk Management System (RMS) by CBEC, the processes in parts (i) and (ii) are applicable only in select cases. The process in part (iii) is applicable only to select commodities that require conformance to plant quarantine, animal quarantine, food safety and security, drugs, and cosmetics laws.

Use of automation and risk management. The Indian Customs EDI System (ICES) and RMS are operational at all major ports, airports, and ICDs. While the ICES provides an automated workflow system for customs clearance of cargo and improves transparency, the RMS focuses on providing facilitation to the compliant and less risky consignments, and targeting the more risky consignments for detailed scrutiny. At present, about 50% of the consignments are facilitated by the RMS. In these cases, neither the documents nor the cargo is subject to scrutiny by Customs, and duties can be paid electronically.

Exports

The following options are available to an exporter to manage the logistics of export cargo clearance:

Clearance of goods from the gateway port or airport. The exporter can take the cargo to the gateway port or airport for export. In this case the customs examination of cargo, if any, takes place at the gateway location. While the exporter is free to take the cargo to the port packed and stuffed in containers, he has to be prepared for unpacking/destuffing the cargo in the port for examination, if needed.

Clearance of cargo from the CFS. The CFS is a satellite location of another customs location. Cargo is taken to a CFS for clearance in cases when the parent port does not have the facilities for storage and the de-stuffing of goods, or when an exporter chooses to use a CFS due to its superior facilities.

Clearance of cargo from ICDs. The exporter can have the clearance formalities completed at an ICD of his convenience with connectivity to the gateway port. Once the cargo is cleared at the ICD, it is sealed by CBEC and then the carrier transports the cargo to the gateway location for actual export. At the gateway location, only the intactness of the seal is verified by CBEC before permitting the loading of cargo on the vessel for export. In case of export through ICDs, export benefits such as the duty drawback are processed and granted to the exporter after the goods leave the ICD (without waiting for export from the gateway port).

Clearance of cargo at the factory. This is a facility for an exporter to have cargo customs cleared at his doorstep. The export goods are stuffed and sealed in the presence of CBEC officers at the factory of manufacture or any other approved premises of the exporter. The exporter will have the advantage of doing the handling and stuffing in a manner suitable to the nature of cargo. After clearance, such containers are sealed by CBEC officers. At the gateway location, only the intactness of the seal is verified by CBEC before permitting the loading of cargo on the vessel for export.

Manufacture-in-bond scheme. Section 65 of the Customs Act, 1962 provides for manufacture under bond. An operator desirous of using this facility functions as per the Manufacture and Other Operations in Warehouse Regulations Act, 1966. He can import goods without payment of duties, undertake permitted activities in the warehouse, and export the goods. The Export Oriented Unit/Electronics Hardware Technology Park/ Software Technology Park units, ship building units, and who import goods and export them after carrying out repairs and re-conditioning can work under this provision.

Suggestions and Conclusions

Trade facilitation is impacted by the (i) efficiency of operations at ports and other CBEC stations, (ii) performance of regulators and private players (e.g., shipping lines; port, ICD, CFS, and air cargo operators; importers and exporters; customs brokers; and transporters), (iii) quality of infrastructure, and (iv) connectivity. Keeping in mind the prevalent state of trade facilitation, the following measures, if taken, would help enhance the trade facilitation and boost the efficiency and productivity of VCIC.

While issues relating to the operation of major ports are handled by the Ministry of Shipping, all other ports fall under the jurisdiction of state governments. The regulatory and infrastructure requirements to be met by the port operator are codified under the Handling of Cargo in Customs Areas Regulations, 2009. Unless there is coordination right from the stages of development and planning the expansion of the facility, the issues of compliance with regulations, adequate staffing, and installation of ICT facilities will arise. This, in turn, may lead to delays in the commencement of port operations and to sub-optimal utilization of the developed infrastructure. Therefore, any initiatives to develop new customs ports or expand existing customs ports need to be coordinated between the concerned government, the developer (if any), and CBEC.

The availability of adequate customs staff is important for the efficient functioning of ports and other customs stations, particularly in a scenario of rapid growth in the number of custom stations. A shortage of customs staff is one of the reasons for delays in cargo clearance. CBEC Circular 16/2013, dated 10 April 2013, lays down the staffing norms at various CBEC facilities. As per the norms, 32 customs officers have to be posted on a cost recovery basis for a sea port. However, fixed staff strength for every port may not suit the requirements of each port. The staffing norms should be based on quantum factors (e.g., number of import and export declarations and containers) and the type of cargo handled (e.g., bulk, containers).

It is also important that CBEC anticipates the manpower and infrastructural requirements for the next 3–5 years, and initiates approvals for these to be able to meet evolving trade facilitation needs.

Experience shows that the clearance of export cargo under the factory stuffing process is a more efficient manner of the completion of export formalities. This is because the process happens at the doorstep of the exporter, the handling of cargo is done by the exporter, the packed and stuffed cargo is not disturbed at the gateway port, and the time spent at the gateway location is minimized. Hence, exporters should be encouraged to use this facility.

The trans-shipment of containers should be allowed from a gateway port to a CFS of another customs station based on logistical considerations subject to the monitoring of the secure movement of cargo between these locations. At present, such movement is allowed only between the CFS and its parent port and is not conducive to creating fair competition.

The use of CFSs should be monitored by CBEC and the port authorities to ensure that they are used only in circumstances where the port facility lacks space and/or facilities to handle specific shipments. Shipping agents and port operators should not force the importer or exporter to move cargo to a CFS and monopolies should not be encouraged by favoring certain CFSs over others.

Although the customs workflow is automated, traders have to file the supporting documents (e.g., invoice, bill of lading, and packing list) physically. The supporting documents are required to be filed during the assessment process or at the stage of taking delivery of cargo. The requirement of physical submission of the supporting documents detracts from the efficiency of automated trade and creates unnecessary interfaces.

All traders who need to pay customs duties have to do so before clearance of individual shipments. This applies even to trusted traders such as accredited clients and authorized economic operators (AEOs). As a result, the duty payment forms an additional step in the clearance process. The facility of deferred payment of duties may be provided to the trusted traders to help them evacuate their cargo expeditiously. (CBEC provides deferred payment facilities to registered manufacturer and service providers for central excise duties and service taxes, respectively.)

The filing of import declarations prior to arrival of the cargo's bills of entry is allowed under Section 46 of the Customs Act. However, discussions with CBEC indicate that this facility is being used sparingly by the trade. A study by the Center for WTO Studies in India found that 53% of declarations are filed after 24 hours of filling the manifest and 26% are filed after 3 days. The use of this facility should be encouraged as it would help in the expeditious clearance of cargo from ports and other customs stations.

While under domestic law, some additional facilitation has been provided to AEOs, greater benefit will accrue to them if their status is recognized in other countries and given the attendant facilitation benefits. For example, if an Indian exporter with AEO status exports to another country and the goods are facilitated in the later country without the need for physical examination, owing to the AEO status of the exporter, it would be a major facilitative

Table 3.6: **List of Notified Customs Stations—Andhra Pradesh, Telengana, and Chennai**

Ports

Andhra Pradesh	Chennai
Kakinada	Ennore
Krishnapatnam	Chennai Sea port
Masulipatnam (export only)	Kattupalli
Visakhapatnam	
Gangavaram	

Airports

Andhra Pradesh	Telengana	Chennai
Visakhapatnam	Shamshabad (Hyderabad)	Chennai
Renigunata		

ICDs

Andhra Pradesh	Telengana	Chennai
Anaparthi	Hyderabad	Tondiarpet
Chirala (export only)	Thimmapur	
Kakinanda (export only)		
Karedu (export only)		
Reddipalem		
Chimakurthy (for export of granite)		
Marripalem		

Source: Study team analysis.

Coastal Ports in Andhra Pradesh

- Bheemunipatnam
- Calingapatnam
- Navaspur
- Vadarevu
- Surasani (Yanam)

measure. Mutual recognition agreements between India and its trading partners would enable this process (Table 3.6).

