Impact of Infrastructure Investment: A Study of Private Sector Investment in Infrastructure in India

Final report

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We seek to bring about lasting positive change using analytical and practical policy expertise. Through our global network of offices, we work in partnership with national decision makers to research, design, implement, and evaluate impactful public policy.

We work in all areas of social and economic policy and governance, including health, finance, education, climate change, and public sector management. We draw on our local and international sector experts to provide the very best evidence-based support.

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Abbreviations

AfDB	African Development Bank
ASSOCHAM	Associated Chambers of Commerce and Industry of India
CGE	Computable general equilibrium
CII	Confederation of Indian Industry
CMIE	Centre for Monitoring Indian Economy
CSO	Central Statistics Office
DARE	Department of Agricultural Research and Education
DFI	Development Finance Institutions
DFID	Department for International Development
DIT	Department for International Trade
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GMM	Generalized Method of Moments
GoI	Government of India
GSDP	Gross State Domestic Product
HCR	Head Count Ratio
ICAR	Indian Council of Agricultural Research
IDFC	Infrastructure Development Finance Company
IDI	In-depth Interviews
IFC	International Finance Corporation
IIC	Inter-American Investment Corporation
IO	Input Output
IPICOL	Industrial Promotion & Investment Corporation
IREDA	Indian Renewable Energy Development Agency
IV	Instrumental Variables
JIBC	Japan International Bank for Cooperation
KII	Key Informant Interviews
NSDP	Net State Domestic Product
NSSO	National Sample Survey Office
OPM	Oxford Policy Management
PCA	Principal Component Analysis
PPP	Public Private Partnerships
SAM	Social Accounting Matrix
SDP	State Domestic Product
SME	Small and Medium Enterprises
TOR	Terms of Reference
USICEF	US-India Clean Energy Finance

1 Introduction

Oxford Policy Management (OPM) has been contracted by the DFID South Asia Research Hub to conduct a study on the socioeconomic impacts of infrastructure investment. The current study seeks to assess the broader impacts of private investments in different types of infrastructure in DFID's focus sectors. Their investments have been in made in low-income states (Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan and Uttar Pradesh) and in a specific range of focused sectors (clean energy, agricultural infrastructure, social infrastructure, affordable housing and urban infrastructure).

Our study will feed into the DFID's private sector development strategy and also supplement a number of independent evaluations being conducted concurrently. This study is also important as majority of research conducted on the contribution of infrastructure investment to economic growth currently focuses on the traditional/core sectors such as transport, conventional power and telecommunications.

2 Policy Recommendations

2.1 Background

Economic theory, supported by various research studies, has shown significant positive correlation between infrastructure investments and economic growth. In a resource scarce scenario, a big push in infrastructure could create a disequilibrium where investments might grow at a higher rate than income[1], and income at a higher rate than consumption, indicating a lag in poverty outcomes in the short or medium term. Far from this being an engine of economic growth, the typical infrastructure investment fails to deliver a positive risk-adjusted return when overstretched (Ansar, Flyvbjerg, Budzier, & Lunn, 2016). Investing in unproductive infrastructure projects often results in a boom, during the construction period, followed by a bust, when forecasted benefits fail to materialize and projects therefore become a drag on the economy. Therefore, the probability of a positive impact on employment, inequality and poverty depends on well-designed investment frameworks, guided by appropriate economic analysis poverty focussed choice of techniques and sectors, and quality and efficiency of infrastructure investments.

2.2 The Case for Private Sector Investment

Despite the recent evidence of economic slowdown, India remains a fast-growing lower middle-income country. To catapult the economy to a continuously higher growth path, India should bridge its burgeoning infrastructure deficit. The Union Budget (2019-20) proposal to invest US$ 1400 billion in the next five years though aspirational, clearly reiterates the focus of Government. While the thrust on sectors like affordable housing, alternate/clean energy and agri-infrastructure (to double farmer income) are the right push on high multiplier sectors and dominantly poverty focused, dominant investments have often been channelled to core large infrastructure leaving critical gaps for last mile which facilitate access to and connect large infra and are pro-poor. The public sector alone is incapable of bridging the infra-investment gap, for which India is aiming at substantial leveraging of private capital, around the order of 50:50. There is, therefore, a definite need for private sector intervention in key infrastructure sectors.

A fast-growing economy increases the pressure on deficit infrastructure manifold. The growth in infrastructure investments in recent years in India has not manifested in significant growth in employment and reduction in poverty, as evidenced by Hunger Index, widening Gini-coefficient and marginalisation of the poorest. India's "missing middle", the high rate of rural outmigration and rise in

[1] A. O. Hirschman's *Theory of unbalanced growth*

income poverty (Himanshu, 2019) indicate the need for more targeted approaches in creating safety nets and making the 'market work for the poor.' **According to the finance ministry's Economic Survey (2019), India needs to spend 7-8% of its gross domestic product on infrastructure every year, and private sector participation in the infrastructure space is critical since funding can't depend on public investment alone.**

Development Finance Institutions continue to support private sector investment across key sectors. Private sector investment can also be channelled in through impact investments. India's impact investment[2] space, though not linked to large infrastructure projects, has over the last decade expanded to include the clean energy sector as well (Pandit & Tamhan, 2017). As of 2014, the distribution of impact investments in different industry sectors shows that close to two-thirds of the total investment in India has been in the banking, financial services, and insurance (BFSI) segment, most of which can be attributed to the investments in micro-finance companies (Rajan, Koserwal, & Keerthana, 2014). Other sectors that accounted for significant amounts of impact investments were agriculture, health care and non-financial consumer services as these three sectors accounted for 90% of the total investments (Rajan, Koserwal, & Keerthana, 2014).

Thus, there is scope for private sector/impact investor actors to not only augment existing public expenditure, but to support last-mile investments, address sub-sectoral public investment gaps, move into sectors traditionally 'captured' by the public sector, and focus on innovative and long-term financing mechanisms.

2.3 Sectoral Findings

We provide an overview of key findings in terms of existing opportunities and gaps in private sector engagement as well as employment generation potential across the renewable energy, education, urban affordable housing, urban waste management and agricultural logistics/warehousing sectors. The analysis was conducted through a combination of literature review and key informant interviews.

1) Renewable Energy:

Key points:

[2] The Global Impact Investing Network (GIIN) defines impact investing *as investments made into companies, organisations, and funds with the intention of generating social and environmental impact alongside a financial return.*

- Experts suggest that it is increasingly becoming a preferred asset class for infrastructure developers because of falling solar tariffs, and improvements in wind technology.

- The Renewable Energy Country Attractiveness index 2018 marks the Indian renewable energy sector as the fourth most attractive[1] renewable energy market in the world.

- The socioeconomic impacts of renewable energy investments are twofold: 1) indirect benefits through use of cleaner sources of energy and quality of energy access 2) direct and indirect employment under projects. While it is difficult to impute the indirect socio-economic benefits, data suggests that renewable energy projects have generated considerable employment benefits in India between 2012 and 2018. In 2018, the total country-level sectoral employment stood at 719,000, with the highest amounts seen in the Wind and Solar PV subsectors.

- More than US$ 42 billion has been invested in India's renewable energy sector since 2014 and new investments in clean energy in the country reached US$ 11.1 billion in 2018 (India Brand Equity Foundation, 2019).In terms of FDI inflows, there has been a surge of equity investments between 2016 and 2018 (**Error! Reference source not found.**), with an increase of almost 46% between 2016-17 and 2017-18.

- Debt costs of renewable energy projects in India is 24 percent to 32 percent higher than what it is in the United States and Europe, calculated on the basis of the levelized cost of energy.

- The renewable energy sector financing in India continues to be associated with a host of risks, such as policy and regulatory risks, perceived risks, technology-related risks, off-taker risks, and foreign-exchange risks. These vary based on the renewable energy source in question. Some of these risks have been addressed by creating single window clearance facilities in some states like Tamil Nadu and Andhra Pradesh to expedite the process of clearance (Sarangi, 2018). For instance, these states have identified solar energy zones and solar energy parks to attract investors into the sector. This can be replicated in other states as well to streamline the process of investment into the sector (Sarangi, 2018).

2) Education:

- In 2002, the Government of India allowed 100 percent Foreign Direct Investment (FDI) in the education sector through the automatic route. Since then and up to March 2019, the sector has received cumulative FDI worth Rs 17,262.83 crore (US $ 2.47 billion) (India Brand Equity Foundation, 2019).

- Impact investments in the sector are primarily targeted towards populations that are at the base of the socio-economic pyramid. These investments are different from market-rate investors who target middle and upper-class populations and consider these investments for financial returns. The conversation on impact investment is nascent. Impact bonds in India also remain at a preliminary stage, with only one contracted in education (Ravi, Gustafasson-Wright, Sharma, & Jones, 2019). According to a report by D. Capital Partners, 'Most deals remain small, and investment in schools currently dominates deal-making, with more innovative technology and management models just beginning to emerge. As yet, few business models deliver strong immediate financial return while reaching the most vulnerable beneficiaries' (D. Capital Partners, 2013).

- There is a strong correlation between public investment in education, child development and empowerment (India spend, 2019). States like Kerala and Himachal Pradesh (HP), which spent more on education as compared to other states, have scored higher on the empowerment index- accounts for attendance at all levels of the schooling, and indicators on sex ratio at birth and early marriage (ibid, 2019). States like Madhya Pradesh and Rajasthan which spent less than half per child as compared to Kerala and HP scored significantly lower on the empowerment index (ibid, 2019).

- In terms of job creation, the sector has been seeing a very gradual increase in employment over the last decade, with a growth rate of 1.35% between 2015-16 and 2016-17.

- The case has also been made that the returns (in terms of income) to higher education are greater, making this a good space for development finance institutions to put in their money. Increasing demand for education and a reduction in trend of government spending has led to an increase in opportunities for operational scale-growth and top-line growth by the private sector (India spend, 2019). These opportunities have already led to conversations on strategic partnerships on multiple fronts such as, between foreign universities and educational institutions in India; public-private partnerships (PPP) where government schools could be operated by low-cost private schools and; ed-tech initiatives that are currently not regulated. A growing demand for education, in the context of gaps in government funding and capacity gaps in delivering quality education also leaves adequate room for innovative investment in the sector.

3) Urban Housing:

- Ever since the government has made affordable housing a priority and introduced policy changes, such as the introduction of PMAY and

relaxing of FDI investments in housing, there has been a growing interest and investment of the private sector in housing for EWS and LIGs. Instances of private sector investments in affordable housing is concentrated between the years 2015 to 2019.

- These investments not only reflect the private sector's careful interest to invest in affordable housing, it also shows that the government's interest to include the private sector into affordable housing to meet the housing demands. Public Private Partnerships in affordable housing is another way through which the government is engaging with the private sector in affordable housing. However, literature shows that PPP in affordable housing has met with limited success in meeting its objectives of reducing urban housing shortage (HUDCO/HSMI, 2016).

- Some of the reasons why PPP has not been able to achieve its desired impact are - Lack of physical and social infrastructure; limited mobility and employment opportunities; and existing economic vulnerabilities of the economically weaker sections of society for whom such housing is being constructed (HUDCO/HSMI, 2016).

- An estimated 284.74 crore person days of employment has been generated under PMAY (U) which includes 88.79 crore person days of direct employment and 195.95 crore person days of indirect in nature as on 31.3.2019, a (Ministry of Housing and Urban Affairs, 2019). As per NSSO estimates, 280 working days are to be treated as jobs, thereby it translates to creation of 101.69 lakh jobs in total, out of which 31.71 lakh as direct and 69.98 lakh as indirect (Ministry of Housing and Urban Affairs, 2019).

- For facilitating cross learning and practical solutions in areas related to sustainable urban development and affordable housing, the government of India has signed several Memorandum of Understanding (MoU) with countries including Netherlands, Japan, Germany, France, Sweden, UK, Denmark, Singapore, European Union, Morocco, Saudi Arabia etc (Ministry of Housing and Urban Affairs, 2019). The Joint Working Groups (JWG) constituted under the MoUs hold regular meetings to discuss issues of mutual importance and exposure field visits are undertaken to one another's countries, as a part of international collaboration in the field of Sustainable Urban Development and affordable housing (Ministry of Housing and Urban Affairs, 2019).

4) Urban Waste Management

- India's waste management sector is expected to be worth US$13.62 billion by 2025 (Dunseith, 2017). As per industry projections, municipal solid waste management sector in India is projected to see capital and Operations and Maintenance requirement of close to USD 65 Billion by 2030 (BusinessWire, 2019).

- There is a clear mandate from the current government to tackle the problem of solid waste and e-waste mismanagement. Solutions such as waste-to-energy technologies are being promoted and deployed.

- Urban Local Bodies consistently face budgeting issues and are not able to provide adequate technological and infrastructure support to projects. Cost efficiency gains will occur if private sector developers work with public entities in these areas.

- Private sector engagement is still very limited, and finance for high upfront capital projects is hard to secure, making this a good sector for development finance initiatives that focus on leveraging funds, and building the entrepreneurial landscape.

- Improved waste recovery rates, through the informal sector, can lead to employment opportunities for about 500,000 rag-pickers (as of 2019). According to the International Finance Corporation, the electronic waste sector will create 4.5 lakh direct jobs by 2025 and another 1.8 lakh jobs in the allied sectors of transportation and manufacturing (PTI, 2019).

- The government allows 100% FDI under the automatic route for urban infrastructure areas including waste management subject to relevant rules and regulations. This also shows a clear interest of the government in leveraging private investment.

5) Agricultural Logistics and Warehousing

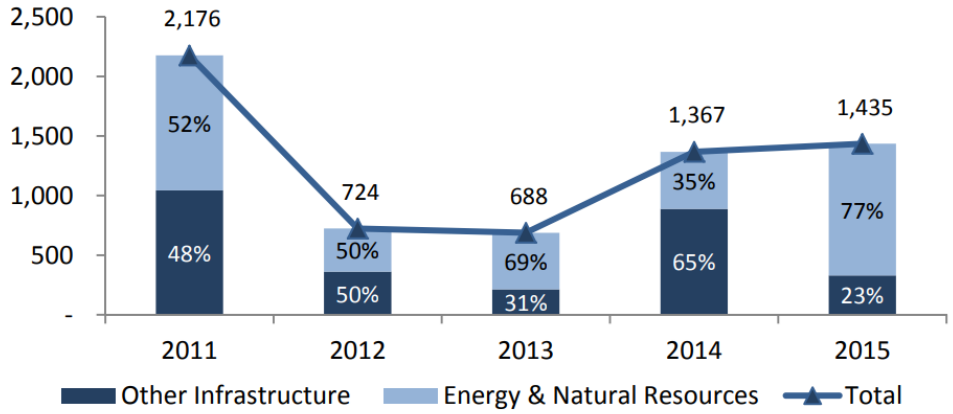
- Till very recently, regulatory barriers had constrained the development of storage and processing infrastructure but measures like inclusion of agriculture warehousing under priority sector lending by RBI, subsidy schemes, tax incentives and the Warehousing Act (which will promote negotiability of warehousing receipts) have helped private players take an active interest in the same. The Private Entrepreneur Guarantee Scheme is one such initiative to incentivize private investment for construction of warehouses by private entrepreneurs, with a Food Corporation of India guarantee to hire them for 10 years, assuring a fair return on investment by the entrepreneur.
- Based on a recent study on the logistics sector, the overarching INR 14,19,000 crore logistics sector in India will create 3 million new jobs between 2018-2022.
- As per the government's report of the committee on Doubling Farmer's Income (2017), additional investment in the cold storage investment has the potential of producing approximately 30,47,900 jobs.
- There are a variety of avenues for private sector investment. For example, in terms of cold-chain, some sub-sectors that require investment include: Modern Pack- houses, Reefer, Trucking, Cold Store (bulk and hub), Ripening Units, and Last-mile distribution.

2.4 Choice of Investment Instruments

Globally and in India, loan products dominate private infrastructure investments. Of total investments, 70% was debt-financed, with 24% of this raised from bilateral providers, and 22% from commercial providers. There have also been new hybrid investment instruments in mature sectors (such as investments in road assets through infrastructure investment trusts (InvIT)).

Private equity infrastructure investment has continued to stay focused primarily on the energy and natural resources sector (See Figure 1).

Figure 1: Private Equity Investment



Source: The Fourth Wheel, 2016

In terms of impact investment, based on a recent study by Brookings India, which is based on primary data from key stakeholders interviews, (Ravi, Gustafasson-Wright, Sharma, & Jones, 2019), half of the impact investors in India (50%) had average investments above $20 million for the current financial year. Of these investments, nearly 75% of impact investors made equity investments in portfolio companies, followed by 17% that made pure debt investments and 8% who made debt, equity & blended instrument investments. The impact sector in India recorded 48 exits between 2010 and 2015 (Ravi, Gustafasson-Wright, Sharma, & Jones, 2019).

Our Key Informant Interviews (KIIs) across the selected sectors indicate that multi-instrument approach would allow greater flexibility to test a broader range of interventions in the market and generate evidence to feed back into policy dialogue with the Government of India. However, it was also suggested that venture capital, whether debt or equity, is limited and where it is available, it tends only to reach mature sub-sectors in developed states. KIIs also suggest that private organisations find it challenging to work with governments because of uncertainty in contracts and clauses as they keep changing. KIIs reiterate that this is also linked to issues related to policy and regulation that subdue

investment in PPPs, limit the appetite of equity investors, and also lead to a negative sentiment in the lending community.

3 Analysis

3.1 Methodology

The methodology comprises of 1) Literature Review 2) Quantitative Analysis, and 3) Qualitative Analysis. The literature review covers country and state level sources, as well as broader theoretical sources on existing avenues for quantitative analyses. For each of the sectors analyzed, an in-depth literature review has also been conducted. The quantitative analysis methodology comprises of a) sectoral ranking based on correlation b) analysis of secondary employment data at the sector level. The qualitative analysis comprised of in-depth interviews with key informants.

3.1.1 Literature Review

We conducted a literature review to deepen our understanding of the direct and indirect linkages between infrastructure investment, poverty and economic growth. These linkages are difficult to disentangle and, at the state-level, depend on factors such as effective measurement of baseline conditions. The literature reviewed helped to frame our understanding of how causality for impacts can be measured, especially in light of variations in population, growth, investment, income distribution and poverty levels across states. The literature review was conducted by assessing theoretical and empirical papers that deal with 1) infrastructure and poverty or growth linkages at the a) national level and b) state level, followed by 2) debt and equity studies that look at the evolution of investment tools.
In addition to this broader literature review, each of the sector analysis has included extensive literature review.

3.1.2. Quantitative Analysis

A. Sectoral Ranking: Pearson product correlation using Stata

To understand the degree of correlation between poverty and inequality outcomes, and investment, OPM ran a correlation analysis. OPM used the Pearson product correlation method. We have used this set of rankings to reiterate the need to analyze the landscape of priority sectors (Renewable Energy, Urban Housing, Urban Infrastructure- Waste Management, Education, and Agricultural Logistics and Warehousing).

The variables we use are the capital outlay figures, i.e., the total capital expenditure in each of the economic and social sectors- transport, urban infrastructure, medical and health, education, food storage and warehousing and housing. Capital outlay figures function as a proxy for private investment. The correlation coefficient is tested at the 90% confidence level.

The correlation table and overall rank based on *Growth* and *Below Poverty Line BPL) proportions* for the sectors of interest is given below:

Capital outlay	GDP	Below poverty line	Growth rank	BPL rank	Score	Developmental Rank
Transport	0.7392	-0.6464	2.0	2.0	2.00	1
Energy	0.7424	-0.4226	1.0	4.0	2.50	2
Urban Infrastructure	0.6661	-0.2547	5.0	6.0	5.50	5
Medical	0.7152	-0.5755	3.0	3.0	3.00	3
Education	0.6898	-0.6986	4.0	1.0	2.50	2
Food storage and warehousing	-0.3806	-0.1413	7.0	7.0	7.00	6
Housing	0.6231	-0.3226	6.0	5.0	5.50	4

The capital outlay on transport, energy and education seem to have maximum correlation/association with developmental outcomes measured as a combination of economic growth and poverty reduction.

