

# INFRASTRUCTURE PRIORITIES FOR JOB CREATION IN INDIA

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# Foreword

One of the biggest challenges for Indian policy-makers is to ensure that growth of India's GDP comes along with growth of more opportunities for Indian citizens to earn better incomes through good jobs that enable them to continue to learn and improve their skills. That is the way to make growth more inclusive. That the Indian economy is not producing enough such jobs, even though it is growing fairly impressively, is known to policy-makers. Therefore, many programs have been launched for skilling, promoting entrepreneurship, supporting MSMEs, etc.

This study by IDFC Institute has focused on the segment of the economy that has the most potential to provide opportunities for jobs and for skill development on the job viz. small enterprises. Small firms are the seeds of growth. They employ more people per unit of capital than large firms do. Therefore, the growth of small firms must be nurtured by policy-makers. This report provides some guidance to policy-makers. It makes three significant contributions.

Firstly, the report makes the case for focusing on the development of semi-urban areas. The country's spatial development framework has so far been split into two: 'rural' development and 'urban' development. Cities are considered the 'engines of growth'. Large cities contribute more to GDP. Therefore, urban development, until recently, was focused too much on the improvement of infrastructure in large cities. Rural areas and villages, on the other hand, are where most Indians live presently. Therefore, rural development programs have been rightly receiving attention too.

Semi-urban areas have fallen into the cracks in-between. Whereas they are the real engines of growth of the economy. Cities do provide 'economies of aggregation'. Therefore, people from rural areas migrate to cities for opportunities, for employment and for starting enterprises. Manufacturing enterprises generally need more space to operate than service enterprises do. And space is precisely what becomes more expensive in cities where activities are more compacted than in rural areas. Moreover, manufacturing can create more environmental pollution. Therefore, manufacturing enterprises find semi-urban areas most attractive—near enough a city, yet outside it. The neglect of infrastructure in semi-urban areas is one of the reasons India's manufacturing sector has not grown much larger and more competitive. It has remained a much smaller part of India's economy than in China, Thailand, and other Asian developing economies, even though India has not lacked engineering and technical skills.

The problem is, policy frameworks have focused on either urban infrastructure or rural infrastructure, and the needs of semi-urban areas have been neglected. This is evident

whenever one visits such areas—bad roads, overflowing drains, garbage, stagnant water, etc. Therefore, this study has concentrated on understanding what infrastructure is required in semi-urban areas from the perspective of small manufacturers. What infrastructure should generally scarce, government's budgetary and administrative resources be focused on?

The second contribution this report makes is to focus policy-makers' attention on strengthening 'clusters' of small enterprises. Such clusters form organically in semi-urban areas, especially manufacturing clusters, but also service industry clusters—like transporters and repair shops, for reasons mentioned already. However, the productivity of enterprises within these clusters is hampered by the poor infrastructure available to them. India's policy-makers want small Indian enterprises, especially manufacturers, to connect with global supply chains. They are being urged to export more. Exhortations are very well but they glide over the difficulties small enterprises have in connecting with global supply chains. Individually, small enterprises are too small to be noticed. And, they must become more competitive too. The presence of many enterprises together in one place can provide them with 'aggregation benefits' provided the cluster is efficient.

Small enterprises must connect together in a strong 'internal supply web' to be able to connect with 'global supply chains'. Together, enterprises can have more visibility and more clout in global supply chains. And, they can also benefit from trade and interactions amongst themselves within the cluster to improve their competitiveness internationally. This requires better internal infrastructure in the cluster—both, the 'hard' infrastructure of roads, common effluent treatment and other utilities, etc., as well as the 'soft' infrastructure of training facilities, etc.

The researchers faced methodological challenges while preparing this report. Good data was not easily available about conditions in semi-urban areas because, as mentioned before, policy attention has been focused so far on either rural or urban.

Moreover, since the growth of enterprises is an organic and complex process, it is not very amenable to data-driven research, even if accurate data-sets were available about some of the variables. Therefore, unless many variables are considered together, in a systems' view, the constraints on growth cannot be understood fully. The solutions have to be systemic too. Fixing only the constraints of the 'hard' infrastructure, will not lead to the growth of competitiveness of enterprises; nor will it lead to generation of more jobs. The 'soft' infrastructure must be strengthened along-side too.

For example, building more roads in semi-urban clusters will not by itself, improve the productivity of enterprises. Proof of this are the many, underutilized and ineffective industrial estates built around the country over the past fifty years. Nor will provision of more skill training centers alone create more jobs. Proof of which is the large numbers of young people who have been provided skill training in the United Progressive Alliance (UPA) and National Democratic Alliance (NDA) governments' drive in the last ten years to skill-up millions of young people. The majority of these people, by all accounts, are yet to find good jobs.

Semi-urban clusters have to be studied as complex, self-generating systems. Many forces impact their growth and competitiveness. Moreover, these forces interact amongst themselves—the quality of the physical infrastructure with the quality of the governance of the cluster; the quality of the training facilities with the quality of the management of the enterprises in which the skilled persons are placed; etc.

It is imperative for India to grow many more, small and competitive enterprises. This study has focused attention on where it needs to be—on semi-urban agglomerations, and on the requirements of small enterprises. It has also analysed the needs of hard infrastructure. It will be very worthwhile to follow up this study with another, more systemic study of enterprise clusters to devise a 'whole of government' policy approach for their improvement.



**Arun Maira**

Former Member of Planning Commission of India  
April 26, 2019

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# Preface

Jobs have become the centerpiece of any conversation on the Indian economy. While India has witnessed high growth rates in the post-liberalisation period, the record on employment has been rather patchy. The scale of the employment challenge is shrouded in confusion and uncertainty, mostly due to the lack of comprehensive, reliable, and timely data. Available employment estimates, although they are dated and do not capture the complete picture, convey that good quality jobs are not being created at the pace they ought to be.

Therefore, the foremost challenge for the newly elected government is clear: if India is to reap the benefits of its demographic dividend in the same manner that China did, creating these jobs is critical. To tackle this successfully, three broad sets of issues must be addressed — unshackling cumbersome regulation for businesses, educating and skilling the workforce, and providing necessary physical infrastructure, which not only helps enterprises grow but also directly creates a large number of jobs.

This report focuses on physical infrastructure and its ability to boost job creation. More specifically, it makes the case for including the impact of infrastructure on stimulating job growth as part of the decision making calculus while determining infrastructure investment priorities. Further, since infrastructure requirements are not a one-size-fits-all but vary depending on the economic geography of a region, the report identifies regional priorities and compares the employment effects of providing different types of infrastructure across these regions. In other words, it is among a handful of rigorous studies that identify infrastructure needs at the sub-state level and provide estimates of the potential number of jobs created if these needs are met.

The task of estimating job numbers from infrastructure investments is made difficult due to absence of data at a disaggregate level as well as a sound methodology. To get

around the problem of lack of data, the study undertook a survey of 2,500 firms in 18 peri-urban districts across different states that were selected as areas with potential for high growth. The aim of the survey was to understand the infrastructure challenges of firms in these districts. The team then devised a model to estimate job creation from the cost savings that will accrue to firms if the particular infrastructural challenge is resolved. The study finds that connectivity through roads is the essential physical infrastructure that firms demand and is likely to have the most impact on job creation by propelling firms' growth.

The project was funded by Ford Foundation and I would like to thank Mr. Srinivasan Iyer for the funding support. The survey was conducted by Kantar-IMRB, a leading market research agency, under the careful supervision of IDFC Institute researchers. I am immensely grateful to my colleagues at IDFC Institute, Dr. Vivek Dehejia and Dr. Vaidehi Tandel, for leading the research team consisting of Harshita Agrawal, Prakhar Misra, and Sharmadha Srinivasan. Dr. Abhay Pethe's guidance was key to successfully completing this project. I would also like to thank members of the Advisory Council — Dr. Indradeep Ghosh, Dr. Amartya Lahiri, Dr. Rajiv Lall, Dr. Santhosh Mathew, Dr. Rinku Murgai, and Ms. Roopa Purushothaman — for their unwavering support for both the project and IDFC Institute.

I hope this report will be useful to academics, researchers, and entrepreneurs, but most of all to policymakers. My sincere hope is that it will be an additional tool for making informed decisions about infrastructure investments, especially for surmounting the hurdle of weak employment generation so that India can continue on its path to prosperity.



**Dr. Reuben Abraham**

CEO and Senior Fellow, IDFC Institute

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# Abbreviations

**ASI:** Annual Survey of Industries

**CCI:** Cabinet Committee on Infrastructure

**CES:** Current Employment Statistics

**CMIE:** Centre for Monitoring Indian Economy

**DDP:** District Domestic Product

**DES:** Directorate of Economics and Statistics

**DFC:** Dedicated Freight Corridor

**DMSP-OLS:** Defense Meteorological Satellite Programme  
– Operational Linescan System

**EDFC:** Eastern Dedicated Freight Corridor

**EPFO:** Employees' Provident Fund Organization

**ESIC:** Employees' State Insurance Corporation

**FGDs:** Focus Group Discussions

**GDP:** Gross Domestic Product

**ICDS:** Integrated Child Development Services

**IFC:** International Finance Corporation

**ILO:** International Labour Organization

**IMF:** International Monetary Fund

**JNPT:** Jawaharlal Nehru Port Terminal

**MAR:** Marshall-Arrow-Romer

**MGNREGA:** Mahatma Gandhi National Rural Employment Guarantee Act

**MoSPI:** Ministry of Statistics and Programme Implementation

**MoLE:** Ministry of Labour and Employment

**MUDRA:** Micro Units Development and Refinance Agency

**NDA:** National Democratic Alliance

**NIC:** National Industrial Classification

**NIIF:** National Investment and Infrastructure Fund

**NPS:** National Pension Scheme

**NSSO:** National Sample Survey Office

**NTL:** Night-time Lights

**PLFS:** Periodic Labour Force Surveys

**PMGSY:** Pradhan Mantri Grameen Sadak Yojana

**PPP:** Public Private Partnership

**PPP:** Purchasing Power Parity

**QES:** Quarterly Employment Survey

**RBI:** Reserve Bank of India

**REMI:** Regional Economic Modeling, Inc

**RIMS:** Regional Input-Output Modelling Systems

**SCINS:** Standing Committee on Infrastructure Statistics

**WDFC:** Western Dedicated Freight Corridor

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# Executive Summary

India faces the crucial policy challenge today of ensuring that its 473 million strong workforce has access to adequate employment. A dynamic private sector is essential for meeting this challenge. The state has an equally critical role to play. By prioritising infrastructure investment, governments can provide direct employment in large numbers. And they can enable the private sector which is impeded by absent or poor infrastructure.

Given the objective of job creation, this study aims to develop a sound methodology to answer the policy questions of what infrastructure to provide and where. It uses data from a primary survey of 2500 enterprises across 18 districts and a model to estimate the number of jobs created as a result of costs saved by firms. It finds that connectivity, in the form of high quality roads, has the potential to catalyse firm growth and spur job creation across different economic geographies.

The starting assumption is that urbanisation is crucial for creating jobs. Therefore, by providing infrastructure in areas that have the potential for rapid urbanisation, policy makers can leverage agglomeration economies to boost net employment. We make use of night-time lights data to identify 18 districts across India that are on the cusp of rapid urbanisation and growth. The next assumption is that districts with similar economic activities will have similar infrastructure requirements. For instance, districts where manufacturing is the dominant economic activity will require the same type of infrastructure and have similar potential for job creation. These homogenous districts together form a region. Based on the economic activity, we identify three types of regions viz. services region, industrial region, and agro-allied region.

The model works as follows. Firms currently incur costs due to absent or poor infrastructure. Government investment in infrastructure will allow firms to invest these costs that they save in more capital for their businesses. Labour input also rises (in terms of increase in labour cost), determined by the existing capital-labour ratio. Given wages per worker, we can estimate the increase in the number of workers hired. The final step is to compute elasticities in order to estimate the percentage change in employment associated with a percentage change in savings. The survey collects data on the types of infrastructure issues, the employment size of firms, their annual turnover and input costs, and cost savings to firms if the infrastructure is provided. With respect to infrastructure issues, each firm was asked to identify at most three types of infrastructure out of a list of ten whose absence or poor quality had the biggest impact on their business and operations. The analysis and estimates are at the broader regional level.

61% of the firms in the agro-allied region stated that roads were a problem. The second most common problem, cited by 33% of firms, was electricity. Around 28% of agro-allied firms identified water supply as an issue. The leading infrastructure issue for industrial firms was roads, with 84% of them identifying it as an impediment. The second most cited problem was wastewater and effluent treatment (33%), followed closely by water supply (32%). The most cited infrastructure problem for services firms was roads (64.5%), followed by electricity (33%) and water supply (23%).

Finally, we estimate employment elasticity — that is, the effect of a 1% increase in cost saving associated with infrastructure provision/improvement on percentage change in employment. We find that for firms in the agro-allied region, the highest employment elasticity is associated with roads. For every 10% increase in cost saving for firms due to improvement/provision of roads, 1.9% more jobs can be created. For firms in the industrial region, the employment elasticity associated with cost savings due to provision of water supply is the highest. For every 10% increase in cost saving here, 4.3% more jobs will be created. Like the agro-allied region, for firms in services region too, the employment elasticity associated with roads is the highest. We estimate that for every 10% increase in cost saving due to improvement/provision of roads 5.6% more jobs can be created. Comparing across regions, we find that employment elasticities are highest in the services region followed by the industrial region.

Looking at the results, we can conclude that issues as road congestion and poor quality of roads are a major concern for firms — and therefore, investing in upgradation and maintenance of this infrastructure could result in higher cost savings. Furthermore, the induced employment effects of building roads are quite high and have the potential to unlock growth among firms across regions.



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# **INTRODUCTION**

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## 1.1

# Objective

Infrastructure investment has a significant impact on economic growth, employment generation and quality of life. It is therefore important that governments get their investment priorities right. This has been a challenge for India. In the absence of a formal method to aid decision-making, such investment is guided by previously conceived predispositions, political motives, or a crude experiential understanding of the impact of infrastructure. Moving to an evidence-based and methodical approach is essential – not just for catalysing growth but also for making a dent in India’s jobs problem.

India’s working age population is growing by about 16 million every year (Mckinsey & Company, 2017). Estimates suggest 10-12 million people from this will enter the workforce every year, over the next two decades (Mody and Aiyar, 2011; World Bank, 2017). Another estimate, widely quoted, is that 1 million people enter the labour force every month, according to Labour Ministry data (Mishra, 2016). As per the latest available data from 2012, India’s current workforce stands at 473 million and 300 million will be added by 2040 (Mody and Aiyar, 2011; International Labour Organisation, 2017).

While there is contradictory data on the number of jobs being created, even the most optimistic figures do not look encouraging. Given the urgency of this problem and infrastructure investment’s potential for catalysing employment, policymakers should consider prioritising it. This project aims to develop a methodology to estimate the impact of infrastructure investment on job creation in India. We recognise that such estimates will vary across regions, economic sectors, and by types of infrastructure. We therefore wish to compare the impact across different typologies and infrastructure types to identify investment

priorities that could potentially have a significant and catalytic impact on employment. The objective is to create a tool/ methodology that can be used by a government department to objectively assess the impact of a proposed infrastructure investment in a given region.

The central question that this study is attempting to answer is:

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Given a particular economic geography, what types of infrastructure could create the most impact on employment?

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An important caveat here is that the term “impact” does not indicate a precise causal estimate. Indeed, causation becomes difficult to establish on account of practical issues: unavailability of granular data, unreliable multiplier estimates of job creation, and parallel investments in various infrastructure and employment schemes. An additional clarification is necessary. The aim is not to build generalised estimates of employment multipliers, but rather to develop a robust and scalable methodology to undertake context-specific assessments of investment impact.

## 1.2

# Motivation

One of India’s biggest policy challenges is creating jobs for its burgeoning population. While there is some debate regarding trends and the number of people joining the workforce, the magnitude is non-trivial (Basole et al, 2018). Moreover, millions of people continue to leave the agriculture sector, which has seen decades of declining productivity (Ibid.). Between 2004 and 2011, approximately 37 million people left agriculture, and between 2011 and 2015, the corresponding number was 12 million (Ibid.). Aside from structural reforms, which take a considerable amount of time to initiate and materialise, there are very few

interventions that a government can undertake in order to address the jobs problem.

Infrastructure is certainly one such. There is enough evidence from around the world to suggest that infrastructure investment could lead to substantial job creation. In an International Finance Corporation (IFC) Economics note, the authors mention, “...debates on the creation of new jobs in the [infrastructure] sector essentially talk about increasing the share from a starting point of about 7.7% to at most 10-12%. This is not huge, but not negligible either, in

particular keeping in mind that these are the direct jobs in the sector.” In fact, a 2012 World Bank report actively looks at infrastructure development as a source of employment in the Middle East and North Africa region (Estache and Garsous, 2012).

In India too, the National Democratic Alliance (NDA) government articulated a commitment towards using infra-

structure as a tool to enable employment. Finance Minister Arun Jaitley, in the 2018-19 budget speech, laid special emphasis on infrastructure as a tool to create jobs. This willingness by the government to invest in infrastructure makes it imperative to answer questions like: ‘what kind of infrastructure?’, ‘where should it be built?’, ‘how much should be invested on aggregate on infrastructure?’.

### 1.3

## How to use the report

This report uses primary data on employment and infrastructure issues for selected Indian districts collected through an enterprise survey. It also collates data from secondary sources on a number of economic parameters. Researchers and policymakers can get a richer understanding of economic activity within districts as well as the state of infrastructure. We group districts into industries, services, and agro-allied regions based on the dominant economic activity. Using data from the enterprise survey, we estimate employment numbers at the regional level.

The report presents a methodology for estimating the induced effect of infrastructure provision on employment. This methodology can be applied to estimate impact across different economic geographies. Finally, it provides a list of priority sectors in infrastructure for different regions with the objective of catalysing employment.

### 1.4

## Structure of the report

This report has eight main chapters including the introduction. Chapter 2 provides a general background in terms of an overview of employment and infrastructure provision in India. It also briefly describes the different methodologies used in previous studies that estimate the employment effects of infrastructure projects. In chapter 3, we present the rationale for focusing our analysis on certain regions that are likely to see rapid growth in the future and the use of Night-Time Lights (NTL) to identify these. This chapter also explains why we selected specific physical infrastructure types, why we are interested in examining induced employment effects across different economic geographies, and why we rely on primary survey data for the study. Finally, it explains the model we use to estimate the employ-

ment effects. The detailed methodology, data sources, and limitations are presented in Chapter 4. Chapter 5 presents an economic profile of the selected districts. Chapters 6 and 7 present the results from the analysis. These include the major infrastructure impediments identified in the enterprise survey, the number of jobs currently provided by private enterprises across regions, and, finally, the number of jobs that could potentially be created if infrastructure investments are made, given all other things remaining the same. Chapter 8 concludes.

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# **BACKGROUND**

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# Nature of employment statistics in India

India has witnessed an average growth rate of 7.1% in the 2013-2017 period.<sup>i</sup> The accompanying pace of employment has been a major challenge. Although existing employment data is dated, sporadic, and unreliable with estimates varying widely, the consistent theme across all sources is that India isn't producing nearly as many jobs as it should be.

## Existing datasets on employment

A task force led by Professor Arvind Panagariya has assessed existing sources on employment generation. This section summarises the findings of the task force. There are four types of existing databases for measuring employment: a) Household surveys b) Enterprise surveys c) Administrative data d) Data from government schemes.

**Household surveys:** The main drawback of the household surveys is the low frequency of data collection. There are two official household surveys viz. the Employment-Unemployment Survey conducted by the National Sample Survey Office (NSSO) under Ministry of Statistics and Programme Implementation (MoSPI) and the Annual Labour Force Survey conducted by Ministry of Labour and Employment (MoLE). The Population Census under the Office of the Registrar General & Census Commissioner also collects household-level data. The Employment-Unemployment Survey (NSSO) is conducted only once every five years and the data is made available after a lag of a year.

The last survey (68th round of NSS) for which data is available was in 2011-2012. The Annual Labour Force Survey last conducted in 2015-16 suffers from low frequency and a seasonal bias as data is collected only during a certain part of the year. The population census is conducted once in ten years and hence also suffers from low frequency. The census also provides information on broad categories of employment (main, marginal, and non-workers) rather than a detailed breakup as provided by the other household surveys. The Annual Labour Force Survey and Employment Unemployment Surveys have now been discontinued and will be replaced with a new labour force survey that will be conducted annually. This new series will be called the Periodic Labour Force Surveys (PLFS).

**Enterprise surveys:** The enterprise surveys suffer from outdated frame, limited coverage of firms in the frame, and low frequency of data collection. The Economic Census under MoSPI covers only non-agricultural establishments and omits self-employed/small establishments. The Annual Survey of Industries (ASI) only covers manufactur-

ing units registered under the Factories Act 1948. The other firm level surveys are the Unorganized Sector Surveys of Industries and Services (NSSO), Quarterly Employment Survey (QES) (Labour Bureau), and the MSME Census (Ministry of Micro, Small and Medium Enterprises). Each of these surveys has issues regarding incomplete coverage, infrequent data collection and sampling errors that render the sample unrepresentative of the population.

**Administrative data:** The main administrative datasets are the Employees' Provident Fund Organization (EPFO), the Employees' State Insurance Corporation (ESIC) and the National Pension Scheme (NPS). The EPFO database is an administrative dataset of companies that employ more than 20 people. An increase in job numbers as per the Employees' Provident Fund Organisation (EPFO) would capture not just new job creation but also a shift from an informal to a formal job. All of these datasets capture formal sector employment exclusively and relying on them will give an incomplete picture of job creation in the whole economy.

**Data from government schemes:** Government programmes such as the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Pradhan Mantri Grameen Sadak Yojana (PMGSY), Micro Units Development and Refinance Agency (MUDRA), and Integrated Child Development Services (ICDS) programme can be used to infer employment generation. The main limitation is that they provide a limited understanding of actual job creation and cannot be used for comparison across time periods.

## Employment scenarios based on available data

Employment creation estimates based on different types of data may be affected by the limitations of the databases themselves and estimates based on different sources may not be comparable. Further, infrequent collection precludes us from getting continuous trends in employment data. Nevertheless, the available estimates show that India has not been producing the requisite 12 million jobs a year in the last decade. Between 2005 and 2010, India added 11 million jobs at the pace of only 2 million jobs a year (Planning Commission, 2014). A recent study uses payroll data from the EPFO and estimates that 7 million jobs were created in 2017-18 (Ghosh and Ghosh, 2018). This number has been criticised by other economists as being an overestimate (Chakravarty, 2018).



They argue that the EPFO captures additions to payroll which could signify formalisation instead of job creation. The Centre for Monitoring Indian Economy (CMIE), a private independent think tank, conducted a sample survey last year and estimated that India lost 11 million jobs in 2018 and total employment fell from 408 million in December 2017 to 397 million in December 2018 (Vyas, 2019).

Given this wide disparity in estimates owing to differences in datasets and absence of a single reliable source, the need for robust high-frequency data with complete coverage and a sound survey methodology cannot be overstated. India needs a jobs data collection survey along the lines of the

Current Employment Statistics (CES) survey conducted by the Bureau of Labour Statistics in the United States.