Establishment of a Single Window. Traders have to approach different government agencies to fulfill their statutory requirements. There is duplication in data and documentary requirements and multiple inspections of the same goods by different agencies, resulting in additional costs and delays. Establishment of a Single Window would enable the parties involved in international trade to lodge standardized information and documents at a single entry point to fulfill all import, export, and transit-related regulatory requirements. A lead agency (CBEC, most often) should be responsible for coordinating and obtaining clearances from regulatory agencies and giving final clearance to the trader. Operations of other regulators, such as Quarantine and FSSAI Drug Controller, should be synchronized with CBEC's RMS and a multiple agency-single inspection system put in place. A National Single Window (NSW) could therefore be established to provide integrated and timely responses from regulatory agencies to reduce cargo clearance times and the cost of doing business. The NSW could be integrated into eBiz, the platform offering core G2B services.

Capacity building of private sector stakeholders. Studies on trade facilitation show that the players in the private sector (e.g., importers, exporters, shipping lines, and customs brokers) also contribute to avoidable delays and increased transactions cost. Illustratively, the Center for WTO Studies found that in 45% of all cases, importers take more than one day to pay the assessed customs duty despite the availability of electronic payment facilities; very few importers use the advance filing facility to speed up cargo clearance; shipping agents charge arbitrarily to issue a delivery order; and shortages of transport and handling equipment lead to delays in the movement of cargo. This underscores the importance of raising awareness and building capacity of traders, particularly small and medium-sized enterprises to ensure that the benefits of the facilitative environment created by the regulatory regime are harnessed optimally.

Conduct of TRS and BPA+ studies. To clearly map the processes in the key ports that feed and cater to the needs of VCIC, and to identify the bottlenecks to be addressed and areas for improvement, the conduct of studies based on global practices, such as a Time Release Survey (TRS) and Business Process Analysis Plus (BPA+), is recommended. This would enable extensive study of the export and import transactions with a view to chart the costs, time, and processes involved from end-to-end, leading to recommended steps that would enhance the ease of doing business.

Appendix 3.8: Special Economic Zone

India is a leader in Asia in developing export processing zones (EPZs), setting up the first EPZ in Asia in Kandla in 1965. A Special Economic Zone (SEZ) Policy was announced in April 2000 to reduce the multiplicity of authorities and clearances required. The policy also sought to facilitate the development of world-class infrastructure to attract foreign investments in India. SEZs in India functioned under this provision until 2006. The SEZ Act was passed in 2005 and rules subsequently came into effect in 2006. The new act aimed to simplify procedures and provide for Single Window clearance for all central and state government matters. A range of fiscal concessions were enacted in the SEZ Act, 2005, including

- duty free import and domestic procurement of goods for development, operation, and maintenance of SEZ units;
- 100% tax exemption on export income for SEZ units under section 10AA of the Income Tax Act for the first five years, 50% for next five years, and 50% of the ploughed back export profits for next five years;
- exemption from the minimum alternate tax under section 115JB of the Information Technology Act;
- external commercial borrowing by SEZ units of up to US$500 million per a year (without any maturity restrictions) through recognized banks;
- exemption from central sales tax;
- exemption from service tax;
- Single Window clearance for central and state level approvals; and
- exemptions from state sales tax and other levies as extended by the respective state governments.

The policy elements of SEZs in India are captured in Table 3.7.

Table 3.7: **Policy Elements of SEZs in India**

Policy Element	Special Economic Zone (SEZ)
Administrative supervision	Individual Development Commissioners
Establishment approval	Government of India
Trade approval	Single Window
Minimum start-up capital	none
Ownership requirements	none
Geographical limitations	location approved by Government of India
Size requirement	40–1,000 hectares minimum, depending on output[a]
Sectoral prohibitions	none
Value-added requirement	Must have positive net foreign exchange
Specific item prohibitions	recycling, used textiles, chemicals, organisms, illegal substances and weapons, and other specific items
Domestic export allowance	none
Domestic import allowance	none
Export tariff discount	100%
Import tariff discount	100%

continued on next page

Table 3.7 *continued*

Policy Element	Special Economic Zone (SEZ)
Other tax liabilities	Minimum Alternative Tax, Dividend Distribution Tax, Service Tax
Tax holiday	15 years
Environmental controls	none aside from domestic laws; some prohibitions on water-intensive units
Labor laws	Must adhere to all Indian labor laws; labor officer on-site

[a] In cases of information technology (IT) and IT-enabled services (ITES) SEZs, there will be no minimum land area requirement, but they will have to conform to a minimum built-up area requirement.

Source: A. Aggarwal. 2010. Economic Impacts of SEZs: Theoretical Approaches and Analysis of Newly Notified SEZs in India. *Munich Personal RePec Archive Paper*. No. 20902. Available at http://mpra.ub-muenchen.de/20902/

The SEZ Act, 2005 envisaged a key role for the state governments in export promotion and the creation of related infrastructure. A Single Window SEZ approval mechanism was established in the form of a 19-member, inter-ministerial SEZ Board of Approval (BoA). The applications duly recommended by the state governments are considered by this BoA. Following an inspection report certifying the contiguity and vacancy of the area, an area is notified as an SEZ. The SEZs (Amendment) Rules, 2013 brought additional reforms, including new rules reducing the minimum land requirement for setting-up different categories of SEZs. The rules also focuses on greater flexibility in utilizing SEZ land tracts, sectoral broad-banding, and an exit policy for SEZ units.

India's SEZ policy rests on four pillars: supporting free access of imports, duty drawbacks, tax exemptions, and providing better infrastructure and institutional arrangements. The policy support to the SEZs is to promote exports and attract foreign direct investment. However, one of the critical aspects of the ineffective development of SEZs is that there is no consistency in SEZ policies among different branches of the government. In 2005, along with the new SEZ Act, the Government of India introduced two specific provisions in the Income Tax Act, 1961 removing the requirement of units operating in a SEZ to pay the Minimum Alternate Tax and Dividend Distribution Tax. In 2011, the Finance Ministry withdrew these concessions using authorization under the Finance Act, 2005. These taxes were not anticipated by SEZ units in making investment decisions. Therefore, reversing the 2011 provisions and the continuation of benefits such as incentive schemes would benefit SEZ units. The tax regime should have synergy with the Department of Commerce's SEZ policies to help create a favorable investment climate, facilitate the ease of doing business in SEZs, and attract production investment. Another retrograde practice is the assessment of custom duties on goods manufactured in SEZs based on their full value upon entry into the domestic tariff area. In economies such as the PRC; Republic of Korea; Malaysia; and Taipei,China, customs duties on domestic tariff area sales are assessed only on the imported materials used in the production of SEZ exports. The PRC also allows duty-free domestic sales in case the SEZ product is based on new technology. Further, under free trade agreements with Southeast Asian and East Asian countries, imports of agreed products from partner countries to India enjoy zero or minimum duties. Therefore, imports from SEZs with a full range of duties are making products uncompetitive for the domestic market.

Another critical aspect of the ease of doing business is the creation of online clearance mechanisms for both imports and exports by the Development Commissioner, SEZ Online, which significantly reduces costs and time requirements. Most of the clearances required include applications for establishing units, the claims and legal undertakings for extension are handled online. SEZ Online provides aggregate information across all SEZs that support policy formulation. It also facilitates the monitoring of end users. On the other hand, the Indian Customs Electronic Commerce and Electronic Data Interchange Gateway (ICEGATE) provides e-filing services to the trade and cargo carriers, and other clients of the Customs Department. ICEGATE offers a host of services, including electronic filing of the bill of entry (import goods declaration), shipping bills (export goods declaration), and related electronic messages between the Customs Department and trading partners using communication facilities (e.g., e-mail, web-upload, and FTP) using the communication protocols commonly used on the internet. Therefore, two different electronic systems exist within India, one for SEZs and another for the rest. There is no link between the two systems as the former works under the aegis of the Department of Commerce and the latter under the Central Board of Excise and Customs. There is also no provision of electronically sharing data collected by each of these systems. The integration of both platforms and synergy between the two relevant government entities would help in developing a unified system and thereby ease regulatory and compliance procedures. Information about the current state of SEZs are summarized in Table 3.8 and Table 3.9.