Note on correlation analysis methodology: The Pearson product-moment correlation coefficient, often shortened to Pearson correlation or Pearson's correlation, is a measure of the strength and direction of association that exists between two continuous variables. The Pearson correlation generates a coefficient called the Pearson correlation coefficient, denoted as *r*. A Pearson's correlation attempts to draw a line of best fit through the data of two variables, and the Pearson correlation coefficient, *r*, indicates how far away all these data points are to this line of best fit (i.e., how well the data points fit this new model/line of best fit). Its value can range from -1 for a perfect negative linear relationship to +1 for a perfect positive linear relationship. A value of 0 (zero) indicates no relationship between two variables.

B. Secondary Employment Data Analyses

For each of the sectors, where data has permitted, we have used secondary data to understand employment generation trends at the either the national or state level. Due to the lack of data at the state level and therefore no conclusion using multiplier studies, we have used existing data on employment. Sources of secondary data have included the Reserve Bank of India's KLEMS database, National Sample Survey Office employment data, International Renewable Energy Association's employment analysis data, and the National Institute of Public Finance and Policy's analysis data for the Ministry of Urban and Housing

Affairs. The data range is varied for each of these sources but falls between 2011-12 and 2018-19. The table below cites employment data across sectors:

Table 1: Sectoral Employment Data

Sector	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Renewable Energy (based on IRENA cumulative employment data)					416,000	385,200	432,000	718,700
Education (based on RBI KLEMs data)	14,203,000	14,420,000	15,121,000	15,337,000	15,532,000	15,741,000		
Urban Housing (proxied by PMAY cumulative employment data)				18,92,000				
Transport and Storage (proxy for Agriculture logistics and warehoushing- indicative of trends)	18,973,161	19,442,510	19,608,139	20,424,265	20,579,135	20,702,873	20,843,122	

Based on a secondary literature review, we have a set of specific sectoral employment insights, which are also mentioned in our detailed sectoral findings:

1) Renewable Energy

In 2018, the total country-level sectoral employment stood at 719,000, with the highest amounts seen in the Wind and Solar PV subsectors.
According to IRENA estimates, there has been an increase of 20,000 jobs in the Solar PV subsector. While jobs in off-grid solar applications cannot be calculated with precision, it is estimated that this might approximately be the double of on-grid solar jobs (IRENA, 2019).

2) Education

The sector has been seeing a very gradual increase in employment over the last decade, with a growth rate of 1.35% between 2015-16 and 2016-17.
The sector employed 15.74 million people in 2016-17, compared to 13.76 million in 2010-11.

3) Urban Affordable Housing

An estimated 284.74 crore person days of employment has been generated under PMAY (U) which includes 88.79 crore person days of direct employment and 195.95 crore person days of indirect in nature, as on 31.3.2019 (Ministry of Housing and Urban Affairs, 2019).
As per NSSO estimates, 280 working days are to be treated as jobs, thereby it translates to creation of 101.69 lakh jobs in total, out of which 31.71 lakh as direct and 69.98 lakh as indirect (Ministry of Housing and Urban Affairs, 2019).

4) Urban Waste Management

According to the International Finance Corporation, the electronic waste sector will create 4.5 lakh direct jobs by 2025 and another 1.8 lakh jobs in the allied sectors of transportation and manufacturing (PTI, 2019).

5) Agricultural Logistics and Warehousing

Based on a recent study on the logistics sector, the overarching INR 14,19,000 crore logistics sector in India will create 3 million new jobs between 2018 – 2022. The breakdown of these jobs is given below (TeamLease, 2018):

- Road Freight will account for 1.89 million new, potential, logistics jobs (63% of all potential jobs in the sector)
- Rail Freight (40K incremental jobs), Waterways (450K incremental jobs), Air Freight (400K incremental jobs) and Warehousing (120K incremental jobs) will contribute a million more jobs over the next 4 years
- Courier Services will create 60K incremental jobs and Packaging will create 40K incremental jobs, over 2018 – 2022
- Developing and optimizing logistics infrastructure across the country will result in a pan-India distribution of the 3 million new, incremental, jobs
- Delhi-NCR, Mumbai, Chennai and Bangalore will generate 1.74 million incremental and Kolkata, Hyderabad and Pune, together, will contribute 682K incremental jobs
- As per the government's report of the committee on Doubling Farmer's Income (2017), additional investment in the cold storage investment has the potential of producing approximately 30,47,900 jobs.

3.1.3 Qualitative Interviews

We conducted **in-depth Interviews (IDIs)** with stakeholders to augment our quantitative findings. IDIs are a qualitative research tool conducted with one person, where the person is understood to provide useful insight about either the organisation which they are a part of or the programme that they are participating in or implementing. The questions in an IDI are structured logically but are open-ended and the interview is respondent-led. The duration of the interviews we conducted ranged from 45 minutes to one hour. See a detailed mapping of respondents in Annex A.

3.2 Literature Review

Country Level

Literature suggests that infrastructure investment has direct and indirect impacts on economic output indicators such as growth, poverty and inequality. (Calderón and Servén 2004), based on a panel study covering 100

countries, find that the magnitude of infrastructure stocks has a significant causal effect on long run economic growth. (Cook 2003) maps out literature on infrastructure and poverty linkages in China, India, Thailand and Indonesia and finds that transport and education infrastructure have been the main drivers of poverty reduction.

The positive and negative impact channels of infrastructure can be direct or indirect (Fourie 2006). The extent of these impacts depend on a variety of factors, including the affordability and reliability of infrastructure services and the extent of opportunities opened up (Jones 2004). Theoretically, positive channels of impact can be through the creation of i) employment linked to the construction and maintenance of investment ii) access to the direct benefits of infrastructure (such as reduced costs) iii) access to infrastructure services that lead to better economic opportunities such as improved incomes iv) Efficient re-allocation of public expenditures v) enhancing private investment (Inderst 2006; Jones 2004). The World Bank ((Brenneman and Kerf 2002) has mapped out literature that looks at the poverty alleviation impact of infrastructure access as a direct benefit of infrastructure investment in energy, water and sanitation, information and communication technologies, and transportation. This paper finds that the impact channels (of infrastructure on poverty) are through growth directly, increasing economic opportunities specifically targeted to the poor, direct savings, direct impact on health and well-being, and improved access to education.

Impact pathways can be specific to sectors such as transport, energy, water and waste as well as social infrastructure such as education and health (Inderst 2006). Energy investments, for instance, can lead to poverty reduction by i) increasing literacy and time for reading because of improved lighting ii) lowering costs of energy iii) increasing productivity of businesses owned by or that employ the poor iv) reducing damages to manufacturing from power outages and surges (Brenneman and Kerf 2002). Improvement and development of transport infrastructure improves business climate, creating an environment conducive to poverty reduction. Impact pathways here include increased access to health care, improvements in safety, reduction in household costs associated with transportation time, and improvement in pollution conditions (Brenneman and Kerf 2002). Using state-level, it was found that in India, a government investment of one billion rupees on roads decreased overall income poverty (using head-count measures) by 0.87 percent (Fan, Hazell, and Thorat 1998) Similarly, improvement in water and waste infrastructure allows for the reduction in water costs and the time spent accessing water as well as medical costs (by reducing the prevalence of water borne and waste related diseases). Indirect benefits include improved education due to reduction in classroom pupil absenteeism (due to a reduction in water-borne diseases) (Brenneman and Kerf 2002).

Empirical models used to determine causal impacts on output and poverty include production functions, cost functions, growth accounting, and productivity models. Younus uses a Cobb Douglas specification, employing an

index for social/economic infrastructure constructed using Principal Component Analysis (Younus 2014). The results suggest that social infrastructure investment has a positive impact on Gross Value Added per capita. Social Accounting Matrix (SAM) multiplier models and Computable General Equilibrium (CGE) models can be used to enable estimations of impact of infrastructure on GDP, workers by types, household categories and other institutions. CGE models can be adapted to measure growth and structural change as well as to evaluate the impact of development strategies on income distribution, and can range from input-output and linear programming to non-linear specifications (Dervis, de Melo, and Robinson 1989). SAM models allows users to analyse the effects of exogenous injections on economic systems, through multiplier analysis; modelling involves categorizing the analysis matrices into endogenous and exogenous accounts (Defourny and Thorbecke 1984).

Using both SAM and CGE models, and by simulating a 20% rise in expenditure, Raihan (Raihan 2011) studies the impact of infrastructure investment in Bangladesh. The author finds that the increase in infrastructure-related expenditures raise overall gross domestic product (GDP) by more than 8% and increase the incomes of a broad range of people by 6%–8%. The World Bank (Straub 2008) maps out existing literature empirically linking infrastructure investment to economic growth in developing countries: 63% of the specifications analysed find a positive and significant link between infrastructure (investment, stock or flow) and some development outcome (such as GDP and poverty).

(Calderón and Servén 2004) use panel data for multivariate regressions to measure the impact of infrastructure development on economic growth and income distribution. They estimate GDP growth equations and augment them to include infrastructure quantity and qualitative indicators as regressors, in addition to standard controls. To account for the potential endogeneity of infrastructure (as well as that of other regressors), this study uses a variety of Generalized Method of Moments (GMM) estimators. They find that growth is positively affected by the quantity of infrastructure assets, and (ii) income inequality declines with higher infrastructure quantity and quality. Using Vector Error Correction Models (VECM), (Pradhan and Bagchi 2013) examine the effect of transportation infrastructure on economic growth in India over the period 1970–2010. The authors find causality between road transportation and economic growth.

Several studies have also looked at the impact channels of specific infrastructure projects on poverty and growth outcomes. The World Bank (Beguy, Dessus, and Garba 2015) estimated the impact of the Niger Dam project on GDP. Based on a GDP deflator model, by using information on the project's construction, operation, and anticipated returns, the authors were able to assess the project's net impact on the economy and weigh up the costs and benefits of different approaches. It was found that while costs would, on average, equal to more than 10 percentage of 2013 GDP levels during 2014-48, the expansion of domestic production spurred by increased demand during the construction phase

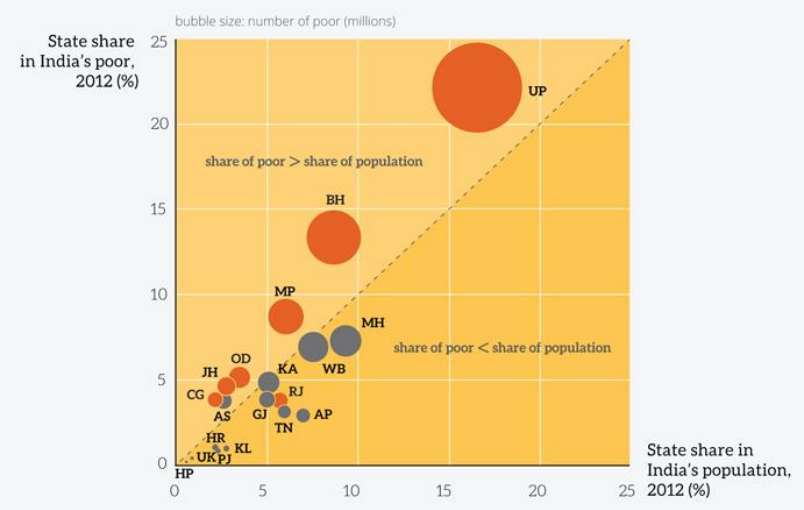
would increase GDP by 0.25 percent points above the baseline projection and boost fiscal revenues by an additional 0.45 percentage points of GDP during this time period.

Other approaches have also been used to measure the impact of infrastructure projects on poverty and growth. Japan International Cooperation Agency (Nagamatsu 2003) studied two large-scale projects in the transport sector in Northern Vietnam, and found that impacts on poverty and other socio-impact indicators varied based on the region in question. This was due to region-specific trends in foreign investment, as well as baseline social environment and living standards. Impact pathways identified here included increased levels of factory employment, industry linkages, fiscal contributions and industrial growth.

State Level

Growth and poverty can also be analysed at the Indian state level, but it is important to understand baseline inter-state variations in both, as well as the factors that lead to this variation. For instance, growth rates across states in India have not been constant, nor has there been convergence in growth between states. Krishna (Krishna 2004) produces a strong review of state level growth and variation over time, and finds that the four most volatile states in India have been Orissa, Rajasthan, Gujarat and Uttar Pradesh while the three least volatile states were Punjab, Maharashtra and Kerala. Analysis also shows that social infrastructure has been an important determinant of investment decisions. Through analysis based on an opinion poll of CEOs, it was found that institutional and political factors are crucial in determining investment decisions, in some cases more important than the physical stock of social infrastructure (Karnik et al 2000).

Figure 2: State share in poverty and population



Source: World Bank. 2018. India States Briefs

The World Bank (Li, Rama, and Zhao 2017) looks at growth convergence across Indian states, disaggregated at the district level, and finds that living standards strongly converge across districts and places below the district level, with growth being fastest in the mid-range between purely rural places and major urban centres. It posits that divergence at the state level is because low-income states do not generate enough 'fast-growing' geographical locations. Access to electricity, transport infrastructure and markets are strong determinants of convergence; locations with a bigger share of medium and large firms were seen to grow substantially faster. Social inclusion i.e., access to finance, gender equality and social homogeneity, as well as governance indicators such as law-and order at the state level, and labour regulations are also a determinant of convergence.

A recent state-level study (India State Briefs 2018), based on data from the National Sample Survey and Registrar General and Census Commissioner, also corroborates this finding. Despite the country's rapid economic growth after the mid-2000s, low income states (Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan and Uttar Pradesh), continue to lag behind. Poverty reduction in these states has also not been on par with other relatively higher income states (see Figure 2) Uttar Pradesh and Bihar have the highest share of poor at the national level, greater than their share of the country's total population.

Before understanding the impact that infrastructure has on regional poverty and growth, it is also important to assess baseline regional infrastructure quality and quantity disparities, and what drives them. Factors such as resource mobilization, per capita income and population density may result in unequal infrastructure expenditure across states to begin with (Mohanty, Bhanumurthy, and Dastidar 2017). In India, it is also found that more spending in infrastructure-deficit states, political stability, and positive spatial dependence in infrastructure can reduce

inter-state imbalances in infrastructure creation (Mohanty, Bhanumurthy, and Dastidar 2017).

To specifically understand regional impacts of infrastructure on growth, authors such as (Sahoo and Dash 2009) model state level data. They employ an index of infrastructure stock and estimate growth using a Cobb Douglas production function. They find that infrastructure stocks, labour force and total investment play an important role in economic growth in India. They run Granger causality tests and determine that there is unidirectional causality from infrastructure development to output growth.

Similar state/province- specific causal relationships have been found in other countries as well. A study by the Asian Development Bank and the Resources Centre for Economic Development (Asian Development Bank 1999) uses public expense as an infrastructure proxy for 25 Indonesian provinces, proving that poverty rate reductions were caused by increased investments in roads, health, agriculture, education, sciences, and technology. Runsinarith (Runsinarith 2008) finds that mobile technology has the greatest impact on poverty reduction, followed by electricity, roads, and irrigation.

Gross fixed capital formation can also be used as an input to develop the incremental capital-output ratios (ICOR), in order to understand state-specific investment needs for improving growth. For instance, using existing Gross State Domestic Product figures and a target annual real growth rate, the Planning Commission was able to ascertain the amount of investment (private and public) needed by Uttar Pradesh during the specified period (Planning Commission of India 2008).

Channels of Infrastructure Investment

The nature (private or public) as well as channels of investments (debt, equity, guarantees) can also have an impact on how quickly sectoral changes take place, therefore affecting the rate at which poverty is alleviated and/or growth converges across rich and poor states. There can also be a relationship between the type of investment and quality of infrastructure, which may have direct impacts on poverty and growth.

Channels of investment by the private sector have diversified over time. Blended finance[3] is now being increasingly deployed in order to meet growing infrastructure investment needs, which are not being met solely through public funds (Mustapha, Prizzon, and Gavas 2014). The idea is to use innovate funding channels to crowd-in private investment. Development Finance Institutions (DFIs), for example, have recently started employing equity investment (EI) and guarantees, along with conventional debt, as an investment tool. For instance,

[3] Blended finance is defined as the complementary use of grants (or grant-equivalent instruments) and non-grant financing from private/public sources to allow projects to become financially viable. Source: (Mustapha, Prizzon, and Gavas 2014)

DFIs such as the African Development Bank (AfDB) have begun to focus on developing tools to enhance finance specifically for SMEs. In 2012, the African Guarantee Fund earmarked capital of $50 million aimed at providing initial financial guarantees to lending institutions and capacity building support to SMEs; the fund aims to raise its capital to $500 million(African Guarantee Fund for Small and Medium-Sized Enterprises n.d.). While financial guarantees are a part of the blended finance toolkit, they are not used frequently by DFIs.

Globally, though equity investment has provided DFIs with higher returns than loans, it also represents potentially relatively higher volatility than loans. For instance, Inter-American Investment Corporation's (IIC) equity returns averaged 7% between 2001 and 2015, slightly above the loan yield of 6%, but with much more volatility (OVE 2017). DFIs report that gross returns and volatility for direct investments have been even higher than for funds, which at least benefit from some inherent diversification (OVE 2017). However, equity has allowed DFIs to positively impact local equity markets and attract additional commercial capital for firms by providing positive market signals. In India, however, DFI equity have not all been yielding high returns.

The second benefit of such investments is that DFIs and other investors can selectively build capacity in specific infrastructure sectors known to have more effective direct and indirect impacts on poverty and growth. This can have further positive effects on the way credit is distributed across sectors, and on small and medium infrastructure projects specifically, areas that have been significantly neglected by financiers. However, in order to attract private financing, baseline conditions with respect to commercial/demand risks, regulatory risks, cost of capital, and political instability need to be understood (Estache and Fay 2010).

The proportion of DFI finance with respect to overall investment figures is very low, and to understand channels of impact better, therefore, it is important to be able to attribute tool-specific effects to poverty and growth. This would entail identifying and tracking output indicators, measuring design and policy additionality, and measuring economic and social rates of return (Spratt and Collins 2012) for each tool at the onset of the investment.

Key conclusions based on our draft literature review include, but are not limited to, the following:

- Positive and negative impacts on poverty and growth can occur through a multitude of channels, both direct and indirect. Indirect energy and transport investment impacts on poverty take place through reduction in energy/transport costs, improved educational outcomes, and increased business productivity. Similarly, water and sanitation infrastructure investments can lead to better health outcomes (and reduced medical expenditure) and better classroom pupil outcomes. Agricultural infrastructure investment (which often overlaps with all three- energy, transport and water), provides direct impacts through increased farmer productivity.

- These impacts can vary at the subnational level. This is because of the variation in baseline poverty and growth conditions as well as the existing stock of infrastructure.
- The impact channels can also be sector-specific, indicating the need for incorporating sector specific variables in empirical models.
- The most commonly used models to determine causal impacts on output and poverty include production functions, cost functions, growth accounting, and productivity models.
- In terms of modelling impact channels empirically, the biggest challenge is to understand and address multi-collinearity as well as reverse-causation.
- There is limited literature evaluating the specific impacts of debt and equity tools on poverty and growth. However, the current trend shows that DFIs are increasingly diversifying their investment approaches and are including equity as a viable investment tool, though this is mostly through a variation in fund structures.

Private Sector Impact Investment in India

In India, Venture Capital (VC) funding picked up only after 2006, however VC investments in social enterprises are still only a fraction of the total VCPE investments that happen in the country (Rajan, Koserwal, & Keerthana, 2014). The average amount of impact investments made in a year is around $180 million (based on the investments during the seven-year period from 2006 to 2012), whereas the average yearly VC investment in India during the same period is about $812 million (Rajan, Koserwal, & Keerthana, 2014). The average yearly Private Equity investment (other than in real estate) during the same period is about $9.1 billion (Rajan, Koserwal, & Keerthana, 2014). Therefore, in terms of size, impact investments account for about 22% and 2% of the total VC and PE investment, respectively. In terms of deals, there has been an average of about 69 impact investments in a year (during 2006–
2012), whereas in the case of VC and PE investments, it is about 354 and 878, respectively (Rajan, Koserwal, & Keerthana, 2014). Thus, impact investments accounted for about 20% and 8% of the deals in VC and PE investments, respectively. Taken together, this showed that average VC investments in social enterprises were smaller than the average VCPE investment (Rajan, Koserwal, & Keerthana, 2014).