The Bureau has been collecting and publishing jobs data for over a century. Approximately 60,000 households are selected and surveyed on a rotational basis. It is a quick response survey with each respondent answering fixed questions pertaining to employment status. We need a comprehensive household survey that is carried out on an annual basis, employs technology to minimise errors and speed up data collection, and publishes results with minimal time lag.

## 2.2

# Infrastructure impediments to job creation

Job creation is not the only problem. Most people who do have jobs are employed in sectors associated with low productivity. The KLEMS India database published by the RBI (Reserve Bank of India) shows that post-liberalisation, the highest employment creation has taken place in construction, followed by trade, miscellaneous services, transport and storage, and education.<sup>ii</sup>

While construction is a more productive sector than farming — which millions have left in this period — it has low productivity compared to manufacturing and services. Traditionally, as countries experience economic growth, low productivity agriculture declines in significance while manufacturing grows and is ultimately overtaken by the

services sector. But manufacturing in India has stagnated over the last four decades, contributing to less than 15% of Gross Domestic Product (GDP) (Planning Commission, 2014). Inadequate physical infrastructure has been identified as one of the key reasons for it not taking off (Government of India, 2011). Given that manufacturing can absorb large swathes of the low-skilled labour force previously occupied in agriculture, our central question becomes particularly important. Understanding and addressing infrastructure impediments will enable manufacturing firms to be more productive and generate more jobs.

## 2.3

# Infrastructure investments

## Need for infrastructure

The World Bank defines infrastructure as ‘a framework that included, but was not limited to, bridges, telephone services, electricity, transportation, water supply’ (United Nations, 2001). The importance of infrastructure to development is borne out by the growth pattern of many countries — the rise of China on the back of infrastructure building, Japan’s heavy investment in infrastructure after World War II, and the rise of America in the 20th century, bolstered by large scale investments in railroad infrastructure. A vast amount of research attests to the vital role that infrastructure investment plays in contributing to national

growth and development (Aschauer, 1989; Ganelli and Tervala, 2015). The International Monetary Fund (IMF) states that infrastructure investment of approximately 1% of GDP in advanced economies produces on average an increase of 1.5% in GDP over four years.<sup>iii</sup> For India, Murty and Sowmya (2011) estimate that increasing infrastructure investment by 0.5% of GDP will boost growth by 1.8% in the medium to long run.

Ganelli and Tervala (2015) argue that if infrastructure is sufficiently effective, the welfare effects are positive. They estimate that a dollar of public investment increases private consumption by an equivalent of \$0.8. In recent years,

a clear link has been established between investment in infrastructure and reduction in poverty (Ali and Pernia, 2003). Infrastructure investment provides a boost to the economy through increased productivity and employment. The subsequent increase in income and consumption reduces poverty.

The rationale for investment in infrastructure differs in developed and developing economies. It has been recommended as an important fiscal policy tool in developed countries to kickstart growth in the face of a recession (Ball, Delong and Summers, 2014). For the United States, it is estimated that each \$100 billion in infrastructure spending would boost employment growth by roughly 1 million full-time jobs (Bivens, 2017). In poor and developing economies, on the other hand, such investment is important due to the infrastructure deficit and the urgent need to lift millions out of poverty. Thus, on average, low income and developing economies spend more on infrastructure as a share of their economy – 6% of GDP – than developed countries which spend less than 4% of GDP (Gurara et al, 2018).

## Financing infrastructure

Financing infrastructure is a key long-term challenge for developing countries. This requires huge amounts of long-term stable capital, which is primarily supplied by governments. However, the total annual financing needs of developing economies is estimated to be in the \$4.6 trillion to \$7.9 trillion range. Meeting this target will require far more investment – not just from the public sector but also from the private sector (Sundaram and Chowdhary, 2018).

The 2017-2018 Economic Survey stated that India will require \$4.5 trillion worth of investments until 2040 to meet its growing infrastructure needs (Economic Survey, 2018). The survey also suggested that current trends point to India falling short; it will manage around \$3.9 trillion. It witnessed a boom in private sector infrastructure finance during 2007-2012. In this period, the private sector contributed 36.6% of overall infrastructure investment (Hans, 2017). Investment rose from an average of 5% of GDP during 2002-07 to 7% of GDP during 2007-12, with a record number of projects using the Public Private Partnership (PPP) model. India was the top recipient of PPP investment from 2008 to 2012, accounting for half of the total investment in developing economies.

While private financing was expected to account for more than 50% of India's infrastructure needs in the future, it slowed down from 2012 onward. This was due to a number of issues such as delays in land acquisition and environmental clearances leading to project cost and time delays, shifting of utilities, and right of way issues (Singh, 2010). The Kelkar Committee recommended ways ways to revital-

ise the PPP model in India and to strengthen other sources of long term infrastructure financing. The government made some changes based on the recommendations which included establishing the National Investment and Infrastructure Fund (NIIF), a quasi-sovereign body, to support financially viable projects, speeding up environmental and land clearances, introducing a new hybrid annuity model for road projects, and implementing a bankruptcy law.

## Regulatory architecture governing infrastructure provision

Regarding the legal framework of infrastructure development in India, the Constitution clearly demarcates the powers vested in the centre, state and the third tier of government. The centre has exclusive rights to make laws on railways, national highways, major seaports and airports, and telecommunications. Table 2.1 shows a broad classification of the powers vested with the centre and the state.

**Table 2.1 Centre-state division of powers with respect to infrastructure**

Centre	State
Railways	Roads, bridges, ferries etc.
National Highways	Land rights, tenures, revenue
Major Ports	Water supplies, drainage and embankments, water storage, water power
Airports	
Telecommunications	

Source: Compiled from miscellaneous sources

States have the right to devolve the function of infrastructure building to both municipalities and local panchayats for specific projects. Besides a horizontal/federal delineation, there is vertical delineation of regulations and statutes based on the type of infrastructure. Table 2.2 (on page 17) provides a list of these statutes by infrastructure type.

The government has understood the importance of large-scale infrastructure projects since independence. The First and Second Five Year Plans saw heavy public investments in infrastructure projects across key sectors such as power, roads, and irrigation. In recent years, the government has invested heavily in the transportation sector (roads, railways, waterways, and ports) in particular. The Economic Survey (2018) stated that roads were the most dominant mode of transport for India, with 60% of all freight being carried by India's 56 lakh km long road network. Large scale infrastructure projects continue to be undertaken. Table 2.3 (on page 17) provides a brief overview of some of the major projects that are in the pipeline.

**Table 2.2 Statutes and regulators by type of infrastructure**

Infrastructure type	Statute	Regulator
Airports	Aircraft Act 1934	Airports Economic Regulatory Authority
	Airports Authority of India Act 1994	
	Airports Economic Regulatory Authority Act 2008	
Power	Electricity Act 2003	Regulatory Commissions at Centre & State
Ports	Indian Ports Act 1908	Tariff Authority for Major Ports
	Major Ports Trust Act 1963	
Telecom	Telecom Regulatory Authority of India Act 1990	Telecom Regulatory Authority of India
Oil and Gas	Petroleum and Natural Gas Regulatory Board Act 2006	The Petroleum and Natural Gas Regulatory Board
	Petroleum Act 1934	
	Petroleum and Minerals Pipelines (Acquisition of Right of User in Land) Act, 1962	
Roads	National Highways Act of India, 1998	NHAI acts as the regulator as well as the operator.
	Central Road Fund Act, 2000	There are State level regulators as well.
	The Control of National Highways (Land & Traffic) Act, 2002	
Rail	Indian Railways Board Act 1905	Railways acts as the regulator and the operator
	Railways Act 1989	
Coal	Coal Mines Nationalization Act 1973	Controlled by the Ministry through nationalised corporations. No regulator.
	Coal Mines Conservation and Development Act 1974	
Posts	Indian Post Office Act 1898	No regulator

Source: Compiled from miscellaneous sources

**Table 2.3 Current major infrastructure initiatives by government of India**

Initiative	Description
Bharatmala	The programme will connect 550 districts in the country through road transportation. A total of around 24,800 kms is being built under Phase I of Bharatmala, which will be implemented over a five year period. In addition to this, around 2,100 km of coastal roads and 2000 km of port connectivity roads have also been identified to be undertaken under this programme.
Sagarmala	The key objective of the programme is to increase the share of coastal shipping and inland navigation. Under the Sagarmala Programme, 415 projects on port modernisation, new port development, port connectivity enhancement, and port-linked industrialisation will be undertaken. The project is envisioned for a period of twenty years.
Delhi Mumbai Industrial Corridor	This is a multimodal high axle load dedicated freight corridor (DFC) between Delhi and Mumbai, covering an overall length of 1483 km and passing through six major states viz. Uttar Pradesh, NCR of Delhi, Haryana, Rajasthan, Gujarat, and Maharashtra. The end terminals are at Dadri in the National Capital Region of Delhi and at Jawaharlal Nehru Port near Mumbai. Various trunk infrastructure projects like development of roads and utilities, drainage, sewerage are being developed.
Dedicated Freight Corridor	The government has commissioned the building of dedicated railways freight corridor where the Eastern Dedicated Freight Corridor (EDFC) is from Ludhiana to Dankuni in West Bengal for an overall length of 1850 kms. The Western Dedicated Freight Corridor (WDFC) is from Jawaharlal Nehru Port Terminal (JNPT) to Dadri in Uttar Pradesh, which will cover a length of 1500 kms.
Smart Cities projects	The Smart Cities projects involve the implementation of urban development plans based on five year action plans, formulated after a detailed analysis of infrastructure gaps in over 500 cities, accounting for about 70% of country's urban population. The projects to be launched under smart cities include solid waste management projects, water supply projects, sewage treatment plants and development of open and green spaces.

Source: Compiled from miscellaneous sources

That said, the pace of infrastructure investment has slackened. Investment and project related data accessed on the CMIE database points to the fact that there were half as many new projects in December 2018 as there were around the same time in 2017 – comparable to the low witnessed in 2004. Project implementation too remains a concern as stalled projects reached a record high of 24.7% in the December quarter of 2018 (Kwatra, 2019). The investment issues that India faces are primarily due to weak capacity

utilisation of existing plants and the wariness of banks to lend due to the piling up of bad loans. Unless India fixes these underlying structural issues of project implementation and financing, infrastructure investment is unlikely to see a major uptick.

## 2.4

# Measuring the impact of infrastructure investment on jobs

As seen in previous sections, the case for infrastructure investment has usually been made from the viewpoint of boosting a country's growth and this has been supported through research. However, the view that infrastructure is an instrument for stimulating job growth is increasingly gaining importance. Creation of jobs has become a concern for both developed and developing economies. Infrastructure investment has become particularly salient for developed countries looking to spur growth, and ultimately jobs, during a crisis recovery (Estache and Garsouse, 2012). As for developing economies, public policy analysis has increasingly started focusing on a jobs-centric approach to infrastructure. This section reviews the literature that has attempted to estimate impact of infrastructure investments on job creation. In particular, it focuses on the methodologies used in different studies.

Investment in infrastructure gives rise to three types of jobs – direct, indirect, and induced jobs. Direct jobs refer to those created for the purpose of building infrastructure. During the process of infrastructure provision, industries with linkages to this activity (such as industries supplying raw material) see a rise in demand, and therefore, increase in the number of jobs. This is the indirect effect of infrastructure on job creation. Ultimately, growth in these industries leads to an increase in the incomes and consumption of those employed there, which boosts other industries and services. Furthermore, new businesses could come up because of this spending, leading to further job creation. Existing businesses benefit from the provision of infrastructure in various ways such as reduced transport costs due to improved transport connectivity or increased productivity due to reliable access to power and water. This gives rise to induced employment effects. This study is primarily concerned with estimating this employment effect.

A number of studies estimate the employment (direct, indirect, and induced) effects of either a particular infrastruc-

ture project or of different types of infrastructure investment in a particular region using different methodologies. The three primary methods used to calculate the employment effects of infrastructure are: i) using administrative project databases ii) conducting surveys, and iii) construction and use of multipliers based on Input-Output tables.

Administrative datasets on jobs, that is data by either government agencies or international organisations (World Bank, International Labour Organization), provide estimates of direct job creation for specific infrastructure projects calculated in terms of number of labour hours taken for the project (IFC, 2012). For example, IFC estimated the job creation number for Echogreen, an eco-chemicals manufacturing firm in Indonesia, where direct jobs were calculated through the client's employment data and indirect jobs through interviews of its local supply chain. The limitation of using the administrative payroll datasets as well as the survey and interview method is that they enable the calculation of only direct and indirect jobs. A survey on a much larger scale involving firms in the supply chain as well as in other sectors would be required to estimate induced employment effects.

The American Recovery and Reinvestment Act of 2009, which was put in place after the 2007-08 recession, had a 15% component focused on infrastructure projects.<sup>iv</sup> The Department of Transportation estimated the job impact, where direct jobs were calculated through grant-recipients reporting the number of hours of labour they hired for their particular infrastructure project. The total labour hours were divided by the average number of hours per worker for a year to arrive at the number of direct jobs. Indirect jobs were estimated by studying the supply chain. The model estimated the quantity of raw materials sourced from supplementary industries to build that infrastructure and the additional number of labour hours that were used to pro-





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duce these raw materials. Finally, the total induced employment was calculated through analysing the increase in expenditure data (published by the Labour Bureau of Statistics) of households in the concerned regions and dividing by the average cost of hiring an additional worker for a year.

Employment multipliers are the most commonly used method for calculating induced employment. Multipliers for a specific region are constructed through Input-Output tables, which represent an accounting framework to describe production and flows of goods and services between sectors of the economy. In these tables, column entries typically represent inputs to a specific sector, while row entries represent outputs from a given sector. When Input-Output tables are constructed for a closed economy with a household sector, sector-specific multipliers can be calculated.

Anderson et al (2001) estimated direct and indirect employment generated by expenditure on improving federal-aid highway projects using Input-Output analysis on economic data provided by the US department of Commerce. Input-Output tables of the economy, crucial to building multipliers, are published either by the government or built by private companies (such as IMPLAN in the US) to help estimate economic impact. Models like Regional Input-Output Modelling Systems (RIMS II) and Regional Economic Modeling, Inc. (REMI) also estimate multipliers. For countries where Input-Output tables are not available, researchers have estimated induced employment effects by borrowing infrastructure sector-specific multipliers from other countries. Schwartz et al (2009) investigate the impact of different types of infrastructure projects undertaken as part of the stimulus plans in the Latin American and Caribbean region. They estimate that US \$1 billion

investment in infrastructure would result in the creation of 40,000 direct and indirect jobs.

They estimate direct employment using project data from World Bank studies and calculate indirect and induced employment, specifically for the roads sector, using multipliers ratios derived from the US Federal Highway Administration. Ianchovichina et al (2013) use a similar method to estimate employment for the Middle East and North Africa region. They adopt the approach used by Schwartz, where they borrow multipliers from a study of a similar regional economy. The multipliers were taken from an International Labour Organization (ILO) study on Egypt which provided information on all Input-Output tables and the calculated multipliers for various sectors.

Our study aims to primarily estimate the induced employment of different types of infrastructure investment for a region. We aim to compare the induced employment effects across types of infrastructure to suggest investment in the type that would create the most number of jobs. The approach that we have taken for estimation (the details of which we will delve into in the next chapter) is different from any of the other methodologies used.

# Endnotes

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- iv.** Estimates of Jobs Created by Department of Transportation Programs under the American Recovery and Reinvestment Act of 2009, Retrieved from [https://www.transportation.gov/sites/dot.dev/files/docs/ARRA%201201\(c\)%20Job%20Reporting%20Methodologies.pdf](https://www.transportation.gov/sites/dot.dev/files/docs/ARRA%201201(c)%20Job%20Reporting%20Methodologies.pdf)

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# **OUR APPROACH**

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Chapter 2 outlined the different approaches used by previous studies to estimate the impact of infrastructure on job creation. However there are limitations to using these approaches. These are as follows:

- i.** Lack of administrative datasets: The unavailability of administrative datasets listing all infrastructure projects at the sub-state level with details regarding their total costs and labour hours employed makes it difficult to estimate even direct job creation.
- ii.** A problem with applying Input-Output method at sub-state level: While Input-Output tables are compiled at the national level in India by the Central Statistical Organisation, researchers have attempted constructing regional Input-Output tables (Swaminathan, 2008; Singh and Singh, 2019). However, our analysis will require Input-Output tables at the district level. While other papers have adopted and suitably tweaked their multipliers from similar regions or have used national multipliers, the heterogeneity among different economic geographies is a major factor in not employing multipliers constructed at a larger scale.

- iii.** Project-level surveys are inadequate: Besides being expensive and time consuming, project level surveys for collecting information about labour hours worked in building infrastructure and in ancillary industries would fail to capture induced employment effects, which materialise over longer time periods.

Thus, a novel approach was required for estimating employment effects of infrastructure provision at a regional level in India. This chapter provides the rationale for this approach given the objective of identifying what type of infrastructure could be associated with the largest increase in employment across different economic geographies.

# Economic growth most likely to happen in urban and peri-urban areas

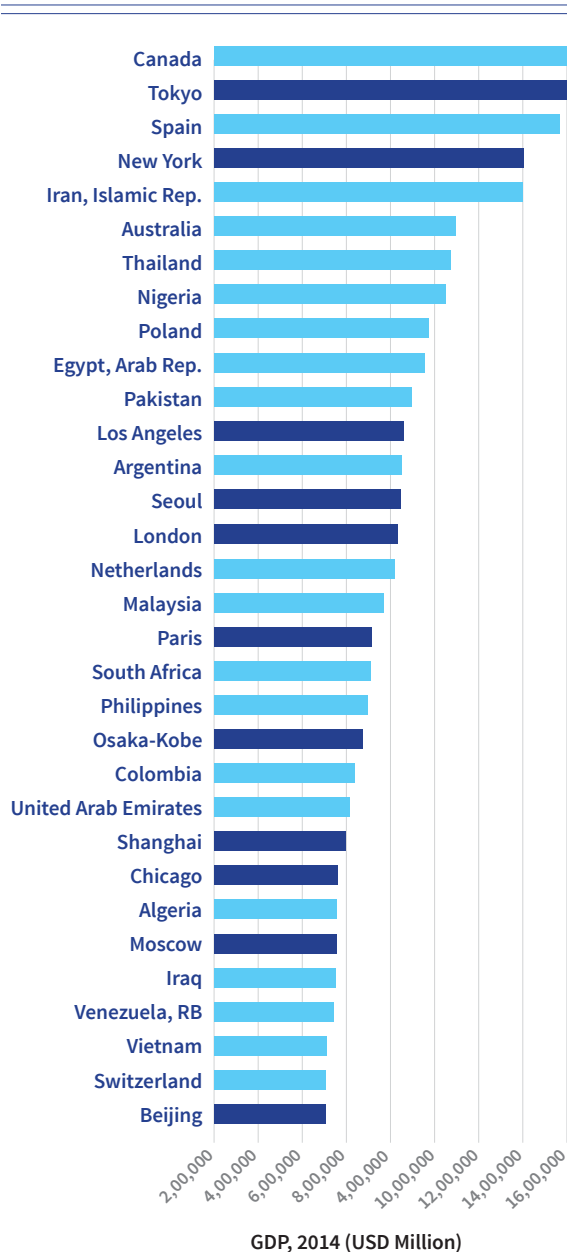
## Urbanisation is key to economic growth

The world is now living in the ‘urban century’ (Kourtit et al, 2015). Out of the 7.6 billion people globally, about 55% (United Nations Department of Economic and Social Affairs, 2018) currently live in urban areas that generate over 80% of the global GDP, confirming the fact that cities are the locus of economic activity. The top 600 cities contributed \$30 trillion (more than half of global GDP) to global GDP in 2007 (McKinsey Global Institute, 2011). Some major cities contribute more to global GDP than most countries, as seen in Figure 3.1.

There is evidence of a strong relationship between urbanisation and per capita income, or in a broader sense, economic growth. Although, the relationship between urbanisation and economic growth is not causal (Bloom et al, 2008; Henderson, 2003; Bertinelli and Strobl, 2007; Polese, 2005), there is a high degree of correlation at least in the short run (Henderson, 2000; Henderson, 2003). Henderson (2003) estimates a correlation coefficient between the urbanisation rate and the log of per capita GDP to be around 0.85. We run a linear regression for urbanisation and log GDP per capita for the years 1997, 2007, 2017 to see if it holds over time. For GDP per capita data, we use World Bank GDP per capita for the year 1997, 2007, 2017 on a Purchasing Power Parity (PPP) basis. Urbanisation and GDP per capita, according to our tests are positively correlated as seen in Figure 3.2.

Studies have identified some of the key reasons that could explain the strong association between urbanisation and growth. The most prominent among these is the presence of agglomeration economies in cities that improve productivity of labour and capital. By locating close to each other, industries and people benefit from improved access to labour and product markets. Henderson (1986) suggests that output-per labour-hour is higher in firms that are part of geographic clusters of the same industry, also referred to as ‘localisation’ externalities or Marshall-Arrow-Romer (MAR) externalities. Concentration also enables intra- and inter-industry knowledge spillovers. Glaeser et al (1992) suggests that knowledge spillovers across industries is instrumental in their growth. Geographical clusters of diverse industries enable exchange of varied ideas, also

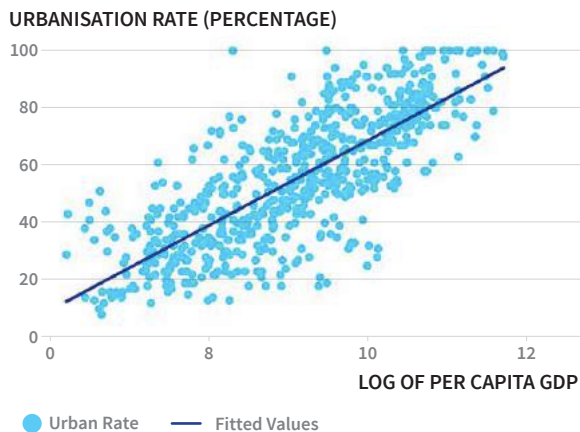
Figure 3.1 GDP of selected countries and cities



Source: Country GDP - World Bank. City GDP - Brookings analysis of data from Oxford Economics

Note: The GDP estimates are based on Purchasing Power Parity (PPP). The dark blue rows are cities.

**Figure 3.2 Correlation between urbanisation and GDP per capita for 1997, 2007 & 2017**



Source: World Bank

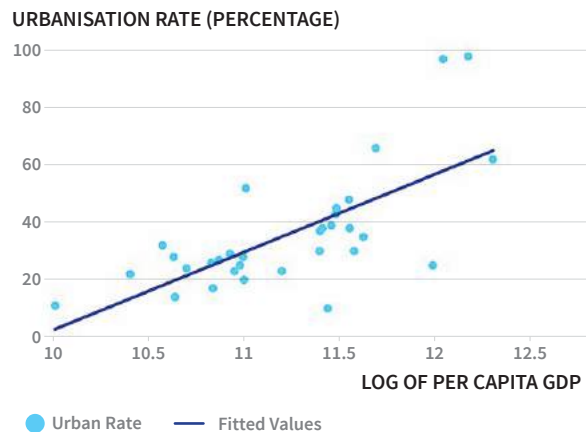
known as ‘Diversification’ (Jacobs, 1969), contributing to exceptional economic growth.