Table 3.8: **Fact Sheet on SEZs** (as of 1 September, 2014)[a]

- Number of formal approvals: 564
- Number of notified SEZs (as of 29 August 2014): 388 out of 564 (+7 central government, + 11 state and private SEZs)
- Number of in-principle approvals: 38
- Operational SEZs (as of 30 June 2014): 192 (19 are multi-product SEZs and the remaining are IT/ITES, engineering, electronic hardware, textiles, biotechnology, gems and jewellery, and other sector-specific SEZs)
- Units approved in SEZs (as on 30 June 2014) : 3,818
- Total land area of SEZs : 61,624 hectares
- Total investment (as of 30 June 2014): INR3,01,655.71 *crore*
- Total employment (as of February 2006): 1,34,704 persons
- Total employment (as of 30 June 2014): 12,77,645 persons

Exports from SEZs are listed in the table below. Two SEZs accounted for nearly 42% of total SEZ exports in 2011: the Jamnagar refinery and DLF Infosys Mangalore.[b]

2005–06	2012–13	2013–14 (as of 31 March 2014)	2014–15 (as of 30 June 2014)
INR22,840 *crore*	INR4,76,159 *crore* (growth of 31% from 2011–12)	INR4,94,077 *crore* (growth of 4% from 2012–13)	INR1,21,637 *crore* (growth of 7% from 2013–14)

[a] http://www.sezindia.nic.in/writereaddata/pdf/factsheet.pdf
[b] Based on the interviews of the officials of the Department of Commerce.

Table 3.9: **Fact Sheet on SEZs in Andhra Pradesh**[a]

- Number of formal approvals to the undivided state (as of 6 August 2014): 108 (out of which 41 are located in the newly created Andhra Pradesh)
- Total exports from 26 functional SEZs of the undivided state: INR6,958 *crore*[b]
- Main destination country of exports: United States (about 35% of total SEZ exports)

a http://www.sezindia.nic.in/writereaddata/pdf/listofformalapprovals.pdf
b Based on data collected from the stakeholders.

CHAPTER 4

Urbanization and Land Management Framework

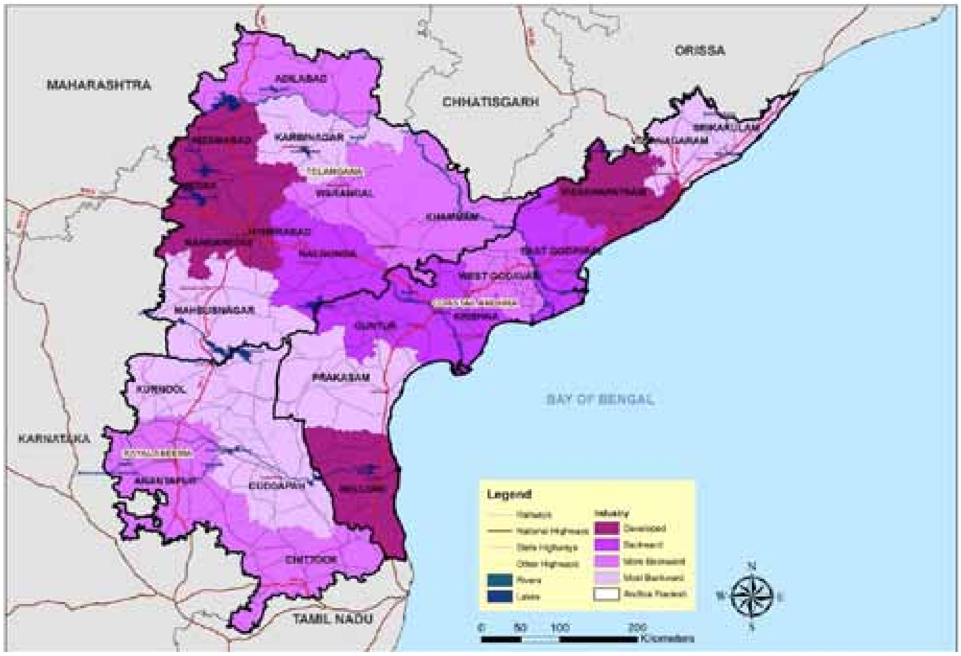
Strategic Framework for Proactive Urbanization and Land Management

Urbanization Pattern in the Corridor

Industrialization and Urbanization in the Corridor

The industrial profile of Seemandhra is depicted in Figure 4.1. The variables selected for assessing the level of industrial development in Seemandhra include (i) percentage of industrial workers among total workers, (ii) number of electrical connections to industries per *lakh* (100,000) population, (iii) value of productive capital (in INR terms) per *lakh* population, and (iv) net industrial value added per *lakh* population. According to the industrial profile indicator, Vizag and Nellore have a high level of industrial infrastructure and development, followed by Guntur, Krishna, and East Godavari. Among these districts, Vizag

Figure 4.1: **Industrial Development in Seemandhra**



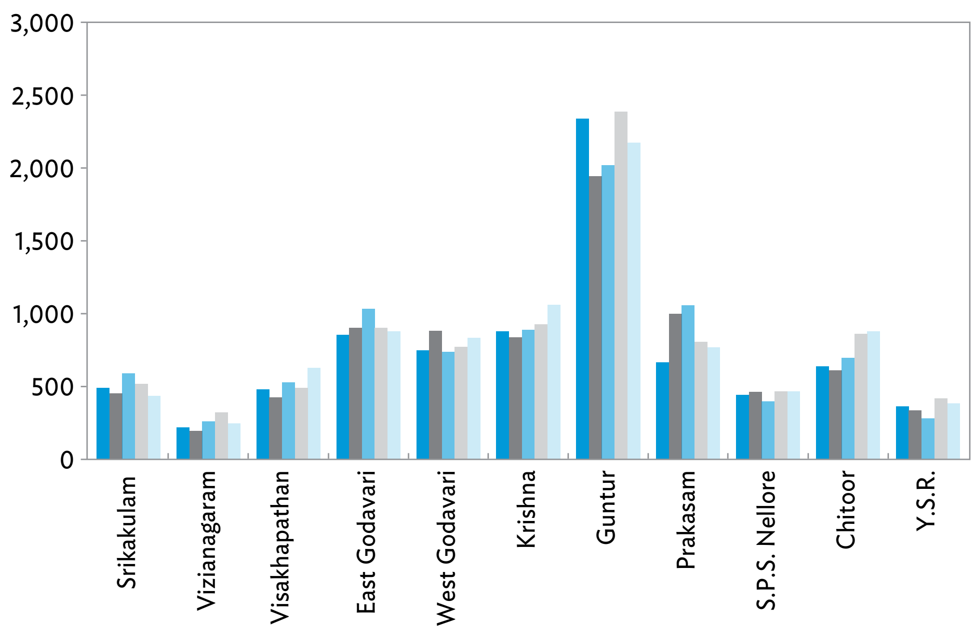
Source: Study team compilation.

has the highest share of urban population in total population (47.5%), followed by Krishna (41.0%), Guntur (33.9%), Nellore (29.1%), East Godavari (25.5%). The least industrially developed districts of West Godavari, Srikakulum, and Prakasam have urban population shares of 20.5%, 16.2%, and 19.5%, respectively. The analysis shows that there is a positive correlation between industrial development and urbanization in the corridor.

The total number of industries in each district in 2005–2010 is depicted in Figure 4.2. Although in absolute terms, Guntur tops the chart—followed by East Godavari, Krishna, and Prakasam—this shows that simply considering the number of industries does not explain the degree of urbanization in different districts. A composite index that includes output, the number of workers employed, and the net industrial value per *lakh* population is more useful to understanding the urbanization trends that are propelling growth in the corridor.

According to a report prepared by APInvest and Federation of Indian Chambers of Commerce and Industry (FICCI) in 2007, Vizag, Guntur, East Godavari, and Chittoor top the list of the most industrialized districts along the coast.[1] Vizag has a diverse industrial base, including bulks and pharmaceutical, automobiles, sugar, fertilizers and chemicals, engineering, iron and steel, IT/TES, and electronic hardware. Guntur has sugar, cement, textile, and food processing industries. East Godavari has fertilizer and chemical, paper, and food processing industries. Chittoor has sugar and food processing

Figure 4.2: **Number of Factories in the Districts of Seemandhra**



Source: www.districtsofindia.com

[1] Commissionerate of Industries, Government of Andhra Pradesh, and FICCI. 2007. *Doing Business with Andhra Pradesh*. Available at http://www.aponline.gov.in/apportal/HomePageLinks/ap_biz.pdf