The distribution of investments in different industry sectors shows that close to two-thirds of the total investment has been in the banking, financial services, and insurance (BFSI) segment, most of which can be attributed to the investments in micro-finance companies (Rajan, Koserwal, & Keerthana, 2014). Other sectors that accounted for significant amounts of investments were agriculture and health care and non-financial consumer services as these three sectors accounted for 90% of the total investments (Rajan, Koserwal, & Keerthana, 2014).

VC funding, according to Rajan et al, for social enterprises differ markedly when compared to other segments of VCPE industry in India. For example, BFSI segment accounted only for 24% of the overall VCPE investment 24% of the overall VCPE investment but in terms of deals, IT&ITES and the manufacturing sector were the top two sectors in the overall VCPE investments (Rajan, Koserwal, & Keerthana, 2014). They also find that VC funding for social enterprises was characterized by a high degree of concentration in the BFSI segment, because of the micro-finance sector (Rajan, Koserwal, & Keerthana, 2014). Rajan et al (2014) find that VC investments were happening in comparatively earlier stages in social enterprises, indicating the important role played by VC funding in social enterprises.

On the basis of their origin, Rajan et al (2014) classified investors as either a domestic or foreign fund. Foreign investors accounted for 61% of the total sample (Rajan, Koserwal, & Keerthana, 2014). Though this was a high proportion, it was lower than the proportion of foreign investors (71%) seen in the overall VCPE industry in India (Rajan, Koserwal, & Keerthana, 2014). Main Venture Capitalists (MVC) investors accounted for 61% of the total sample which indicated an interest among MVC investors to invest in social enterprises, and the ability of these enterprises to meet the return expectations of such funds (Rajan, Koserwal, & Keerthana, 2014). Within the Social Venture Capitalist (SVC) segment, domestic investors accounted for one-third of the sample, and foreign investors accounted for the remaining two-thirds (Rajan, Koserwal, & Keerthana, 2014). Due to its large market size, India has become a destination for attracting investment because of its large market size (Rajan, Koserwal, & Keerthana, 2014).

In India, Rajan et al (2014) show that domestic venture funds and SVC invest for longer as compared to MVC and foreign funds. Duration of investment can be defined as the time interval between investment and exit by the venture fund (Rajan, Koserwal, & Keerthana, 2014). The average investment duration of an SVC fund was 57 months, whereas it was 46 months for an MVC fund (Rajan, Koserwal, & Keerthana, 2014). Similarly, the average duration of investment by a domestic fund (54 months) was also higher than that of a foreign fund (47 months). With respect to other investments, the average duration of investment in social enterprises was 50 months, which was substantially higher than the average investment duration of 17 months for overall VCPE investments in India (Rajan, Koserwal, & Keerthana, 2014). The big difference in investment duration was actually seen between the domestic MVC and domestic SVC investors where the average duration of investment for domestic SVC investors was 65 months, which is 71% more than the average duration of investment for domestic MVC investors (Rajan, Koserwal, & Keerthana, 2014). Since social enterprises were expected to take more time in scaling up, they would need investors who can stay invested in the company for a longer duration and who would not unduly pressure the entrepreneurs to provide them a quick exit (Rajan, Koserwal, & Keerthana, 2014).

These findings show that VC funds have emerged as an effective channel to attract private-sector capital for social enterprises (Rajan, Koserwal, & Keerthana, 2014). Social enterprises that seek to be commercially viable with sustainable operations need not be dependent only on the traditional sources of capital but can also success- fully receive investment from venture funds (Rajan, Koserwal, & Keerthana, 2014). Though the emergence of VC funding for social enterprises has been recent, the growth has been robust (Rajan, Koserwal, & Keerthana, 2014). Creation of dedicated SVC funds has benefited both the investors and enterprise (Rajan, Koserwal, & Keerthana, 2014). For investors, such funds provided an opportunity to invest in assets that created social impact while also delivering financial returns (Rajan, Koserwal, & Keerthana, 2014). For investee companies, these funds have provided much-needed early-stage capital (Rajan, Koserwal, & Keerthana, 2014). The study shows that the VC investment trends in social enterprises have been quite different from those seen in the overall VCPE industry (Rajan, Koserwal, & Keerthana, 2014). Financial inclusion has been the main investment thesis, as evidenced by the large number of investments in microfinance companies, however, other sectors that are socially relevant, including health care, agriculture, and education, have also received considerable investment (Rajan, Koserwal, & Keerthana, 2014).

Results indicate that most investments facilitated consumption at the Base of Pyramid (BoP). However, it is the investments that generated income and employment at the BoP would create a far higher social impact (Rajan, Koserwal, & Keerthana, 2014). On the whole, SVC investors are prepared to stay invested in a company for a longer duration, compared to MVC funds (Rajan, Koserwal, & Keerthana, 2014). The average investment duration of an SVC fund was 57 months, whereas it was 46 Months for an MVC fund. The results also highlight the need for creating strong domestic SVC funds as domestic SVC funds invest early, make smaller investments, and stay invested longer (Rajan, Koserwal, & Keerthana, 2014). For example, domestic SVC funds had an average investment duration of 65 months, whereas it was 45 months for a foreign SVC fund (Rajan, Koserwal, & Keerthana, 2014). Therefore, a robust growth in domestic SVC funds would significantly benefit social enterprises (Rajan, Koserwal, & Keerthana, 2014)

3.3 Data Limitations

At the onset of the project, we conducted an extensive review of sectoral and macroeconomic data both at the national and state level. While reviewing existing data, we looked at the feasibility of using specific data sources considering their periodicity, level of disaggregation, and relevance to our empirical modelling. We also identified, where possible, proxy data points in cases where data is not available or is of poor quality. Data was accessed using both governmental and private sources. We aligned our modelling setup to fit,

as best as possible, to the data that was at our disposal. Quantitative data analysis was initially conducted in the following parts:

1. **Principal Component Analysis (PCA):** At both the national and sub-national level, we created a PCA index of infrastructure quantity and public expenditure outlay variables. This was done to account for the high degree of multi-collinearity.
2. **Sub-national level regression analysis:** State level regression analysis was conducted using data from 2000-2017. Analysis was done for more than the DFID intervention period to be able to get a larger number of observations. The panel consists of data from both DFID intervention states (Bihar, UP, Odisha, West Bengal) and the comparatively well-off states of TN, Maharashtra and Rajasthan.

At a broader macro-context, the econometric analysis was undertaken with a view to understand the impact of infrastructure investment (including private sector investments) on economic prosperity in the low-income states of India. The models set up were based on an extensive review of literature and econometric analysis techniques to present the most robust and technically sound methods of quantitative analysis considering relevant checks and sanity checks. The quantitative exercise was a way to empirically understand the linkage between infrastructure investments and developmental outcomes. The period for the regression was considered from 2000 onwards, owing to DFID's intervention period for its existing private sector investments portfolio across low income states for which data was available. Since the ultimate objective of the exercise was to look at developmental outcomes, the regression models measured 'growth' using a measure of real GDP, inequality (Gini coefficient) to measure equity and poverty estimates at the state level using household-level expenditure data. (National Sample Survey Office's Monthly Per Capita Expenditure).[4]

However, during the course of the project, we found several data related limitations:

- There was limited access to private sector investment data, despite using paid sources. Information related to private equity deals and venture capital investment were not accessible.
- Most of the infrastructure and non-infrastructure variables could not be disaggregated by rural versus urban since they are reported on an aggregate basis- this affected the output of our econometric analysis.

- OPM did not had access to DFID's evaluation activities for each of their investment projects. We have therefore not been able to link or validate DFID's investment performance (in terms of socio-economic outputs) to our analysis. It would have been useful to investigate the relevance of the independent evaluation exercises being carried out, to our study, or to conduct this study through primary data collection for DFID projects.

- High frequency data, especially at the state level, was unavailable for the sectors of interest.

Time series data collection for indicators at a sub-sector level at the state level in India was one of the biggest challenges of this exercise. The OPM team made persistent efforts to build a database and draw out as much data on both infrastructure and non-infrastructure indicators which impact developmental outcomes like growth, poverty and inequality based on several assumptions and calculations through both paid and publicly available databases and websites. Given data limitations, however, the analysis was not robust enough to be used to determine the exact impact/quantum or the attributably of various indicators on developmental outcomes.

4 Findings

4.1 Renewable Energy

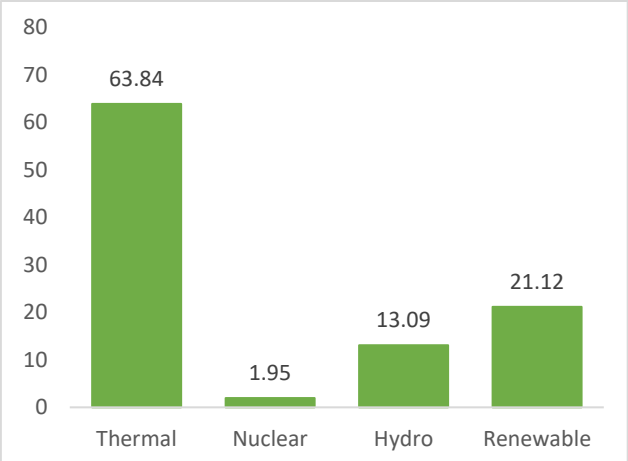
1) Background and Context

Indian context

The Renewable Energy Country Attractiveness index 2018 marks the Indian renewable energy sector as the fourth most attractive[1] renewable energy market in the world. As of October 2018, India ranked 5th in installed renewable energy capacity (India Brand Equity Foundation, 2019). Since the Paris Agreement in 2016, the focus of Government of India has shifted to clean energy and has become attractive for investors (India Brand Equity Foundation, 2019). At the Paris Accord, India made Nationally Determined Contributions (NDCs) that by 2030, 40 percent of the installed power generation capacity will be based on clean sources and 175 GW of renewable energy capacity will be installed by 2022 (Ministry of New and Renewable Energy, 2018). More than US$ 42 billion has been invested in India's renewable energy sector since 2014 and new investments in clean energy in the country reached US$ 11.1 billion in 2018 (India Brand Equity Foundation, 2019).

Since 2017, there have been important developments with regards to investments in the renewable sector in India. Renewable energy sources have a combined capacity of 21 percent of India's total energy capacity as seen in the table below (Ministry of New and Renewable Energy, 2018).

Figure 3: Share of renewable energy in overall installed capacity in 2018 (%)



Source: (Ministry of New and Renewable Energy, 2018)

Of this 21 percent, wind power accounted for the highest at 46 percent followed by solar with a share of 36 percent while the remaining market was captured by biomass at 12 percent and small hydro projects catering to 6 percent (Invest

India, 2019). Resurgence of the wind sub-sector in India was also indicated in interviews with KIIs. The solar sub-sector received investments over US $ 10 billion in the financial year 2017-18 and the world's largest solar park was launched in India in Karnataka in 2018 (India Brand Equity Foundation, 2019).

Private Equity (PE) investments in India's wind and solar power have increased by 47 per cent in 2017 (January 1 to September 25) to US$ 920 million, across nine deals, as compared to US$ 630 million coming from 10 deals during the corresponding period in 2016 (India Brand Equity Foundation, 2019). Interviews with KIIs show that multi-lateral organisations are keen to strategize their investments which in are in line with government's priorities.

Global Context

Since the landmark COP 21 Paris agreement in 2016, efforts are being made globally to combat climate change and accelerate investments in low carbon future. As of 2018, global clean energy trends show $332.1 billion investments in renewable energy excluding large hydro-electric projects, but including equity raised by companies to invest in smart grids, digital energy, energy storage and electric vehicles (Antonich, 2019). Much of the investment in clean energy R&D is driven by North America (International Energy Agency, 2018). Global energy investment, between 2015 and 2018, saw a decline in part driven by continued decline in renewable technology costs (Antonich, 2019) (International Energy Agency, 2018). But more recently, positive trends have been observed as investments gradually move away from fossil fuel energy. For example, the world's largest sovereign wealth fund that manages $1 trillion of Norway's assets, will divest from fossil fuels and will limit their exposure to fossil fuels by investing in renewable energy technologies[5]. State-backed investments continue to account for a rise in the global energy investment as they remain resilient in oil, gas and thermal power in comparison to the private sector (International Energy Agency, 2018).

[5] Ambrose, J. 2019. World's biggest sovereign wealth fund to ditch fossil fuels. *The Guardian. https://www.theguardian.com/business/2019/jun/12/worlds-biggest-sovereign-wealth-fund-to-ditch-fossil-fuels*

Figure 4: Global Job Creation in the Renewable Energy Sector

Source: (IRENA, 2019)

Literature shows that there has been varied growth in sub-sectors of renewable energy. Overall investment in solar dropped 24 percent to USD 130.8 billion, while wind investment rose 3 percent to USD 128.6 billion with offshore wind having its second-highest year with USD 25.7 billion invested (Antonich, 2019). With regards to consumption, of the three end uses of renewables – electricity, heat and transport - the use of renewables grew fastest with respect to electricity driven by the rapid expansion of wind and solar technologies (International Energy Agency; International Renewable Energy Agency; United Nations Statistics Division; World Bank; World Health Organisation, 2019). Hydropower remains the largest source of renewable electricity, accounting for 68% in 2016, followed by wind, bioenergy, solar, and geothermal (International Energy Agency; International Renewable Energy Agency; United Nations Statistics Division; World Bank; World Health Organisation, 2019). In emerging markets, auctions are supporting larger renewable project for instance, the average size of awarded solar PV projects in auctions rose by 4.5 times while that of onshore wind rose by half over 2013-17, helping to support economies of scale (International Energy Agency, 2018). In Europe, tendered large projects are mainly concentrated in offshore wind; auctions have generally not resulted in large, land-based renewables projects (International Energy Agency, 2018).

Globally, investments in renewable energy have increased in some countries while decreased in others over the last few years. Between the period of 2017-18, China continued to lead with total investments of USD 100.1 billion with US ranked as the second-highest country, investing USD 64.2 billion, an increase of 12 percent (Antonich, 2019). Europe saw clean energy investment leap 27 percent to USD 74.5 billion, but investments decreased in Japan to USD 27.2 billion, down 16 percent, India at USD 11.1 billion, down 21 percent, and Germany at USD 10.5 billion, down 32 percent (Antonich, 2019). Renewable energy accounted for over 95 percent of electricity generation in countries where

abundant hydropower resources had already been exploited, such as in Norway, Paraguay, Uruguay, Ethiopia, Costa Rica, and Nepal (International Energy Agency; International Renewable Energy Agency; United Nations Statistics Division; World Bank; World Health Organisation, 2019). Variable wind and solar electricity accounted for the majority of renewables for example, the share of variable renewable electricity had already exceeded 50 percent in Denmark and ranged between 15 percent and 25 percent in Ireland, Germany, Spain, Italy, and the United Kingdom (International Energy Agency; International Renewable Energy Agency; United Nations Statistics Division; World Bank; World Health Organisation, 2019).

In terms of the socio-economic benefits of investments in renewable energy, the International Renewable Energy Agency (IRENA) estimates that the indirect and direct employment generated by the renewable energy sector globally amounted to at least 11 million (in 2018). The solar photovoltaic (PV), bioenergy, hydro and wind power subsectors were the biggest employers (Figure 4). However, the nature of employment generated (i.e., location on the value chain) varies based on the level of diversification of supply chains, trade patterns, industry reorganization and consolidation trends (IRENA, 2019). Over time, maturity in renewable energy subsectors will lead to greater automation, and lesser employment generation. The exact timelines for this transition would depend on the country context.

2) Investment Trends

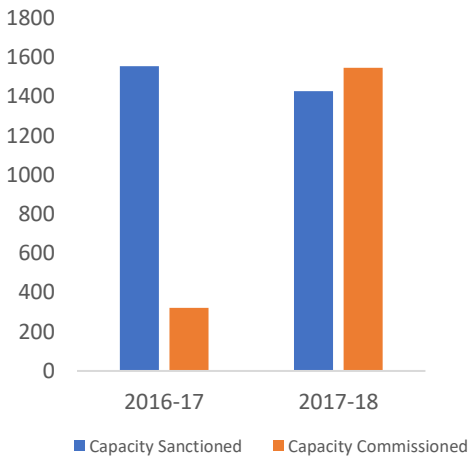
In terms of FDI inflows, there has been a surge of equity investments between 2016 and 2018 (**Error! Reference source not found.**), with an increase of almost 46% between 2016-17 and 2017-18. The investment trends run in parallel with those of conventional power equity inflows.

However, from our KIIs, we gather that there has been a reluctant attitude among the banking communities to finance renewable energy projects primarily due to associated risks and uncertainties with these projects (Sarangi, 2018). KIIs share that management of economic risks and provision of incentives is essential for PPP investments along with public commitment. They also say that private organisations find it challenging to work with governments because of uncertainty in contracts and clauses as they keep changing.

With regards to debt and equity financing, KIIs say that opportunities of debt financing have reduced, there is preference amongst private organisations with an impact investment mandate towards equity financing, especially for smaller projects because equity is perceived to be more responsible and linked to reputation. Data shows that 70 percent of funds are sourced from debt and 30 percent are mobilized as equity funding (Sarangi, 2018). Debt costs of renewable energy projects in India is 24 percent to 32 percent higher than what it is in the United States and Europe, calculated on the basis of the levelized cost of energy. KIIs also suggest using a mix of financial instruments such as equity along with guarantee or support debt financing with loans.

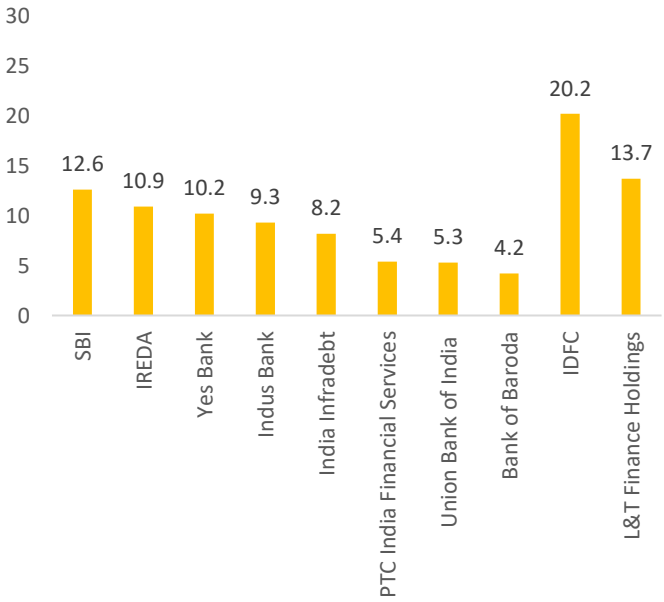
A variety of investors are found in the renewable energy space in Indian market despite the renewable energy dominated by bank finances in India (Sarangi, 2018). These range from commercial banks such as Yes Bank to private equity investors, institutional investors such as L&T, and t o development banks. There is also a growth of venture capital type of investors that support the equity component under the project-based financing mode (Sarangi, 2018). Experts suggest that is increasingly becoming a preferred asset class because of falling solar tariffs, and improvements in wind technology. Private equity investors such as Actis and Abraaj Group have also set up renewable energy investment platforms. Similarly, the UK government's Centre for Development has set up Ayana Renewable in collaboration with Ever Source Capital and the National Investment and Infrastructure Fund of India.