While concentration of population within cities has positive effects as cities continue to grow in size, diseconomies in the form of increased congestion could set in, offsetting the gains from urbanisation. People and economic activity are compelled to move away from city centres due to both haphazard and unplanned growth resulting in overcrowding, and land use policies that are put in place to control densities. A good urban road network facilitates movement of population to the suburbs and peri-urban areas. Suburbs retain most of the characteristics of an urban centre whereas peri-urban regions are characterised by urban as well as rural attributes since they are situated between the suburbs and the rural areas. Peri-urbanisation occurs when decentralisation of jobs and residences evolves from suburban areas to peri-urban regions. Given extremely large population sizes in cities across most developing countries, there is a dire need for creating a network of roads and trunk infrastructure to allow sustainable expansion and development in suburban and peri-urban areas. These regions are where the next phase of urbanisation and economic growth is likely to take place.

## Urban expansion in India

According to the decadal Census of 2001 and 2011, India’s urban population grew from 286.1 million to 377.1 million. Although India’s urbanisation process has been slower than many countries and the urban share of total population remains very low, in absolute terms the number is very large. Furthermore, the correlation between urbanisation rates and economic development — as measured by per capita GDP — is strong (see figure 3.3).

**Figure 3.3 State level urbanisation rate and per capita GSDP**



Source: Author’s own.

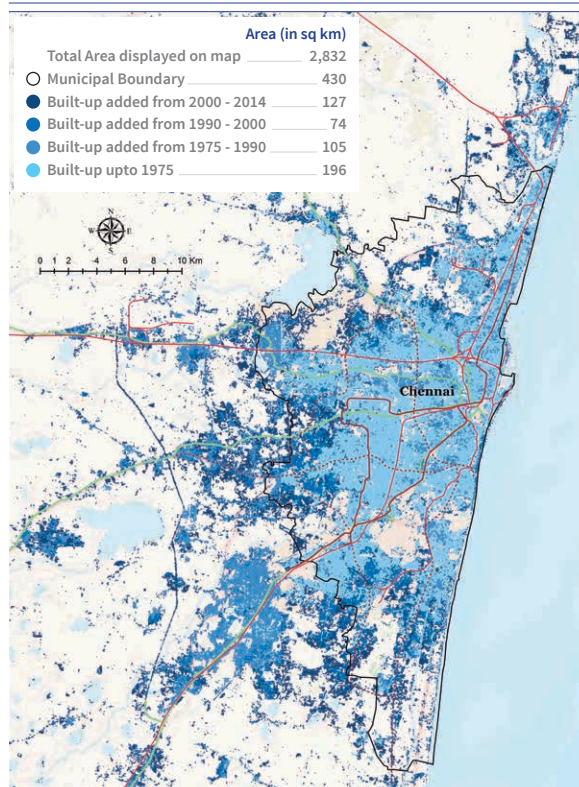
Note: Does not include Lakshadweep, Dadra & Nagra Haveli, and Daman & Diu due to lack of data on GSDP. Urban population rate data from Census of 2011. Per capita GSDP at factor cost (in constant prices) for the year 2012-13 from Reserve Bank of India (ON848) & Past Issues. This source did not provide per capita income for West Bengal. For West Bengal, we make use of Census of India 2011 and GSDP (in constant prices) for the year 2012-13 from Central Statistical Organisation (ON1794) to estimate per capita incomes.

India’s largest cities are among the most populous in the world. Over time, unplanned governance, congestion, and restrictive land use policies aimed at controlling densities have contributed to growth of urban population beyond city boundaries. For instance, population growth in cities like Delhi, Mumbai, Hyderabad, and Kolkata has been lower within administrative boundaries than in the peripheries. Population growth in Delhi between 2001 and 2011 was 1.9% but 4.1% in the periphery to the east (Ellis and Roberts, 2016). When satellite data for built-up area is mapped, it is evident that Indian cities are expanding beyond municipal boundaries and thriving. Figures 3.4 and 3.5 depict population growth beyond the municipal boundaries of Chennai and Kozhikode.

The peripheral growth of cities is inevitable. These areas suffer from neglect due to weak local governments that are unable to cope with rapid development resulting in unplanned and poorly governed development along with poor amenities and quality of infrastructure. Given the strong correlation between economic growth and urbanisation — and that historically Indian cities have made significant contribution to the state and national GDP — peri-urban areas could contribute to future economic growth. But for this to happen sustainably, effective governance and adequate provision of infrastructure are crucial.



Figure 3.4 Chennai's urban expansion (1975 to 2014)



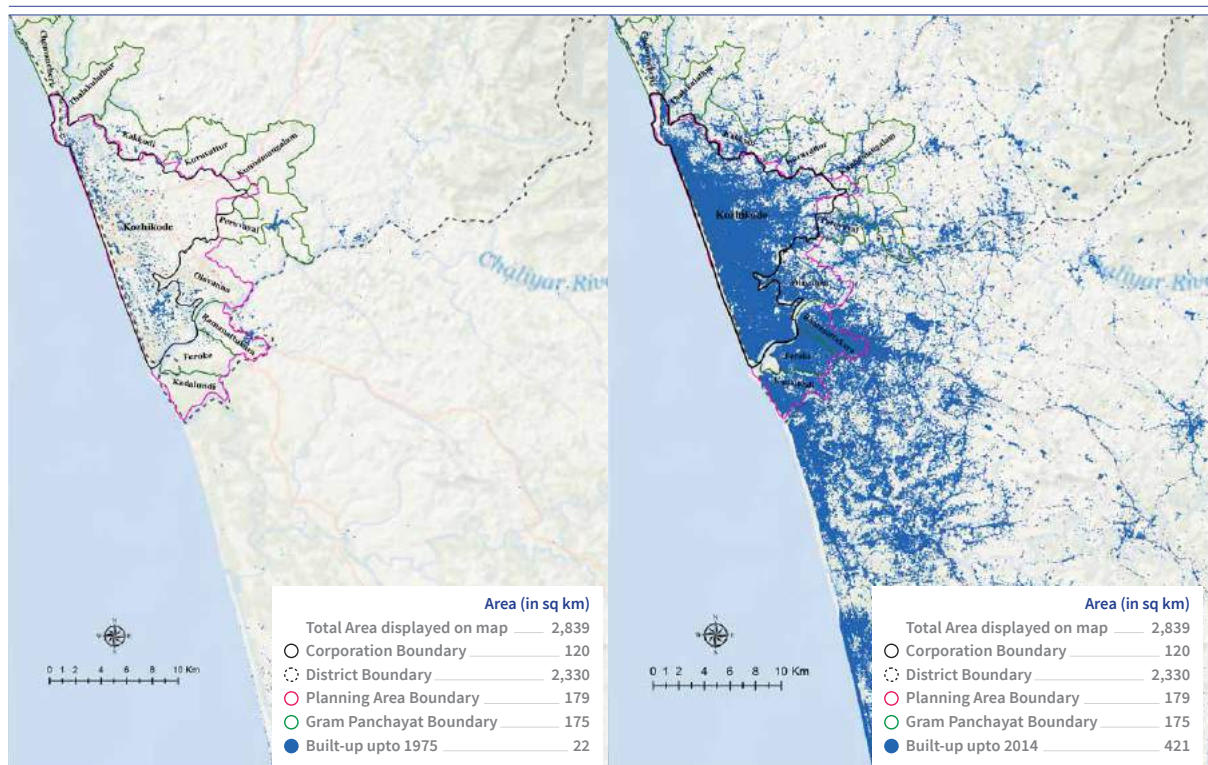
Source: IDFC Institute and Urban Expansion Observatory (UXO)

## Night-Time Lights proxy for urbanisation and economic growth in absence of granular data

### Night-Time Lights as proxy for economic activity

Given that there is peri-urbanisation and certain regions are poised to experience significant growth in population size and economic activity and thus become job magnets, it is critical to identify them. Due to poor quality of granular data on economic activity, this study relies on Night-Time Lights (NTL). NTL is the artificial light emitted from human settlements like residences, offices, factories, retail shopping areas, parking lots, airports, vehicles etc., at night. These settlements may be in cities, towns, villages or any other area that emits light. Hence, there is a strong correlation between urban settlements and night-time lights. This is satellite data collected by the United States Air Force Defense Meteorological Satellite Programme – Operational Linescan System (DMSP-OLS) sensor. These satellites have been circling the Earth since 1970 but the digital archives of the imagery captured by the sensors are only available from 1992.

Figure 3.5 Kozhikode's urban expansion (1975 to 2014)



Source: IDFC Institute and Urban Expansion Observatory (UXO)

NTL as a proxy is advantageous due to data being available over time and for almost any part of the earth. Other types of data such as electricity consumption may not always be available for all countries and at disaggregated levels (Henderson et al, 2012). NTL may be a better dataset to capture informal activity than GDP and can be captured more frequently with fewer time lags.

There is considerable research demonstrating the efficacy of NTL as a proxy for economic activity, output, poverty, and urbanisation. Elvidge et al (1997), first studied the correlation between NTL and economic activity and concluded that NTL can be used as a proxy for measuring variables like annual growth or development. Sutton and Costanza (2002) find a high correlation between luminosity and GDP per square kilometer at the national level.

Ebener et al (2005) show that illuminated areas and percentage of frequency of lighting can predict GDP per capita at the national and subnational levels. They also used DMSP-OLS data to estimate GDP. Henderson et al (2012) observed a correlation between GDP growth and growth in NTL to estimate true GDP growth. This research concluded that NTL can be used as a proxy for long term GDP growth but also for short term fluctuations in growth. Chen and Nordhaus (2011) conclude that NTL can be used as a proxy for output in countries where there has been no population census for at least a decade or that have questionable operative systems.

Welch and Zupko (1980), Elvidge et al (1997), and Sutton et al (2001) establish a strong correlation between NTL and urbanisation. Bhandari and Roychowdhury (2011) first studied the link between sub-national GDP and NTL data for India. A high degree of correlation, somewhere between 0.73 and 0.87, was observed between the natural log of DDP (District Domestic Product) and natural log of sum of lights. The correlation was the highest with total GDP. A limitation of the model was that Mumbai and other metropolitan cities were outliers in this study, probably due to a high number of vertical settlements and greater level of industrialisation not captured by the model. DDP is collected by the State Directorate of Economics and Statistics (DES) based on a methodology similar to that of the Central Statistics Office. Due to lack of accountability, there are no incentives for states to adhere to the standard methodology for calculating DDP. For most states, DDP is available only since 1999 and only for a short period. District and state boundaries have been changing making comparability across district and over time difficult.

Since district level GDP data calculated by respective state governments seems unreliable and NTL data as a proxy for sub-national GDP has been widely accepted, we use it for this research study.

## Night-Time Lights as proxy for urbanisation

NTL data is being used as a proxy for urbanisation for this study due to the unreliability of urbanisation data in India. Urbanisation is underestimated by the Census or the administrative definition. The administrative definition defines urban areas as 'statutory towns' – areas governed by municipal corporations, municipal councils and nagar panchayats. India is 26% urban using the administrative definition.

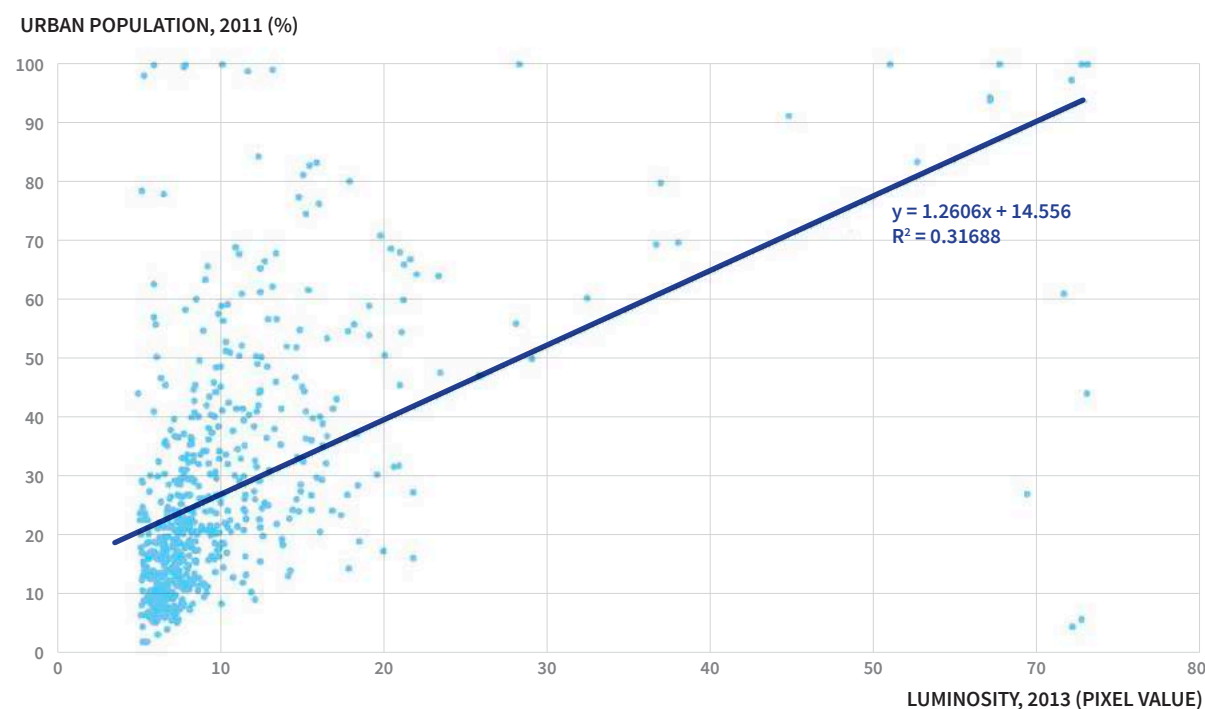
According to the Census of India, urban areas are defined as areas with a population threshold of 5000 persons, a population density of minimum 400 persons per square kilometre and 75% of the male population working in non-agricultural activities. Based on this definition, India is 31% urban. However, this low urbanisation could be the result of using a highly restrictive definition. Tandel et al (2018) use a population threshold of 5,000 to define urban areas and find that India's is 47% urban when this threshold is applied.

Furthermore, using population counts and densities within administrative boundaries to calculate urban rates could result in underestimating the true extent of urbanisation when there are dense contiguous built-up areas having "urban-like" features that do not individually make the population cut-off, such as in the case of Kerala (see Figure 3.5 on page 27).

Due to these inaccuracies in measuring urbanisation and potential for underestimating its true extent, we depend on NTL as a proxy. Figure 3.6 (on page 29) shows the scatter plot of urbanisation rates and luminosity (ie. NTL) levels at the district level for the year 2013 – the last year for which we have NTL data.



Figure 3.6 Correlation of night-time lights and urban population



Source: Author's own.

Data source: Census of India, 2011 and DMSP data - US Air Force Weather Agency and data processing - NOAA's National Geophysical Data Center

### 3.2

## Physical infrastructure is essential to catalyse economic growth

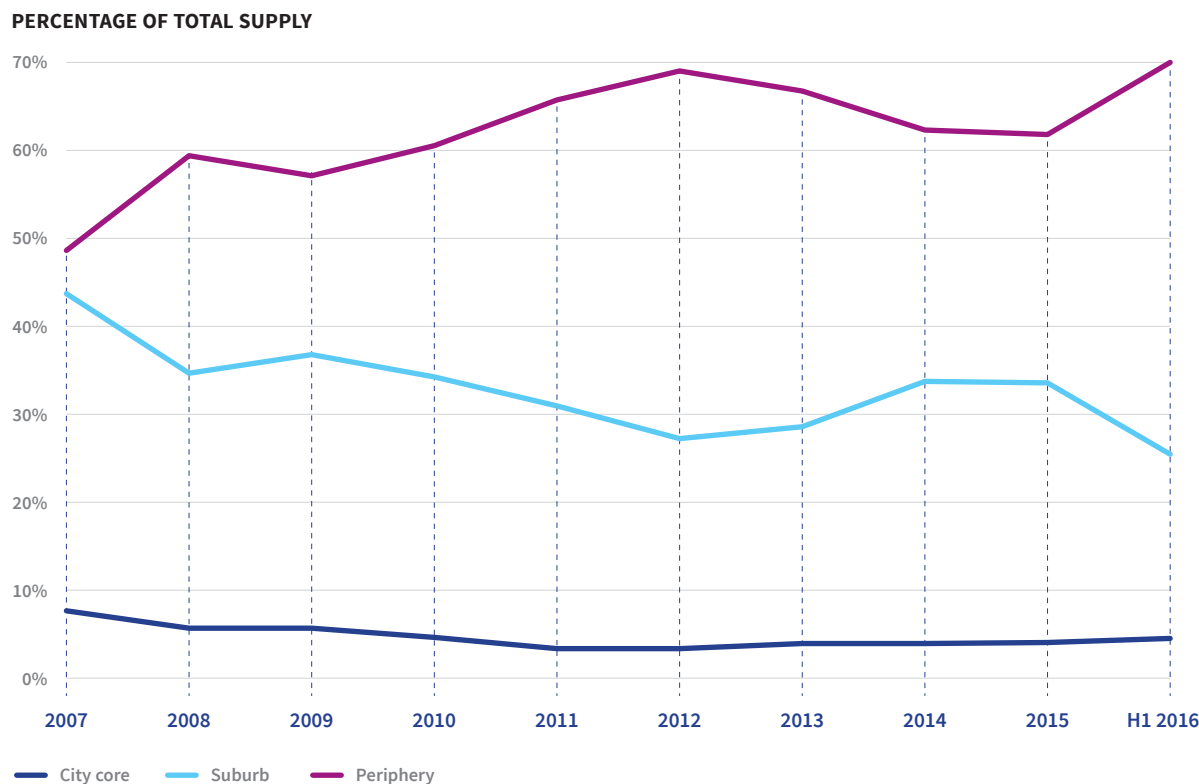
In chapter 2, we established that adequate infrastructure is essential for and sustains economic activity, and catalyses employment. These relationships have been observed universally. Cities are a system integrated with physical, social, and enabling infrastructure. All three are essential for cities to thrive. Social infrastructure like provision of health services, education and entertainment, and enabling infrastructure like governance, public policy, and finance are essential for liveability of citizens. Social infrastructure, for instance, is critical for promoting productive use of physical infrastructure, thereby contributing to higher economic growth and better quality of life. Physical infrastructure like transport, communication, water and power are instruments of development. These assets are essential for economic activity to prosper and for livelihoods to sustain. Developing countries require re-sequencing of infrastructure investment priorities while accounting for resource constraints and the goal of employment generation. Investment in physical infrastructure will yield returns large enough to re-invest into the economy for

social and enabling infrastructure.

The peripheries of cities that have been expanding rapidly require infrastructure to facilitate jobs and sustain urban growth. Residential housing for the dispersed population and commercial real estate for decentralised businesses are of significant importance in urban peripheries. In Figure 3.7 (on page 30), one can see that over the years the share of peri urban regions in the total housing supply has grown and this accounted for most of the total housing supply in 2016. Thus, it is imperative that these regions are provided with adequate infrastructure such as amenities, roads, and mass transit systems.

The Manual Infrastructure Statistics report released by the Central Statistics Office provides the results of various committees that attempted to define infrastructure or to define the measure of infrastructure. The Rangarajan Commission, Cabinet Committee on Infrastructure (CII), the Rakesh Mohan Committee, the Ministry of Finance,

Figure 3.7 Share of total housing supply across city core, suburb, and periphery



Source: “Residential Real Estate, an investible asset”, KPMG and Magic Bricks, June 2017, p.22

Department of Economic Affairs and various other departments of the government have been involved in this process. The Standing Committee on Infrastructure Statistics (SCINS) was constituted by the Central Statistics Office with representatives from various subject matter ministries. SCINS standardises concepts and definitions of infrastructure and suggests improvement of infrastructure statistics based on the requirements of planners and policymakers and international practices. It categorises infrastructure into Transport, Energy/Power, Communication, Irrigation, Drinking water supply, Sanitation and Storage with multiple sub-categories for each.

We believe that India must prioritise physical infrastructure. Thus, for the purposes of this study, we have restricted our analysis to the following types of infrastructure:

- Roads
- Railways
- Sea Transport
- Inland Water transport
- Air transport

- Telecommunication and internet
- Post and courier
- Water treatment – Treatment of wastewater and effluents
- Water supply
- Electricity

These together or subsets thereof will be crucial for specific economic activity types that we consider. Since this study does not consider agriculture in the sectoral analysis, the infrastructure types pertaining to that sector have been dropped. They include storage and irrigation. Additionally, since our emphasis is stimulating economic activity and employment generation and not citizen liveability, we exclude drinking water supply and sanitation.

## Induced employment captures long-term effects of infrastructure provision

As established in chapter 2, sustained employment generation is of crucial importance for any economy. For India, it is an emergency of sorts considering the pace at which the workforce is growing.

Literature confirms that infrastructure investment is said to be instrumental in creation of large-scale employment. The impact of infrastructure investment on employment is anticipated to be at multiple levels. At one degree it is on individuals employed in construction of the infrastructural asset, which is termed as direct employment. Another degree of impact on employment will be through backward and forward linkages to the infrastructure sector. Indirect employment will be generated in firms through supply chains of goods and services for the construction of the infrastructure. A third degree of impact on employment is through spillover effects after the infrastructure is created. This is the induced employment, created where the infra-

structural asset is built, due to thriving economic activity and cost savings for firms as a result of the infrastructure. It is the employment generated as a result of scaling up of firms, higher incomes and increased consumption.

This study emphasises the estimation of induced employment as a result of infrastructure investment. Induced job creation is over a long term unlike direct and indirect job creation which is temporary i.e. for the time that the infrastructure is being created.

## Impact of infrastructure on employment differs by economic geography

Employment elasticities and potential for job creation primarily depend on the type of economic activity and vary across sectors. Thus, regions specialising in manufacturing activities will have different job creation rates and potential than regions specialising in services.

Broadly, economic activity can be agricultural or non-agricultural. Currently, the agricultural sector employs the largest share of the population. According to the 68th NSS Employment Unemployment Round, nearly 50% of the population is engaged in agriculture. However, millions are leaving this sector whose contribution to India's GDP is continually declining (Basole et al, 2018). Creating jobs in manufacturing and services in order to absorb this workforce is a major policy challenge. Therefore, we focus on non-agrarian sectors of the economy. Based on dominant economic activity, we identify three types of economic geography: agro-allied dominant regions, industries dominant regions, and services dominant regions. Agro-allied

regions have a largely rural population and therefore significant agricultural activity. All agro processing and allied industries will benefit from locating in primarily agricultural regions since these will economise on cost of transporting raw materials, which are agricultural goods. Industries comprise all manufacturing activity together with construction activity. Typically, large numbers of low-skilled non-agricultural employment is generated by these sectors. Finally, services regions are areas dominated by services sector.