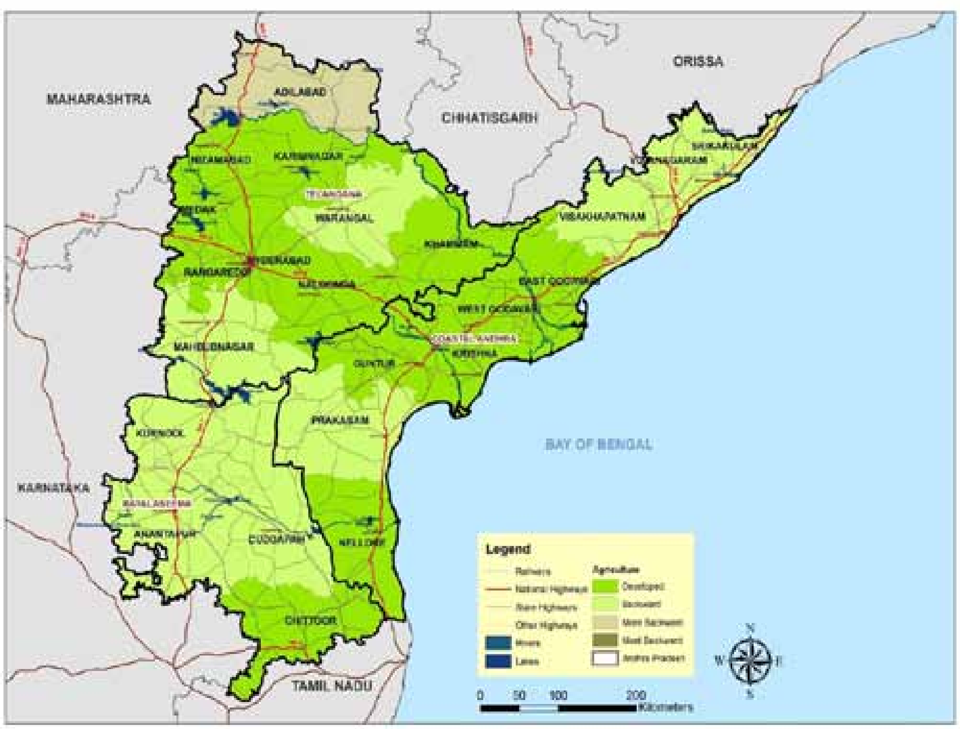
industries. Nellore's leading industry is leather. In Prakasam, granite industry is the main industrial activity.

Agriculture and Urbanization in the Corridor

A composite indicator was developed for assessing agricultural development along the corridor in Seemandhra comprising (i) gross area sown, (ii) net area sown, (iii) gross area irrigated, (iv) net area irrigated, (v) yield per acre (rice), (vi) short-term agricultural loans per 1,000 acres of gross sown area, (vii) number of tractors per 1,000 acres of net sown area, (viii) livestock and poultry per *lakh* rural population, and (ix) veterinary professional per *lakh* livestock. The results are plotted in Figure 4.3. The highest degree of agricultural development is found in the districts of Krishna, Guntur, East Godavari, West Godavari, Nellore, and Chittoor. These districts are irrigated by the Godavari and Krishna rivers and their canals. The land is quite fertile and highly suitable for growing rice, and the yields per hectare are quite high (Figure 4.4). Cropping intensity, however, is quite low (70%–90%) since it is inversely related to yields. One or two crops of rice per year are sufficient for farmers to make profits; hence, they do not sow the land multiple times in a year.

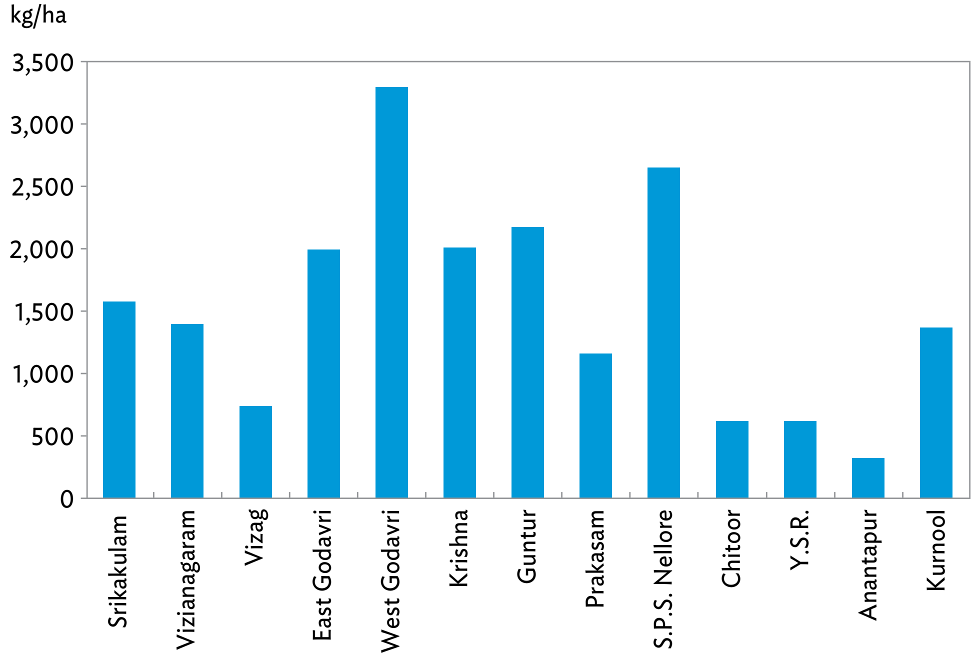
When we compare agricultural development to urbanization, a similar positive correlation emerges as in the case of industry. The higher the agricultural yield in a district, the higher the percentage of urban population. For example, Krishna has an urban population of 41.0%; Guntur, 33.9%; Nellore, 29.1%; and East Godavari, 25.5%. All of these districts are highly developed in terms of agriculture and agricultural productivity per hectare.

Figure 4.3: **Agricultural Development along the Corridor**



Source: Study team compilation.

Figure 4.4: **Productivity of Crops in Seemandhra Districts**



kg/ha = kilogram per hectare.
Source: Statistical Abstract of Andra Pradesh, 2013.

Urban Governance and Industrialization

The existing governance system treats urbanization and industrialization as distinct processes requiring different management systems. This section discusses issues related to the disconnect between urbanization and industrialization processes.

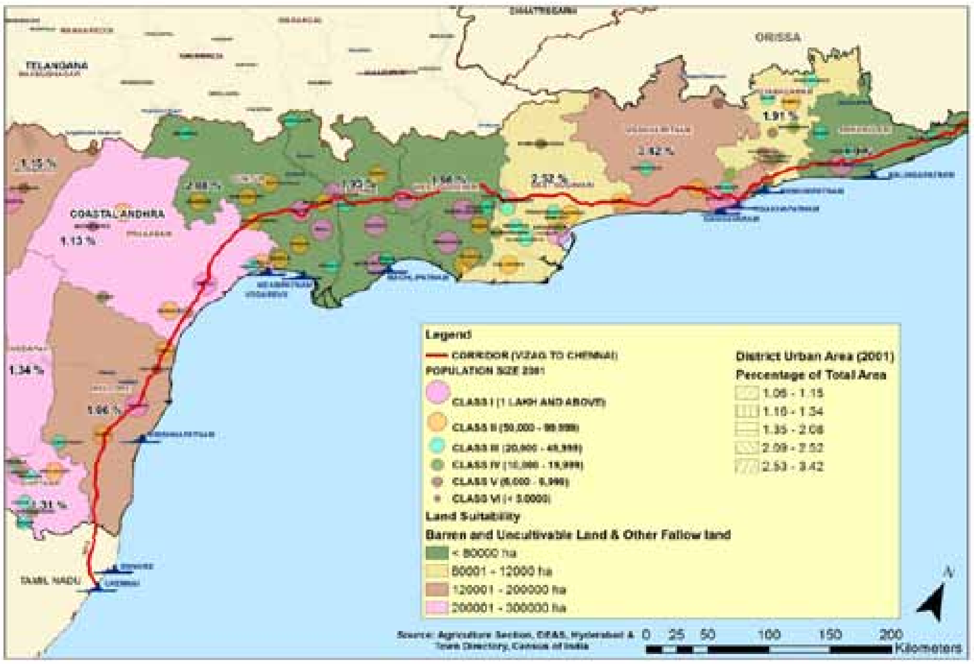
The Feedback Loop between Industrial–Economic Development and Urbanization

In any region—not necessarily one taking the form of a corridor—economic growth and urbanization seem to be synched in a feedback loop. While the feedback loop is almost always positive in terms of economic and urban growth, the outcomes in terms of equity, sustainability, and quality of life are not necessarily positive unless development is effectively planned and guided.