Figure 5: Solar loans commissioned/sanctioned by IREDA (MW)



Data also shows that most of the investment commitments to renewable energy is made by non-banking financial institutions. This can be seen in Figure 6. In 2018, IREDA committed roughly 10.9% towards the total committed amount, with 1546 MW of solar energy loans sanctioned in 2017-18. The quantum of loans sanctioned by IREDA has been steadily rising over the years (IREDA Annual Report, 2017).

Figure 6: Share of Total Committed Amount (%)

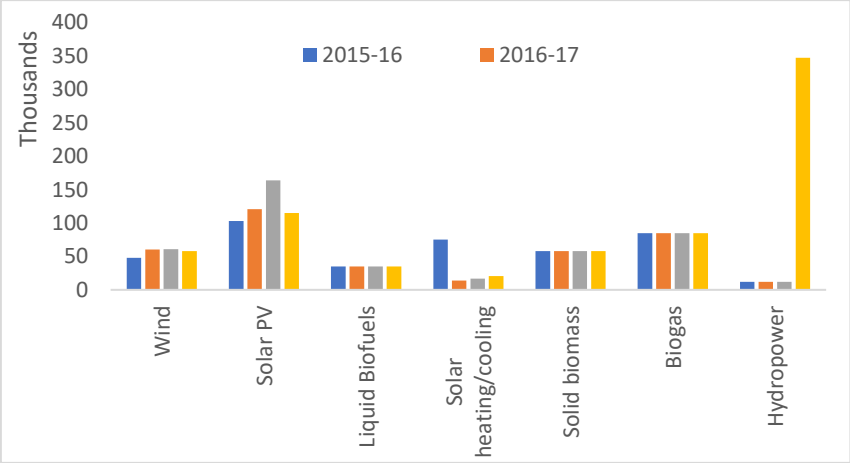


3) Socio-Economic Impacts at the National Level

The socioeconomic impacts of renewable energy investments are twofold: 1) indirect benefits through use of cleaner sources of energy, contributing to climate change mitigation efforts, and quality of energy access 2) direct and indirect employment under projects. While it is difficult to impute the indirect benefits, data suggests that

renewable energy projects have generated considerable employment benefits in India between 2012 and 2018. In 2018, the total country-level sectoral employment stood at 719,000, with the highest amounts seen in the Wind and Solar PV subsectors (see Figure 7). According to IRENA estimates, there has been an increase of 20,000 jobs in the Solar PV subsector. While jobs in off-grid solar applications cannot be calculated with precision, it is estimated that this might approximately be the double of on-grid solar jobs (IRENA, 2019). Though the distribution of these employment benefits across states can't be ascertained, jobs are expected to be distributed primarily across the states with the highest contribution of renewable energy generation per subsector.

Figure 7: Renewable Energy: Cumulative jobs per annum



Source: IRENA data, 2019 (note- limited availability of employment figures for liquid biofuels, biogas and hydropower; for 2017- 18, employment figures were only available for large hydro; solar PV figures in 2018-19 are limited to grid connected only).

Based on a set of assumptions [6], we have split these jobs across DFID's states of interest (Uttar Pradesh, Madhya Pradesh, Odisha, Jharkhand, Chhattisgarh, Bihar, and Rajasthan). Based on national employment statistics generated IRENA for each renewable energy sector, further analysis was done to get state level employment figures.

The following are the approximate per MW job creation statistics:

Sector	Number of jobs per MW installed
Wind	2
Solar	8

[6] We have derived state level estimates based on the split of renewable energy generation capacity.

Biomass	7
Small Hydro	3

This was done by assuming the split of employment data based on the quantum of installed capacity each of the DFID interest states contributed towards.
So far, the largest quantum of employment has been created in the solar sector (Grid interactive Solar PV); Rajasthan, Uttar Pradesh and Madhya Pradesh are the leading states owing largely to their large annual installed capacity additions in the solar sector.

Table 2: Renewable Energy: Cumulative jobs created per subsector and state (as of Fiscal Year 2017-18)

State	Solar	Wind	Small Hydro	Biomass
Rajasthan	23716	12114	13	325
Madhya Pradesh	12015	7099	53	323
Uttar Pradesh	22978	0	14	2387
Chhattisgarh	4074	0	42	620
Odisha	3888	0	36	1043
Bihar	1079	0	39	325
Jharkhand	309	0	2	87

4) Political Economy Challenges

A key challenge that emerges from interviews with KIIs and from the literature is poor implementation of policies and projects. India is based on the idea of cooperative federalism which implies effective and continuous coordination between different political entities such as central government and state governments (Sarangi, 2018). This often leads to uncertainty as decision-making, especially for energy investments, as they do not lie under the purview of the centre alone but also with state governments (Sarangi, 2018). This in turn creates market segmentation within the country and consequently, India is not viewed as a single market by domestic and foreign investors (Sarangi, 2018). The uneven distribution of renewable energy resources across the country further makes increases the market segmentation and makes the renewable energy investment market volatile and short-term (Sarangi, 2018). Policy-level uncertainties also generate scepticism amongst investors.

This uncertainty in decision-making and volatility in the renewable energy investment market often leads to delay in commissioning of projects and makes banks reluctant to provide the necessary finance for the sector (Sarangi, 2018) (Sree Ram, 2018). Some of these risks have been addressed by creating single window clearance facilities in some states like Tamil Nadu and Andhra Pradesh to expedite the process of clearance (Sarangi, 2018). For instance, these states have identified solar energy zones and solar energy parks to attract investors into

the sector. This can be replicated in other states as well to streamline the process of investment into the sector (Sarangi, 2018). KIIs also discussed political economy challenges such as credibility of organisations. They said that for investors the credibility of private sector entities is utmost important. Although, they find that the government has been progressive and pro-development at the macro-level to ensure private sector participation- other countries make approvals very difficult.

The perception that India is an expensive destination for investments is another challenge as it makes India less viable for investors due to strict regulations, cap on tariffs, and high costs of debt. In the solar sub-sector, the cap on tariffs, imposition of duties on solar panels, infrastructure constraints, execution and operating challenges have made investors worried about the viability of projects so much so that some of auctions were withdrawn due to lack of enough participants (Sree Ram, 2018). A similar concern regarding the viability exists in the wind sub-sector as well. In the wind sub-sector, cap on tariffs and lack of visibility on the business or the order inflows (which are contingent on auctions) plunged the industry into crisis, impacting the whole supply chain (Sree Ram, 2018).

India is considered to be an expensive destination for investment in renewable energy. A reason for this is the high cost of debt. Literature shows that distinctions between the costs of debt for India and other countries exist largely due to high interest rates, short debt tenures, and lack of non-recourse debt (Sarangi, 2018). Debt is available for a short tenure typically for a period up to eight years, whereas given the life span of most of renewable energy projects, a debt tenure of 12 to 15 years looks more promising (Sarangi, 2018). The ideal financial market would be long-term financial markets such as insurance and pension funds but the long-term finance available through insurance and pension funds constitute only a small fraction of the household financial savings in India (Sarangi, 2018). There are also considerable financial sector regulation issues that limit the ability of lenders to invest in less than AA rated entities and instruments.

The renewable energy sector financing in India is associated with a host of risks, such as policy and regulatory risks, perceived risks, technology-related risks, off-taker risks, and foreign-exchange risks (Sarangi, 2018).

Risks generate lot of uncertainties and further compound the availability of required finance (Sarangi, 2018). In addition, renewable energy investment is an unfamiliar type of investment among the investors due to the limited history of renewable energy development in the country as a result investor do not always have past records to show the performance data/indicators (Sarangi, 2018). The required data or performance indicators are either not available or partly available. This enhances the perceived risks of the banking system, which eventually enhances the cost of capital (Sarangi, 2018). Not only this, even the success of the new instruments, such as green bonds, is based on the premise that the investors are well convinced of the purpose of such bonds. Often in

developing country settings, investors are sceptical about the purpose and use of instruments such as green bonds, compounding the problem of mobilizing the necessary finance (Sarangi, 2018). To minimize the aforementioned risks, coordination between the state governments and central governments along with public financing support is required in the high-risk areas (Sarangi, 2018).

Literature shows that the Government of India is committed to increased use of clean energy sources and is already undertaking various large-scale sustainable power projects and promoting green energy heavily (India Brand Equity Foundation, 2019). These investments also have the potential to create many employment opportunities at all levels, especially in rural areas (India Brand Equity Foundation, 2019). As part of the Paris Accord, Government of India is aiming to achieve 225 GW of renewable energy capacity by 2022 (India Brand Equity Foundation, 2019). India's renewable energy sector is expected to attract investments of up to US$ 80 billion in the next four years.

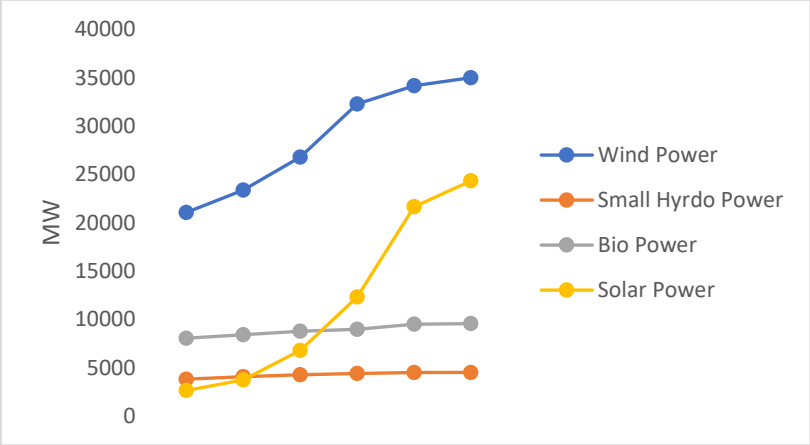
5) Sectoral Outlook

Policy trends and regulatory environment

The government has committed to reduce emissions intensity of GDP by 33 to 35 percent below the 2005 levels and increase the share of non-fossil fuel in total capacity approximately 40 percent by 2030 (Invest India, 2019). Indian Railways, for instance, is taking increased efforts to maximise the use of clean fuel to cut down emission level by 33 per cent by 2030 (India Brand Equity Foundation, 2019). The government of India has introduced policies to make investment and growth in the renewable sector lucrative; the Electricity Act of 2003 allows FDI up to 100 percent under the automatic route for renewable energy generation (Invest India, 2019).

The figure below shows the progress made in generating renewable energy between 2013 and 2018.

Figure 8: Cumulative achievement in MW between 2013 and 2019



Source: (Ministry of New and Renewable Energy, 2018)

There are various policy instruments introduced by the government to encourage investments in renewable energy from the private sector. Renewable portfolio obligations (RPO), renewable energy certificates, and feed-in-tariff (FiT) schemes are some of the regulations that drive the renewable energy sector in the country (Sarangi, 2018). RPO mandates power distribution utilities and other obligated entities to procure a certain percentage of electricity from renewable energy sources (Sarangi, 2018). However, issues exist related to the compliance of such obligations, primarily due to concerns related to the financial health of electricity distribution utilities at the state-level (Sarangi, 2018). This compliance problem also has led to the piling up and oversupply of renewable energy certificates (RECs) (Sarangi, 2018). These regulatory requirements (such as REC in lower solar tariffs) have also gradually become irrelevant with the introduction of competitive-bidding mechanisms as a procurement mode of renewable energy (Sarangi, 2018). This tariff based competitive bidding process involves reverse e-auction and notified standards for deployment of solar photovoltaic systems/devices (Ministry of New and Renewable Energy, 2018).

Sub-sector Incentives:

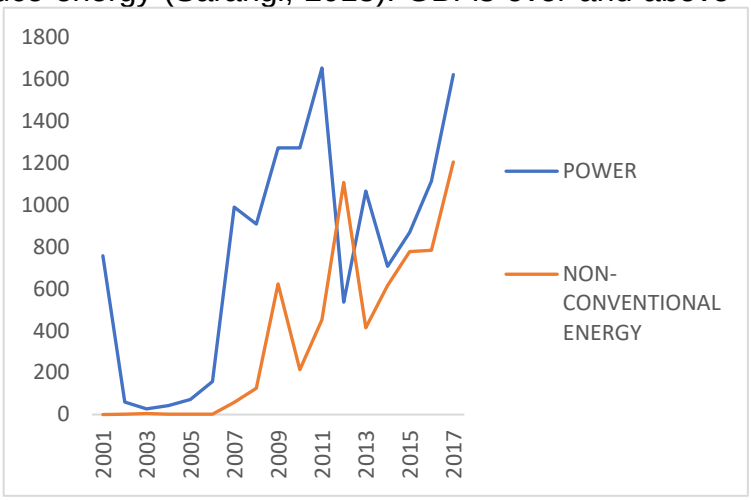
The government is also developing policies and regulations such as National Wind-Solar Hybrid, Hydropower Policy (2018-28) and Off-Shore Wind Energy Policy that will help guide investments in various sub-sectors of renewable energy such as wind and solar energy (Invest India, 2019). The development of the National Wind-Solar Hybrid Policy and National Offshore Wind Energy Policy, and the expansion of the wind industry has resulted in a strong ecosystem, project operation capabilities and a manufacturing base (Ministry of New and Renewable Energy, 2018).

Figure 9: FDI equity inflows in the power and non-conventional energy sectors ($million, DIPP data)

It has proposed 60 solar cities and approved $1.3 billion for setting up 50 solar parks by 2020 (Invest India, 2019). It has also developed encouraging incentives for development such as provide custom and excise duty benefits to the solar rooftop sector, which in turn will lower the cost of setting up as well as generate power (India Brand Equity Foundation, 2019)

Along with these, the government has also implemented various incentive-based schemes to encourage investments such as - accelerated depreciation (AD), generation-based incentive (GBI) schemes, and viability gap funding (VGF) (Sarangi, 2018). AD, introduced in 2009 and a key scheme for wind projects, is a tax-based incentive on the tax returns of the project developers (Sarangi, 2018). For instance, the latest information shows that solar projects are eligible to avail depreciation of about 40 percent of their investment (Sarangi, 2018). Generation-

based incentive mechanisms (GBI) offer an incentive per kWh of grid interactive solar and wind energy generation to mobilize encourage investors to not only set up projects but to also produce energy (Sarangi, 2018). GBI is over and above other incentives such as feed-in-tariffs, which are provided by state utilities (Sarangi, 2018). But the rapid growth of the renewable energy market and the consequent fall in tariffs, which have almost achieved parity with thermal power tariffs resulted in these incentives to be withdrawn (Sarangi, 2018). A third type of incentive scheme introduced is the viability gap funding (VGF), which is a one-time grant provided by the government to finance economically justifiable infrastructural projects that are not financially viable (Sarangi, 2018). An example of this would be that the Solar Energy Corporation of India (SECI) used the VGF scheme to promote solar energy generation in the country (Sarangi, 2018).



4.2 Education

1) Background and context

With approximately 29% of India's population between the age group of 0-14 years, the education sector offers a significant opportunity for investment. The education sector in FY18 is estimated at Rs 6,40,891.3 crore (US $91.7 billion) and is expected to reach RS 7,06,587.9 crore (US $ 101.1 billion) in FY19 (India Brand Equity Foundation , 2019). According to a report by the rating agency CARE Ltd, the market size of the Indian education system was estimated at USD 100 billion in 2018 and is expected to almost double to USD 180 billion by the year 2020 (Nishith Desai Associates, 2018).

Despite the projected growth of the education sector, the Government of India (GoI) has allocated a low percentage of the GDP towards education as reflected in the total union budget- education budget fell from 2.55% of the GDP in 2014-15 to 2.05% in 2018-19 (Raman, 2019). The union budget for the current financial year, 2019-20, however saw an increase of nearly Rs 10,000 crore that the budget estimates of 2018-19 for education, making a total of Rs 94,853.64 crore. Of this total share, Rs 56,536.63 crore has been proposed for elementary education and Rs 38,317.01 crore has been allocated to higher education (Nanda, 2019). In higher education, India has one of the largest networks of higher education (including both public and private) institutions in the world with

41,901 colleges and 993 universities and; over 250 million school going children, which is more than any other country (India Brand Equity Foundation , 2019).

Investing in education is a state subject in India where after the 14th finance commission, constituted in January 2013, there has been an increase in the pool of untied funds for the states, thereby increasing their discretion on spending on education and other avenues within the social sector category. The effect of this measure is also reflected in significant inter-state variations in spending on education with the richer states spending more on education given more fiscal space to do so. However, poorer states such as Madhya Pradesh and Jharkhand seem to be raising their expenditure on education at a rate that either matches, or surpasses the education expenditure of relatively developed states like Kerala (Bhattacharya & Kundu, 2017).

Education and Human Development

According to the Human Capital Index released by The World Bank as part of the World Development Report 2019, 'a child born in India today will be only 44 per cent as productive when she grows up as she could be if she enjoyed complete education and full health' (Press Information Bureau, Government of India, Ministry of Finance, 2018).

There is a strong correlation between public investment in education, child development and empowerment (India spend, 2019). States like Kerala and Himachal Pradesh (HP), which spent more on education as compared to other states, have scored higher on the empowerment index- accounts for attendance at all levels of the schooling, and indicators on sex ratio at birth and early marriage (ibid, 2019). States like Madhya Pradesh and Rajasthan which spent less than half per child as compared to Kerala and HP scored significantly lower on the empowerment index (ibid, 2019). The New Education Policy released by the central government in May 2019 suggests increasing spending on education from 10% of total government expenditure to 20% by 2030. This claim however does not match the decreasing trend, after correcting for inflation, on education expenditure by the government since 2015 (Ibid, 2019). In fact, six of the states that have relatively spent more on education have seen a decrease in spending (from 16.05% to 13.52%) between the years 2014-15 and 2019-20 (ibid, 2019).In addition to a correlation between education and the empowerment index, there is also a strong correlation between education, especially at the higher education level and employment. Numerous studies both on India and worldwide have argued for the positive correlation between education levels and employment prospects (Watkins, 2015). The *World Development Report 2018: 'Learning to Realize Education's Promise'* argues that without learning, education will fail to deliver on its promise to eliminate extreme poverty and create shared opportunity and prosperity for all (World Bank, 2017). **India also faces a serious policy challenge because of lack of push in the areas of education and employment (Jha, 2015).** Research shows that since

65 percent of India's population in 2012 was of the working age, over time, if India's youth is productively engaged, the country's private financial savings and physical capital investment are likely to boom (Jha, 2015). Mass education of youth and their gainful employment in productive jobs is central for capitalizing on India's demographic dividend and a critical input into such job creation would be the rapid skilling of India's youth (Jha, 2015).

Increasing demand for education and a reduction in trend of government spending has led to an increase in opportunities for operational scale-growth and top-line growth by the private sector (ibid, 2018). These opportunities have already led to conversations on strategic partnerships on multiple fronts such as, between foreign universities and educational institutions in India; public-private partnerships (PPP) where government schools could be operated by low-cost private schools and; ed-tech initiatives that are currently not regulated.

Impact investing landscape in India

In India, the conversation on impact investment is nascent. According to a report by D. Capital Partners, 'Most deals remain small, and investment in schools currently dominates deal-making, with more innovative technology and management models just beginning to emerge. As yet, few business models deliver strong immediate financial return while reaching the most vulnerable beneficiaries' (D. Capital Partners, 2013). Given the initial stages of impact investment for education, private financers are mainly of two categories. First, donors who are looking to reach to the lowest income populations without financial returns to their investment and second, finance-first investors who target middle and upper-class population with a motive for profitable financial returns (ibid, 2013).

A growing demand for education, in the context of gaps in government funding and capacity gaps in delivering quality education leaves adequate room for innovative investment in the sector. However, for impact investment in education there are a few concerns (i) high impact in a short-time frame would not be considered as a realistic expectation (ii) be open to innovative ideas when considering improved social impact of education like low-cost tablets or improving back-office management systems or through a collaborative process that combines a diverse set of experience and expertise (ibid, 2013).