# Implementation

In this section we briefly discuss the steps involved in undertaking our analysis.

## Identification of the region

As explained in section 3.1, we assume that urbanisation is key to growth and employment in India. The challenge therefore was to identify regions which are on the threshold of rapid urbanisation. Infrastructure investments in these regions will have the most catalysing effect on job creation.

We considered a region to be a collection of districts sharing similar characteristics in terms of the nature of their economic activity. Therefore, we considered district as the unit of analysis. This is due to the following reasons: a. it is a basic administrative unit in India, b. data on economic activity and employment is often not available at a disaggregate level below the districts, c. it is the seat of an important bureaucratic position with powers to make decisions, d. much of government administration and policy decisions can be feasibly undertaken at the scale of the district.

We used NTL data to identify districts across India which are on the cusp of rapid urbanisation and growth. We then classified districts as agro-allied, industries, and services. All agro-allied districts together formed the agro-allied region, all industries districts formed the industries region, and all services districts formed the services region.

## Identification of infrastructure impediments in the region

Employment is created through private enterprise and infrastructure problems affect the efficient functioning of enterprises by driving up costs. Resolving these problems will allow enterprises to grow and thus create more employment. The underlying assumption is that firms will scale up their operations if constraints in terms of availability and

quality of physical infrastructure are alleviated. Other constraints that could affect expansion — such as access to finance or rigid labour laws — are outside the scope of our study. Since there is no available data at a regional level on the infrastructure issues facing entrepreneurs, we conducted a primary survey of entrepreneurs. We focused on physical infrastructure, for reasons explained in section 3.2.

## Estimation of induced employment from infrastructure provision

Through the survey, we collected information regarding turnovers, number of employees, nature of input costs, and cost saving if the infrastructure gap was closed. We then estimated the potential number of jobs created through cost saving and firm expansion due to infrastructure provision. This is estimated for different infrastructure types as well as for regions. The detailed model is given in section 3.6. The underlying assumption is that the existing dominant economic activity in the region will create the most number of jobs.

# Model

This section presents the model used to estimate number of jobs created as a result of investment in infrastructure.

## Assumptions

- i. Exogenous technological change does not have an impact on the firm's operations in the short run.
- ii. The ratio of capital to labour remains the same before and after the infrastructure is provided. This follows from the first assumption.
- iii. All cost saving is invested back into the business through increased spending on capital in order to grow the business.

We assume a standard Cobb-Douglas production function for the firm:

$$Y_{it} = \alpha L_{it}^{\beta 1t} K_{it}^{\beta 2t}$$

Where,

$Y_{it}$ : Output in terms of rupees of firm  $i$  in year  $t$

$L_{it}$ : Labour input in terms of rupees for firm  $i$  in year  $t$

$K_{it}$ : Capital input in terms of rupees for firm  $i$  in year  $t$

With infrastructure investments, firms save costs that they currently incur due to poor or absent infrastructure. Let us assume that the cost saved in the next year is  $I_{it+1}$ . This cost saved is invested back in the business in the form of increase in capital input.

Therefore,

$$K_{it+1} = K_{it} + I_{it+1}$$

Given  $L_{it}$ ,  $K_{it}$  and  $K_{it+1}$  and assuming a constant  $K/L$  ratio –  $k$ , we can estimate  $L_{it+1}$  using the equation:

$$L_{it+1} = K_{it+1}/k$$

Therefore, the change in labour input is given as

$$\Delta L_i = L_{it+1} - L_{it}$$

After imputing wages per worker from total labour costs and number of workers currently employed, we will be able to estimate the increase in number of workers.

The final step is to compute elasticities in order to estimate how much employment will change with a percentage change in savings. For this, we run a linear regression with log of change in employment as the dependent variable and log of costs saved as the independent variable. The regression equation takes the following form:

$$\ln \text{ change empt} = \alpha + \beta \ln \text{ change cost savings} + \epsilon$$

The value of the coefficient  $\beta$  can be interpreted as the magnitude by which a percentage change in cost savings affects percentage change in employment. We can run this regression for each subcategory of region and infrastructure type to estimate elasticities for these sub-categories.

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Photo credits: iStock.com/GCShutter

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# **METHODOLOGY, DATA, AND LIMITATIONS**

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This chapter describes the process for selecting the districts for the study and discusses in detail various elements of the primary enterprise survey such as sampling method, sample size, and survey instruments. Finally, it sets out the limitations of this study.

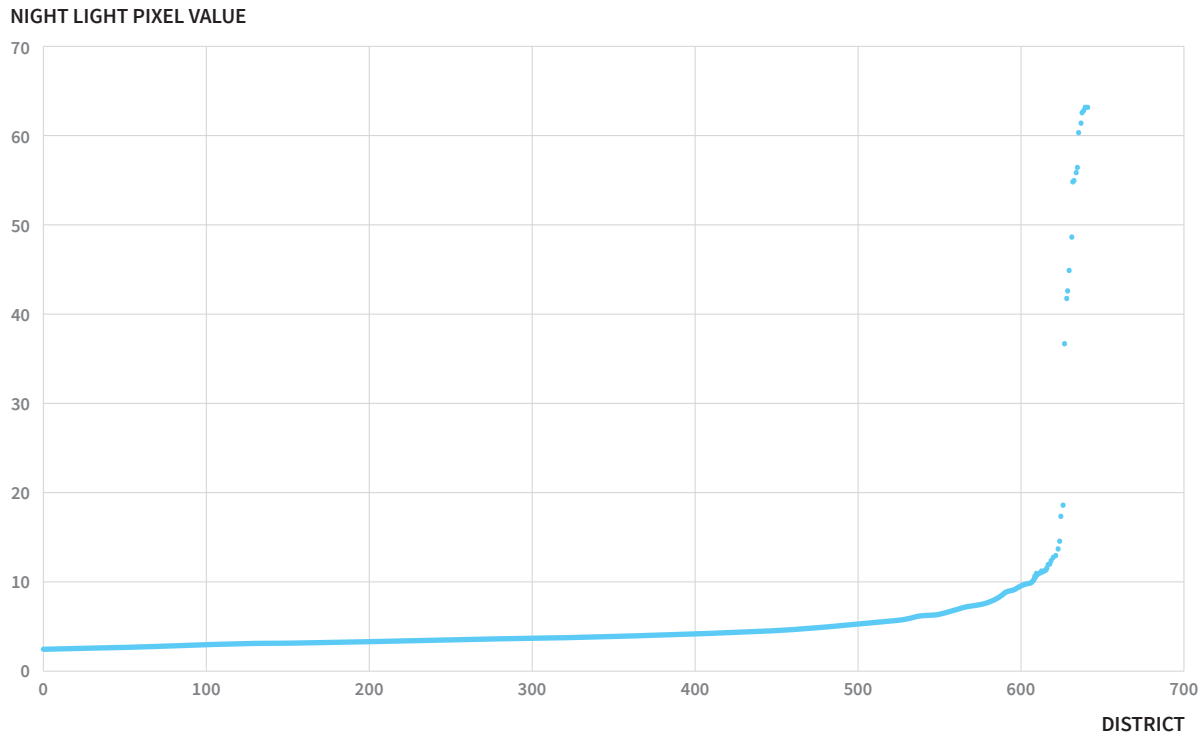
## 4.1 Selection of districts and regional classification

As discussed in chapter 3, the idea of the study was to focus on regions that have potential for growth since infrastructure investment there is likely to have the greatest impact on employment. We begin at the district level which is the most disaggregated administrative unit for which there is adequate data on aspects such as investments, employment, demographics. The starting point is to identify the districts that are likely to see high levels of growth in the near future.

We make use of NTL to plot the stage of development of all Indian districts. As argued in chapter 3, NTL is a good proxy for economic development and levels of urbanisation and is

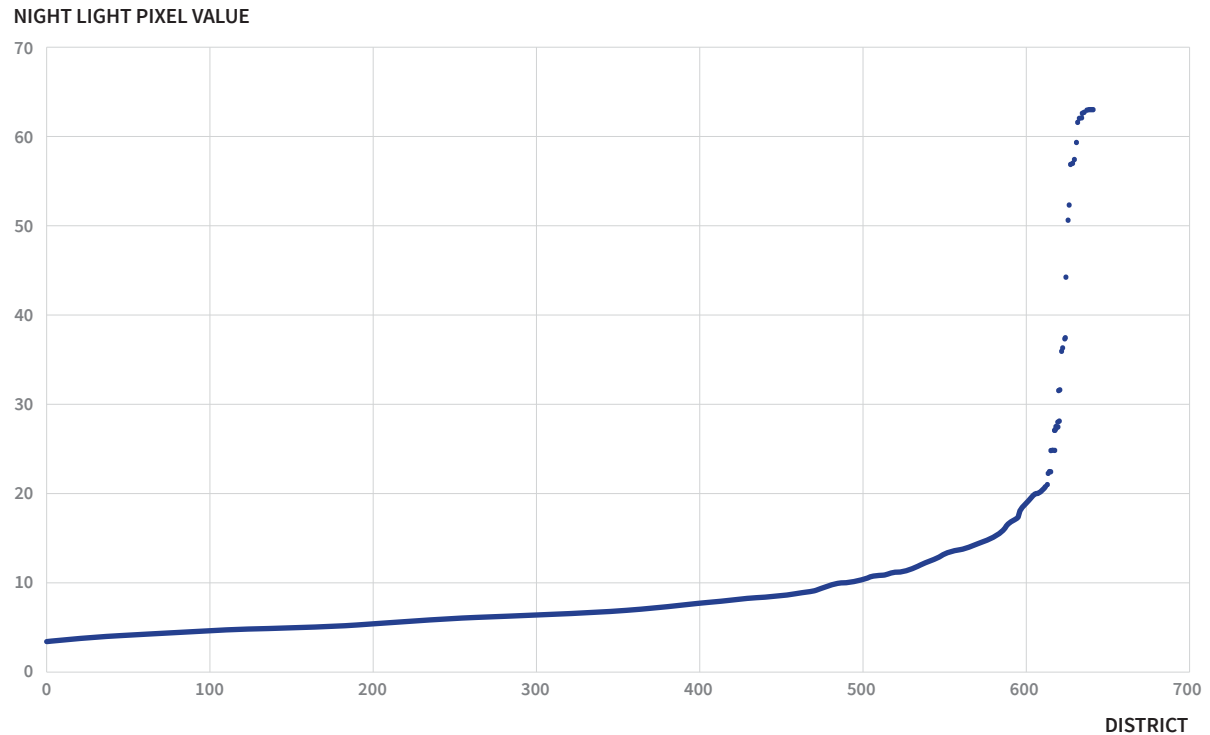
commonly used by researchers when official data is either missing or of poor quality. NTL is observed using satellite data and values are assigned for each pixel. The spatial resolution of the pixels generated by the satellites is about 0.86 square kilometres and these pixels can be aggregated for any geographical area. The values for each pixel range from 0 (no light) to 63 (bright light). The areas that emit very low light, like rural areas with most of the land used for agricultural purposes, have been coded as 0. The areas like metropolitan regions which are richer and denser, emitting bright light, are top-coded at 63. We plot NTL values of all Indian districts (641 districts) for years 1992 to 2013. The number of districts has been increasing since 1992 as existing

Figure 4.1a District-wise NTL distribution (1992)



Source: Author's own.  
Data source: DMSP data - US Air Force Weather Agency and data processing - NOAA's National Geophysical Data Center

Figure 4.1b District-wise NTL distribution (2013)



Source: Author's own.

Data source: DMSP data - US Air Force Weather Agency and data processing - NOAA's National Geophysical Data Center

districts got divided. For ease of comparability of district level data over time, we have considered the list and number of districts as on 2013. Pixel-level NTL values since 1992 were aggregated to get district level values using district boundaries of 2013. We observe an 'S' curve throughout, indicating that the districts with the highest luminosity values cluster at the top of the curve. Although, the shape of the curve remains the same through the years, the bend or the 'hockey stick' part of the 'S' curve shifts upwards. Figures 4.1a and 4.1b demonstrate this. The bend in NTL distribution in 2013 occurs at much higher levels of NTL values compared to the bend in 1992. We can infer from this that most economic development is happening in those districts situated on the bend and that they are on the cusp of becoming developed regions. To provide an impetus to this economic development, we propose infrastructure investment in those districts that lie at the bend in the year 2013 (latest available DMSP NTL data). They have luminosity values ranging from about 18 to slightly over 22.

Using this method, we identify 18 districts for the analysis. To classify a district as agro-allied, industries, or services we look at:

- i. The rural and urban share of population for each district
- ii. Sectoral composition of enterprises enumerated in the Sixth Economic Census Directory of Establishments for each district

We make use of the descriptions of economic activity provided by 2008 National Industrial Classification (NIC) 2 digit codes. We exclude the following primary sector activities from the analysis: Crop and agriculture production, forestry and logging, fishing, and mining. The agro-allied activities include manufacturing of food, beverages, tobacco products, wood products except furniture, and paper products. The activities classified under the manufacturing category (except manufacturing of food, beverages, tobacco products, wood, and paper) together with construction activities are considered to be industries. Services is a residual category comprising all economic activities that are not classified as agro-allied or industries. Among services, we do not include educational activities. We classify districts having majority rural populations (more than 50%) as per the 2011 census as agro-allied. We then look at the sectoral composition of enterprises listed

**Table 4.1 Regional classification of selected districts**

District	Regional classification	District	Regional classification
Ambala (Haryana)	Services	Karnal (Haryana)	Agro-allied
Amritsar (Punjab)	Services	Kurukshetra (Haryana)	Agro-allied
Dadra & Nagar Haveli (UT)	Industries	Lucknow (Uttar Pradesh)	Services
Ernakulam (Kerala)	Services	Ludhiana (Punjab)	Industries
Gandhinagar (Gujarat)	Services	Mahe (Puducherry)	Services
Ghaziabad (Uttar Pradesh)	Industries	Rangareddy (Telangana)	Services
Howrah (West Bengal)	Industries	Rewari (Haryana)	Agro-allied
Jammu (Jammu and Kashmir)	Services	Sonipat (Haryana)	Industries
Kancheepuram (Tamil Nadu)	Services	Thiruvallur (Tamil Nadu)	Industries

Source: Author's own

Note: UT is short for Union Territory

in the Directory of Establishments of the Sixth Economic Census for each district. The Directory of Establishments of the Sixth Economic Census (2013-14) provides state and union territory-wise details of establishments having 10 or more workers. Districts that have the highest number of establishments belonging to services sectors are classified as services and those having the highest number of estab-

lishments belonging to manufacturing and construction sectors are classified as industries.

Using this method of classification, we have three districts in the agro-allied region, six districts in the industries region, and nine districts in the services region. Table 4.1 provides the list of districts and the regional classification.

## 4.2

# Enterprise survey

The primary findings of this report are based on a survey of enterprises across the selected districts. The objective is to identify the type of infrastructure deficit that affects enterprises most for each region and cost savings to firms if the infrastructure is provided. Using the model described in chapter 3, we will use the data provided by enterprises to estimate the number of jobs created if savings are invested back in the business.

## Sample frame

The first step is to identify the appropriate survey frame of enterprises covering the selected districts. In India, a detailed list of establishments for states and union territories is provided by the Annual Survey of Industries (ASI) and by the Fifth and Sixth rounds of the Economic Census. Both the ASI and Economic Census are implemented by the MoSPI.

The Directory of Establishments of the Sixth Economic Census (2013-14) provides information on the industry sector — using the 2008 3 digit NIC codes — along with details such as names, addresses, broad activity, ownership

category, and employee size class. It covers both manufacturing and services establishments. The ASI frame provides data on firms that are registered under Sections 2m(i) and 2m(ii) of the Factories Act, 1948 for all states and union territories except Nicobar, Arunachal Pradesh, and Mizoram.<sup>v</sup> This frame contains names and addresses of establishments along with 4 digit NIC codes and number of employees. The frame is updated periodically and the latest available frame is for the year 2016-17.

Although the ASI frame is updated more frequently than the Economic Census Directory of Establishments, it only covers organised manufacturing and excludes services. Further, the ASI frame contains units that have closed down or moved. Due to these reasons, we make use of the Directory of Establishments for our survey. Within this frame, we do not consider public sector enterprises. While infrastructure issues affect operations of both public and private enterprises, the former do not operate with a profit motive and other considerations often affect scaling up as well as expansion or increase in hiring within public sector firms. Each district has been classified to a region based on the method described in section 4.1. Therefore, we consider



**Table 4.2 District-wise total number of establishments**

District	Classification	Total Number of Establishments
Ambala	Services	555
Amritsar	Services	601
Dadra & Nagar Haveli	Industries	638
Ernakulam	Services	5,447
Gandhinagar	Services	127
Ghaziabad	Industries	860
Howrah	Industries	1,018
Jammu	Services	634
Kancheepuram	Services	1,749
Karnal	Agro-allied	113
Kurukshetra	Agro-allied	112
Lucknow	Services	1,433
Ludhiana	Industries	2,658
Mahe	Services	67
Rangareddy	Services	3,094
Rewari	Agro-allied	15
Sonipat	Industries	406
Thiruvallur	Industries	1,766
<b>Total</b>		<b>21,293</b>

Source: Sixth Economic Census Directory of Establishments (2013-14)  
 Note: For Ernakulam, the initial sample size of 526 could not be achieved. To maintain the total sample for services region, 226 additional interviews were conducted in Ambala, Amritsar, Jammu, Kancheepuram, Lucknow, and Rangareddy.

only those establishments that belong to the region. For example, if Rangareddy is a services region, we consider only services establishments from the Directory of Establishments (and not the total number of all establishments in Rangareddy). Table 4.2 provides the number of establishments for the 18 selected districts.

## Sample size and selection

The total sample size for the enterprise survey is 2,500 firms. As discussed in section 4.1., the 18 districts were grouped into three regions viz. agro-allied region, industry region, and services region based on shared economic characteristics. We stratify by region, since that is one of the focuses of our analysis.

Therefore, using the population size from the Directory of Establishments (shown in Table 4.2), we obtain a minimum sample size for each region for a confidence interval of 95% and confidence level of 5%. Thus, we arrive at a sample size of 148 for the agro-allied region, 365 for the industries region, and 374 for the services region. Thus the total sample size is 887. The sample size is then distributed across each district as follows:

**Table 4.3 District-wise initial and final sample sizes**

District	Initial Sample Size	Final Sample Size
Ambala	57	95
Amritsar	62	85
Dadra & Nagar Haveli	80	80
Ernakulam	561	400
Gandhinagar	13	13
Ghaziabad	108	108
Howrah	128	128
Jammu	65	73
Kancheepuram	180	200
Karnal	78	78
Kurukshetra	78	78
Lucknow	148	195
Ludhiana	333	333
Mahe	7	7
Rangareddy	319	345
Rewari	10	10
Sonipat	51	51
Thiruvallur	221	221
<b>Total</b>	<b>2500</b>	<b>2500</b>

Source: Author's own

$$\text{① Minimum sample size for district} = \frac{\text{Number of firms in district}}{\text{Number of firms in region}} \times \text{Total minimum sample size for region}$$

For example, Thiruvallur has 24% of the total firms in the industries region (comprising six districts) and therefore 24% of the minimum sample size required for the region is assigned to Thiruvallur. A sample size of 2,500 was chosen to survey a higher number of firms for certain districts (having sample size greater than 30), where possible. The additional sample of 1,613 (which is the difference between 2,500 and 887) is distributed across all districts in the following manner:

$$\text{② Additional sample size for district} = \frac{\text{Number of firms in district}}{\text{Total number of firms}} \times \text{Total additional sample size}$$

For example, Thiruvallur has 8% of the total firms for 18 districts (which is 21,293) and so 8% of the additional sample is allotted to it. The final sample size was calculated as follows:

③

Sample size for district =

$$\text{Minimum sample size of district} + \text{Additional sample size of district}$$

Except for Gandhinagar, Mahe, and Rewari the sample size in all districts is greater than 30. It is large enough to be representative at the district level (that is, allow us to produce population level estimates) for five districts in the industries region viz. Dadra and Nagar Haveli, Ghaziabad, Howrah, Ludhiana, and Thiruvallur.

For each district, the sample was drawn from the frame using simple random sampling without replacement.

## Strategy for replacement and no responses

To account for non-responses, where the number of firms in the frame was sufficiently large, we selected three times the number of the required sample size. Interviewers were asked to first complete as many interviews as possible from the first list of respondents and then refer to the second and third list of respondents if they could not meet the quota from the first list alone. Once the supplementary lists were also exhausted without meeting the quota, additional lists of firms were provided until the quota was met.

For Rewari, Karnal, and Kurukshetra, the requisite number of surveys had to be completed by interviewing firms that were not in the sample provided that the firm belonged to the same broad industry as the region (that is, only agro-allied firms could be interviewed in an agro-allied district). Subsequently, a similar method was followed for other districts due to incomplete or outdated contact details provided in the Directory of Establishments that made it difficult to track establishments. The targeted number of interviews was achieved by ensuring that quotas of 2 digit NIC codes and area pincodes drawn from the first list of responses were maintained.

Finally, for Ernakulam, the initial sample size of 526 could not be achieved. Due to non responses, it was 400. To maintain the total sample for services region, 226 additional interviews were conducted in Ambala, Amritsar, Jammu, Kancheepuram, Lucknow, and Rangareddy. Column 3 in Table 4.3 (on page 41) provides the final sample size.

## Key questions covered in survey instrument

The objective of the survey was to collect quantitative information that forms the input for the model described in Chapter 3. The survey instrument was designed to serve this objective.

The survey covers four aspects:

- a. Type and nature of infrastructure impediments firms face
- b. Firm turnover, input costs, and the impact of infrastructure on costs
- c. Number of workers hired, type of workers, and desired number of workers
- d. Impact of past interventions in resolving infrastructure issues

We limit the questions to the types of infrastructure discussed in Chapter 3 and ask firms to identify up to three types that create impediments to their business due to their absence or poor quality. We then ask firms to identify the specific issues they face for the infrastructure type selected. For instance, for roads, firms are asked whether the issues they face include poor quality of roads, no pucca roads, narrow roads, traffic jams, or if the highway is at a distance. Where applicable, we ask firms to state the number of days it takes for them to transport goods or to get inputs or raw materials. In case of electricity and water supply, we ask firms to report the number of hours of insufficient power and water supply they face.

With regard to details about their business, firms provided information about turnover (for three years at most), plans for future growth (in terms of turnover), total input costs and their breakdown in terms of the following components:

- Fuel Cost
- Water
- Electricity
- Wages
- Rent on Property
- Machinery and Equipment
- Maintenance
- Miscellaneous

They had to identify the extent of cost saving and type of costs that would be affected by the identified infrastructure gap being filled. Finally, firms were asked to specify the number of workers presently employed in the establishment, wages paid, and desired number of workers.