Historically, industrialization and urbanization have proceeded together. However, in India, from the 1980s onwards, industries have moved away from the core cities for the following reasons:

- Governments gave incentives for new industries to locate in less-developed areas.
- Polluting industries were forced to relocate outside cities.
- Land became costly and difficult to consolidate in urban areas.
- City governments do not consider local economic development as their mandate and do not actively promote industrialization.

Figure 4.5: **Land Available for Urbanization in Various Districts**



Source: Study team compilation.

This type of scattered industrialization has had several impacts—both in existing cities and in new locations. In many cities, industries moved out, but the workforce stayed. Having lost their industrial jobs, the workforce shifted to informal service sector opportunities. In most cases, the new industrial locations did not have planned urban development or even adequate workforce housing. Therefore, haphazard development mushroomed around these new industrial locations to cater to workforce accommodation and to absorb the multiplier effect of industrial growth.

The result is that we now have a dichotomy: urban areas with some industry and industrial areas with some supporting urbanization. The dichotomy is also visible in the structures for the development, administration, and governance of urban and industrial areas (Figure 4.5). While traditional cities have a combination of municipal bodies and development authorities, new industrial areas are typically managed by "Notified Area Committees," or such other structures, which have stakeholder representation and a limited mandate for providing services and carrying out maintenance. Of late, new structures are emerging such as the Industrial Area Local Authority in Andhra Pradesh and the Regional Development Authority in Gujarat.

Existing Institutional Framework for Urban and Industrial Development in the Corridor

Both Andhra Pradesh and Tamil Nadu have well-established institutional frameworks for managing urban development and industrial development, not dissimilar to the rest of the country. Table 4.1 gives a brief overview of the typologies of urban and industrial development, and the corresponding management systems in Andhra Pradesh and Tamil Nadu.

Table 4.1: **Overview of the Typologies of Urban and Industrial Development and the Corresponding Management System in Andhra Pradesh and Tamil Nadu**

Typology of Development	States where Applicable	Governance, Administration, and Development Agencies	Land Management Mechanisms
Cities and Towns	Both states	• Governance and administration, primarily through local government structures (municipalities, municipal corporations) • Area planning and development through urban development authorities or state level agencies like the department of town and country planning • Para-statal agencies like housing boards and infrastructure development boards	• Primarily through land acquisition for creation of roads and infrastructure • Bulk of usable real estate space including that required directly for economic development is created by the private sector
Notified Industrial Areas, Industrial Estates, and Industrial Townships	Both states	• Planned and developed by state industrial development corporations • Andhra Pradesh has the concept of industrial area local authority (though not robustly implemented in practice) • Otherwise they are mostly governed and administered by local town or village *panchayats*; local management is through Notified Area Committees	Primarily through land acquisition
Integrated Townships	Andhra Pradesh	• Private sector led planning and development with acquisition support and bulk infrastructure provision from state-owned corporations	Private sector- and state-led land acquisition
Integrated Investment Regions and Industrial Areas	Andhra Pradesh	• Existing governance structures for industrial areas	Land acquisition is the predominant mechanism
Special Economic Zones	Both states	• State-led or private sector-led	Land acquisition
National Industrial Manufacturing Zones	Both states	• Public–private partnerships (PPPs) facilitated by the state government	Land acquisition

Source: Study team analysis

In each state, there is a range of organizational entities engaged in promoting urban and industrial development. Tables 4.2 and 4.3 present a matrix of the organizations, and the roles they play, for Andhra Pradesh and Tamil Nadu.

Table 4.2: **Roles and Responsibilities of Institutions in Andhra Pradesh**

	State	Andhra Pradesh				
Role	**Institutions**	**APIIC**	**Area Development Authorities**	**HMDA**	**ULBs**	**HMC**
Planning	Master planning, zoning, Regulations					
	Detailed development plans					
	Surveys and acquisition drawings					
Land Management	Govt. land acquisition for specific purpose					
	Govt. land pooling					
	Joint venture with private land owner or infrastructure developer			Through creation of special purpose vehicle		
	Govt. land banks through acquisition					
	Private sector acquisition					
	Private sector land pooling					
Development	Bulk infrastructure					
	Last mile infrastructure					
	Industrial development facility					
	Industrial development support infrastructure (logistics, transport, warehousing)					
	Urban area development (residential, education, health)					

APIIC = Andhra Pradesh Industrial Infrastructure Corporation, HMC = Greater Hyderabad Municipal Corporation, HMDA = Hyderabad Metropolitan Development Authority, ULBs = Urban Local Bodies.

Source: Study team analysis.

Table 4.3: **Roles and Responsibilities of institutions in Tamil Nadu**

Role	State	Tamil Nadu						
	Institutions	**TIDCO**	**SIPCOT**	**DTCP**	**CMDA**	**ULBs**	**TNUDF**	**CMC**
Planning	Master planning, zoning, Regulations							
	Detailed development plans							
	Surveys and acquisition drawings							
Land Management	Govt. land acquisition for specific purpose							
	Govt. land pooling							
	Joint venture with private land owner or infrastructure developer							
	Govt. land banks through acquisition							
	Private sector acquisition							
	Private sector land pooling							
Development	Bulk infrastructure							
	Last mile infrastructure							
	Industrial development facility							
	Industrial development support infrastructure (logistics, transport, warehousing)							
	Urban area development (residential, education, health)							

CMC = Chennai Municipal Corporation, CMDA = Chennai Metropolitan Development Authority, DTCP = Directorate of Town and Country Planning, SIPCOT = State Industries Promotion Corporation of Tamil Nadu Limited, TIDCO = Tamil Nadu Industrial Development Corporation, TNUDF = Tamil Nadu Urban Development Fund, ULBs = Urban Local Bodies.

Source: Study team analysis.

Need for Synergizing Urban Development and Industrial Development

Indian urban development and management agencies are focused on land use planning and municipal service provision. Local economic development is not part of their mandate. Cities generally do not seek to influence the location of economic activities by providing infrastructure and services.

Agencies that promote industrial development focus on the economics of setting up and operationalizing industrial facilities. Concerns about urbanization are limited to provision of workforce housing. As a result, new industrial developments arise in locations away from existing cities and new urban agglomerations form around them in an unplanned and haphazard manner.

It is now accepted that industrial development promotes urbanization and that a certain level of urbanization is necessary to support industrialization. However, the default response to the above recognition is to promote new urban development near new industrial development. The proposals range from workforce housing to townships to greenfield megacities. Often, there is complete disregard for the impact of new industrial development on existing urban and rural settlements. During the process of creating new industrial development and supportive urban development, requisite human and other resources come from existing settlements, promoting their growth but usually without planning.

One of the reasons for this neglect is that economic corridor development is run almost exclusively under the direction of the industries departments of the states. The urban development departments have little, if any, role to play. It is interesting to note that even in Gujarat, where an integrated approach is most evident, the industries department enacted its own legislation, the Special Investment Regions (SIR) Act, incorporating all the useful provisions of the Gujarat Town Planning and Urban Development Act. For the implementation of SIRs, they even employed retired town planning officials or poached serving ones. In effect, the Gujarat Industries Department subsumed the urban development function, at least in the context of new industrial development.

With a regional planning approach, it is possible to synergize urban and industrial development. However, the regional planning that happens in the context of economic corridors, such as the Delhi–Mumbai Industrial Corridor (DMIC), is limited to planning for regional infrastructure or analyses to support locational decisions for industrial parks and other large-scale facilities. It does not extend to spatial or land use planning at the regional scale. A regional strategy for urbanization and industrialization is required, along with other major initiatives for economic development.

Such a strategy should link existing industrial clusters and urban areas with new industrial hubs and urban centers through infrastructure networks, the most important one being transportation. This will enable the corridor development process to effectively use the capital, human resources, and infrastructure available in existing settlements to build new centers. There will be inevitable growth impetus in these existing settlements in the initial phase, which must be planned for.

Modern Governance Systems for New Urban-Industrial Complexes

Integrated urban-industrial complexes are emerging as a new genre of development with great potential. Two commendable examples include Sri City in Andhra Pradesh and Mahindra World City in Tamil, which are well-managed developments that are private-sector-led and government-mandated. There is a need to mainstream such arrangements for governance and management of this new genre of urban-industrial complexes.