2) Investment trends

According to a study conducted by Brookings India, 'education now represents the largest impact sector, alongside agriculture, in terms of interest from Indian impact investors…Typical models in Indian impact investing in education are either business-to-business (portfolio company sells to schools) or business-to-customer (portfolio company delivers educational services directly to students), with a majority of investors moving away from

typical non-profit school models towards delivering disruptive education services enabled through technology or market segmentation' (Ravi, Gustafasson-Wright, Sharma, & Jones, 2019). Impact bonds in India also remain at a nascent stage, with only one contracted in education (Ravi, Gustafasson-Wright, Sharma, & Jones, 2019).

National Investment trends

There have been a few initiatives taken by the government for the infrastructural development of education sector. These are:

- The Central Government plans to disburse US$ 1 billion to states for introducing skill development initiatives (India Brand Equity Foundation , 2019)
- Rise in budget allocation for education sector by 17% i.e. Rs 150 crore for establishing new IITs and IIMs in India.
- A proposal was proposed for setting up 6000 schools at block level as model schools in the 12th Five Year Plan.
- Fund of Rs 1000 crore has also been allocated to National Skill development Fund as an initiative.
- Provide incentives to private sector for creation of infrastructure for higher education
- The government-initiated measures to establish four regional centers of Indian Institute of Mass Communication (IIMC) to promote excellence in journalism.
- The allocation of Rs.636215 crore to UGC (University Grants Commission) which involves the finances for deemed and central universities across India.
- Survey by apex industry body, ASSOCHAM, predicts an investment of Rs. 4,500 crore over next three years
- To increase the IT spending from an estimated $356 million in 2008 to $704 million by 2012, reflecting in a Compounded Annual Growth Rate (CAGR) of 19 percent during 2007-2012

Foreign Direct Investment

In 2002, the Government of India allowed 100 percent Foreign Direct Investment (FDI) in the education sector through the automatic route. Since then and upto March 2019, the sector has received cumulative FDI worth Rs 17,262.83 crore (US $ 2.47 billion) (India Brand Equity Foundation , 2019). In sum, the education sector receives 0.57% of the total FDI equity inflow, with the highest inflow received by the services sector (Finance, Banking, R&D, Courier, Tech and others) at 17.63% (Department of Industrial Policy and Promotion).

According to a report by PwC, FDI in the unregulated higher education segment is seeing a considerable inflow: a sum of USD 492 mn between April 2000 and January 2012. This inflow is not possible in the regulated segment of higher

education due to restrictions on the need to set-up a legal entity (trust/ society) (PwC, 2012).

There have been a series of mergers and acquisitions deals especially since 2017. In August 2019, the Maharashtra International Education Board (MIEB) signed a collaboration agreement with Google India (ibid, 2019).

Public Private Partnership (PPP) model

Under the PPP model education continues to be a public good albeit with a private sector approach towards the operation of various education units. While education remains a not-for profit activity, there is room for making a 'reasonable surplus' from educational activities (Nishith Desai Associates, 2018)

For higher education, where the impact of investment in terms of employment is argued to be the highest, there are four PPP models:

1. *Basic Infrastructure model*- Here the private sector invests in the basic infrastructure of the school like buildings and teaching supplies while the government tends to operational costs like teacher salary, allowances and other operational expenses.

2. *Outsourcing model*- The private sector looks after both infrastructure and operation of the school and the government pays the private sector directly for the specified services.

3. *Equity of Hybrid model*- Infrastructure investments are shared between the government and the private sector and the private sector looks after the operations and management of the educational unit.

4. *Reverse outsourcing model*- Government invests in infrastructure entirely and the and the private sector is responsible for the operation and management of the educational unit.

The policy debate in India on PPP has been divided between a private-aided school system and a PPP model where the government has minimum intervention with the operation of the school including charging of de facto for-profit school fees as proposed by the eleventh plan (Tilak, 2010).

3) Socio-economic benefits

Impact investment is targeted towards populations that are at the base of the socio-economic pyramid. These investments are different from market-rate investors who target middle and upper-class populations and consider these investments for financial returns (Ravi, Gustafasson-Wright, Sharma, & Jones, 2019).

Existing literature suggests that the return to investment in higher education is significant in India (Mitra, Returns to education in India: Capturing the heterogeneity, 2019). This returns to higher education in terms of salaried employment, is greater for urban women and for men and women from socially backward communities leading to a need for strategic investment in higher education for these communities (Mitra, Returns to education in India: Capturing the heterogeneity, 2019).

Literature on investment for education confirms that additional years of education has a significant influence on GDP per capita or its growth; providing knowledge and skills to individuals contributes to human capital by enhancing their productivity and employability which in turn contributes to the overall income and development of the country (UNICEF, 2015).

In India, returns to higher education are not uniform across different sections of the society. According to Mitra, while marginal rates of return increased with consecutive higher education levels, these returns are lower for the Scheduled Tribes (STs) and Scheduled Castes (SCs) and the Other Backward Class (OBC) categories. The differences in rates of return for the STs and SCs and the 'general' category is the highest in the private sector. Besides, women display higher rate of return for higher education than men (Mitra, 2019). This claim of women displaying higher rate of return for higher education such as a senior secondary degree, technical diploma/ certificate and graduation is furthered by another study by Mendiratta and Gupt (2015).

However, the claim of greater rate of return for women is true for higher education and for urban women only. At the primary education level, returns to female education is lower than male education and the gap increases further at the middle level. For rural women, there is a fall in returns at the post graduate level (Mendiratta & Gupt, 2015).
Further emphasising on the diversification and exclusion problems of the job market in India, Sikdar (2019) argues that while chances of availing a regular salaried job upon receiving higher education is higher amongst the socially deprived sections, these sections also find it harder to access higher education due to either being first generate literate or the financial demands of a higher education. A structural investment into providing affordable education to the socially deprived sections could greatly address the gap between differential employment opportunities amongst different sections in the society (Sikdar, 2019).
While there has been an overall improvement in attainment of basic/primary education, here too we see community-based differences. Only 47 percent of the ST population has received primary education as compared to 67 percent of the non-ST population. For educational attainment STs in rural areas are usually worse of. ST women attain an average of just 4 years of education in comparison

to non-ST women who attain nearly 7 years of education (Das, Hall, Kapoor, & Niktin).

As far as employment generation is concerned, the education sector has had steady, but not rapid growth in employment over the years (direct). The sector saw an increase employment from 15,532,000 to 15,741,000 from 2015-16 to 2016-17.

Figure 10: Employment Generated in the Education Sector (in 1000s)

Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Employment	13,765	14,203	14,420	15,121	15,337	15,532	15,741

Source: (KLEMS data- Reserve Bank of India, 2017)

4) Political Economy Challenges

There are however a few factors that are important for identifying the right opportunity for private sector investment in education in India. These are:

- A thorough due diligence process considering India's complex corporate securities, exchange control and taxation laws (ibid, 2018).
- An understanding that most of the educational groups are relatively small and have a low capital base. So, while strategic investment opportunities exist, the deal sizes could be smaller than the what developed markets tend to offer (ibid, 2018).

5) Sectoral outlook

For the National Institution for Transforming India (NITI) Aayog, a central body affiliated to the Government of India which provides both directional and policy inputs and relevant technical advice to central and state governments, education holds an important place in its strategy for the year 2022. The 'strategy for 2022' broadly classifies education into four categories: school education, Higher education, Teacher education and training and skilling. (NITI Aayog: Government of India, 19 December, 2018)

The online education sector, also known as the ed-tech sector, is unregulated and has attracted rapid investments from the private sector. Online education is pitched as a set of pre-packaged interactive classes which are both low cost and the subscribers can pace their classes. **According to a report by KPMG, India's online education industry is expected to grow almost eight times to hit USD 1.96 bn by 2021 (Nishith Desai Associates, 2018).** There are five business models for ed-tech in India (i) primary and

secondary supplement education (ii) test preparation (iii) reskilling and online certification (iv) higher education and language and (v) casual learning (ibid, 2018).

Under school education, focus will be on universal access and retention in school and the need to improve learning outcomes. These can be achieved by formulating mechanisms to enforce regulations on teacher qualifications and absenteeism; rationalize public school structure and undertake individualized tracking; provide children the option to branch into vocational courses (ibid, 2018).

Under higher education, focus will be on increasing gross enrolment ratio from 25% in 2016-17 to 35%. This increase in enrolment for higher education is expected to be achieved by ensuring effective coordination of higher education regulators; compulsorily accredit higher education institutions; linking funds to outcomes through the Ministry of Human Resource Development (MHRD) and Higher education funding agency (ibid, 2018).

Under teacher education and training, focus will be on resolving teacher absenteeism, enforcing minimum standards and improving in-service training. These are expected to be achieved through establishing a committee to develop an objective criteria to recognize institutions; redesign in-service teacher development programmes; set-up a national electronic teacher registry; design teacher-demand forecast models for all levels (ibid, 2018).

Lastly under skilling, focus will be on increasing proportion of formally skilled labour from 5.4% of workforce to 15% and ensuring inclusivity. This objective is expected to be achieved by establishing a regulatory body to lay down minimum standards for players; initiating vocational education from standard VIII; streamlining claim process for reimbursement under National Apprenticeship promotion Scheme (ibid, 2018).

Globally, there seems to be interest in investing in e-learning. Also coined as the ‘next generation learning’, e-learning promises to provide educational innovation which harness the potential of technology for improved learning and college readiness and completion, especially in the USA (Bill and Melinda Gates Foundation , 2010).

4.3 Urban Affordable Housing

1) Background and context

Estimates for urban housing shortage show that there is a housing shortage of nearly 30 millon units in rural areas and 10.2 million) units in urban areas (NITI Aayog, 2018). This reflects “housing poverty” in India, i.e. an aggregate of those who live in non-liveable, temporary, overcrowded and dilapidated homes: those

who live in unacceptable conditions as well as those who are homeless (D'Souza, 2019).

As the term 'affordable' is relative, first and foremost it becomes important to understand how the term 'affordable' is conceptualised as what is perceived to be 'affordable' by one social group may not be so for another group. Affordability is conceptualised as disposable income and affordable housing is categorized in terms of cost of a house, as a proportion to the total income of a household by HUDCO (HUDCO/HSMI, 2016). According to them, the cost of affordable house should not exceed five times the household gross annual income and the EMI/rent should not exceed 30 per cent of the household's gross monthly income (HUDCO/HSMI, 2016). The PMAY guidelines (2015) define low income groups as households having an annual income between Rs.3,00,001 (Rupees Three Lakhs One) up to Rs.6,00,000 (Rupees Six Lakhs) where states/UTs shall have the flexibility to redefine the annual income criteria as per local conditions in consultation with the Centre. The PMAY guidelines also explain economically weaker section homes or EWS homes as an all-weather single unit or a unit in a multi-storeyed super structure having carpet area of up to 30 sq. m. with adequate basic civic services and infrastructure services like toilet, electricity etc (Ministry of Housing and Urban Poverty Alleviation, 2015). The Report of the Technical Group (TG-12) on Estimation of Urban Housing Shortage (2012), shows that there has been a huge gap in demand and supply or urban housing in India (D'Souza, 2019). This can be seen in the table below –

Table 3 Distribution of estimated urban housing shortage in India (million)

Factors	As at end-2012
Households living in non-serviceable katcha	0.99
Households living in obsolescent houses	2.27
Households living in congested houses	14.99
Households in homeless condition	0.53
Total Urban Housing shortage	**18.78**
I. Economically Weaker Sections (EWS)	10.55
II. Low Income Group (LIG)	7.41
III. Medium and High income group (MIG+HIG)	0.82 (4%)

Note: Value in parentheses are percentage shares
Source: Report of Technical Group (TG-12) on Estimation of Urban Housing Shortage 2012, Ministry of Housing and Urban Poverty Alleviation

To address the shortage of affordable housing, as the pace of urbanisation increases, the government introduced a policy called the Pradhan Mantri Awas Yojana (PMAY) in 2015. The mission of PMAY is to support construction of houses up to 30 square meter carpet area with basic civic infrastructure (Ministry of Housing and Urban Poverty Alleviation, 2015). According to the PMAY guidelines (2015), slum redevelopment projects and affordable housing projects in partnership should have basic civic infrastructure such as water, sanitation, sewerage, road, toilet facility, electricity etc. and houses constructed under the

mission should conform to the standards provided in National Building Code (NBC). PMAY is implemented through four verticals - In situ slum redevelopment; affordable housing through credit linked subsidy; affordable housing in partnership; and subsidy for beneficiary-led individual house construction (Ministry of Housing and Urban Poverty Alleviation, 2015). The table below shows the progress of PMAY(U) till March 2019:

Table 4 Progress of PMAY(U)

Sr. No.	Particulars	Progress from 1.1.2018 to 31.03.2019	umulative as on 31.3.2019
1	City/Town Covered (Nos)	1,084	4,445
2	Project(s) Approved (Nos)	9,263	16,512
3	Investment (Central, State & Beneficiary) (Rs. in Crore)	2,78,789.97	4,73,688.01
4	Central Assistance Involved (Rs. in Crore)	68,782.81	1,24,651.92
5	Central Assistance Released (Rs. in Crore)	36,244.59	49,394.09
6	Houses Involved (Nos)	44,14,148	80,38,107
7	Houses Grounded for Construction (Nos)*	26,17,503	45,44,981
8	Constructions of Houses Completed (Nos)*	20,28,569	25,05,440
9	Houses Occupied (Nos) *	17,97,687	22,91,638

* Includes incomplete works of earlier NURM scheme completed after 2014
Source: Annual Report 2018-2019, Ministry of Housing and Urban Affairs

For facilitating cross learning and practical solutions in areas related to sustainable urban development and affordable housing, the government of India has signed several Memorandum of Understanding (MoU) with countries including Netherlands, Japan, Germany, France, Sweden, UK, Denmark, Singapore, European Union, Morocco, Saudi Arabia etc (Ministry of Housing and Urban Affairs, 2019). The Joint Working Groups (JWG) constituted under the MoUs hold regular meetings to discuss issues of mutual importance and exposure field visits are undertaken to one another's countries, as a part of international collaboration in the field of Sustainable Urban Development and affordable housing (Ministry of Housing and Urban Affairs, 2019).

2) Investment Trends

Ever since the government has made affordable housing a priority and introduced policy changes, such as the introduction of PMAY and relaxing of FDI investments in housing, there has been a growing interest and investment of the private sector in housing for EWS and LIGs. Instances of private sector investments in affordable housing is concentrated between the years 2015 to 2019. In 2015, Shapoorji Pallonji Group has attracted one of the largest foreign direct investments in India's affordable housing segment, with Standard Chartered Private Equity, World Bank member IFC and the Asian Development Bank committing $200 million or about Rs 1,280 crore in a joint venture with the Mumbai-based conglomerate (Babar, 2015). The JV will develop about 20 million sq. ft. of affordable home space in Mumbai, Pune, National Capital Region, Chennai, Kolkata, Bengaluru and Ahmedabad in the next eight years (Babar, 2015). The investment assumes significance given its size and the government relaxing the minimum built-in area required in projects as well as capital requirement and eased the exit norms (Babar, 2015). The IFC in 2017 planned to invest as much as $200 million in India's largest mortgage lender Housing Development Finance Corp. Ltd (HDFC) (Choudhary, 2017). It said that it will invest by buying five-year non-convertible debentures (NCDs) or masala bonds (Choudhary, 2017). The funds will be used by HDFC for on-lending to developers of affordable housing projects across India and HDFC has additionally committed to allocate up to Rs42 billion ($600 million equivalent) from its own resources for on lending to developers of affordable housing projects in India (Choudhary, 2017). More recently, PNB Housing Finance Ltd said that it had raised $100 million (around ₹690 crore) from IFC (LiveMint, 2019). This shows IFC's emphasis on the affordable housing sector and that it is keen to expand to smaller towns and cities and reach low-income customers with loans to buy homes and help raise their living standards (LiveMint, 2019).

Interviews with key informants highlight that there is a mixed preference for equity and debt investments and this preference depends on risk assessments conducted by each developer.

These investments not only reflect the private sector's enhanced interest to invest in affordable housing, it also shows that the government is deeply interested in

incentivizing the private sector to invest in to affordable housing to meet the housing demands.

Public Private Partnerships (PPP) in affordable housing is another way through which the government is engaging with the private sector in affordable housing. However, literature shows that PPP in affordable housing has met with limited success in meeting its objectives of reducing urban housing shortage (HUDCO/HSMI, 2016). Some of the reasons why PPP has not been able to achieve its desired impact are - Lack of physical and social infrastructure; limited mobility and employment opportunities; and existing economic vulnerabilities of the economically weaker sections of society for whom such housing is being constructed (HUDCO/HSMI, 2016). An instance of this limited success is the provision of rental housing units in Maharashtra under the PPP model (HUDCO/HSMI, 2016). In order to address the housing shortage of 1.94 million units, the Government of Maharashtra (GoM) initiated the Rental Housing Scheme (RHS) with the aim of generating 97,574 rental housing units through 51 rental housing projects (HUDCO/HSMI, 2016). Out of the 51 projects, 32 were located in municipal areas, except for Navi Mumbai and Matheran Municipal Council areas, and the remaining 19 were in the Urbanisable Zone 1 and Urbanisable Zone-2 areas of the Mumbai Metropolitan Region (HUDCO/HSMI, 2016). Private developers were offered incentives in the form of FSI in return for providing self-contained tenements of 160/320 sq. ft. carpet area (HUDCO/HSMI, 2016). However, in August 2014, the rental housing scheme was turned into an 'Affordable Housing Scheme', where the constructed rental units were sold to beneficiaries but several of the units constructed under the Rental Housing Scheme remain unoccupied and are yet to be either sold or allotted to future residents (HUDCO/HSMI, 2016).

3) Political Economy Challenges

To meet the rising demand for affordable housing, the government has introduced several policy features as part of PMAY. This can be seen in the two verticals that are part of PMAY namely, the credit linked subsidy and the affordable house partnership, along with the introduction of the Real Estate Regulation Act (RERA), 2016.

In order to expand institutional credit flow to the housing needs of urban poor, credit linked subsidy is provided on home loans taken by eligible urban poor (EWS/LIG) for acquisition or construction of house (Ministry of Housing and Urban Poverty Alleviation, 2015). Beneficiaries of Economically Weaker section (EWS) and Low Income Group (LIG) seeking housing loans from Banks, Housing Finance Companies and other such institutions would be eligible for an interest subsidy at the rate of 6.5 % for a tenure of 15 years or during tenure of loan whichever is lower according to the guidelines (Ministry of Housing and Urban Poverty Alleviation, 2015). According to the Annual Report 2018-19, the coverage of the Mission was earlier limited to all statutory towns as per Census 2011 and towns notified subsequently but to ensure that the benefits admissible reach a large segment of the population, the scheme guidelines have subsequently been

revised thrice. With the last amendment dated 12th January, 2018 coverage is now extended to the entire urban areas consisting of all statutory towns and areas including Notified Planning /Development Area/ Industrial Development Authority/ Special Area Development Authority/Urban Development Authority or any such Authority under State legislation which is entrusted with the functions of urban planning and regulations (Ministry of Housing and Urban Affairs, 2019). Given below is a breakup of beneficiaries and subsidy released under CLSS during the period from January 1, 2018 to March 31, 2019 along with cumulative progress as on March 31, 2019 -

Table 5: Beneficiaries and subsidies released under CLSS between 1st January 2018 to 31st March 2019

Details for CLSS scheme	No. of Beneficiaries		Subsidy (Rs. in Crore)	
	From 1.1.2018- 31.03.2019	Cumulative Total	From 1.1.2018- 31.03.2019	Cumulative Total
CLSS for EWS/LIG	3,28,029	4,00,292	7,722.99	9,178.14
CLSS for MIG	1,56,587	1,67,658	3,309.97	3,538.94
Total	**4,84,616**	**5,67,950**	**11,032.96**	**12,717.08**

Source: Annual Report 2018-19, Ministry of Housing and Urban Affairs

Through the second vertical, affordable housing in partnership, PMAY intends to provide financial assistance to EWS houses being built with different partnerships by States/UTs/Cities (Ministry of Housing and Urban Poverty Alleviation, 2015). Central Assistance of Rs.1.5 Lakh per EWS house is provided by Government of India in projects where at least 35% of the houses in the projects are for EWS category and a single project has at least 250 houses (Ministry of Housing and Urban Affairs, 2019).