## Expert interviews

As part of the study, we conducted 15 semi-structured interviews with experts across diverse fields. These included infrastructure experts, regional experts, sectoral experts, and employment experts. The objectives of the interviews were:

- a. To get a perspective on the relationship between infrastructure, sectoral and regional growth, and employment creation, the key issues related to each, and what policies have been implemented to address them
- b. To get feedback on the enterprise survey questionnaire and the proposed analysis

The range of topics covered in the expert interviews were as follows:

### Infrastructure

- a. The transformation of infrastructure as a result of policy changes (if India is promoting and investing in an overall infrastructure development policy)
- b. The current state of infrastructure and factors affecting infrastructure investments
- c. The impact that past and current infrastructural developments have had on regions and sectors. That is, whether providing infrastructure can explain to some extent the growth of regions, sectors and employment generation
- d. How infrastructure decisions and investments in a particular region are made
- e. What type of infrastructure should be prioritised in India
- f. Whether infrastructure investments can catalyse job

## Focus group discussions

In addition to conducting a firm level survey and semi-structured interviews with experts, we held Focus Group Discussions (FGDs) in five locations. The purpose for these FGDs was:

- i. To get more qualitative and in-depth understanding of the infrastructure impediments that enterprises face and potential changes in employment in their sectors
- ii. To validate the responses gathered from the survey with responses from the FGD participants

creation in India. What policy measures are required to improve infrastructure specifically for sectoral growth and job creation

### Sectoral composition

- a. What are the factors for emergence of clusters of particular sectors in particular regions
- b. Sectoral trends and the contribution of different sectors to economic output and employment
- c. Infrastructural impediments that are likely to affect different sectors and infrastructure requirements for different sectors to boost productivity
- d. What leads to employment generation in particular sectors and what role does infrastructure play in the same
- e. Policy measures required for boosting sectoral growth and employment generation

### Employment creation

- a. Employment trends across sectors and geographical regions
- b. Future employment scenarios and challenges in employment creation
- c. Policy measures required to enable these trends

We conducted each FGD in a different district across all three regions. The districts selected were Karnal (agro-allied region), Sonapat (industrial region), Howrah (industrial region), Rangareddy (services region), and Gandhinagar (services region). The participants of the FGDs include proprietors and senior management (Owner/Proprietor/CXO/Managing Director) of enterprises belonging to the dominant economic activity of that district. The key discussion points during the FGDs were as follows:

## Infrastructural impediments

Participants were asked whether they were in agreement with the infrastructure impediments identified by respondents in the enterprise survey in their districts. If they did not agree, participants were asked to identify what they felt were the infrastructure constraints they faced in operating their businesses. Another point that was validated was the costs that firms incurred as a result of the infrastructure constraint. Participants were asked whether they had taken any steps like forming a lobby or collectively investing in building an infrastructure asset to overcome the constraint in the absence of government action. Finally, they were asked about the impact of the government resolving the problem on their business expansion, productivity, employment, etc.

## Input costs

Participants were asked how they plan for expanding operations. They were asked whether a particular component takes priority. This was done in order to interpret if the firms only think of capital investment or if changes in employment feature in this reinvestment. We also asked them about their biggest component of input costs to try and understand how they may reinvest the savings from the rectification of the infrastructural issue. Additionally, to estimate employment generation, we asked participants how they would plan hiring of employees once the business expanded and the nature of employees they would hire. Lastly, we asked participants to give an overall view of all other constraints that they faced.

### 4.5

## Limitations

This section highlights some of the limitations of the analysis and what is outside the scope of the report, either due to unavailability of necessary data or infeasibility, or both.

- i. While the analysis focuses on potential job creation associated with providing infrastructure, we do not look at the quality or nature of jobs being created. Our primary analysis is based on a survey of firms belonging to both organized and unorganized sectors and we do not make a distinction between the two. Similarly, although potential for job creation may vary with firm size and age, we do not ex ante differentiate firms along these parameters.<sup>vi</sup>
- ii. Some countries use software developed by their respective governments to estimate job creation figures. On the other hand, Latin American countries use previously constructed multipliers by tweaking the methodology and using the data on wage assumptions, sub-sector leakages, skilled and unskilled labour divisions in project documents. However, there is insufficient data at the district level in India preventing us from using any of the conventional methods for this study.
- iii. We identify the dominant economic activity for a region based on a single data source viz. the Economic Census Directory of Establishment. This collates data on all establishments that hire 10 or more workers. In order to validate this, we have compared our classification with other district sources of economic activity, such as the District MSME reports, where these are available.
- iv. There could be a number of historical and locational factors responsible for the prominence of sectors in certain districts. Furthermore, clusters could arise purely by accident or because of tax and other incentives provided by state governments. We do not examine the reasons for formation of clusters for the purpose of this report.
- v. Technological change and innovation can result in significant changes in production methods and also affect services. Typically, such changes are associated with a substitution of labour by capital and therefore potential job losses. However, rapid technological changes may also result in creation of new kinds of jobs. The net effect on jobs is difficult to determine. Although we recognise this critical role that technology and innovation play, analysing their impact on net job creation is beyond the scope of this report.

# Endnotes

- v. Except for Maharashtra and Rajasthan, Section 2m(i) defines a factory as a place having 10 or more workers with power and Section 2m(ii) defines a factory as a place having 20 or more workers without power. For Maharashtra and Rajasthan, Section 2m(i) defines a factory as a place having 20 or more workers with power and Section 2m(ii) defines a factory as a place having 40 or more workers without power. See - <http://www.csoisw.gov.in/cms/cms/Files/5.pdf> (accessed on 21 November 2018).
- vi. Haltiwanger et al. (2013) study the private sector in the United States and find that net job growth is positively associated with new firms. The size of firms does not affect job growth once the age of firms is controlled for.

# References

- Center for Economic Forecasting and Analysis (2000). Analyzing the Economic Impact of Transportation Projects using RIMS II, IMPLAN and REMI. [online] Florida State University. Available at: <https://cefa.fsu.edu/sites/g/files/imported/storage/original/application/18d780904fc532b3cf0bcdcc8a082bfa.pdf> [Accessed 7 Jan. 2019].
- Haltiwanger, J., Jarmin, R. S., & Miranda, J. (2013). Who creates jobs? Small versus large versus young. *The Review of Economics and Statistics*, 95(2), 347-361.
- Implan.com. (2019). Economic Impact Analysis for Planning | IMPLAN. [online] Available at: <http://www.implan.com/> [Accessed 3 Dec. 2018].





A large, stylized number '5' is centered on the page. It is composed of several overlapping shapes in different shades of blue. The top bar is a solid dark blue rectangle. The vertical stem is a lighter blue shape that tapers slightly. The bottom curve is a large, light blue semi-circle. The text 'DISTRICT PROFILES' is overlaid on the lower part of the '5' in white, bold, sans-serif font. A thin white horizontal line runs across the page below the text.

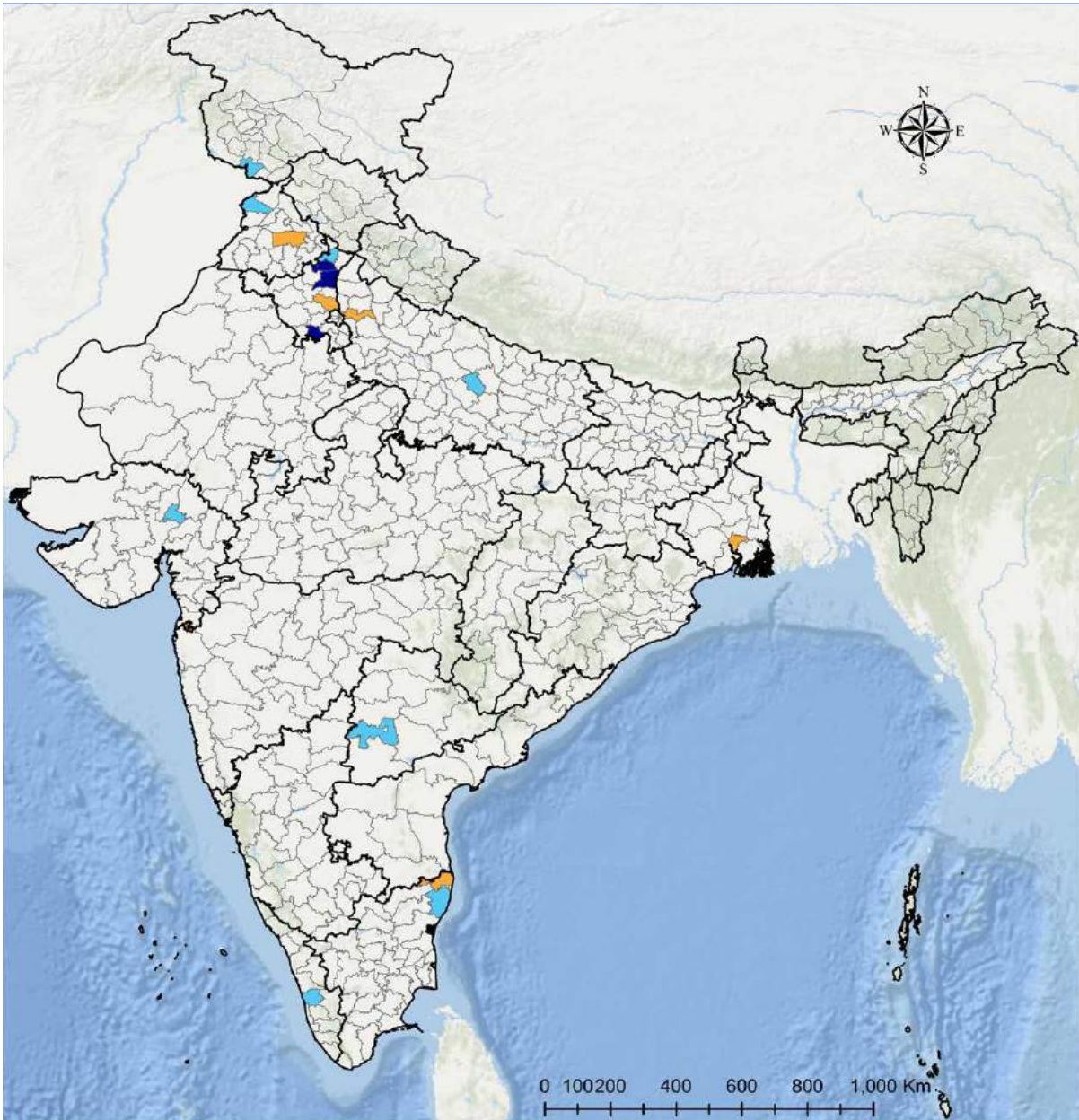
# **DISTRICT PROFILES**

Previous chapters described the process for selecting the key districts for analysis. This chapter provides basic demographic and economic details about these districts. Demographic information includes population, gender composition, urban-rural populations, and literacy rates.

Further, the chapter discusses the state of infrastructure and nature of infrastructure investments at the district-level. Finally, it provides details about the type of industries and share of the workforce in all districts.

# 5.1 Demographics and geography

Figure 5.1 Geographical location of selected districts



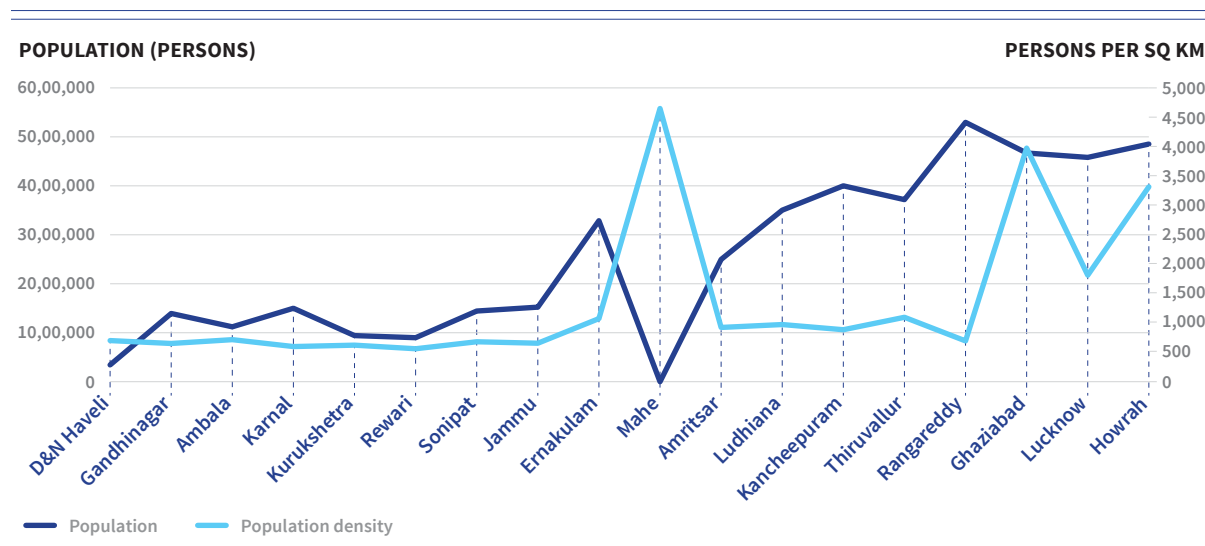
Source: IDFC Institute and Urban Expansion Observatory

Figure 5.1 (on page 48) shows the location of districts and their regional classification. The districts belong to the states of Jammu and Kashmir, Punjab, Haryana, Uttar Pradesh, and West Bengal in the North and East and Telangana, Tamil Nadu, Kerala, and Gujarat in the South and West. Two districts – Mahe and Dadra and Nagar Haveli – are union territories.

Figure 5.2 graphs the population number and density for all districts. Rangareddy is the most populous district with a population figure exceeding 50 lakhs. Howrah, Ghaziabad, and Lucknow follow closely with population figures between 45 and 50 lakhs. Dadra and Nagar Haveli, Kurukshetra, and Mahe have population lower than 10 lakhs with

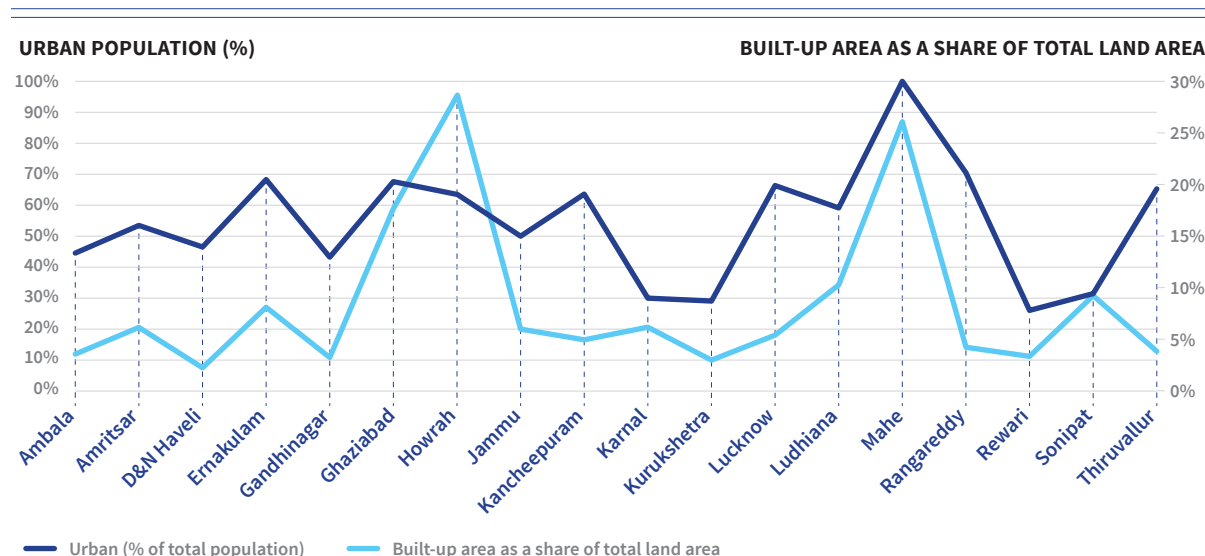
Mahe having the lowest population. Despite having an extremely large population, Rangareddy has a density of only 707 persons per square kilometer. Mahe has the highest density owing to an extremely small geographical area. Both Ghaziabad and Howrah have high densities along with large population in absolute terms. We depict the share of urban populations and share of built-up area for each district in Figure 5.3. The ratio of built-up area to land area measures the extent of settlement within the districts. Most of the selected districts are highly urbanised in terms of share of urban population. Rewari district, with 26% of its population in urban areas, is the least urban. Kurukshetra, Karnal, and Sonipat have urban population rates

Figure 5.2 Population and population density



Source: Author's own. Data source: Census of India, 2011

Figure 5.3 Share of urban population and built-up area



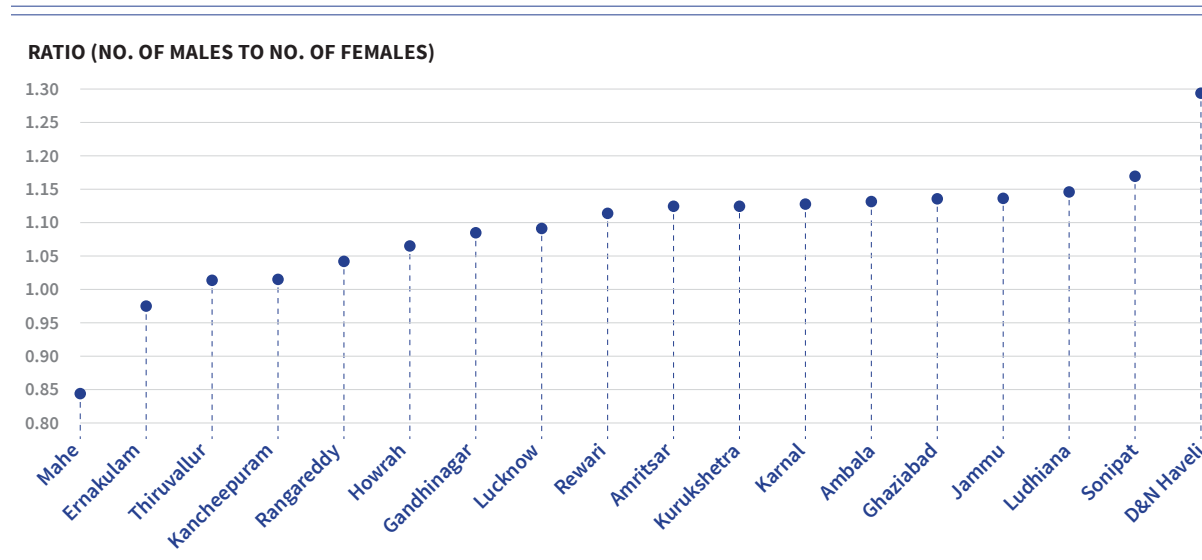
Source: Author's own. Data source: Global Human Settlement Layer (2014), Urban Expansion Observatory and Census of India (2011)

that are lower than the national urban share of 31%. Mahe is 100% urban and Rangareddy is 70% urban. While there is a positive correlation between urban share and ratio of built-up area to total land area across districts, it is relatively weak. Overall the share of built-up area ranges from 2.3% (Dadra and Nagar Haveli) to 28.6% (Howrah). The ratio of number of males to number of females varies from 0.84 in Mahe to 1.29 in Dadra and Nagar Haveli (see Figure 5.4). This gender ratio is most favourable for females in Mahe and Ernakulam – districts that are considered to have high levels of human development. The gender ratio is

slightly better for districts in Tamil Nadu and is least favourable in Dadra and Nagar Haveli.

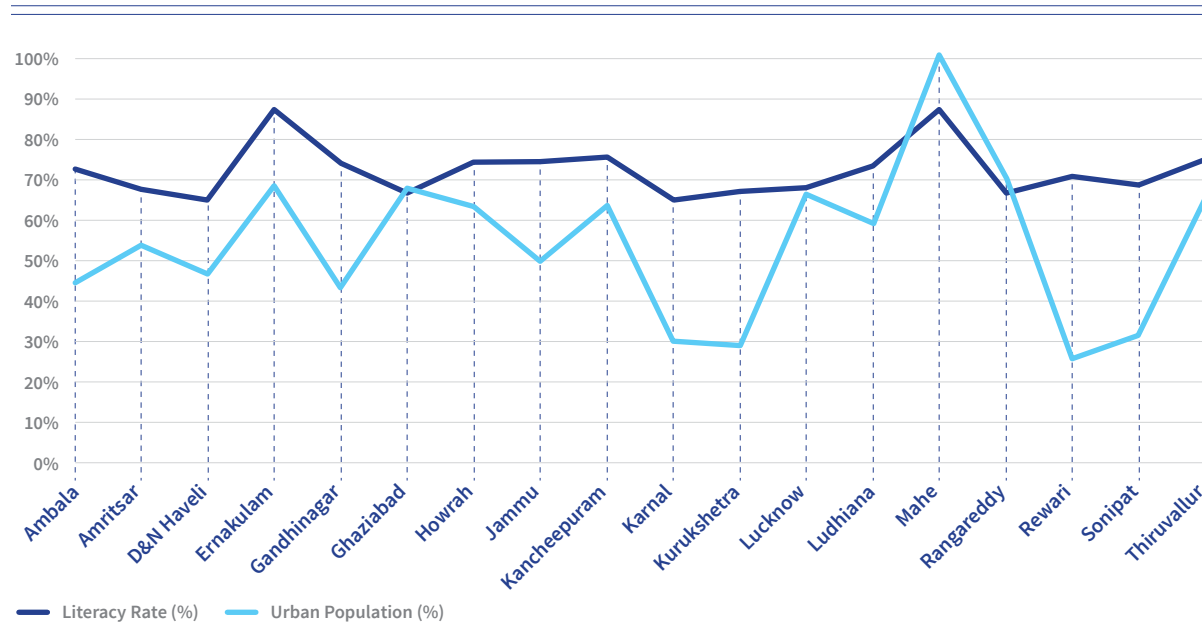
Figure 5.5 depicts the literacy rates for all districts and in comparison with the urbanisation rates. Literacy rates are above 65% for all districts and are once again highest in the highly developed Ernakulam and Mahe districts. They do not vary widely across districts. The lowest literacy rates are in Dadra and Nagar Haveli and Karnal at nearly 65%. In general, we observe a positive correlation between literacy rates and urbanisation rates.

**Figure 5.4 Ratio of males to females in districts**



Source: Author's own. Data source: Census of India, 2011

**Figure 5.5 Literacy rates and urbanisation in districts**



Source: Author's own. Data source: Census of India, 2011



# Infrastructure

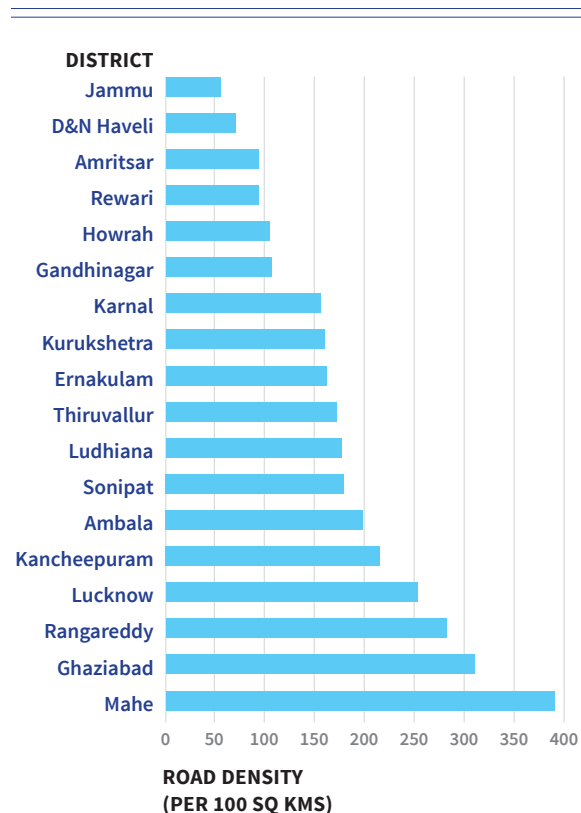
This section assesses the nature of infrastructure in selected districts. As discussed in previous chapters, the report focuses on physical infrastructure essential for economic activity to flourish: all modes of transport, electricity, water supply and wastewater treatment, telecommunications, and post and courier services. District level data on physical infrastructure such as water supply, electricity, and telecommunications are available only for households.