Integrating Urbanization and Modern Economic Activities

Manufacturing and other modern economic activities require a local resident workforce coming from various strata of society. Over time, such economic activities generate a multiplier effect, giving rise to a whole ecosystem of subordinate production and supply chains, and services. Urban centers foster this development, while also requiring a strong economic base upon which to thrive. While historically this symbiotic relationship has evolved in each city, it is also possible to plan for and achieve it in a proactive manner.

Proactive Urbanization and Economic Development at New Locations

Synergizing urbanization and economic development at new locations requires both long-term and short-term strategies.

Long-Term Strategies

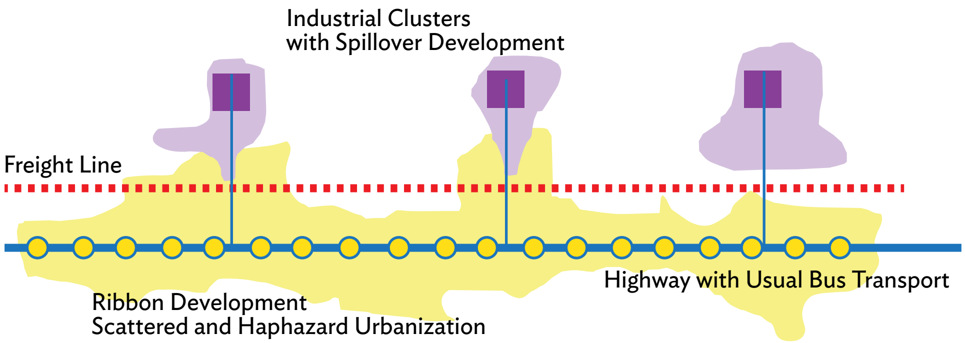
- **New urban development at or near new economic centers.** Such development should include affordable housing, social infrastructure, and municipal services. The planning for such developments should not be static, end-state designs, but rather should have the genetic code for continued growth and expansion in a coherent structure.
- **Hierarchically structured public transport networks at regional and local levels.** During corridor development, it is important to create an effective regional transportation system connecting existing and new urban centers with existing and new clusters of economic activity (manufacturing and other types). This should be supplemented by local public transport systems in urban areas as well as manufacturing centers.

The following scenarios provide a simplistic illustration of how the transportation system can influence the form of urbanization at the regional scale. The scenarios assume that there is a (i) rail line for large-scale freight movement with stations at strategic locations based on raw material sources and industrial growth centers; and (ii) system for transporting people and goods on a smaller scale, which may include highway, passenger rail lines, and bus transport.

Scenario 1: Ribbon development and scattered, haphazard urbanization

This scenario describes new industrial clusters away from existing cities with no new investment in transportation or urban development, resulting in ribbon development along the highway and scattered, haphazard urbanization all over the region (Figure 4.6).

Figure 4.6: **Scenario 1: Ribbon Development and Scattered, Haphazard Urbanization**

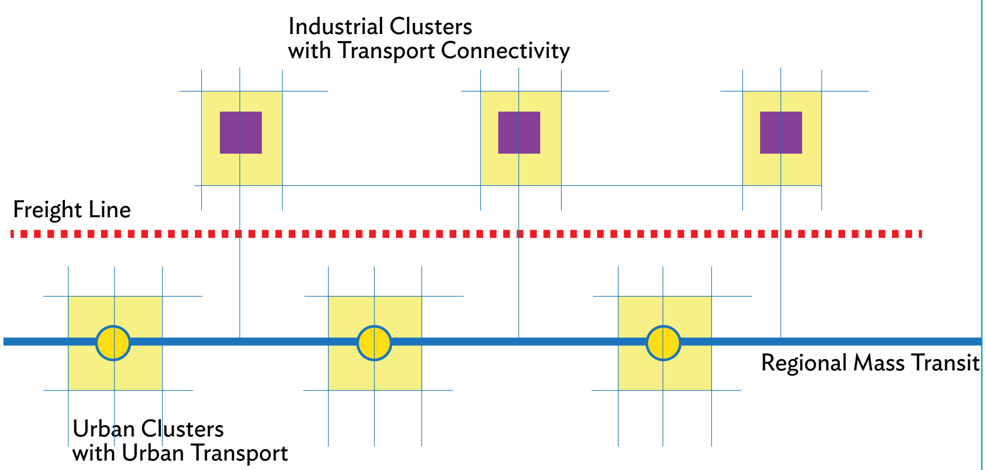


Source: Study team analysis.

Scenario 2: Industrial clusters and urban clusters connected by mass transit

This scenario describes new industrial clusters away from existing cities supported by investments in (i) supportive urban development near industrial clusters at a safe distance; (ii) improved urban infrastructure in existing cities; and (iii) regional mass transit connecting existing urban areas, new urban areas, and new industrial clusters (Figure 4.7).

Figure 4.7: **Scenario 2: Industrial Clusters and Urban Clusters Connected by Mass Transit**



Source: Study team analysis.

Haphazard development in unsafe locations happens primarily because of a tradeoff in costs that the entrepreneur is faced with—the cost of carrying inventory versus the cost of a daily commute. Therefore, investing in regional mass transit and local urban transport ahead of manifest demand is strategically the most effective means of ensuring planned urbanization to support industrial development.

Short-Term Strategies

- **Strengthening existing urban centers.** When the corridor development process starts, there is an immediate growth impact on existing urban centers, resulting in increased demand for affordable housing and municipal services.
- **Public transport connections to economic centers.** As a prelude to the long-term strategy of building regional and local transportation systems, it is important to start by making effective public transport connections between existing urban centers and new growth locations.

New Economic Activities in Existing Urban Areas

In the process of creating new growth centers, economic activity in existing centers is ignored. There are several opportunities that should be explored in this context:

- brownfield redevelopment in closed or unused industrial lands to bring in new economic activity appropriate for the location,
- promotion of compatible economic activities in core city areas as well as the growing urban periphery, and
- strengthening support systems for sustaining new economic activities.

Urban Infrastructure Needs

Urban infrastructure that supports new economic growth centers can include a wide range of facilities. The following are the most essential and fundamental to supporting growth.

- **Affordable workforce housing.** Nuanced strategies are needed for different income groups in the short- and long-term. For low-income workers, it may be necessary to create affordable housing in nearby villages and towns, where affordable social infrastructure is available, since these workers are most affected by commuting costs. Middle- and high-income groups may prefer housing in nearby large towns in the short-term until new urban centers are fully established. In the long-term, the strategy should be to facilitate the establishment and growth of new urban centers with amenities in strategically meaningful locations.
- **Efficient public transport.** The real cost of housing is a combination of the cost of the house plus the cost of municipal services and transportation. Therefore, the provision of efficient and affordable public transportation can resolve the issue of affordable housing to some extent. As described above, the short-term strategy should be to connect existing settlements to the new development centers by transport services. The long-term strategy should be to establish a stable, hierarchical system of regional and local transport, and enabling the growth and development of both urban and economic centers in a synergistic manner.
- **Reliable municipal services, social infrastructure, power, and telecom services.** Infrastructure for water supply, sanitation, health, and education are essential to attract quality human resources to a new growth center. In the emerging development scenario, reliable power and telecom services are equally important. In the short-term, the approach should be to strengthen these facilities in nearby existing settlements

and connect them with public transport. In the long-term, the new urban centers should provide all of these facilities.

Land Management Challenges

Over the last few decades, land acquisition has become an increasingly contentious issue. Land availability has declined, land values have risen, and the legal and political fallout of acquisition has been aggravated. The perception of inequity and injustice surrounding compulsory acquisition has also been accentuated, especially when the acquisition is for economic development. Land owners resist displacement, expect higher compensation, demand effective rehabilitation, and desire to participate in the upside of the development that follows.

LARR Bill 2013

As a consequence of the issues mentioned above, the Government of India decided to reform the Land Acquisition Act, 1894. The first version of the new bill was presented by the Ministry of Rural Development in 2011. After consultations and revisions, in September 2013, both houses of Parliament approved The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation, and Resettlement Bill 2013 (LARR Bill 2013) repealing the previous Land Acquisition Act of 1894. The new law applies in cases where the acquisition is made by the government (i) for public use or for transfer to a public–private partnership (PPP), or (ii) for transfer to a private entity. In the first case, 75% of owners must consent to the government's acquisition; in the second case, 80% of owners must consent. It also applies if the acquisition is made by a private party beyond thresholds set by the relevant state government. LARR does not apply to land acquired under 13 acts, which are listed in the fourth schedule, covering a wide range of economic corridor projects such as ports, logistics, warehousing, agro-processing, manufacturing and investment zones, tourism development, and housing.