To ensure regulation and promotion of real estate sector in an efficient manner and to protect the interest of home buyers, the Real Estate (Regulation and Development) Act, 2016 (RERA) was passed by the Parliament in March, 2016 heralding a new era of transformation in the real estate sector (Ministry of Housing and Urban Affairs, 2019).

Despite these policy changes, challenges remain for private sector investment in this sector according to KIIs and literature review. High cost of land, which is the consequence of a number of factors, is one of the principal challenges (Ministry of Housing and Urban Affairs, 2017). Financing the land is another major challenge that developers/ builders face in delivering affordable housing (Ministry of Housing and Urban Affairs, 2017). The absence of a clear title is also a serious deterrent for participation by financial institutions and real estate developers in new as well as redevelopment projects of real estate (Ministry of Housing and Urban Affairs,

2017). In the absence of redevelopment and densification of available lands, land remains underutilized - further contributing to shortage of land and to high land prices (Ministry of Housing and Urban Affairs, 2017) (IDFC Institute, 2018). Once a house has been constructed, transaction costs such as inordinately high registration fees and stamp duties add to the cost of property transactions in India (IDFC Institute, 2018). These fees discourage buyers from declaring the true value of the property while reporting a transaction (IDFC Institute, 2018). According to the World Bank's Ease of Doing Business Report 2018, the cost to register a property is around 9.1% of the property value in New Delhi and 7.6% in Mumbai (IDFC Institute, 2018). The lack of transparency in the housing sector along with the absence of an updated market database and limited access to reliable information are impediments to seamless transactions (IDFC Institute, 2018). Transaction costs include all direct and indirect costs incurred in transfer of property from seller to buyer such as stamp duty charges, registration fees, Goods and Services Tax, agent's commission and legal fees (IDFC Institute, 2018).

Land regulations also pose as a challenge for investments in affordable housing.[7] One of the most common land-use regulations cities enforce is restriction on the Floor Space Index (FSI), also known as the Floor Area Ratio (FAR) which are implemented to limit the amount of floor area that can be built on a given plot of land (IDFC Institute, 2018). FSI rules restrict population density in cities by limiting how much floor area can be built (IDFC Institute, 2018). In India, one of the primary arguments against relaxing FSI restrictions is that this would lead to an increase in the city's population, which would put additional pressure on already stressed urban infrastructure, such as roads, water supply, sanitation, waste disposal and public spaces (IDFC Institute, 2018). FSI limits prescribe a ceiling on the total floor area permitted to be built in a city. But given that the amount of land available is finite and population pressure on cities continues to rise, rigid FSI rules increase the price of floor area. This has two effects: people are either forced to live away from the central business district where land prices are lower, or occupy smaller spaces in the core city as house prices go up (IDFC Institute, 2018). FSI restrictions lead to cities expanding spatially and result in a net welfare loss (IDFC Institute, 2018). FSI limits have thus increased urban sprawl (horizontal growth) instead of making cities taller (vertical growth) (IDFC Institute, 2018). Indian cities have some of the most restrictive FSI regimes in the world (IDFC Institute, 2018).

Adding to the challenges related to housing is that builders often raise financing at multiple points during the development of the project,

[7] There have been positive regulatory steps taken as well: a) Real Estate Regulation and Development (RERA) Act, 2016, which which seeks to protect home-buyers as well as help boost investments in the real estate industry b) The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (LARR Act), that regulates land acquisition and lays down the procedure and rules for granting compensation, rehabilitation and resettlement to the affected persons in India

including from buyers who pay advances in slabs based on completion of goals (IDFC Institute, 2018). In some cases, builders prefer slower construction so as to have enough time to raise financing for later stages of the project which delays completion and fuels a vicious cycle that results in a large number of stalled projects and long-drawn legal disputes (IDFC Institute, 2018).

The central bank needs to revisit this policy to ensure adequate credit to the housing sector, while putting in place safeguards to prevent worsening of the NPA problem (IDFC Institute, 2018). One of RBI's main concerns in allowing builders to borrow directly from formal banking institutions for land acquisition is that this might add to the bad loans on banks' balance sheets (IDFC Institute, 2018). As a result, the existing Non-Performing Assets (NPAs) in the housing sector in India are low (1.47%) compared to other sectors in the economy (5%). Given that majority of the banking sector comprises of Public Sector Undertakings (PSUs), and even private lending can be heavily influenced by the government, RBI is erring on the side of caution by prohibiting such lending altogether, however, these constraints impose significant costs on home-buyers, that are currently not accounted for in RBI's approach (IDFC Institute, 2018).

There are challenges to RERA 2016 as well. According to the IDFC report (2018), RERA, however, is unable to compel governmental authorities at different levels to abide by a specific timeline to provide clearances. If builders are unable to meet the timelines agreed to with buyers due to delays in obtaining these clearances, they still have to bear the burden of penalties, refund and interest payments (IDFC Institute, 2018). The additional regulatory costs to comply with the provisions, rules and regulations of RERA may lead to a consolidation in the market as smaller builders get bought out by larger players or become unprofitable (IDFC Institute, 2018). As a result, small builders who provide a necessary service to the low-income segment of the housing market, may cease to exist and this could negatively affect consumers as the resultant decrease in competition may eventually increase prices (IDFC Institute, 2018).

3) Socioeconomic Benefits

Investment in the housing sector has both direct and indirect impact on economy and has significant bearing on employment generation, according to the Annual Report 2018-19 by the Ministry of Housing and Urban Affairs. In order to assess the magnitude of employment generated due to investment made under PMAY (U), a study was conducted by National Institute of Public Finance and Policy (NIPFP) for the period of June, 2015 to 31st January, 2019 (Ministry of Housing and Urban Affairs, 2019).

An estimated 284.74 crore person days of employment has been generated under PMAY (U) which includes 88.79 crore person days of direct employment and 195.95 crore person days of indirect in nature, as on 31.3.2019 (Ministry of Housing and Urban Affairs, 2019). As per NSSO estimates, 280 working days are to be treated as jobs, thereby it translates to creation of 101.69 lakh jobs in total, out of which 31.71 lakh as direct and 69.98 lakh as indirect (Ministry of

Housing and Urban Affairs, 2019). A state-wise distribution of direct employment generated by PMAY (U) and other related schemes is given in the table below.

Table 6: State Level Direct Employment

State Level Direct Employment Generated under PMAY (U)						
States/UTs	**Person days (in Crore)**			**Jobs (in Lakhs)**		
States/UTs	**BLC, CLSS** (individual)	**AHP, ISSR, CLSS** (Apartments)	**PMAY (U)**	**BLC, CLSS** (individual)	**AHP, ISSR, CLSS** (Apartments)	
Andhra Pradesh	2.84	5.86	8.70	1.01	2.09	3.11
Bihar	0.72	0.06	0.78	0.26	0.02	0.28
Chhattisgarh	0.65	0.34	0.99	0.23	0.12	0.35
Goa	0.00	0.02	0.02	0.00	0.01	0.01
Gujarat	1.63	4.74	6.37	0.58	1.69	2.27
Haryana	0.19	0.32	0.51	0.07	0.11	0.18
Himachal Pradesh	0.03	0.01	0.04	0.01	0.00	0.01
Jammu & Kashmir	0.08	0.00	0.08	0.03	0.00	0.03
Jharkhand	1.23	0.08	1.32	0.44	0.03	0.47
Karnataka	2.13	2.09	4.21	0.76	0.74	1.50
Kerala	0.64	0.03	0.67	0.23	0.01	0.24
Madhya Pradesh	4.07	1.70	5.77	1.45	0.61	2.06
Maharashtra	0.46	5.00	5.46	0.16	1.79	1.95
Orissa	0.63	0.13	0.77	0.23	0.05	0.27
Punjab	0.22	0.15	0.37	0.08	0.05	0.13
Rajasthan	0.25	0.84	1.09	0.09	0.30	0.39

Tamil Nadu	3.52	1.12	4.64	1.26	0.40	1.66
Telangana	0.18	2.22	2.41	0.07	0.79	0.86
Uttar Pradesh	3.04	1.13	4.17	1.09	0.40	1.49
Uttarakhand	0.24	0.04	0.27	0.08	0.01	0.10
West Bengal	2.00	0.50	2.50	0.71	0.18	0.89
Sub-total (States)	24.74	26.39	51.13	8.84	9.42	18.26
Arunachal Pradesh	0.04	0.00	0.04	0.01	0.00	0.01
Assam	0.27	0.01	0.28	0.10	0.01	0.10
Manipur	0.11	0.00	0.11	0.04	0.00	0.04
Meghalaya	0.01	-	0.01	0.00	-	0.00
Mizoram	0.03	0.00	0.03	0.01	0.00	0.01
Nagaland	0.03	-	0.03	0.01	-	0.01
Sikkim	0.00	-	0.00	0.00	-	0.00
Tripura	0.85	0.00	0.85	0.30	0.00	0.31
Sub-total (NE)	1.34	0.02	1.35	0.48	0.01	0.48
A&N Island	0.00	-	0.00	0.00	-	0.00
Chandigarh	0.00	0.00	0.00	0.00	0.00	0.00
D&N Haveli	0.00	0.03	0.04	0.00	0.01	0.01
Daman & Diu	0.00	0.01	0.01	0.00	0.00	0.00
Delhi	0.05	0.35	0.40	0.02	0.12	0.14
Lakshadweep	-	-	-	-	-	-
Puducherry	0.03	0.00	0.04	0.01	0.00	0.01
Sub-total (UTs)	0.09	0.40	0.49	0.03	0.14	0.17

Grand Total	26.17	26.80	52.97	9.35	9.57	18.92

Source: NIPFP estimations; BLC- Beneficiary Led Construction; CLSS- Credit Linked Subsidy Scheme ; AHP- Affordable Housing in Partnership; ISSR- In-Situ Slum Redevelopment

4) Sectoral Outlook

The role ascribed to the government is more of a facilitator, and not a direct producer of affordable housing stock as the government is envisioned as a force that enables innovation, scaling of viable solutions, and correction of markets (D'Souza, 2019). According to both KIIs and literature review, growth aspects of this sector and of private investments are enhanced if there is reform in the land use regulation; reduction in costs to build; reform of the rental market; and reduction in transaction costs (IDFC Institute, 2018).

4.4 Urban Waste Management

1) Background and context

The 2030 Sustainable Development Goal 12 focuses on sustainable consumption and production. Target 5 of this goal is to cut waste generation through prevention, reduction, recycling and reuse. According to the Ministry of Environment, Forest and Climate Change, India produces approximately 62 million tons of waste per annum, with an average annual growth rate of 4% (PIB, 2016). Urban India generates 145,000 tons per day of municipal solid waste (MSW) per day, out of which only about 23% of the total generated waste is being processed or treated, while 72% is land-filled (EY, 2019). Delhi, Mumbai, Kolkata, Chennai, Bengaluru and Hyderabad contribute to the maximum amounts of solid waste generation, which accounts to 21% of the waste generated in the country (EY, 2019). By 2047, it is expected that 1,400 square kilometres of landfill area would be required for dumping India's increasing volumes of municipal solid waste; this space is roughly equal to the combined area of three out of top five most populous cities in India: Hyderabad, Mumbai and Chennai (Annepu, 2012).

Generated waste can be divided into three categories- organic (biodegradable), dry (recyclable), and biomedical (sanitary or hazardous) (Swaminathan, 2018). India's per capita consumption in 2017 was 11kg, and the country produces approximately 0.025 million tons (MT) of dry plastic waste every day. In addition, the proportion of plastic and rubber in municipal solid waste has been increasing rapidly. As such, plastic waste generation will amount to 31.4 million tons per year by 2031. In terms of e-waste, India contributes one of the largest proportions towards global generation. This amounts to roughly 2 million tons of e-waste, with the 214 authorized recyclers and dismantlers only processing or treating 0.036 million tons (in 2016-17). Moreover, India's e-waste is set to keep in pace with population growth and estimated to grow to 5.2 million tons by 2023. The informal sector processes a generated waste, and the health consequences of improper solid waste management are dire; the US Public Health Service has identified 22 human disease linked to improper solid waste

management practices (such as garbage burning, and improper handling or dumping).

State-wise Waste Generation in Urban Areas under Municipal Solid Waste Management in India (As on 31.12.2018)		
States/UTs	**Total waste Generation (In MT/D)**	**Total Waste Processing (%)**
Bihar	2389	43
Chhattisgarh	1649	84
Jharkhand	2126	52
Madhya Pradesh	6424	68
Odisha	2720	12
Rajasthan	6500	56
Uttar Pradesh	15500	57
MT/D : Metric Tonne/Day		
Source : Lok Sabha Unstarred Question No. 250, dated on 05.02.2019.		

To address the problem of waste mismanagement, the government has introduced the Solid Waste Management (SWM) Rules 2016, Plastic Waste Management (PWM) Rules, 2016 and the E–waste (Management) Rules, 2016. The key features of the solid waste management rules, 2016 are the following (Swaminathan, 2018):

i. A mandate for all waste generators to segregate waste, but with no specific penalty on non-compliers
ii. A mandate for bulk generators (any institution with an area greater than 5,000 square metres) to manage their own waste, but with no penalty mentioned for non-compliance of the same.
iii. An extended producer responsibility on brand owners to set up a collect back scheme for managing waste produced during packaging.
iv. Promotion of waste-to-energy plants and a directive to the Department of Fertilisers to market compost along with chemical fertilisers.
v. Provision for local bodies to levy waste collection fees on waste generators, with no penalty on non-compliance.

The following table gives an overview of existing waste to energy plants in selected states:

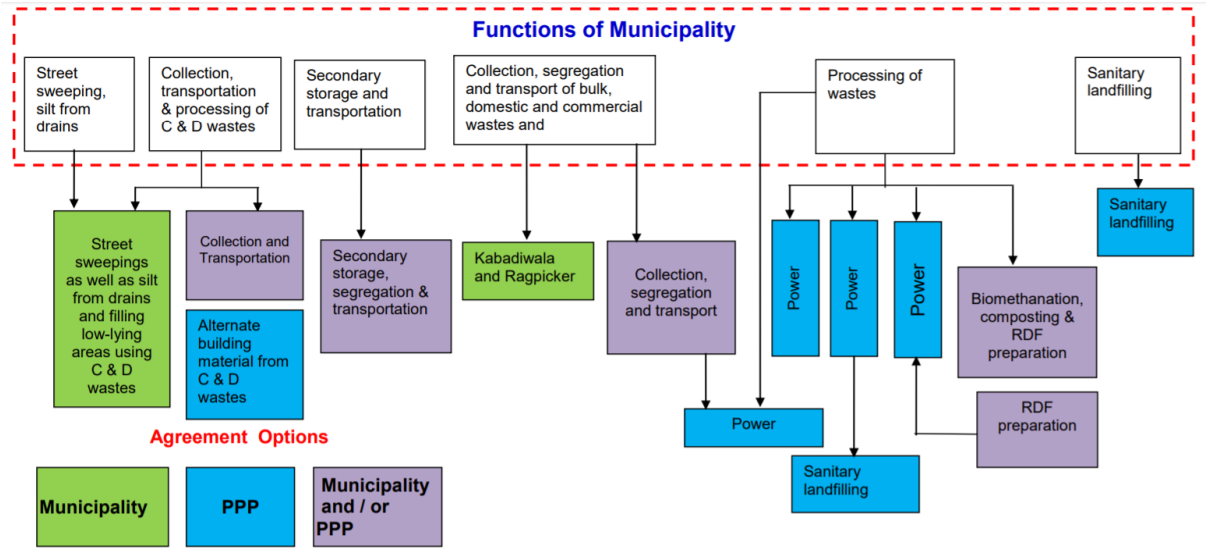
Selected State-wise Number of Waste-to-Energy Plants in India (As on 30.06.2018)				
States/UT	**No. of power**	**No. of biogas**	**No. of CNG**	**Total**
Bihar	-	1	-	1
Chhattisgarh	1	-	-	1

Madhya Pradesh	3	3	1	7
Rajasthan	1	-	2	3
Uttar Pradesh	22	5	1	28
India	**92**	**75**	**14**	**181**
Source: Rajya Sabha Unstarred Question No. 1579, dated on 31.07.2018.				

2) Investment Trends

The government allows 100% FDI under the automatic route for urban infrastructure areas including waste management subject to relevant rules and regulations. **The most common model of private sector engagement in this sector has been through public private partnership (PPP).** The participation of the private sector in MSW started in 2000 and has involved a range of operational activities including door-to-door collection of waste, storage and transportation of waste, composting, final disposal and waste to energy (EY, 2019). The level at which the private sector engagement occurs depends on the type of waste in question. For instance, Figure 9 suggests avenues for private sector participation in waste management (construction and demolition).

Figure 11: Avenues for private sector participation in the construction and demolition waste management



Source: (Planning Commission, 2014)

3) Socio-economic Benefits

About 1.7 million people work in India's informal waste sector (Sandhu, 2017). While some estimates state that nearly 40% of the waste-pickers are children aged below 18 years, what is definite is that these families live off in unhygienic environments, succumbing to malnutrition, extreme poverty, and adverse health infections (Swaminathan, 2018). Most data sources estimate waste pickers

recover about 20 per cent of total recyclable waste (Lucy Oates, 2018). A growing body of literature recognises the contribution the informal sector makes to environmental health, and various stakeholders are calling for the integration of informal waste pickers into formal waste management practices (Lucy Oates, 2018). This integration will result in health benefits to the waste picking community; it will lead to a reduction in the environmental impacts of waste burning given the fact that India releases 6% of methane emissions only from garbage, compared to a global average of 3% (Planning Commission 2014).

A report by IIT Kanpur (2006) found the potential of recovering at least 15 per cent or 15,000 MT of waste generated every day in the country. As per this report, this recovery could also lead to employment opportunities for about 500,000 rag-pickers. According to the International Finance Corporation, the electronic waste sector will create 4.5 lakh direct jobs by 2025 and another 1.8 lakh jobs in the allied sectors of transportation and manufacturing (PTI, 2019).

4) Political Economy Challenges

Private waste management project developers in India experience several barriers to accessing financing for projects that require the use of high technology. Revenue risks, the high up-front capital costs for projects, lack of support from municipal authorities in terms of honouring payment obligations to developers (such as power purchase agreement or payment of tipping fee), limited market options for the sale of end products, misalignment of technology, and low municipal budgets that are insufficient to cover infrastructure costs (EY, 2019). Thus, projects run the risk of not being able to generate sufficient levels of revenue in the long term; initial capital investments become difficult to recoup. There have also been reports of several waste management projects that have failed in the past due to either the failure of technology or technology being misaligned for the type of waste supplied to the waste processing plant in question.

However, in contrast, improving recycling systems has very low capital requirements. The informal sector achieves recycling rates comparable to those achieved by developed country systems. Achieving similar levels of waste collection, sorting and reuse would typically cost 15–20 per cent of a municipality's annual budget. Technology-based methods also threaten the livelihoods of already marginalised waste pickers. Despite these drawbacks, local governments typically opt for imperfect copies of waste management processes in the developed world. (Lucy Oates, 2018).

5) Sectoral Outlook

India has the potential to generate approximately 90 Million Tonnes/Year of waste by 2030-2032 given the fact that the country's high population growth and changing lifestyles are likely to increase waste volumes. The central government has also been implementing the Swachh Bharat Abhiyan, emphasizing waste management at different stages of generation, collection

and disposal. India's waste management sector is expected to be worth US$13.62 billion by 2025 (Dunseith, 2017). As per industry projections, municipal solid waste management sector in India is projected to see capital and Operations and Maintenance requirement of close to USD 65 Billion by 2030 (BusinessWire, 2019).