Data on roads and railway networks are not systematically collected for all districts. We estimated road length and railway track length in kilometers for the 18 selected districts using GIS data. Figures 5.6 and 5.7 provide the road and rail densities for the selected districts. Road density is highest in Mahe, likely due to its extremely small geographical area. This is followed by Ghaziabad and Rangareddy where the road densities are 313 kms per 100 sq kms of area and 285 per 100 sq kms of area respectively. Jammu has the

lowest road density. In terms of rail density, Jammu again does not fare well, having the second lowest density after Mahe. Lucknow, Ghaziabad, and Howrah have the highest rail densities at 22 kms per 100 sq kms, 23 kms per 100 sq kms, and 27 kms per 100 sq kms respectively.

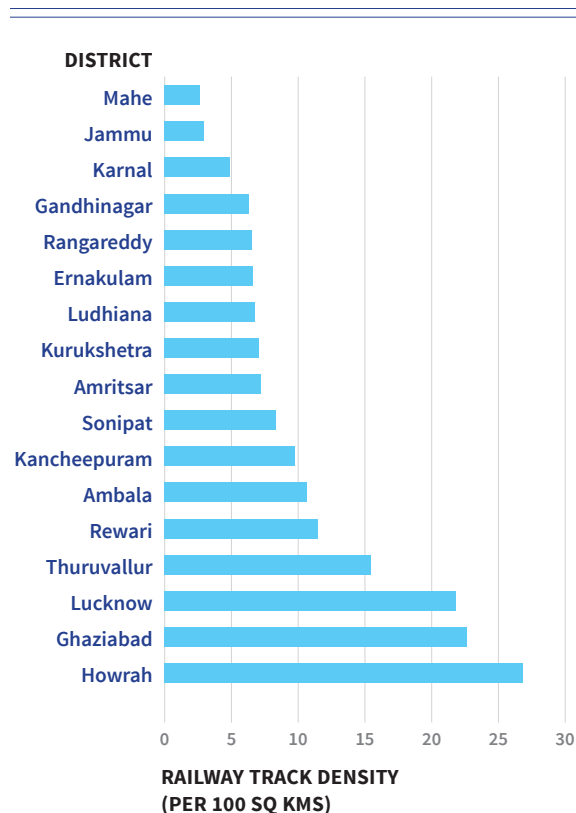
Figure 5.8 (on page 52) provides district-wise share of villages with post offices. The figure excludes Mahe which is 100% urban and hence has no villages. There is considerable variation on this measure of infrastructure. In Ernakulam, 100% of villages have post offices. The gap between Ernakulam and Gandhinagar, the district with the second highest share of villages with post offices (56%), is fairly high. 15% of villages in Lucknow have a post office.

Figure 5.6 Road densities across districts



Source: Author's own. Data source: OpenStreetMap (as of 2018) and Urban Expansion Observatory

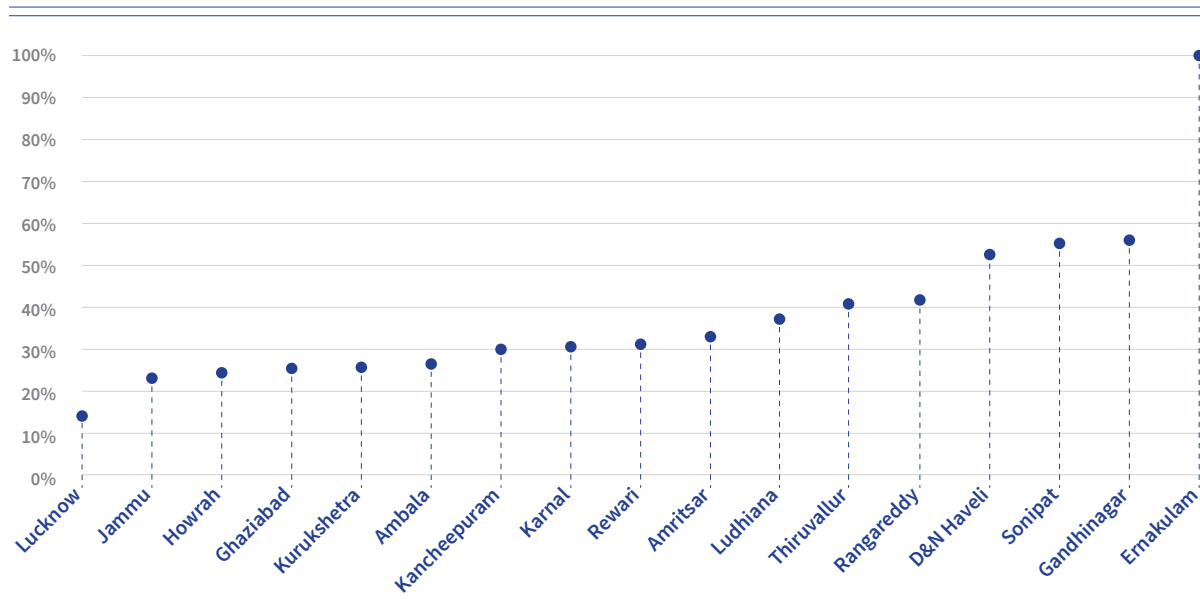
Figure 5.7 Rail track density across districts



Source: Author's own. Data source: OpenStreetMap (as of 2018) and Urban Expansion Observatory

Note: Data unavailable for Dadra and Nagar Haveli

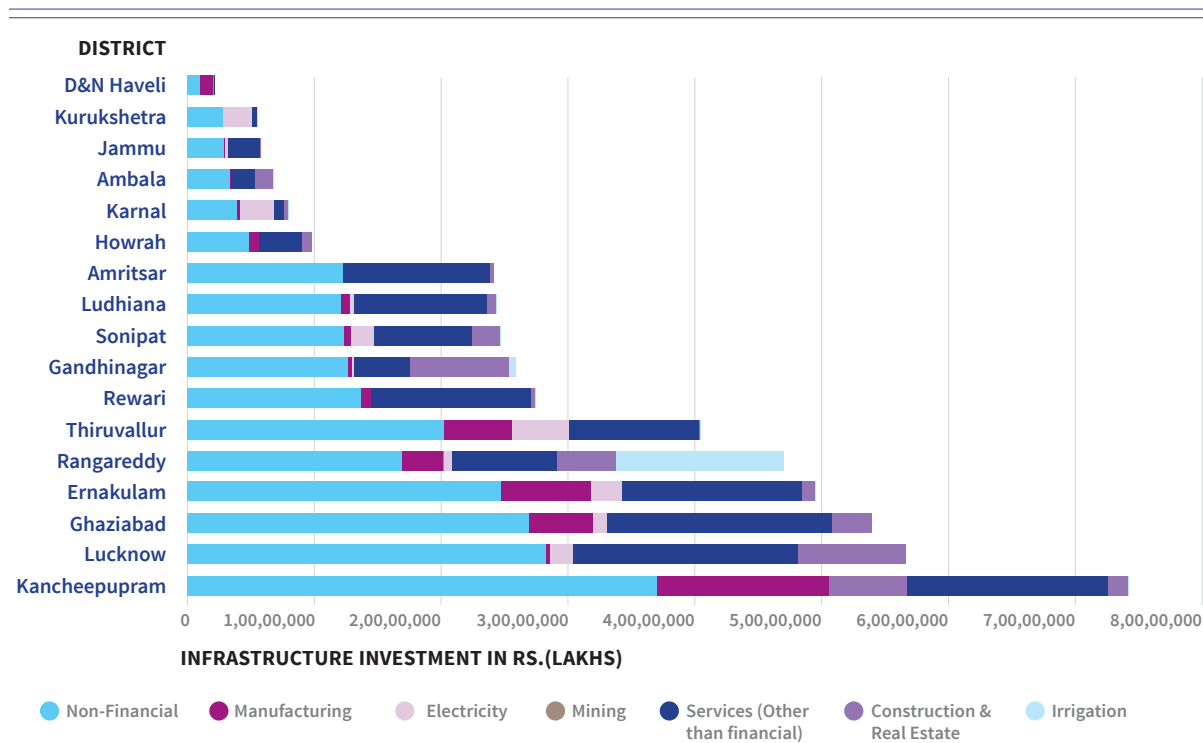
Figure 5.8 District-wise share of villages having post offices



Source: Author's own. Data source: District Census Handbooks

## 5.3 Investments

Figure 5.9 Industry-wise infrastructure investments



Source: Author's own. Data source: CapEx, Centre for Monitoring Indian Economy, 2019  
 Note: Data unavailable for Mahe

Figure 5.9 (on page 52) lays down the composition of investments in infrastructure projects for sectors like manufacturing, mining, construction and real estate, financial services, non financial sectors, services (excluding financial services), electricity, and irrigation. Out of the 18 districts, Kancheepuram has the highest total investments, at about Rs. 7,41,045 crores, in all of the above sectors with the largest share being in the non-financial sector (Rs. 3,70,522 crores). It also tops the list in investments in the manufac-

turing and electricity sectors. Ernakulam, which comes second in terms of investments in manufacturing is behind by almost 50%. Gandhinagar has the highest investments in construction and real estate at Rs. 90,779 crores. The services (excluding financial services) sector sees the highest investments in Ghaziabad, at Rs. 1,77,522 crores. Rangareddy invests the most in irrigation with Rs. 1,32,499 crores spent.

## 5.4

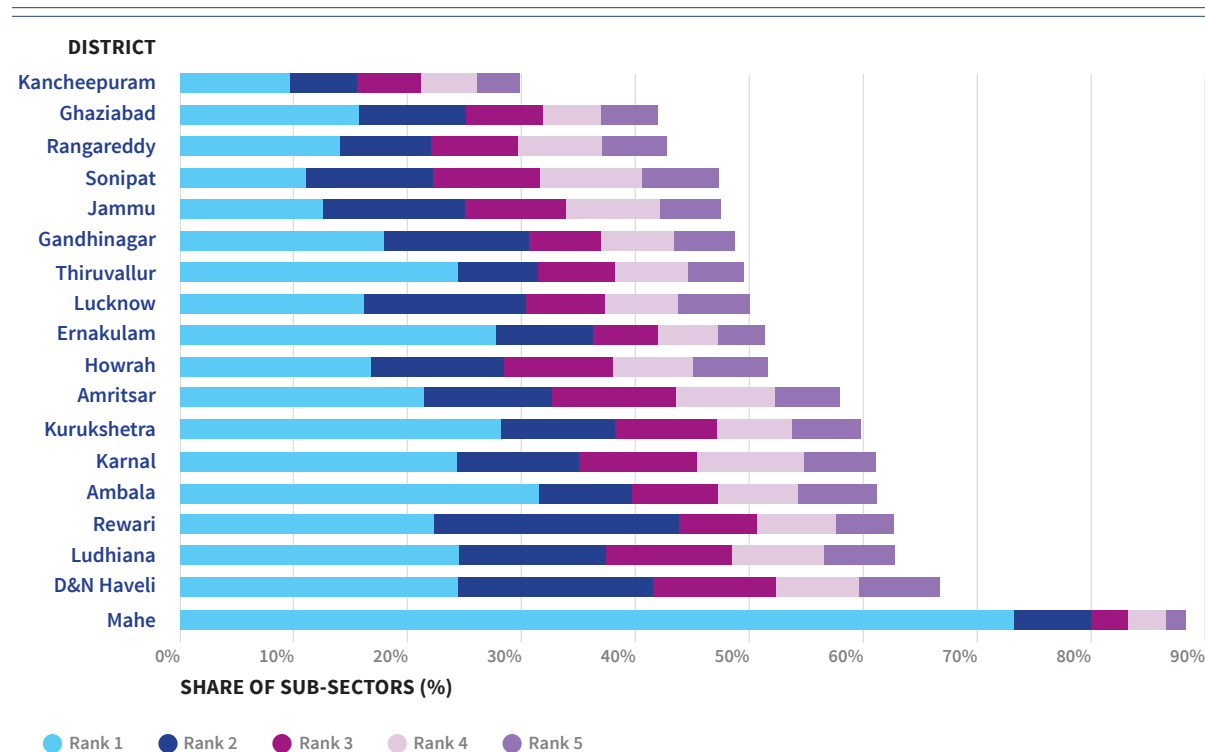
# Industries and employment

Figure 5.10 depicts the top five sectors in each of the 18 districts, calculated by the number of firms in that sector. Mahe's dominant economic activity, as per this data, is in retail trade (excluding motor vehicles and motorcycles). This accounts for 73% of the total firms in the district. It also appears to be the most specialised in that field as compared to other districts. The share of the dominant activity in other districts is significantly lower implying greater diversification of economic activity. A similar trend of specialisation is visible in districts like Ambala, Kurukshetra, and Thiruvallur, whereas the more urban districts like

Ghaziabad, Sonipat, and Howrah have diversified economic activities. Out of the six districts which we have classified as industrial regions, three districts (Thiruvallur, Howrah, and Ghaziabad) have the highest concentration of firms in manufacturing of metal products. The services districts have a very diverse sectoral distribution.

A majority of firms in all 18 districts have between 10-14 employees with Lucknow having 50% of firms in this category. The next dominant employment size category for many districts is 30-99 employees. The districts classified as the services region either have firms with the lowest

Figure 5.10 Composition of top 5 sectors by number of firms



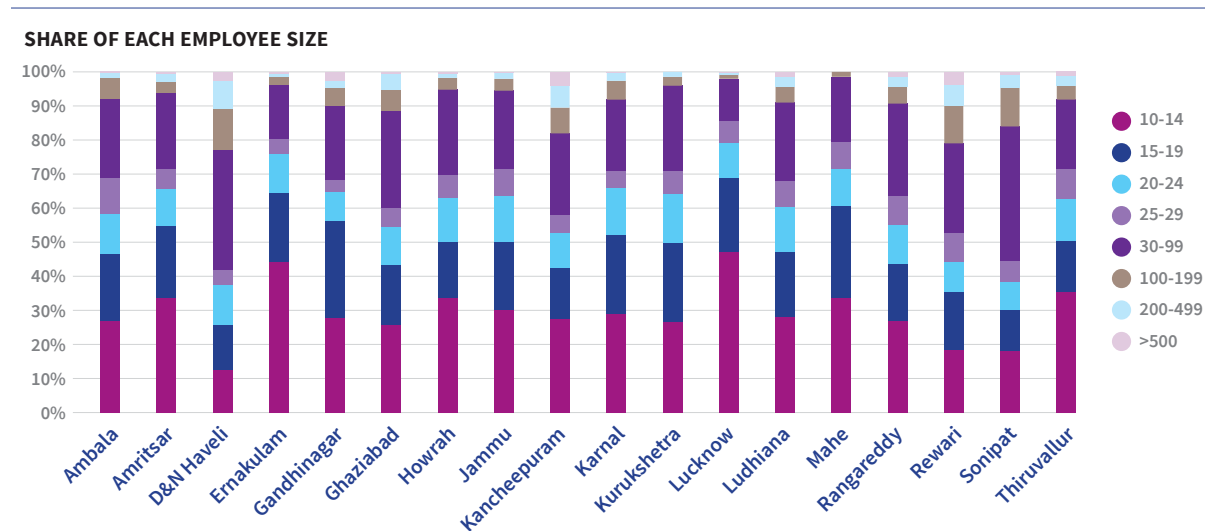
Source: Author's own. Data source: CapEx, Centre for Monitoring Indian Economy, 2019

Note: Data unavailable for Mahe

employee class size or the highest. The industrial districts have the most firms with employee ranges of 30-99 and 100-199, whereas the agro-allied districts have firms with employee class sizes between 20-24 and 25-29. Given that all our 18 districts are peri-urban regions and consequently

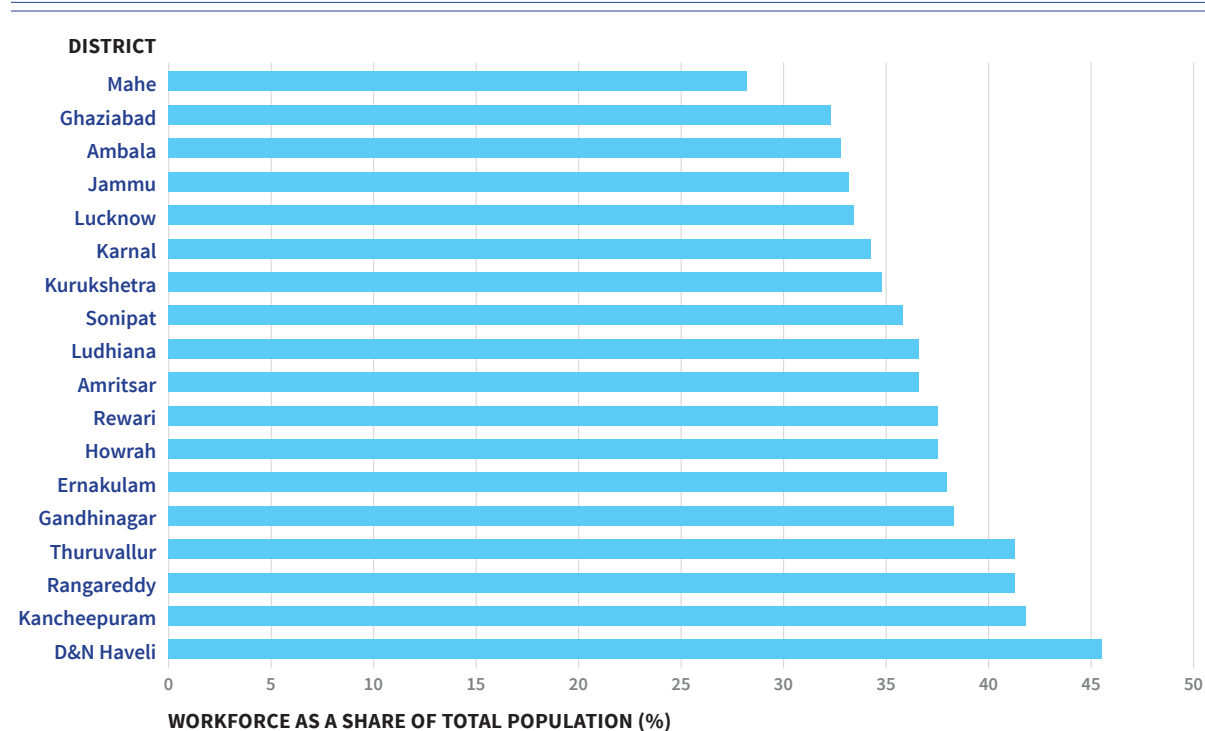
at similar levels of development, it is not surprising to see that the range of workforce participation of all these districts is between 28-45%. The industrial districts are at the lower end of the range whereas the services districts are at the higher end.

Figure 5.11 Break-up of employee size of firms



Source: Author's own. Data source: Sixth Economic Census, 2013-2014

Figure 5.12 Distribution of workforce as a share of population



Source: Author's own. Data source: Census of India, 2011



Photo credit: iStock.com/TomasSereda





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# **SURVEY RESULTS**

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This chapter provides details on the firms surveyed in our study. It describes the nature of activity, age of firms, and employee size distributions. It also provides an examination of turnovers and input costs. Further, it describes in

detail the infrastructure issues facing firms. We provide this separately for the 166 agro-allied firms, 920 industrial firms, and 1413 services firms interviewed.

## 6.1 Firm characteristics

The survey collected data on the type of activity undertaken by firms. This helped inform how infrastructure issues could affect the nature of their business as well as whether the firms have potential for job creation. Among the agro-allied firms surveyed, the predominant activity was manufacturing of food products, with 79% firms describing this as their business. This is considered to be a labour-intensive sector. The second largest sector was manufacturing of paper and paper products, with 12% firms reporting involvement in this sector. The remaining firms were involved in manufacturing of wood and wood products and beverages. Of the industrial firms surveyed, 19% were involved in manufacturing of fabricated metals, 16% were in manufacturing of wearing apparel, and 12% manu-

factured basic metals. The first two sectors are considered to be labour-intensive in nature. The largest share of firms in services was involved in providing security and investigation services (29%). 16% of the firms were in the retail sector and 12% provided financial services. The average age of agro-allied firms – calculated as the difference between the year of registration of the enterprise and 2018 – was 23 years. Figure 6.1 shows the age range and mean age for firms across the three regions.