There are a few specific aspects of the new law that are expected to cause problems. Given the consent clause requiring 75% or more of owners to agree to a land acquisition, the cost of acquisition is likely to increase as much as fourfold. In addition, the time required for the entire process may increase to a minimum of 50 months due to new procedural requirements such as a social impact assessment.

Successful Land Management Strategies

A recent ADB study on planning and land management strategies for economic corridors showcased several approaches that have been successful in various states in India. A few of these are summarized below.[2]

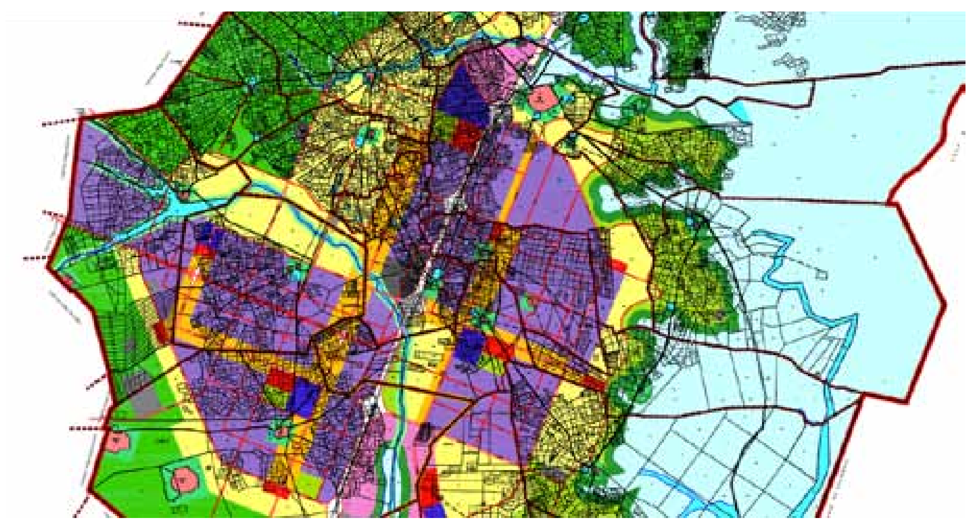
[2] B.R. Balachandran and S. Balachandran. 2014. Land Management and Urban Planning Challenges for Industrial and Agro-Processing Parks: An Assessment in the Context of Economic Corridors (unpublished). Manila: ADB.

Land Pooling: Dholera SIR in Gujarat

The SIRs that are being created all over Gujarat in connection with DMIC take a proactive approach to planning and land management. The SIR Act has embedded provisions for town planning through a clause which states “the provisions of the Gujarat Town Planning and Urban Development Act, 1976, shall, *mutatis mutandis*, apply with respect to the Development Plans and to the Town Planning Schemes made under this Ordinance.” Under this act, the Gujarat Infrastructure Development Board is empowered to declare new SIRs and create Regional Development Authorities for them. These Regional Development Authorities then prepare Development Plans and Town Planning Schemes for the SIRs. Of 13 proposed SIRs in Gujarat, seven have been notified while Development Plans have been prepared for four. The Petroleum, Chemicals, and Petrochemical Investment Region (PCPIR) is already operational.

Each of these Development Plans provides for the planned development of an entire city with the industrial zone as the core, and with residential, commercial, and other uses supporting the core. Plans for city-level transportation networks and open-space networks are also included (Figure 4.8).

Figure 4.8: **Excerpt from Development Plan for Dholera SIR**



Source: Study team compilation.

The planning process does not stop at a macro-level master plan. It is taken to the next level using a land pooling mechanism known as a Town Planning Scheme. At this level, land holdings are reorganized to appropriate the land required for common facilities such as roads, open spaces, and (physical and social) infrastructure. The original land owners give up a portion of their agricultural land holdings and get back a somewhat smaller plot (approximately 50% of their original holdings) that is regular-shaped and part of a properly planned and serviced layout (Figure 4.9).

Figure 4.9: **Excerpt from Town Planning Scheme for Dholera SIR**

Source: Study team compilation.

The SIR case study demonstrates that advance planning for an industrial region creates the possibility of integrating urban development with industrial development in a harmonious manner. The use of land pooling rather than land acquisition enables the participation of original landowners in the upside of the development process.

Magarpatta: Private Sector Land Pooling

Magarpatta City, a special economic zone for electronics and information technology in Pune, was originally multiple plots of agricultural land owned by a farming community known as the Magar. In 1982, the Pune Municipal Corporation marked it as a "future urbanizable zone" in its Draft Development Plan. The Magar clan and their immediate neighbors comprising 123 families decided to develop the land themselves. They pooled 400 acres (162 hectares) and prepared a private township plan, which was submitted to the state government for approval. They registered a company called the Magarpatta Township Development and Construction Company Limited with Satish Magar as its Managing Director. Each family received shares equal to the size of its landholding.

Present-day Magarpatta City consists of three types of real estate development—residential, commercial, the Cybercity, and the special economic zone comprising 12 towers. The development also includes parks and gardens, two schools, and a hospital.

The Magarpatta case demonstrates the possibility of democratic, equitable, and participatory processes for land management driven by private initiative and supported by an enabling local regulatory environment (Figure 4.10).

Figure 4.10: **Magarpatta: Private Sector Land Pooling**

Source: Study team compilation.

CIDCO Policy for Land Management

The City and Industrial Development Corporation of Maharashtra Ltd. (CIDCO) is a company wholly owned by the Government of Maharashtra and was incorporated in 1970 with the specific aim of planning and implementing Navi Mumbai, a planned, self-sufficient, and sustainable city on the mainland across Thane creek adjoining Mumbai. The total project area is about 34,400 hectares and included 95 villages of Thane and Raigad Districts. All of the private land was acquired by the government and placed at the disposal of CIDCO. The 95 *goanthans* (village settlements) were excluded from acquisition. To equip the local people for employment, training programs were instituted in specially set-up technical training institutes for various technical trades and occupations. The *goanthans* were provided social amenities like piped water supply, approach roads, drains, septic tanks, upgraded school facilities, and medical care. The government then announced the 12.5% scheme and extended it to all Project Affected Persons (PAPs). In this scheme, the PAP is given back developed land, which is 12.5% of the land acquired from the individual. Out of the 12.5% entitlement, 30.0% is reserved for social facilities and public utilities. Thus, the net allotment is 8.75% of the land acquired from the individual. The plot allotted to the individual has a 1.5% Floor Space Index and 15.0% commercial component permissible on the plot.

The approaches adopted by CIDCO to rehabilitate landowners economically and to include them in the overall development process by allotting developed land to them were considered pioneering at the time. These approaches remain relevant today.

Haryana Land Acquisition and Land Pooling Policies

The Department of Urban Estates, Haryana acquires land for the development of urban areas by the Haryana Urban Development Authority. Land is acquired under the provisions of the Land Acquisition Act, 1894. In 2010, the Government of Haryana formulated its land acquisition and Resettlement and Rehabilitation (R&R) Policy, in which the interests of land owners are protected by provisions for (i) minimum floor rates (five zones in state—20 *lakhs,* 16 *lakhs,* and 8 *lakhs* per acre) so as to ensure payment of market-linked compensation; (ii) bonuses (30% *solatium* and 20% bonus on non-litigation agreements); (iii) a number of benefits under the R&R Policy, including skill development and jobs as well as payment of an annuity for a period of 33 years (from INR21,000 per acre per annum to INR42,000 for private land for a special economic zone).

In 2012, the Government of Haryana notified a Land Pooling Scheme for development of residential sectors by the Haryana Urban Development Authority, whereby land owners would also be given an option to become partners in the development process. The landowners opting for the Land Pooling Scheme are to be provided developed residential plots measuring 1,000 square yards and commercial plots measuring 100 square yards for each acre of land acquired, or in the same proportion for the land acquired in lieu of the compensation package and all other benefits admissible under the government's R&R policy. Instead of taking the plots, the applicant can also claim the value of the entitled developed land at the allotment rates applicable at the time of launching the residential sector. There are complex options also available, in which the land owner takes a cash advance and then opts either to take land for the remaining amount or return the advance with interest (9%) and take the entire amount of entitled land, or take the rest of the land's value in cash. If the land being acquired is more than one acre, the land owner also has the option of taking land for 50% of his holding and accept compensation plus R&R for the remaining 50%.