Given that Urban Local Bodies (ULB) are not technically or financially strong to manage solid waste according to the Municipal Solid Waste Regulations, 2016 (EY, 2019), there is an opportunity for the private sector to engage in this sector. Public sector participation collaboration with the private sector has the potential to result in cost savings and improves effectiveness and efficiency in delivering services (EY, 2019). Despite significant efforts in recent years, ULBs lack the capacity, budget or infrastructure to manage the rapidly rising volume of waste. Municipalities in India spend an estimated Rs. 70–Rs. 150 (US$1–$2) per capita a year on solid waste management (Lucy Oates, 2018). These figures are a fraction of what cities in the United States of America pay (US$13–60) and less than 1 percent of what Rotterdam, in the Netherlands, pays (US$187) (Lucy Oates, 2018). The possibility of private or donor financing—for example, for large-scale incinerators and waste treatment plants, which municipalities could otherwise not afford—is thus seen as particularly attractive, yet adopting such a technology-focused strategy would likely forgo opportunities for recycling and value creation (Lucy Oates, 2018).

In terms of the waste to energy subsector, India has the potential to generate approximately 3 GW from this route by 2050 (BusinessWire, 2019). The National Thermal Power Corporation is to set up 100 waste-to-energy pollution free plants across the country.

In the waste-to-energy segment, the corporation is collaborating with city municipal corporations for waste-supply. The company will develop a waste-to-energy plant with two city municipal corporations to begin with- East Delhi and Surat, with an expectation of regulated returns in the range of 15.5 percent. (Pillay, 2019).

4.5 Agricultural Logistics and Warehousing

1) Background and Context

The third volume of the Report of the Committee on Doubling Farmers' Income (DFI) assesses the status of post-production operations, with the perspective that a farmer's produce must connect with multiple avenues to obtain value at each place, across time and space, as well as in various forms. Physical connectivity to markets is the primary medium by which farmers can access the opportunity to exchange the produce for money. **The lack of logistics facilities and connectivity to convey their harvest to markets, results in a lowering of the farmers' ability to monetise their produce** (DFI-Committee, 2017).

The report recognized the major challenges in doubling farmer's income lie in the post-production domain. The report also found that the efficient marketing system is only a necessary condition and does not ensure that the higher price discoveries are automatically transferred to the farmer-producers. Therefore, recommended to consider a complement of agri-logistics and warehousing, value addition and agri-marketing as integral to an efficient monetisation system (DFI-Committee, 2017).

An efficient agri-logistics and warehousing strategy enables connectivity between production and consumption zones over both space and time with minimal loss of quality and quantity. Primary focus in agri-logistics should be on preconditioning, storage and transportation of farm produce (DFI-Committee, 2017).

A. Agriculture growth and importance of agriculture logistics and warehousing

Compared with farm production at the start of the 1960s, India now harvests 40 times as much tomato, 14 times more potato, 8 times more wheat, thrice as much in poultry and meat, 13 times more fish, 8 times more milk and almost 40 times more eggs. The scaling up of our food production far surpassed the growth in population (which grew about 2.8 times from approx. 460 million in 1961). India is a net exporter of agricultural products and 7th largest globally (DFI-Committee, 2017).

Having almost 141 million hectares under agriculture (second largest globally), India's concerns today, are about empowering farmers with greater market connectivity to achieve greater value realisation (DFI-Committee, 2017). Producing food in sufficient quantity is no longer the immediate concern; instead now, apprehensions relate more to minimizing post-harvest losses, securing of easy and affordable access to the food and in improving resource use and input management (DFI-Committee, 2017).

DFI Committee reviewed the unit level information from NSSO 70th round,[8] to estimate that losses in case of fruits and vegetables are 34 and 44.6 per cent respectively. Grain inventory in central pool also incurs food loss when its usable life expires within warehouses, due to an inadequate delivery and distribution mechanism. Reducing food loss to such a scale would be an opportunity to add to farmers' income. To ensure that the infrastructure development is market linked, the planners can benefit from adopting an inverse approach, working backwards from consumption to farms (DFI-Committee, 2017).

[8] Chapter-4, Volume-II of the DFI report

B. Food Loss and Sustainability

The food that is lost and wasted, converts into greenhouse gases and has a direct impact on global warming, besides resulting in loss of water used during cultivation. On the basis of global food loss and waste (FLW), reported by FAO at 1.3 billion tons of physical loss, the equivalent in CO_2 emissions is assessed at 4.4 billion tons per annum. This raises acute concern that food loss and waste has a major contribution to climate change from greenhouse gases. Addressing food loss therefore also takes importance in context of environment sustainability.

Food loss is not necessarily due to lack of technology; a large quantum of food loss occurs from a lack of access to the national markets, resulting in localized surplus and discards in the hands of farmers. The answer to food loss, is market linkage and effective logistics. Especially in view of the fact, that many a time, there remains unfulfilled demand, while the surplus is discarded due to inability to connect with that demand.

C. Food Processing Industry

The Indian Food Processing Industry accounts for about 32% of the country's total food market. It has two segments in India – food and grocery retail (92%) and food service (8%). As of 2016, the food processing industry stood at $322 billion. The annual growth rate of the food processing industry during 2015-16 was 7% as compared to around 4.9% in agriculture and 8.06% in manufacturing. The food processing segment constituted 8.71% and 10.04% gross value added in manufacturing and agriculture sectors respectively in 2015-16 (MoFPI, 2014). Agro-processing infrastructure is key to bringing many agricultural outputs to markets and is another avenue for farmers to monetize their production. The food processing industry also helps in minimizing food loss by utilizing non-table variety produce and transforming it into consumer foods.

Figure 12: Gross Value Add (GVA) by Food Processing Industries

Economic Activity - FPI*	2011-12	2012-13	2013-14	2014-15	2015-16
GVA (in Rs. Lakh crore)	1.47	1.33	1.35	1.43	1.53
(%) Growth	1.18	-9.69	1.91	5.78	6.71

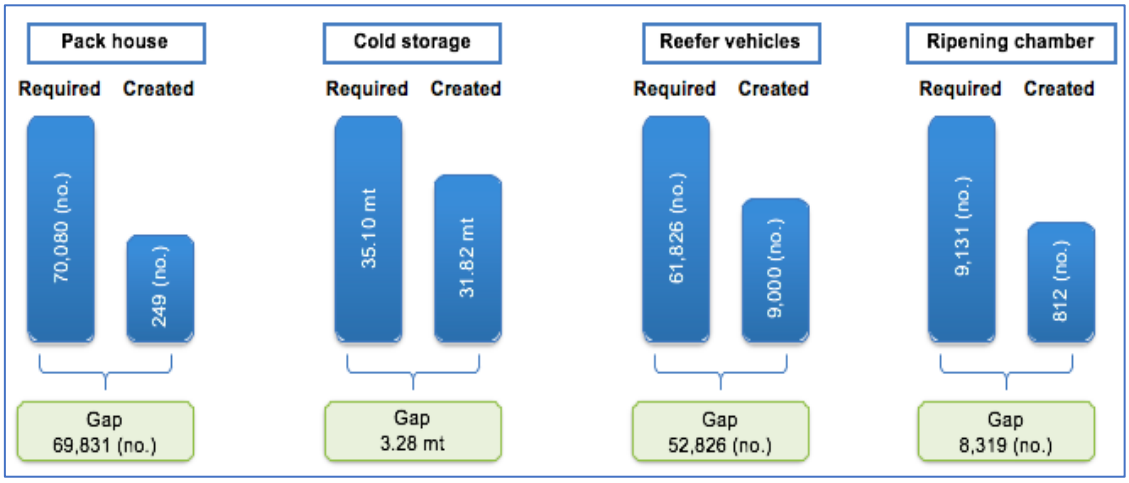
Source: MOFPI Annual Report, 2016

The infrastructure needs of individual processing units are both crop and procedure dependent, **while the common intervention of warehouses and transport, either dry or refrigerated, are a universally shared resource.** Various industrial processes are undertaken in processing units which may include multiple activities for milling, cooking, manufacturing, weaving or those that are preservative in function.

The immense growth in the food processing industry has created huge demand for efficient logistics, cold chain and transport solutions, and service providers. Higher investment in storage and transport capabilities can lower wastage levels, improve nutrient retention during storage and transportation and enhance shelf life of products. The share of processed food industry in the overall logistics stands at around 20-22%. However, the existing ecosystem is not equipped to handle the needs of the overall industry. The post-harvest losses are estimated to be 18% for fruits and vegetables and in the range of 3-6% for other categories.

As of December 31, 2017, there were 7,845 cold storages in the country. Around 10-11% of fruits and vegetables cultivated in India use cold storage due to the expense involved and lack of suitable facilities. In order to avoid post-harvest wastage, private sector agri-warehousing companies play a big role in bridging the gap in demand and supply of storage facilities. Agri logistics and warehousing would become an important sector for private sector investments given this gap. The gap in the agriculture logistics and warehousing facilities is provided below:

Figure 13: Gaps in Logistics and storage facilities



Source: The Ministry of Food Processing Industries

2) Investment Trends in Agricultural Logistics

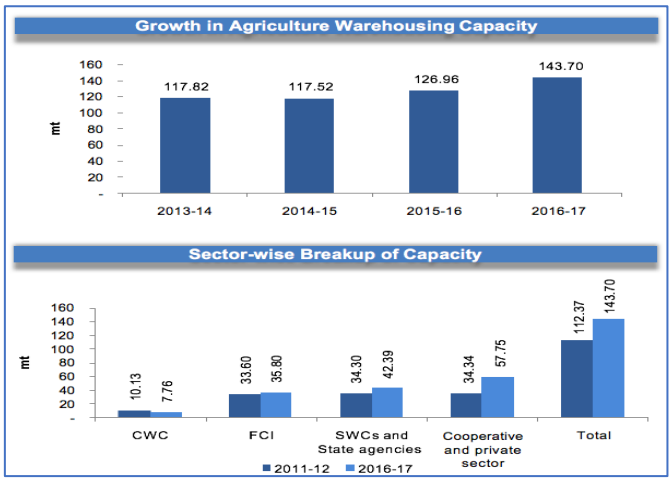
Till very recently, regulatory barriers had constrained the development of storage and processing infrastructure but measures like inclusion of agriculture warehousing under priority sector lending by RBI, subsidy schemes, tax incentives and the Warehousing Act (which will promote negotiability of warehousing receipts) have helped private players take an active interest in the same. The Private Entrepreneur Guarantee Scheme is one such initiative to incentivize private investment for construction of warehouses by private entrepreneurs, with a Food Corporation of India guarantee

to hire them for 10 years, assuring a fair return on investment by the entrepreneur (ICFA, 2011).

Foreign direct investment (FDI) of 100% in the storage and warehousing sector under the automatic route has also been permitted. In addition to this, the government has recently announced infrastructure status to the logistics industry. This decision will enable companies in the logistics and warehousing sector to access funds at lower cost, longer tenure and enhanced limits. Companies would now be accounting for lesser cash outflows due to debt and interest repayments in the initial years unlike earlier, as the debt financing can be taken with longer repayment tenure. It would also enable them to raise larger amounts of funds as external commercial borrowings (ECB), borrow longer tenure funds from insurance companies, pension funds, sovereign funds and also make them eligible to borrow from the India Infrastructure Financing Co. Ltd (IIFCL). Moreover, even the banks would be able to lend to this sector with lower provisioning requirements than earlier. The approval process also gets simplified. The Government of India has set out certain conditions that need to be met for a project to be classified under infrastructure status. The government has defined "logistics infrastructure" to include a multimodal logistics park comprising an Inland Container Depot (ICD) with a minimum investment of INR 50 crore and minimum area of 10 acres, cold chain facility with a minimum investment of INR 15 crore and a minimum area of 20,000 sq ft and/or a warehousing facility with a minimum investment of INR 25 crore and minimum area of 100,000 sq ft. Institutional players will not invest in unorganised and small warehouses; they generally invest or set up large warehouses and huge logistics parks. Currently, the new facilities that are being built by institutional players are generally of large sizes, bigger than the minimum requirements as specified above and hence, they would stand to benefit from the infrastructure status (Knight-Frank, 2018).

A. Agriculture Warehousing Trends and Investments

As per the Economic Survey 2017-18, the logistics sector is worth about $160 billion. Warehousing accounts for a 25% share of the Indian logistics market and is worth around $40 billion. Unorganised sector dominates the warehousing market, with 90% share. The size of Indian unorganised warehousing industry is estimated at around $36 billion. Agricultural warehousing involves the storage of agricultural products such as food grains, cereals, oil seed, sugar, pulses, spices, fruits and vegetables, etc. Between 2013-14 and 2016-17 the agricultural warehousing capacity has increased at a CAGR of 6.84% to reach 143.70 mt as of March 2017.The number of warehouses being registered with Warehousing Development and Regulatory Authority (WDRA) is a good indicator of the growth of organized warehousing in India. As of May 2018, 686 warehouses were registered with the WDRA.



Source: India Infrastructure research

State-wise, Rajasthan and Madhya Pradesh have the highest number of registered warehouses (over 160 warehouses each), followed by Gujarat (134 warehouses), Maharashtra (82 warehouses), among others. During 2016-17, 214 warehouses were registered with WDRA. The notified commodities under WDRA are agricultural commodities such as cereals, pulses, oilseeds and edible nuts and horticultural commodities such as apples, kinnow, date palm, turmeric and tamarind. In order to provide a boost to private sector participation and investments in the sector the government has several schemes. The key schemes are as follows:

1. **Private Entrepreneurs Guarantee Scheme.** To overcome storage constraints and ensure safe stocking of foodgrains across the country, the Government is implementing the Private Entrepreneurs Guarantee (PEG) Scheme for construction of storage godowns under PPP models through private entrepreneurs, Central Warehousing Corporation (CWC) and State Warehousing Corporations Guarantee (SWCs). Under the scheme, FCI gives a guarantee of 10 years to private investors and 9 years to CWC/ SWCs/State (PEG) Scheme Agencies. The scheme is in operation in 22 states. As on March 2018, capacity of 15.15 mt has been sanctioned for construction and 14.13 mt has been completed. Further 0.71 mt is under various stages of construction.
2. **Warehouse Infrastructure Fund:** A special window under Rural Infrastructure Development Fund (RIDF) with a corpus of Rs 20 billion to provide dedicated funds for the creation of a robust warehousing infrastructure in the country was announced in the Union Warehouse Budget of 2011-12. The objective of the scheme is to provide support for creation of scientific storage infrastructure and Infrastructureaccreditation of warehouses in rural areas; provide post-harvest liquidity to farmers; improve access of farmers to wider Fund (WIF) markets and support capacity building initiatives of stakeholders. As of December 2017, Rs 75.70 billion has been

sanctioned and Rs 40.55 billion has been disbursed out of allocation of Rs 100 billion. In the terms of projects, 3,489 projects (3.67 mt) have been completed, as against total sanctioned projects of 5,884 projects (8.76 mt).

3. **Food Processing Fund:** In November 2014, FPF with a corpus of INR 20 billion was set up in NABARD for providing affordable credit to food processing units in designated Food Parks. The scheme entails total allocation of INR 20 billion. As of December 2017, 14 projects have been sanctioned under the scheme and Rs 2.49 billion has been disbursed as loans.
4. **Plan Scheme for construction of storage godowns.** The Department of Food and Public Distribution is implementing a plan scheme for construction of godowns with focus on augmenting capacity in the north-eastern region. Under the Scheme, funds are released to the FCI in the form of equity for land acquisition and for construction of storage godowns, and related infrastructure like railway sidings, electrification, installation of weighbridge, etc. While finalizing the scheme for 11th Five Year Plan, it was decided to expand the scope of the Scheme to States like Himachal Pradesh, Jharkhand, Bihar, Odisha, West Bengal, Chhattisgarh, Maharashtra and Lakshadweep for the purpose of construction of godowns.

B. Major Public and Private Players in the Agriculture Warehousing Space

Warehousing in agriculture is part of the larger agricultural ecosystem. Just like agriculture, the warehousing market is local, unorganised, and fragmented. Major public players are – Food Corporation of India with a capacity of 33.65 mt and Central Warehousing Corporation with a capacity of 10.18 mt (as of March 2018). Large, organised corporate entities have entered this market in the past decade, and many are growing rapidly. They offer better quality services, have better internal systems and processes and can make greater capital investment into the business. Over time, market consolidation is likely to occur along segments.

Details of Few Key Private Players in Agricultural Warehousing

Players		Warehousing	Logistics	Processing	Retailing	No.	Capacity
Standalone storage provider	Sohan Lal Commodity Management Private Limited	Storage and allied services				2,835	9.30 mt*
	National Bulk Handling Corporation Limited	Commodity and Collateral Management				3,000	58 mt
End-to-end logistics provider	National Collateral Management Services Limited	Storage and allied services Multi-modal supply chain services				300	1.85 mt
	StarAgri Warehousing and Collateral Management Limited	End-to-end management of supply chain				800	1.5 mt
Leverage assets	Shree Shubham Logistics Limited	Storage and allied services		Processing and retailing spices and dry fruits		149	9.39 million sq. feet
Captive Logistics	Adani Group	Manage entire supply chain for fresh fruit starting from procurement, storage, logistics and ripening				-	150,000 sq. m

*includes cold storage capacity
Source: Respective Companies

Source: Respective Companies, based on primary discussions

3) Socio-economic benefits

Employment

Based on a recent study on the logistics sector, the overarching INR 14,19,000 crore logistics sector in India will create 3 million new jobs between 2018 – 2022. The breakdown of these jobs is given below (TeamLease, 2018):

- Road Freight will account for 1.89 million new, potential, logistics jobs (63% of all potential jobs in the sector)
- Rail Freight (40K incremental jobs), Waterways (450K incremental jobs), Air Freight (400K incremental jobs) and Warehousing (120K incremental jobs) will contribute a million more jobs over the next 4 years
- Courier Services will create 60K incremental jobs and Packaging will create 40K incremental jobs, over 2018 – 2022
- Developing and optimizing logistics infrastructure across the country will result in a pan-India distribution of the 3 million new, incremental, jobs
- Delhi-NCR, Mumbai, Chennai and Bangalore will generate 1.74 million incremental and Kolkata, Hyderabad and Pune, together, will contribute 682K incremental jobs

Furthermore, as per the governments report of the committee on Doubling Farmer's Income (2017), additional investment in the cold storage investment has the potential of producing approximately 30,47,900 jobs:

Infrastruc-ture Item	All India Required	Manpower per unit (est)	Total Manpower	Remarks

Modern Pack-houses	70,000	40	28,00,000	In operation, pack-houses functioning requires workers for sorting, grading, washing, packaging and material handling. Additionally, will have a technical hand to operate and maintain machines. Depending on produce handled, the total team size can range from 25 to 60 persons.
Reefer Trucks	62,000	3	1,86,000	Each reefer vehicle on long-haul mode operates with 2 drivers and 1 helper. There will also be need to maintain the vehicle prime mover and the reefer unit, which is expected to be covered by the technician at the integrated pack-house and at service stations.
Cold Store (Bulk)	650	6	3,900	Cold store (Bulk) typically operates with a warehouse manager, records keeper, technicians and security. During loading period, temporary handlers are used on contractual basis, also provided by farmers. Over the long holding period, less workers are needed.
Cold Store (Hub)	360	50	18,000	Cold store (Hub) has daily material handling and needs staff to manage inventory and equipment, maintain records, handlers, fork lift operators, etc. For heavy handling periods, logistics

				operators use outsourced handlers.
Ripening Units	8,000	5	40,000	A ripening unit has daily material handling and bulk of workers is for loading and offloading from transport and chambers. A technical operator and records keeper is also employed.
Last-mile distribut-ion	-	-	-	Small vehicles for last-mile delivery, retail shops and street carts form this segment. An estimation of numbers not made. However, approx. 2 million food and retail outlets exist and an average of 2 persons per outlet may be estimated.
			30,47,900	

Case Study 1: Nangal Chaudhary Multi Modal Logistics Park

The Cabinet Committee on Economic Affairs, chaired by Prime Minister Narendra Modi has given its approval to the following proposal of the Department of Industrial Policy and Promotion-

a. Development of Freight Village, an Integrated Multi Modal Logistics Hub (IMLH), Nangal Chaudhary, Haryana on 886.78 acres of land to be implemented by the project Special Purpose Vehicle (SPV) in two phases.

b. Financial sanction of Rs. 1029.49 crore for development of Phase I and in principle approval for development of Phase II of the project. Expenditure on Phase I comprises cost of entire land at Rs. 266 crore including cost of the land to be used for development of Phase II.

c. Investment of Rs. 763.49 crore by National Industrial Corridor Development and Implementation Trust (NICDIT) which includes of Rs. 266 crore as equity and Rs. 497.49 crore as debt in the SPV; and

d. Bidding for trunk infrastructure development by SPV on EPC basis;

Impact: The project has enormous economic value in terms of direct and indirect benefits and multiplier effects on the economy. The economic benefits of the project will include creation of employment, reduction in fuel costs, boosts to exports, reduction in vehicle (trucks) operating cost, reduction in accident related costs, increase in collection of taxes by the State Government, reduction in pollution, etc.
The proposed development of a Freight Village as Multi Modal Logistics Hub is estimated to generate over **4000 direct and 6000 indirect employment**. Job creation will not be limited to core logistics facilities but would also entail opportunities for entire logistics supply chain.