### Employee size and type

One way to measure size of firms is in terms of the number of workers they hire. Around 84% of the firms surveyed reported the number of workers hired by them. The average size of an agro-allied firm is 16 workers. The average sizes of manufacturing and services firms are 43 and 20 workers respectively. Figure 6.2 provides the employee size class distribution of firms for the three regions. We consider four size classes viz. 1 to 9 workers, 10 to 49 workers, 50 to 99 workers, and more than 100 workers. Firms having less than 10 workers are exempt from the provisions of the Factory Act, 1948 for safeguarding the health and safety of

Figure 6.1 Firm age characteristics

Region	AGE IN YEARS		
	Mean	Min	Max
Agro-allied	23	2	68
Industries	22	<1	98
Services	17	<1	118

Figure 6.2 Employee size class of firms

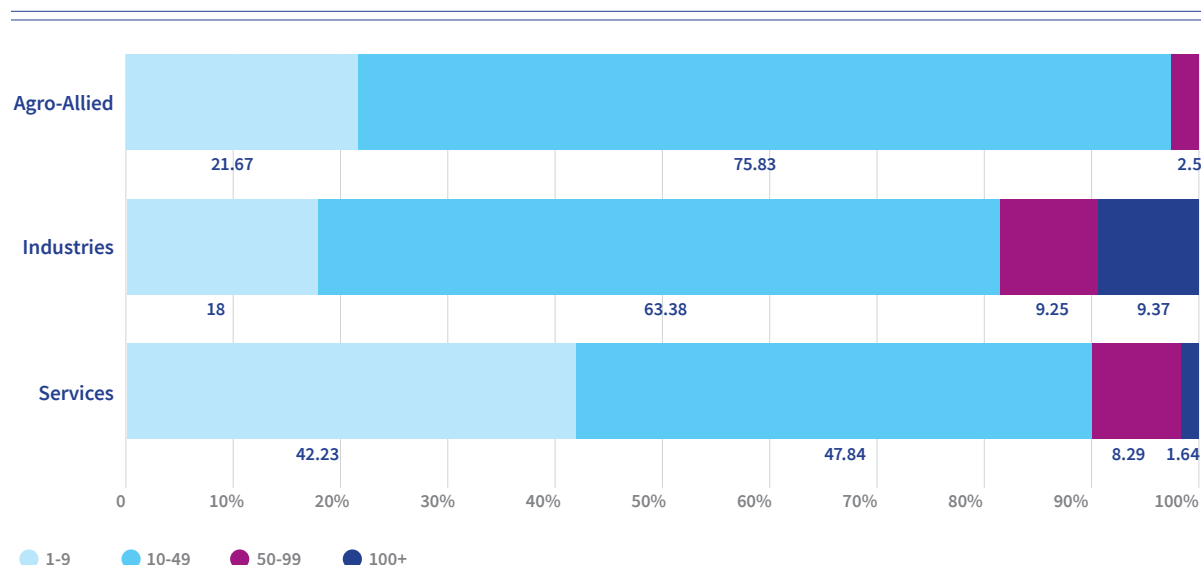
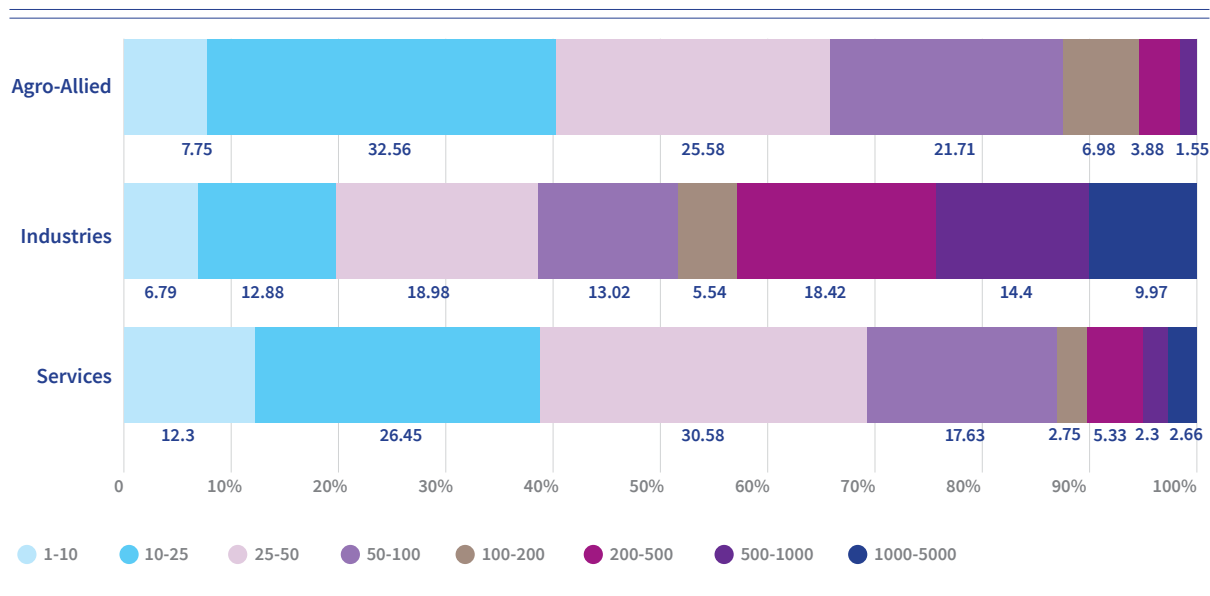


Figure 6.3 Turnover size class of firms



workers. Firms hiring between 10 and 50 workers are usually considered to be small in size while those with fewer than 100 but having 50 or more can be thought of as being medium sized. Firms with more than 100 workers are large firms.

Across agro-allied, industrial and services firms, the largest share of firms employ between 10 to 49 workers. Very few firms hire more than 50 workers and no agro-allied firm hires more than 100 workers. Thus, our sample comprises mostly small and very small firms and very few medium or large firms. Other surveys undertaken at the national level also find that firms in India are predominantly small in size (see Hasan & Jandoc, 2013).

The survey also collected information regarding the nature of employment, that is, whether workers were hired on a permanent or contractual basis. Nearly 62% of agro-allied firms provided information on the number of permanent workers hired. The reporting percentage was the same for industrial firms and was marginally higher (64%) for services firms.

- In the case of agro-allied firms, on average 88% of workers were hired on a permanent basis. 74% of firms reported that all their workers were employed on a permanent basis. On average, industrial enterprises hired 53% of their workforce on a permanent basis whereas the average share of permanent workers for services firms was 54%
- The share of permanent workers in the total workforce ranged between 16% to 100% for agro-allied firms, 5% to 100% for industrial firms, and 0 to 100% for services firms

The nature of jobs (temporary versus permanent) differs from firm to firm and across regions. In general, employ-

ment in the services sector tends to be more temporary or informal in nature compared to the other regions. 19% of services firms reported hiring all workers on a permanent basis.

## Turnover and input costs

### Turnover

Another metric for measuring firm size is in terms of their turnover. We classified firms into different size classes based on their reported turnover. This information helps in two ways. First, it allows us to know what type of firm could provide more jobs when the requisite infrastructure is given. Second, the size of firms informs any inherent bias in the survey results given that we do not stratify by size. Figure 6.3 provides the distribution of firms across turnover classes. Nearly 33% of agro-allied firms have turnover between Rs. 10 lakhs and Rs. 25 lakhs. For industrial and services firms, the largest class in terms of share of total firms was between Rs. 25 lakhs and Rs. 50 lakhs. Around 26% of agro-allied firms belong to this class. The distribution of firms across size classes was fairly even in the case of industrial firms. Services and agro-allied firms have predominantly been small in terms of turnover size.

Firm owners were asked whether they expected their turnovers to increase in the next three years. 83% of agro-allied firms, 82% of industrial firms, and 74% of services firms responded in the affirmative. The average growth rate expected in the next three years for each of the three sectors was 25%. This information captures the perception of entrepreneurs with regard to the business environment in general and their business in particular.

## Input cost

Firms reported their input cost along with a percentage-wise break-down across eight types of input cost. These included costs for fuel, electricity, water, machinery, wages, rents, maintenance, and miscellaneous. Of the total firms surveyed, 74% reported input costs in the last fiscal year. The average input cost of operations in the year 2017-18 was highest for industrial firms at Rs. 4.1 crores followed by services firms (Rs. 38 lakhs) and agro-allied firms (Rs. 38 lakhs).

Electricity was the major input cost for agro-allied firms, making up an average of 23% of input costs. It is not surprising, then, that this is one of the major infrastructure improvements firms wish to see, as we show later in this chapter. Wages made up 18% of input costs – nearly the same as fuel costs and water costs comprised 21% of input costs. The average share in input costs was less than 10% for rent, machinery and equipment, maintenance, and other costs. We classify cost incurred on wages as labour cost and the rest as capital costs. In rupee terms, the average capital cost was Rs. 31 lakhs.

Wages was the major input cost for industrial firms, comprising on average 22% of total input costs, followed by electricity whose average share in input cost was 18%. Both fuel costs and machinery costs had similar average share in total input cost viz. 14%. The average capital cost for industrial firms was Rs. 296 lakhs.

For services firms too electricity was the major input cost, making up 19% of the total input costs on average. Average share of wages was marginally less at 18%. On average fuel costs make up 16% of total input costs. The average capital cost for services firms was Rs. 30 lakhs.

## 6.2

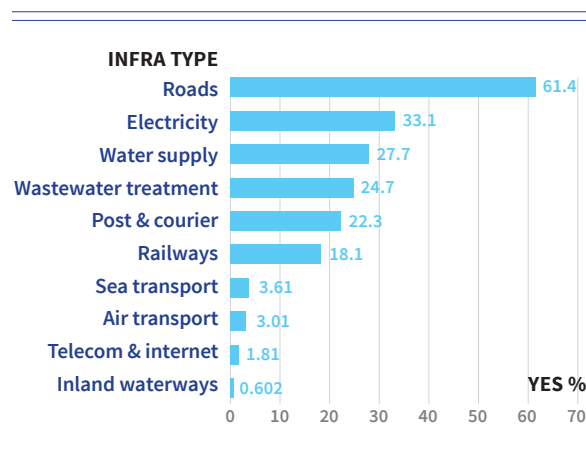
# Infrastructure issues across regions

Each firm was asked to identify at most three types of infrastructure out of a list of ten whose lack of provision and poor quality had the biggest impact on its business and operations. These were not ranked as types of infrastructure issues identified by firms are assumed to be of equal importance. Within each infrastructure type, firms reported the nature of the problem, where applicable, by selecting one or more issues from options provided to them.

## Infrastructure problems in agro-allied region

Among the different types of infrastructure, 102 firms (61%) stated that roads were a problem. The second most common problem was electricity, with 33% of firms stating that this was an issue. Around 28% of firms identified water supply as an issue. Figure 6.5 (on page 61) depicts the different types of issues pertaining to roads. Among firms that identified 'roads' as being an impediment to their business, the main issues highlighted were congestion (77%), narrow roads (32%), and poor quality of roads (20%). Among firms that identified 'electricity' as a problem, the main issues were high prices (67%), load shedding (36%), and unscheduled power cuts (18%). Figure 6.6 shows the share of firms identifying different issues with respect to electricity.

Figure 6.4 Share of agro-allied firms reporting infrastructure is an issue



Of the firms that identified high prices as an issue:

- 24% also reported load shedding to be a problem
- Only 2% reported unscheduled power cuts were also a problem.

Thus, we do not find there to be a major overlap between firms reporting high prices to be a problem and firms that reported load shedding or unscheduled power cuts to be an issue. Of the firms that reported electricity was a problem,

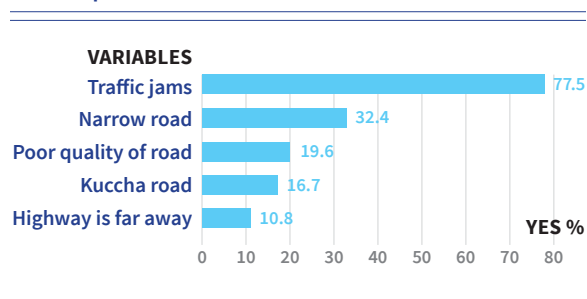
33% used a generator. A large majority of firms stated poor quality of water as being a problem with respect to water supply. The second most cited issue was insufficient quantity of water. Five firms reported expenses for overcoming water supply issues. The average cost toward fixing water supply issues was Rs. 9 lakhs.

## Infrastructure issues in industrial region

The number one infrastructure issue for industrial firms was roads, with 84% firms identifying it as an impediment to their business. The second most cited problem was wastewater and effluent treatment (33%) followed closely by water supply (32%).

Among firms that identified 'roads' as being an impediment to their business, the main issues pertained to poor quality of roads (70%), kuchha roads (51%), and traffic congestion (51%) (see Figure 6.8 on page 60). Among firms that identified wastewater and effluent treatment as a major issue, 70% and 74% firms reported not having access to wastewater and effluent treatment facilities and water treatment facilities respectively. For a large majority of firms that had access, these facilities were self-provided (81% of firms had

Figure 6.5 Share of firms reporting different problems with respect to roads



made their own provision for wastewater and effluent treatment and the share of water treatment was 76%. Firms reported spending on average approximately Rs. 9,000 in a month for treating effluents and around Rs. 12,000 for treating water.

With regard to water supply, 57% of firms cited poor quality of water as an issue, and 40% cited insufficient quantity of water. 70 firms reported spending between Rs. 1,000 and Rs. 5 lakhs in a month to pay for overcoming water supply issues. Average spending was around Rs. 65,000.

Figure 6.6 Share of firms reporting different problems with respect to electricity

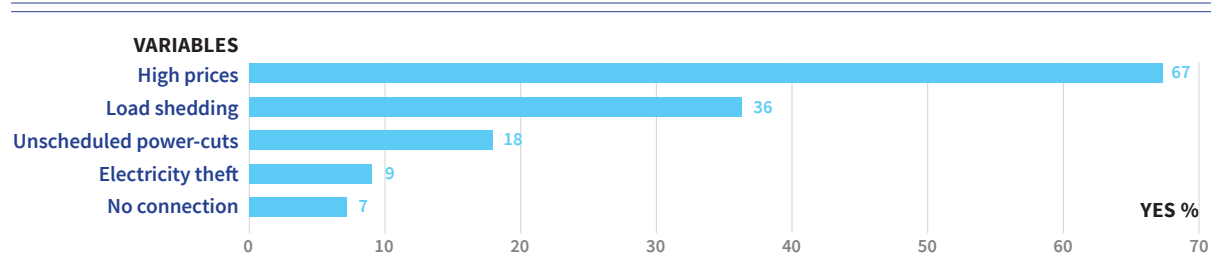


Figure 6.7 Share of industrial firms reporting infrastructure is an issue

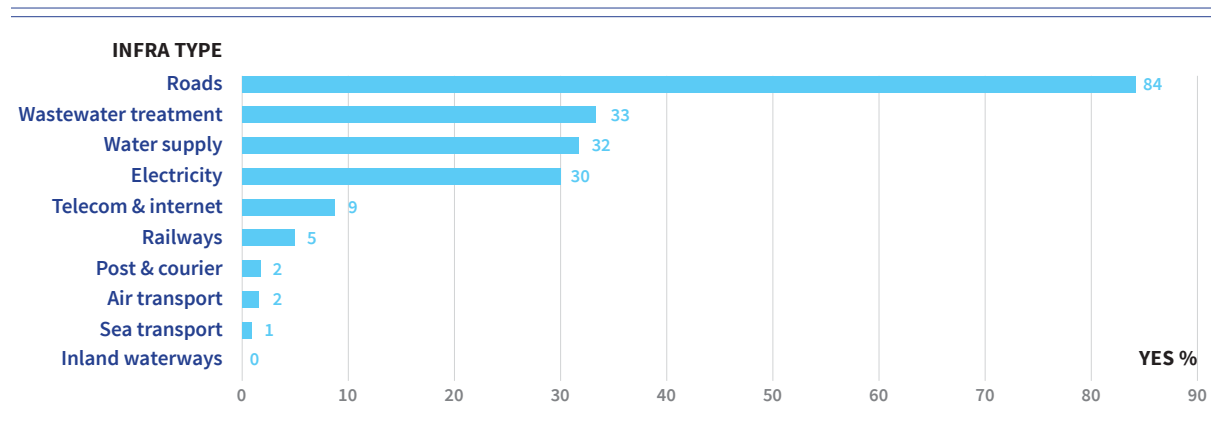




Figure 6.8 Share of firms reporting different problems with respect to roads

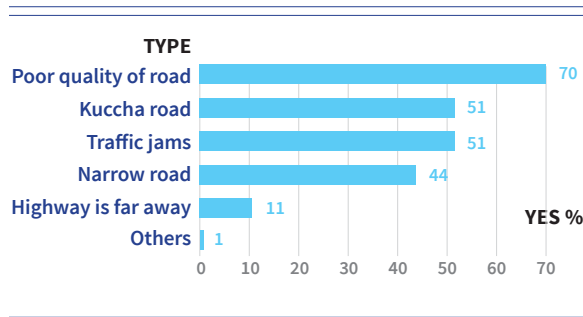
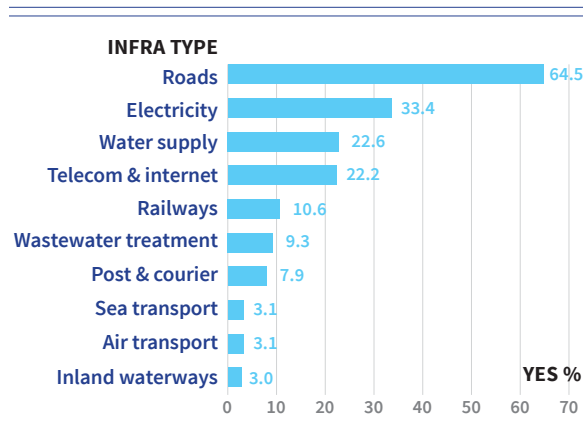


Figure 6.9 Share of services firms reporting infrastructure is an issue



## Infrastructure issues in services region

The most cited infrastructure problem for services firms is roads (64.5%), followed by electricity (33%) and water supply (23%). 22% of firms reported telecom and internet as also being an issue.

With respect to roads, 66% of firms stated that congestion was the issue, 42% of firms reported poor quality of roads as the problem and 32% of firms reported that the roads were too narrow (see Figure 6.10).

Among firms that identified 'electricity' as a problem, the main issues were high prices (70%), unscheduled power cuts (34%), and load shedding (26%) (see Figure 6.11). Around 52% of firms use a generator.

Of firms reporting high prices as an issue:

- 18% also stated that unscheduled power cuts were a problem
- 20% of firms reported that load shedding was a problem

Around 63% of firms cited insufficient quantity of water as an issue and 62% of firms said poor quality of water was a problem with respect to water supply. Of firms reporting that water supply was an issue, 46% had taken steps to sort out the problems. The average cost toward fixing water supply issues was Rs. 1.4 lakhs.

Figure 6.10 Share of firms reporting different problems with respect to roads

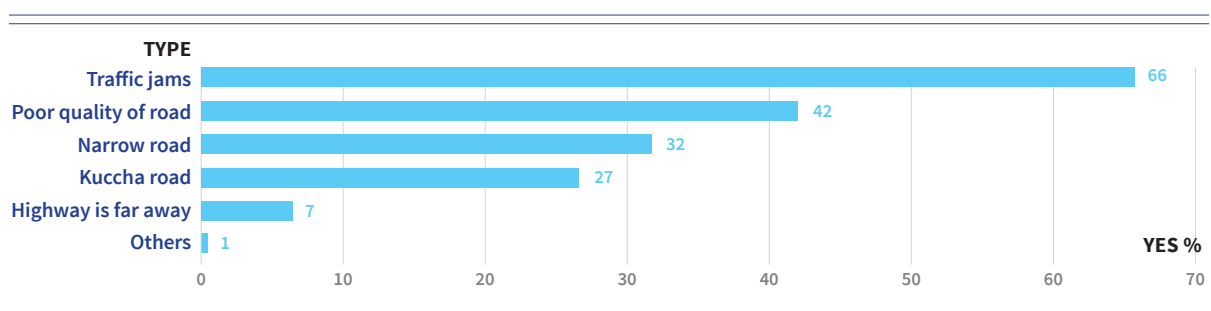
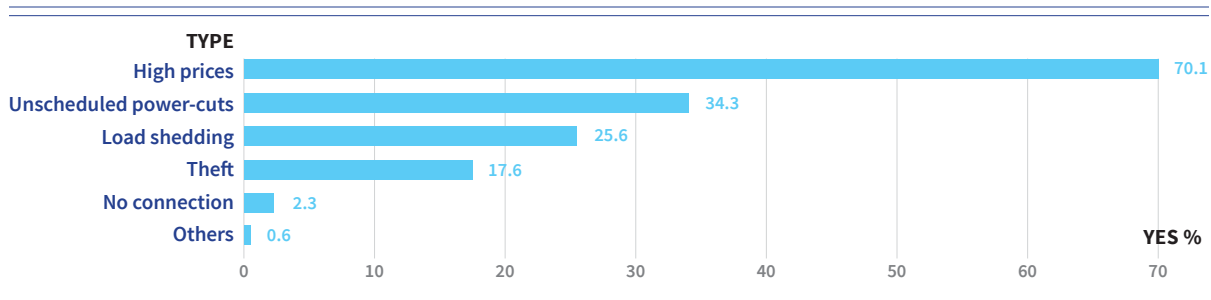


Figure 6.11 Share of firms reporting different problems with respect to electricity



# Infrastructure issues by size of firms

As discussed previously, we classify firms into four size classes based on number of employees. In this section, we report infrastructure problems across these size classes together for all regions. This analysis is motivated by the understanding that employment potential and productivity differ across sizes. Knowing whether there are any patterns or correlation between firm size and the types of infrastructure issues they face will help inform infrastructure priorities. Since we do not stratify for size, the analysis is presented at the sample level. Figure 6.12 depicts this information.

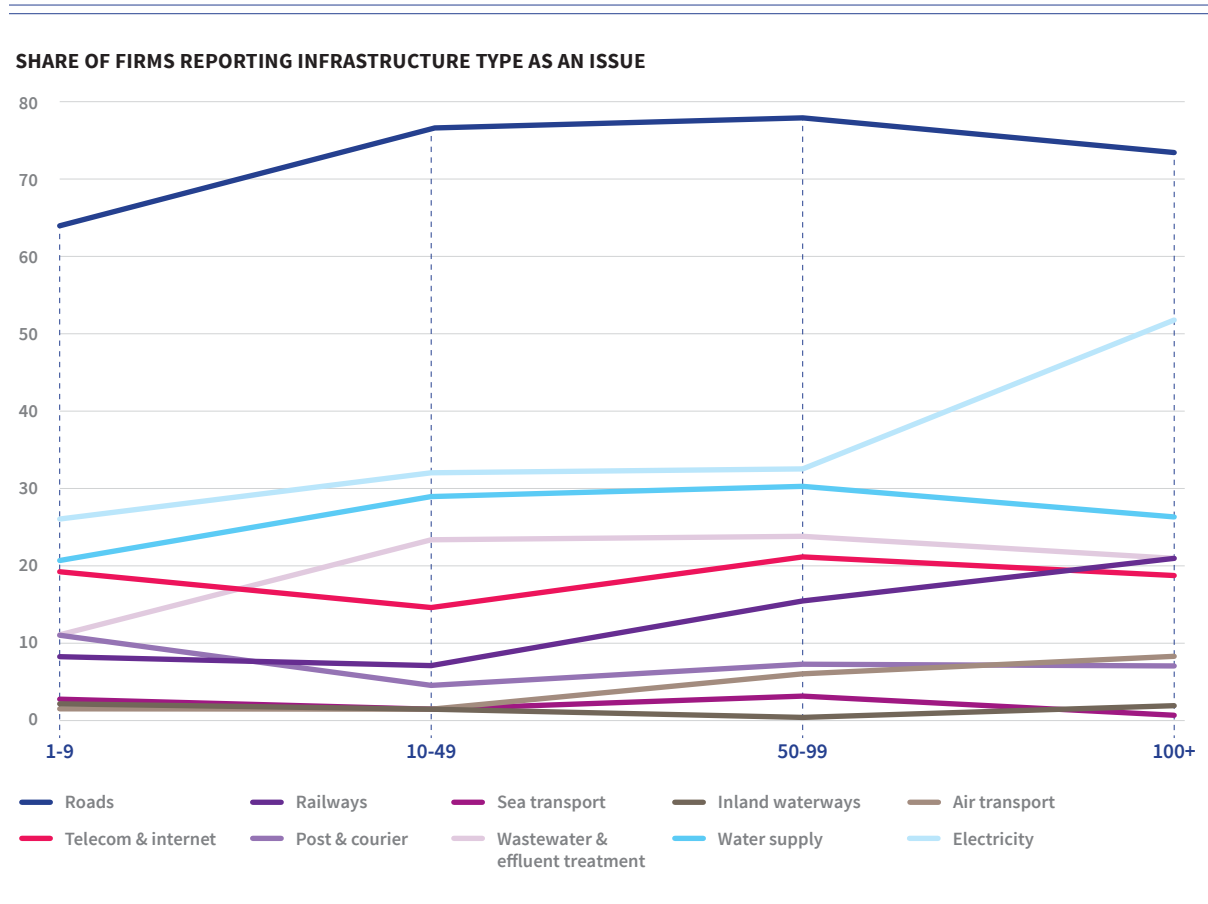
- Roads are an issue for a majority of firms across all size classes
- Electricity is an issue for more than 50% of firms that hire more than 100 employees. A large share of firms

across remaining size classes also identify electricity as a problem although the share is much below 50%

- The share of firms stating that water supply is a problem is similar across size classes
- Around 21% of firms belonging to the highest size class report railways to be a problem but the share is much lower for firms in the remaining size classes

We do not find too much variation among firms across different sizes in terms of the infrastructure problems they face. For example, roads are a dominant issue across size classes and electricity is the second most important problem for firms in all size classes even though the actual shares vary.