The Haryana policy framework is hailed as one of the fairest and most people-friendly schemes in India with a lot of protection for farmers and the opportunity to participate in the upside of the development. There is no information available as to the application of this policy to industrial development projects.

Planning and Land Management Strategy for Corridor Development in Andhra Pradesh

The Government of Andhra Pradesh seeks to deploy appropriate planning and land management strategies for infrastructure and industrial development. Land acquisition will be increasingly difficult, time consuming, and expensive even if the LARR 2013 is diluted. Meanwhile, the case studies show that viable alternatives exist. The practice of land pooling in Gujarat (Town Planning Schemes) is a fair, equitable, economical, and efficient method to consolidate land without any displacement. The case of Magarpatta demonstrates that the same process can be driven by private initiative with limited or no government involvement. The CIDCO and Haryana models of giving land in lieu of land as part of the compensation package also hold promise.

Table 4.4: **Possible Land Management Mechanisms**

Mechanism	Context where appropriate	Issues to be addressed
Land acquisition	• Linear alignments such as rail lines and highways • Location-critical infrastructure such as ports • Other projects where exclusive control of land is critical • Areas with low land value, low agricultural productivity, and low levels of urbanization and other development indicators	• Effective management of the acquisition process without inordinate increases in land value • Creating opportunities for displaced households to participate in the upside of the development • Creating opportunities for value capture by the government
Land banking	• Projects that require large parcels such as industrial parks • Other projects where exclusive control of land is critical • Places where the government already has substantial land holdings • Areas with low land value, low agricultural productivity, and low levels of urbanization and other development indicators	• Consolidation of land in strategic locations • Creating large, contiguous land parcels • Securing the land from encroachment
Land pooling by the government	• Projects that require extended areas (e.g., industrial cities) with a diversity of land uses • Projects where exclusive control of land is not necessary • Projects in which appreciation in land values can yield substantial benefits for land owners who retain a portion of their land	• Statutory backing including legal reforms if needed • Creating effective systems for planning and implementation • Enabling a high level of stakeholder participation • Creating opportunities for local private sector participation
Land pooling by private initiative	• Public–private partnerships (PPP) or entirely private sector projects • Projects where exclusive government control of all land is not necessary • Places where entrepreneurial attitudes prevail • Areas with high land value and high levels of speculative investment	• Creating an appropriate legal framework and policy environment to enable private land pooling • Ensuring that coercive practices are tempered by state intervention if needed
Land assembly by private sector	• PPP or entirely private sector projects • Projects where exclusive government control of all land is not necessary • States with a tradition of supporting private initiative • Land value could be either low or high	• Creating an appropriate legal framework and policy environment to enable private land pooling • Ensuring that coercive practices are tempered by state intervention if needed
Master planning, zoning, and development control	• Projects that require extended areas (e.g., urban areas or industrial cities) with a diversity of land uses • Projects where exclusive control of land is not necessary • Relatively low land value • Urbanizing periphery of existing cities • Diversity and complexity of the development requires the participation of a wide range of private sector players	• Statutory backing including legal reforms if needed • Creating effective systems for planning and implementation • Enabling a high level of stakeholder participation • Creating opportunities for local private sector participation

Source: Study team analysis.

It is recommended that the planning and land management strategy in Andhra Pradesh should use a combination of these mechanisms. Table 4.4 gives an overview of the issues related to various land management mechanisms.

Leveraging Existing Legal and Institutional Framework–Special Development Authorities and Town Planning Schemes

The Andhra Pradesh Urban Areas (Development) Act, 1975 has a provision to create Special Development Authorities (SDA). Two examples are the Cyberabad in Hyderabad and Visakhapatnam–Kakinada PCPIR, which is a part of the proposed Vizag-Chennai Industrial Corridor (VCIC). Once the SDA is created, a Development Plan is prepared and notified for the whole area, designating development zones for industrial and other uses such as residential, commercial, public, institutional, and recreational. Currently, the implementation mechanism for the Development Plan consists mainly of land acquisition for public purpose projects, and layout approval and building permissions for private developments.

If the Government of Andhra Pradesh is interested in introducing land pooling along the lines of the SIRs in Gujarat, it is possible to prepare and implement Town Planning Schemes (TPS) under the Andhra Pradesh Town Planning Act 1920. The Andhra Pradesh Urban Areas (Development) Act, 1975 and the Andhra Pradesh Town Planning Act, 1920 can be used in combination; the Development Plan being prepared under the former and the TPS being prepared under the latter.

There are a few advantages in using the above strategy. The legal framework exists for both SDA and TPS, so work can proceed without waiting for new legislation. Preparing and implementing TPS will integrate physical planning with land pooling. Through this approach, the state can develop a systemic solution in the long-term. However, there are challenges, too. Since TPS have not been prepared in Andhra Pradesh for a long time, the institutional processes have to be created. The physical planning process can take 12–24 months since considerable stakeholder engagement is involved. The town planning establishment within the government would have to be co-opted into this process.

Formulating a New Land Acquisition and Land Pooling Policy

Another strategy to consider, as a concurrent activity, is the formulation of a land acquisition and land pooling policy on the lines of Haryana's policy framework explained above. This policy should consist of these key features:

- Land acquisition
    - Monetary compensation at par with market rates, plus *solatium* and a non-litigation bonus
    - R&R package that includes a house, skills development training, a job, and an annuity

- Land pooling options for land owners
    - Developed land in lieu of acquired land
    - Combination of land and monetary compensation
    - Monetary compensation alone

The main advantages of formulating such a policy are its quick operationalization and considerable leeway for negotiation with land owners. In the case of land pooling, physical planning is not critical to the process. However, some level of physical planning is necessary to make developed plots look attractive. It is important that circle rates be updated to make the monetary compensation attractive. Effective mechanisms for R&R are also important to ensure that the process is smooth.

Key Challenges for Land Pooling for Industry (Without Urban Development)

It is strongly recommended that urbanization and industrialization be synergized wherever possible. In such situations, land pooling becomes attractive as the appreciation in the value of the land retained by the land owners is substantial. However, this may not be possible or desirable in all cases. For example, where hazardous industries are involved, urbanization may be at a different location. In such situations, the option of a land-in-lieu-of-land mechanism will be less attractive if only industrial uses are permitted. One option is to plan industrial parks in such a way that commercial and ancillary industries are allowed in plots given as part of compensation. Wherever possible, residential development should also be allowed at a safe distance and compensation land could also be given. In such situations, other supportive measures like skills development, employment, and social infrastructure need to be generously offered to make the overall deal attractive.

Study Team

The report has been prepared under the overall guidance of Sekhar Bonu, Director, South Asia Regional Cooperation Division and M. Teresa Kho, Country Director, India Resident Mission, Asian Development Bank.

ADB	
Team Leaders	Sabyasachi Mitra Rana Hasan
Team Members	Hoe Yun Jeong Kavita Iyengar Nidhi Kapoor
Consultants	Soumya Chattopadhyay Satish Reddy Kevin Donahue Leilanie Basilio Jolly La Rosa Principe Nicdao Joseph Manglicmot Atul Sanganeria
PricewaterhouseCoopers, India	Manish Agarwal Manish Sharma Mohammad Saif Athar Vikash Sharda Ramya Arigay R. Lakshminarainan Vaishakhi Shah Shubhojeet Chakravarty
Deloitte Touche Tohmatsu India Private Limited	Arindam Guha Anindya Mallick Shubham Gupta
Independent Experts	John Arnold B.R. Balachandran A. Kishore Rao

The team benefited from valuable inputs from Meenu Tewari, Arpita Mukherjee, Ashok Gulati, and Rajat Kathuria at the Indian Council for Research on International Economic Relations, New Delhi; Jayanta Ray of Deloitte Touche Tohmatsu India Private Limited; Partha Mukhopadhyay, Centre for Policy Research; Kunal Sen at the University of Manchester; N. Sridharan at the School of Planning and Architecture, Vijaywada; and Rajeev Singh, Kanupriya Gupta, and Abhijit Sengupta at the ADB India Resident Mission.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to approximately two-thirds of the world's poor: 1.6 billion people who live on less than $2 a day, with 733 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

ASIAN DEVELOPMENT BANK
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org