Figure 6.12 Infrastructure issues by size class of firms



# References

Hasan, R., & Jandoc, K. R. L. (2013). Labor Regulations and Firm Size Distribution in Indian Manufacturing. In J. Bhagwati and A. Panagariya (Eds.), *Reforms and Economic Transformation in India* (15-48), Oxford University Press: New York.









# **ESTIMATING IMPACT ON EMPLOYMENT**

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In the enterprise survey, firms reported the extent of costs saved across eight types of inputs if existing infrastructure problems were fixed. This chapter provides an analysis of the cost savings accrued to firms if infrastructure issues were resolved. Using the model described in chapter 3, all savings are reinvested in the business, which is reflected in an increase in capital costs as operations expand.

It is important to note that these savings will not be realised immediately but will occur over the medium term after infrastructure related issues are resolved. Labour costs will also increase commensurately, and keeping the capital/labour ratio (estimated separately for each firm as the ratio of capital costs and labour cost) as well as wages unchanged,

it is possible to estimate the increase in number of workers. This chapter presents the estimated increase in employment separately for agro-allied, industrial, and services regions. Finally, it presents employment elasticities, derived from cost savings and changes in number of workers. A caveat is that while cost savings are directly reported by firms, the estimated employment is derived based on a model with key assumptions regarding capital labor ratio and wages per worker. Relaxing these assumptions may affect the change in labour cost as well as the employment created. Therefore, the numbers we report should be read bearing this in mind.

## 7.1

# Agro-allied region

We calculated actual savings in Rupees using the percentage cost saved and actual costs incurred by firms for eight different input cost types (costs for fuel, water, electricity, machinery, rent, wages, maintenance, and others). For example, if a firm reported that it would save 10% in fuel costs if the infrastructure issues are resolved, the actual amount saved is estimated as 10% of the actual amount currently being spent on fuel. To avoid the problem of outliers, we drop firms whose reported total savings are greater than 3 standard deviations from the mean. Using this method we eliminated five firms which were outliers.

Based on the reported savings, we estimate that

- Agro-allied firms will save a total of Rs. 5,573 lakhs if all infrastructure problems are resolved. The ratio of total savings to total input cost is 1.1.
- The cost saved per firm is Rs. 32.12 lakhs
- Total new capital cost is around Rs. 9,735 lakhs. The ratio of new capital cost to the old capital cost is 2.34
- Total new labour cost will be around Rs. 2,215 lakhs. The ratio of new labour cost to the old labour cost is 2.4
- Total increase in employment will be around 2911. The ratio of the change in employment to the current total number of workers is 1.1
- Per firm increase in employment will be 21

## Cost saving and employment by type of infrastructure

As reported in chapter 6, 62% of agro-allied firms identified roads as an infrastructure issue. The second most cited issue was electricity with 33% reporting it as a problem, fol-

lowed by water supply with 28% of firms identifying it as an issue. We estimate cost savings accrued to firms if the various problems associated with these three most cited infrastructure areas were addressed. We drop firms that are outliers from this analysis. Table 7.1. summarises the cost savings.

Taking cost savings associated with respect to roads, we find that:

- Total savings are Rs. 1,221 lakhs. The ratio of total savings from roads to total input cost of firms reporting roads as the issue is 0.59
- Cost saved per firm is around Rs. 6.8 lakhs
- Total new capital cost is around Rs. 2,879 lakhs. The ratio of new capital cost to old capital cost is 1.7
- Total new labour cost will be around Rs. 740 lakhs. The ratio of new labour cost to old labour cost is 1.8
- Total increase in employment will be 678. The ratio of the change in employment to the current total number of workers is 0.5
- Per firm increase in employment will be 9

Taking cost savings associated with respect to electricity we estimate that:

- Total savings are Rs. 724 lakhs. The ratio of total savings from electricity to total input cost of firms reporting electricity as the issue is 0.7
- Cost saved per firm is around Rs. 4 lakhs
- Total new capital cost is around Rs. 1,548 lakhs. The ratio of new capital cost to old capital cost is 1.9
- Total new labour cost will be around Rs. 361 lakhs. The ratio of new labour cost to old labour cost is also 1.9

**Table 7.1 Summary of Agro-allied firms**

Class	Roads	Electricity	Water Supply	All
Total savings*	1221	724	724	5574
New capital costs*	2879	1548	1758	9735
New labour costs*	740	361	300	2215
Savings / Total costs	0.59	0.71	0.60	1.10
New capital cost / Old capital cost	1.74	1.88	1.70	2.34
Change in employment#	678	320	583	2911
Change in employment / Total employment	0.46	0.54	0.59	1.11

Note: \*Figures in Rs. Lakhs, #Figures in units

- Total increase in employment will be 320. The ratio of the change in employment to the current total number of workers is 0.5
- Per firm increase in employment will be 9

Taking cost savings associated with respect to water supply we estimate that:

- Total savings are Rs. 724 lakhs. The ratio of total savings from water supply to total input cost of firms reporting water supply as the issue is 0.6
- Cost saved per firm is around Rs. 4 lakhs
- Total new capital cost is around Rs. 1,758 lakhs. The ratio of new capital cost to old capital cost is 1.7
- Total new labour cost will be around Rs. 300 lakhs. The ratio of new labour cost to old labour cost is also 1.7
- Total increase in employment will be 583. The ratio of the change in employment to the current total number of workers is 0.6
- Per firm increase in employment will be 11

Finally, we estimate the employment elasticity, that is the effect of a 1% increase in cost saving associated with infrastructure provision/improvement on percentage change in employment. We find that:

- For every 10% increase in cost saving due to improvement/provision of roads 1.9% more jobs can be created
- Every 10% increase in cost saving due to improvement in electricity could result in a 1.2% increase in jobs
- Every 10% increase in cost saving due to problems of water supply being resolved could lead to 1.3% more jobs being created

Taking the results together, we see that providing roads could lead to the largest savings and most increase in jobs created. However, with regard to electricity and water supply, for the same amount saved, the change in employment from water supply problems being addressed is far greater. These insights can be very useful whilst determining priorities in infrastructure investment in the agro-allied region.

## 7.2 Industrial region

Of the industrial firms surveyed, 70% reported the costs saved for different input costs if infrastructure issues were resolved. We drop 6 firms that are outliers in terms of cost savings using the method described earlier in the chapter.

Based on what industrial firms report:

- Total costs saved if all infrastructure problems were to be addressed will be Rs. 2,77,131 lakhs. The ratio of savings to total input costs is 0.25
- Cost saved per firm is Rs. 58 lakhs
- New capital costs are estimated to be Rs. 10,73,178 lakhs. The ratio of new capital cost to old capital cost is 1.3

- Total new labour cost will be around Rs. 3,92,462 lakhs. The ratio of new labour cost to old labour cost is 1.3
- Total increase in employment will be 71,634. The ratio of the change in employment to present total employment in industrial firms is 0.29
- Per firm increase in employment will be 18

### Cost saving and employment by type of infrastructure

The three most cited infrastructure issues faced by industrial firms are roads, wastewater and effluent treatment,

**Table 7.2 Summary of Industrial firms**

Class	Roads	Waste Water & Effluent Treatment	Water Supply	All
Total savings*	109238	23542	43472	2,77,131
New capital costs*	789285	124004	534683	1073178
New labour costs*	298969	32390	256762	392462
Savings / Total costs	0.12	0.19	0.06	0.25
New capital cost / Old capital cost	1.16	1.23	1.09	1.35
Change in employment#	24693	10784	9016	71634
Change in employment / Total employment	0.13	0.19	0.09	0.29

Note: \*Figures in Rs. Lakhs, #Figures in units

and water supply. We estimate the increase in employment from cost savings accrued to firms if the various problems associated with these three most cited infrastructure areas were addressed. We drop firms that are outliers from this analysis. Table 7.2. summarises the cost savings and results.

Taking cost savings associated with respect to roads, we find that:

- Total savings are Rs. 1,09,238 lakhs. The ratio of these savings to total input costs is 0.12
- Cost saved per firm is around Rs. 23 lakhs
- Total new capital cost is around Rs. 7,89,285 lakhs. The ratio of new capital cost to old capital cost is 1.16
- Total new labour cost will be around Rs. 2,98,969 lakhs. The ratio of new labour cost to old labour cost is 1.1
- Total increase in employment will be 24,693. The ratio of the change in employment due to roads to the total employment is 0.13
- Per firm increase in employment will be 6

Taking cost savings associated with respect to wastewater and effluent treatment, we find that:

- Total savings are Rs. 23,542 lakhs. The ratio of savings to total input costs is 0.19
- Cost saved per firm is around Rs. 4.9 lakhs
- Total new capital cost is around Rs. 1,24,004 lakhs. The ratio of new capital cost to old capital cost is 1.23
- Total new labour cost will be around Rs. 32,390 lakhs. The ratio of new labour cost to old labour cost is 1.2
- Total increase in employment will be 10,784. The ratio of this employment to current employment is 0.19
- Per firm increase in employment will be 6

Taking cost savings associated with respect to water supply we find that:

- Total savings are Rs. 43,472 lakhs. The share of savings to input cost is 0.06
- Cost saved per firm is around Rs. 9 lakhs
- Total new capital cost is around Rs. 5,34,683 lakhs. The share of new capital cost to old capital cost is 1.09
- Total new labour cost will be around Rs. 2,56,762 lakhs. The share of new labour cost to old labour cost is 1.1
- Total increase in employment will be 9,016. The ratio of change in employment to current total employment is 0.09
- Per firm increase in employment will be 6

Next, we estimate employment elasticities, that is the effect of a 1% increase in cost saving associated with infrastructure provision/improvement on percentage change in employment. We find that:

- For every 10% increase in cost saving due to improvement/provision of roads 3.7% more jobs can be created
- For every 10% increase in cost saving due to improvement in wastewater and effluent 2.9% more jobs can be created
- Every 10% increase in cost saving due to problems of water supply being resolved could lead to 4.3% more jobs being created

Of the three types of infrastructure, the cost savings and absolute change in employment associated with roads is highest while the highest employment elasticity is associated with water supply. The average change in employment is uniform across the three infrastructure types.

## Services region

Of the 1,413 firms surveyed for the analysis, 998 firms reported cost savings that would accrue to them if various infrastructure issues were resolved. Of these, 10 firms were identified as outliers in terms of savings reported and have not been included in the analysis. Based on cost savings reported by firms:

- Total costs saved if all infrastructure problems were to be addressed will be Rs. 88,594 lakhs. The share of savings to input cost is 0.3
- Cost saved per firm is Rs. 9 lakhs
- New capital costs are estimated to be Rs. 3,13,880 lakhs. The ratio of these costs to old capital costs is 1.39
- Total new labour cost will be around Rs. 75,661 lakhs. The ratio of these costs to old labour costs is 1.42
- Total increase in employment will be 76,675. The ratio of this change to existing employment in services firms is 0.36
- Per firm increase in employment will be 10

### Cost saving and employment by type of infrastructure

As reported in the previous chapter, the top infrastructure issue among firms in the services region was roads (65%), followed by electricity (33%), and water supply (23%). We estimate increases in employment from cost savings accrued to firms if the various problems associated with these three most cited infrastructure areas were addressed. We drop firms that are outliers from this analysis. Table 7.3 summarises the cost savings and results.

Taking cost savings associated with respect to roads, we find that:

- Total savings are Rs. 33,264 lakhs. The ratio of savings to total input cost is 0.16
- Cost saved per firm is around Rs. 4 lakhs
- Total new capital cost is around Rs. 2,00,116 lakhs. The ratio of these costs with initial capital costs is 1.2
- Total new labour cost will be around Rs. 43,732 lakhs. The ratio of new labour costs to initial labour costs is 1.22
- Total increase in employment will be 28,208. The ratio of change in employment to current total employment is 0.17
- Per firm increase in employment will be 6

Taking cost savings associated with respect to electricity

we estimate that:

- Total savings are Rs. 11,174 lakhs. The ratio of savings to total input cost is 0.15
- Cost saved per firm is around Rs. 1 lakh
- Total new capital cost is around Rs. 73,272 lakhs. The ratio of these costs with initial capital costs is 1.18
- Total new labour cost will be around Rs. 13,549 lakhs. The ratio of new labour costs to initial labour costs is 1.19
- Total increase in employment will be 9,169. The ratio of change in employment to current total employment is 0.13
- Per firm increase in employment will be 4

Taking cost savings associated with respect to water supply we estimate that:

- Total savings are Rs. 18,882 lakhs. The ratio of total savings to corresponding input cost is 0.17
- Cost saved per firm is around Rs. 2 lakhs
- Total new capital cost is around Rs. 1,04,181 lakhs. The ratio of these costs with initial capital costs is 1.22
- Total new labour cost will be around Rs. 31,310 lakhs. The ratio of new labour costs to initial labour costs is 1.3
- Total increase in employment will be 9,356. The ratio of change in employment to current total employment is 0.18
- Per firm increase in employment will be 5

Finally, we estimate the employment elasticity, that is the effect of a 1% increase in cost saving associated with infrastructure provision/improvement on percentage change in employment. We find that:

- For every 10% increase in cost saving due to improvement/provision of roads 5.6% more jobs can be created
- Every 10% increase in cost saving due to improvement in electricity could result in a 4.8% increase in jobs
- Every 10% increase in cost saving due to problems of water supply being resolved could lead to 4.3% more jobs being created

Comparing the results across different infrastructure types for services firms, we find that cost savings, average and total change in employment as well as employment elasticity associated with roads are highest.

**Table 7.3 Summary of Services firms**

Class	Roads	Electricity	Water Supply	All
Total savings*	33264	11174	18882	88,594
New capital costs*	200116	73272	104181	313880
New labour costs*	43732	13549	31310	75661
Savings / Total costs	0.16	0.15	0.17	0.32
New capital cost / Old capital cost	1.20	1.18	1.22	1.39
Change in employment#	28208	9169	9356	76675
Change in employment / Total employment	0.17	0.13	0.18	0.36

Note: \*Figures in Rs. Lakhs, #Figures in units

## 7.4 Comparative analysis

As described earlier in the report, employment elasticities are derived using a log-log regression with change in employment as the dependent variable and cost saving as the independent variable. A log-log regression helps linearise an essentially non linear relationship between our variables of interest and allows us to straightforwardly interpret coefficients as the percentage change in the dependent variable associated with a percentage change in the independent variable.

Table 7.4 shows the employment elasticities from the top three infrastructure constraints for all three regions. It also shows that the coefficient values are statistically significant in all cases except in the case of change in employment in agro-allied firms due to cost saving from electricity. For all other cases, there exists a relationship between change in employment and cost saving. We also report the mean values for existing number of workers in firms in each region. Firms in the industrial region have the highest average number of workers, followed by services. Looking at

elasticities together, we find that employment elasticity is highest for firms in services although the average size of a services firm is less than half that of an industrial firm. Employment elasticity associated with roads is highest for firms in agro-allied and services region whereas employment associated with water supply is highest for firms in industrial regions.

Looking at the results in terms of infrastructure issues reported by firms and employment generation across infrastructure types in tandem, it is possible to conclude that at present, issues such as congestion of roads, and poor quality of roads are a major concern for firms. Therefore, investing in upgradation and maintenance of this infrastructure could result in higher cost savings for firms. Secondly, although employment elasticities associated with costs saved due to infrastructure provisions are low, they are not trivial. The induced employment effects of building roads have the potential to unlock growth among firms across all regions.

There is currently no study that determines the effects of infrastructure investment on job creation at a regional level. The elasticity estimates presented in this report are the first estimates of their kind for the country. Future research that makes use of different data or focuses on other context-specific assessments of the impact of infrastructure can use the model developed for this study and the elasticities as benchmarks or the baseline to compare with their findings.

**Table 7.4 Employment elasticities**

Class	Agro-allied	Industrial	Services
Roads	0.19**	0.37***	0.56***
Electricity	0.12	---	0.48***
Water supply	0.13*	0.43***	0.43***
Water treatment	---	0.29***	---
Mean number of workers	16	43	20

Note: \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1









A large, light blue, stylized number '8' is centered on the page, serving as a background for the text. The number is composed of two circular shapes, one above and one below, connected by a narrow vertical bar. The text 'CONCLUSION' is written in a bold, white, sans-serif font across the middle of the number. A thin white horizontal line is positioned below the text.

# CONCLUSION

This report is the culmination of primary and original research to arrive at a methodology for examining how infrastructure provision could spur enterprises to grow and create the jobs that India urgently needs. Recognising that infrastructure needs will vary across regions, the methodology used gives us estimates of job creation separately for three types of economic geographies viz. agro-allied regions, industrial regions, and services regions.

A study of this scope required granular data on employment numbers, infrastructure provision, and economic geography. Since such data was not forthcoming, we relied on night lights data, which has now been used extensively by researchers. The need for primary research in the form of an extensive enterprise survey also arose due to the

problem of lack of data. The objective of the survey was to collect data on infrastructure problems, turnover and nature of input costs, and employment data for a sample of firms in order to calculate estimates that would be representative at the regional level. Extending from the survey results and drawing from focus group discussions as well as in-depth interviews with experts, this chapter puts forth some key conclusions. Furthermore, it reiterates some of the limitations of the existing study.

## Firms in India tend to be too small

Extensive research on firm productivity and firm sizes in India shows that a large majority of firms in India are extremely small. The report of the All India Sixth Economic Census showed that nearly 72% of all establishments were Own Account Establishments, that is, they had no hired workers. These establishments accounted for 44% of total

employment in India. Only 1.37% of total establishments hired more than 10 workers. The firms surveyed in our study too were predominantly small. A large majority hired less than 50 workers. Smaller firms are typically less productive since they cannot take advantage of economies of scale. They also lack competitiveness.

## Unleashing growth potential of private enterprise is critical for job creation

On the one hand, we have private enterprises that are too small and unproductive to achieve scale despite being labour-intensive. On the other hand, the jobs crisis is worsening by the day as millions leave the agriculture sector. The public sector alone simply cannot absorb the vast numbers of high and low skilled unemployed workers. Despite wide variations in trends of employment growth across sectors, large-scale and labour-intensive sectors continue

to remain the best hope for job creation. This requires creating enabling conditions for firms to scale up their operations. A caveat here is that while private enterprises will create jobs once such conditions are in place, there is very little that can be said about the nature of the jobs — that is, whether they will be high skilled or low skilled, permanent or contractual, etc.

# Although there have been improvements, infrastructure remains a major constraint

The entrepreneurs participating in the survey and focus group discussions stated that infrastructure has improved greatly over time. In particular, new roads and highways have been built, electricity provision has gotten better resulting in fewer hours of power cuts, and telecom and internet penetration have increased. While unavailability may have ceased to be an issue, problems of quality, especially pertaining to infrastructure such as roads, remain. Connectivity is of critical importance for most businesses. For manufacturing firms, it determines access to inputs as well as markets for sale of manufactured products. For services, connectivity is essential to access labour as well as consumers of services. Private solutions formulated by entrepreneurs are not feasible here. Perhaps it should not come as a surprise, therefore, that the highest share of firms across services, industrial, and agro-allied regions identified roads as a major impediment to their operations. Since all firms are located in peri-urban districts, congestion and narrow roads seem to be the major issues.

Resolving these infrastructure issues can lead to significant benefits. The total costs saved by agro-allied firms if infrastructure problems are resolved is around 110% of the total input costs. The costs saved by establishments in the industrial region are estimated to be around Rs. 58 lakhs per firm. These savings will potentially come out of costs currently incurred by firms as a result of infrastructure problems such as power shortage, water shortage, and additional fuel costs due to poor roads, among others. Over the short and medium run, potential costs saved will be ploughed back into the business in terms of investment in capital. This will result in a commensurate increase in number of workers hired. We estimate, for instance, that cost savings for firms in the agro-allied region could translate to an increase in employment that is 110% of the existing total employment in this region. In terms of employment elasticity, we estimate that for firms in the services region every 10% increase in cost saving due to improvement in electricity could result in a 4.8% increase in jobs.

## Job creation has to enter cost benefit calculus while determining infrastructure investment priorities

Governments of the day are tasked with the responsibility of determining how best to utilise limited budgets in meeting infrastructure needs. The potential number of jobs created must be a part of the cost benefit calculus while determining infrastructure priorities. It is possible to estimate the direct and indirect job creation due to infrastructure provision. Induced effects of infrastructure are somewhat difficult to estimate. The report presents a methodology for this purpose. The methodology captures some of the employment impact of infrastructure investment across different economic geographies and for different infrastructure types. Finally, the report provides a list of priority sectors in infrastructure for different regions with the objective of bolstering employment. The findings of the report suggest that investing in roads for agro-allied and

services regions and in water supply for the industrial region could have the greatest catalytic effect on jobs created by enterprises.

The infrastructure can be provided either by the government or the private sector or jointly. Determining which is the most effective method for provision is beyond the scope of this report.

# Overall ease of doing business matters too

In focus group discussions, entrepreneurs highlighted a number of other issues that affect their business. High tax rates was a widely cited issue. Others stated that they have been unable to compete with firms in other countries such as China and as a result have witnessed low levels of growth. Evidently, various onerous regulations with regard to doing business in India have precluded firms from growing and becoming competitive in global markets. There is considerable literature attesting to this. For instance, a 2017 ease of doing business study conducted jointly by NITI Aayog and IDFC Institute highlighted that labour-intensive firms tended to feel constrained by labour-related regulations. A third key challenge was the unavailability of high skilled labour as a result of which they had to expend time and cost in training workers. At first glance, this is puzzling given that there are large numbers of educated youth looking for work. However, on further probing, it becomes evident that high skilled workers are not willing to work at the wages the

smaller entrepreneurs are willing to offer, workers with an educational qualification may still lack necessarily skills, and since the firms are located close to large cities, the high skilled workers in their catchment areas prefer to seek jobs in the big cities instead of peri-urban regions due to a better quality of life in cities.

Reforms in the business regulatory environment continue to be a policy priority for governments both at the state and the centre. Upgrading infrastructure is another crucial way of creating the necessary conditions for businesses to thrive and scale up. In the face of growing unemployment, this task has become even more urgent. Our report strongly complements the policy efforts around improving the business climate by providing an on-ground understanding of the infrastructure deficits across different regions and estimating the benefits that would accrue to firms if they are addressed.

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