Case Study 2: Private participation in agriculture warehousing: SSL and RSWC Partnership

Most 'scientific' warehousing in India is in the Government sector. These were developed in response to the Green Revolution, under FCI, CWC and SWCs, during the 60s-80s. However, over the years, they have suffered from inability to keep up with demand and lack of maintenance. Most do not qualify for Warehouse Receipts for improved cash flow. Public-Private Partnerships and private provisioning of warehousing are viewed as the way forward. RSWC (Rajasthan) is one example (Raghuram, 2018).

Shree Shubham Logistics Ltd.[9] is among the foremost warehousing companies to enter in a Public Private Partnership in the agricultural warehousing and agricultural-logistics sector with its first of kind partnership with the State enterprise Rajasthan State Warehousing Corporation (RSWC). SSL has signed an MOU with the Rajasthan State Warehousing Corporation (RSWC), for management & operations of its warehouses under 38 Locations in the state of Rajasthan.

The SSL-RSWC Partnership Advantage: SSL has upgraded and computerised the RSWC warehouses with electronic weigh bridges of 60/100 MT each, modern testing & certification laboratories, and other infrastructure facilities. This has resulted in better storage for an efficient warehousing system (Shree Shubham Logistics, n.d.).
Key impact of private sector participation owing to management and operations (Shree Shubham Logistics, n.d.)**:**

[9] More information can be found at: https://www.ssll.in/RSWC.php

1. **Warehouse management system:** All the 38 RSWC locations are computerized and connected to RSWC head office.
2. **Approval for Warehouse Receipt Based Financing:** MMLP has been approved by the Public-Sector Undertaking (PSUs), Banks and Financial Institutions to provide the Warehouse Receipt based Financing.
3. **Increasing Revenues:** Since the last 8 years, the revenues of RSWC warehouses has risen threefold
4. **Increase in Income:** Income from diversified activities has increased by approximately 4000%
5. **Accreditation by NCCL:** Most of the RSWC locations are accredited by National Commodity & Derivatives Exchange Limited (NCCL), as delivery centers for various commodities traded on the electronic commodity exchange platform.
6. **Dedicated team to manage operations:** SSL has deployed team of over 200 people to handle and manage operations at all the 38 RSWC warehouses.
7. **Significant Savings:** Significant savings in expenses since taking over of locations under MoU
8. **Threefold increase in Pre-tax Profits:** More than threefold increase in pre-tax profits

4) Political Economy Challenges

Warehousing

Information asymmetry

1. Insufficient information on a warehouse leaves its users unable to judge the value of receipts issued by that warehouse. From a lenders' perspective, the current market comes with risks relating to both the structure of the warehouse (for example its resilience to floods), as well as its management (leading to risks such as theft or fraud). From a depositors' perspective, there is no way to ascertain and ensure that the goods are stored safely and maintained in both quality and quantity (WDRA, 2015).
2. Information asymmetry is also hampering private participation in the segment. The private sector participants are not getting competitive rentals as the government offers storage spaces at low prices (WDRA, 2015).

Inadequate nationwide enforcement and regulation

3. State laws containing legal consequences for offences committed under them vary from state to state, and are applied inconsistently across the country. As a result, there is no national standardization for warehouse regulation and enforcement. Market participants must therefore rest heavily on contractual processes (that are devoid of any statutory backing) to detect violations, impose penalties and adjudicate disputes.

Non-uniform distribution of warehousing facilities

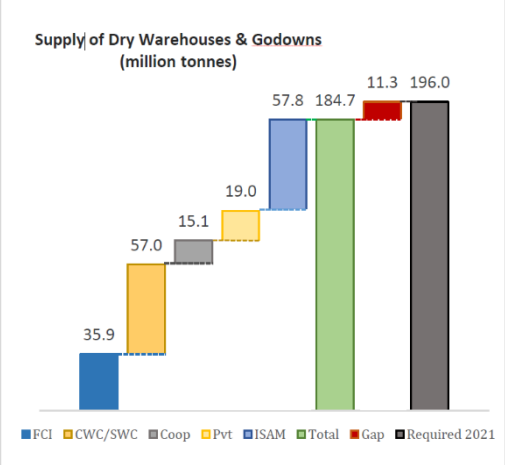
Around 69% of the storage capacity is concentrated in seven major procuring states. Furthermore, the storage capacity available with state agencies is primarily used for keeping central stock of food grains for buffer stock, public distribution systems and other government schemes. This consequently leaves marginal capacity for other players to store their produce. Food grain (mainly wheat and rice) is the main commodity stored, while the other major crops storable in godowns include oilseed, spices and cotton. Although the government has started focusing on building storage capacity through various schemes, the emphasis is still largely on the storage of wheat and rice, which are considered as staple food in the country.

Lack of infrastructure support facilities

Lack of supporting infrastructure like power and specialized transportation to carry goods to and from the warehouses leads to increase in the operating costs, making it unviable for the warehousing company. Absence of these facilities leads to concentration of storage capacities in well- connected areas, while those areas devoid of these facilities lag behind by a huge margin. Besides this, lack of efficient logistic management leads to wastages.

Growing prospects of food grain demand.

Estimates by the National Institute of Agricultural Economics and Policy Research (NIAP - ICAR) reports that foodgrain demand will reach 281 million tonnes by 2020-21,[10] a need for approx. 196 million tonnes of warehousing (about 70 per cent of production) is frequently projected.



In addition to capacity under FCI, Central and State agencies, 65.9 million tonnes of new capacity has been sanctioned since 2001, under the **Integrated Scheme for Agricultural Marketing (ISAM),** of which about 58 million tonnes is the new capacity created as of 31 March 2017. An estimated 7 million tonnes in new capacity remains under construction.

A large share of the warehousing capacity is for use of central and state procurement agencies. The storage capacity includes storage of type 'Cover and

[10] 179 tonnes for direct household consumption and 102 tonnes in indirect demand like fodder, seed, industrial use, etc.

Plinth' (CAP), besides covered warehouses and/or silos. CAP storage is more liable to incur losses and upgradation is required.

The storage with FCI, and a part of warehousing capacity with the CWCs and the SWCs is used for storage of foodgrains procured for Central Pool. The capacity under FCI comprises 15.43 million tonnes owned by FCI, and the balance is hired from private sector, CWC, SWC and state agencies. As on February 2017, the total capacity available for storing Central Pool Stocks was 77.625 million tonnes, with average utilisation of 66 per cent of capacity. This comprises covered godowns of 62.608 million tonnes and CAP storage of 15.017 million tonnes. The idle capacity, 34 per cent in February, would vary through the year, depending on the cyclic procurement and release patterns.

Cold Chain

The AICIC report[11] was the first scientific assessment to evaluate the status of the entire chain of logistics for perishable crops. The study segregated the infrastructure on the basis of categories and from a supply chain perspective. The evaluations were made backwards from 'Fork-to-Farm' for short holding life produce, and in case of long holding items, it assessed the need for storable surplus.

This study highlighted far larger gap remained in the form of village level modern pack-houses, refrigerated transport units and ripening units. The lack of allied infrastructure components left the cold stores for the use of a limited number of produce types. Notwithstanding the world's largest capacity in refrigerated warehouses, India was falling far short of integrating the cold-chain.

Inefficiencies in Infrastructure

The essential activity of physically transporting the farm produce to buyers' destination was largely left to individual commercial interests, which has then developed in a fragmented fashion. Neither was attention paid to provision of farm-gate or village level centres, in the hands of the farming community, to aggregate and prepare the produce for subsequent post-production market linkage.

The private sector participation in agribusiness trade also developed, given the opportunities from government's initiatives as well as the near perpetuity of demand for food and agri-based products. However, the various control orders to regulate and manage the market, did not allow more holistic and larger private enterprise to develop infrastructure for all aspects of agricultural produce in the country.

Integration in the logistics chain

[11] All India Cold-chain Infrastructure Capacity - Assessment of Status & Gap

A farmer cannot sell to the end-consumer and the linkage to the primary consumer is short, usually via the nearest mandi. The procurement by processing units is more efficiently linked to consumer demand as they are usually better organised, with their capacity linked to their marketing capabilities and retail channels. In effect, a pull mode from the market is serviced, which translates into the procurement strategies of traders and processing units. The farmers' growth is hereafter linked to the market growth of processors. This vertical integration is increasingly organized, especially for crop types, with long holding capability and simpler to handle and manage in the post-harvest stage.

The 'difficult' crop types - those that are more perishable and sensitive to handling - need special logistics and this may have deterred equal interest from large players, except a few in the last decade. The expected scale of private sector involvement has been slow to develop in post-production activities in perishables.

To strengthen the marketing reach of the farmers producing perishable food, cold-chain is needed, lack of which is a major inefficiency. The cold-chain has an empowering impact if developed as an agriculture logistics mechanism, in allowing the farmers to safely convey the value as harvested into a choice of markets. The cold-chain is a market channel that allows the harvest to access far away demand, and greater development of the relevant infrastructure is needed.

4) Sectoral Outlook

As per official estimates, the processed food market is expected to grow to $543 billion by 2020 at a CAGR of 14.6%. The government is making all efforts to encourage investments across the value chain. The Ministry of Food Processing Industries has been implementing several schemes under the umbrella of the Pradhan Mantri Kisan Sampada Yojana. These schemes, with an allocation of $900 million for the period 2016 to 2020, are expected to leverage investments of $5 billion for development of infrastructure in the food processing sector.

The Ministry is presently assisting 238 cold chain projects in the country under the Scheme of Integrated Cold Chain and Value Addition Infrastructure. These projects entail cold chain capacity of about 7.6 metric tonnes. Of the 238 cold chain projects, 133 have been sanctioned till April 2018. GST implementation is expected to result in efficiencies in warehousing and logistics space, thereby reducing wastage in food industry. GST could reduce the logistics costs of companies producing non-bulk goods by as much as 20%, according to an estimate by CRISIL. The government 's increased focus on various schemes for providing better infrastructure facilities in the food processing sector will open up various opportunities for private investors. Global supermarket companies are looking at India as a major outsourcing hub. The government has helped by investing in Agri Export Zones (AEZs), mega food parks and providing easier credit.

The non-availability of core infrastructure such as high-tech controlled production facilities, grading and packaging units, cold chain logistics, warehousing and integrated processing units, besides an inefficient supply chain, poor transportation, and erratic power supply, are major concerns across the food value chain, which will see an upside in investments owing to the positive outlook (NorthStar, n.d.).

The warehousing segment for agriculture is exploring the idea of modern warehouses with better infrastructure to reduce storage losses. Though modern technology is being introduced in the warehouses owned/operated by private companies, the godowns operated by government agencies still have a long way to go. Following the success in domestic operations along with increasing confidence and depth of domain expertise and operational competency have emboldened agriculture-warehousing companies to look at the overseas markets to expand operations. The Indian Warehousing industry is estimated to reach a size of Rs 1,000 billion by 2023, growing at a rate of about 11% (WDRA, 2015). The agricultural warehousing accounts for 35% of the total warehousing market. Based on this, the agricultural warehousing market in India is slated to reach Rs 363 billion by 2023.

5 Conclusion

OPM conducted literature review, secondary data analysis, and key informant interviews to understand sectoral outlooks, investment trends, and socioeconomic impacts of private investment. Our literature review offers a range of econometric modelling approaches that can be taken up when data is available. While our initial econometric data analysis did not offer robust results, the exercise highlighted the fact that there is a need to review data availability around investment-linked poverty and growth impact. A revised version of sectoral employment multipliers would also be important to understand employment linkages between sectors.

Based on OPM's subsequent analysis, the choice of sectors analysed included sectors that have seen primarily public sector investments, as well as last mile and small infrastructure. This includes renewable energy, education, affordable housing, urban waste management, agricultural logistics and warehousing. Our key informant interviewees across all of these sectors highlighted specific policy and regulatory considerations that bolster or hinder private investment.

While **renewable energy** is increasingly becoming a preferred asset class because of falling solar tariffs, and improvements in wind technology, debt costs remain high, and subnational political economy challenges remain problematic. **Affordable housing** is only recently being seen as a separate subsector, and the market has started seeing it as a distinct investment category. Our primary and secondary research suggest that the financing needs to be developer focused, in order to market based private entities to flourish.

For the **education sector**, there is evidence to suggest strong correlation between public investment in education, child development and empowerment. Six of the states that have relatively spent more on education have seen a decrease in spending (from 16.05% to 13.52%) between the years 2014-15 and 2019-20, therefore suggesting a lag between actual public expenditure and the suggested spending allocation as per the New Education Policy. Existing private sector investment ranges from donors who are looking to reach to the lowest income populations without financial returns to their investment and second, finance-first investors who target middle and upper-class population with a motive for profitable financial returns. Given the high returns (to lifetime income) of higher education, there are potential subsectors for investors to look into.

Urban waste management, on the other hand, remains a sector that still sees limited private sector investment across several subsectors (such as e-waste, plastic waste). This is mostly due to high up-front capital costs, insufficient project revenues, and technology mismatch. There are multiple avenues for both private investment and PPPs, depending on the type of subsector (for example: e-waste, solid waste, waste-to-energy, plastic waste, recycling).

The processed food market is expected to grow to $543 billion by 2020 at a CAGR of 14.6%. The government is making all efforts to encourage investments across the value chain for **agricultural logistics and warehousing**, including inviting private sector participation. The government ‘s increased focus on various schemes for providing better infrastructure facilities in the food processing sector will open up various opportunities for private investors across the chain. The post-harvest losses are estimated to be 18% for fruits and vegetables and in the range of 3-6% for other categories. There is a demonstrated shortage in cold-chain and warehousing units, and it is clear that the existing ecosystem is not equipped to handle the needs of the overall industry, opening up many avenues for private sector participation.

6 References

Ansar, A., Flyvbjerg, B., Budzier, A., & Lunn, D. (2016). Does infrastructure investment lead to economic growth or economic fragility? Evidence from China. *Oxford Review of Economic Policy*, 360-390.

Antonich, B. (2019, February 7). *Renewable Energy Investments Increased Five-fold Globally Over Past 15 Years*. Retrieved from IISD SDG Knowledge Hub: https://sdg.iisd.org/news/investment-in-renewable-energy-is-clean-but-in-transmission-and-distribution-technologies-not-necessarily/

Babar, K. (2015, July 31). Shapoorji Pallonji bags FDI deal in affordable housing from StanChart, IFC and ADB. *Economic Times*.

Bhattacharya, P., & Kundu, T. (2017, April 26). *How are state governments spending on education, health, and irrigation?* Retrieved from Live Mint: https://www.livemint.com/Politics/PGqjz0bMYX3uF2rZcIFd7H/How-are-state-governments-spending-on-education-health-and.html

Bill and Melinda Gates Foundation . (2010). *Next Generation Learning : The intelligent use of technology to develop innovative learning models and personalized educational pathways.*

BusinessWire. (2019, April 08). *India Waste to Energy and Waste Management Market: 2019-2025*. Retrieved from Business Wire: https://www.businesswire.com/news/home/20190408005577/en/India-Waste-Energy-Waste-Management-Market-2019-2025

Choudhary, A. (2017, May 11). World Bank's IFC to invest $200 million in HDFC. *LiveMint*.

(2012). *Committee on Encouraging investments in supply chains- cold storages- for more efficient distribution of farm produce.* Planning Commission.

D. Capital Partners. (2013). *Impact Investing in Education: An overview of the current landscape.* ESP Working Paper Series.

Das, M. B., Hall, G., Kapoor, S., & Niktin, D. (n.d.). *Indigenous Peoples, Poverty and Development Ch 6: India: The Scheduled Tribes.* Retrieved from http://siteresources.worldbank.org/EXTINDPEOPLE/Resources/407801-1271860301656/Chapter_6_India.pdf

Department of Industrial Policy and Promotion. (n.d.). Quarterly Fact Sheet: Fact sheet on Foreign Direct Investment (FDI) From April, 2000 to June, 2019. https://dipp.gov.in/sites/default/files/FDI_Factsheet_4September2019.pdf. Retrieved from https://dipp.gov.in/sites/default/files/FDI_Factsheet_4September2019.pdf

DFI-Committee. (2017). *Report of the Committee for Doubling Farmers' Income.* Ministry of Agriculture & Farmers' Welfare.

DFI-Committee. (2017). *Report of the Committee for Doubling Farmers' Income (Vol 3).* Ministry of Agriculture & Farmers' Welfare.

D'Souza, R. (2019, March). Housing poverty in Urban India: The failures of past and current strategies and the need for a new blueprint. *ORF Occasional Paper No. 187*.

Dunseith, B. (2017, April 19). *The Waste Management Industry in India: Investment Opportunities*. Retrieved from India Briefing: Dezan Shira and Associates: https://www.india-briefing.com/news/the-waste-management-industry-india-investment-opportunities-14032.html/

EY, A. . (2019). *The big "W" impact: effective management solutions in India.*

GIZ. (2014). *Sustainable Waste Management: Improving ecological, social and economic aspects of waste management.*

HUDCO/HSMI. (2016, April). Shelter. *Affordable Housing* .

ICFA. (2011). Agriculture Logistics and Warehousing. Indian Council of Food and Agriculture.

IDFC Institute. (2018). *India Infrastructure Report 2018: Making Housing Affordable.* Mumbai.

India Brand Equity Foundation . (2019, August). *www.ibef.org*. Retrieved from https://www.ibef.org/industry/education-presentation

India Brand Equity Foundation. (2019, April). *Renewable Energy Industry in India*. Retrieved from India Brand Equity Foundation: https://www.ibef.org/industry/renewable-energy.aspx

India spend. (2019, September 10). Retrieved from https://www.business-standard.com/article/economy-policy/can-india-s-education-budget-fund-increased-spending-in-new-policy-119091000108_1.html

International Energy Agency. (2018). *World Energy Investment 2018.*

International Energy Agency; International Renewable Energy Agency; United Nations Statistics Division; World Bank; World Health Organisation. (2019). *Tracking SDG 7: The Energy Progress report 2019.* Washjngton DC: World Bank Group.

Invest India. (2019, May 30). *Renewable Energy*. Retrieved from Invest India: https://www.investindia.gov.in/sector/renewable-energy

IRENA. (2019). *Renewable Energy and Jobs- Annual Review 2019.* IRENA.

Jha, R. (2015, May 21). *Education and Employment: The big push needed for India's youth*. Retrieved from World Bank blogs : https://blogs.worldbank.org/jobs/education-and-employment-big-push-needed-india-s-youth

Knight-Frank. (2018). *India Warehousing Market Report.*

LiveMint. (2019, July 29). PNB Housing Finance raises around Rs 690 crore from IFC. *LiveMint*.

Lucy Oates, A. S. (2018). *Reduced waste and improved livelihoods for all: Lessons on waste management from Ahmedabad, India.* London and Washington, DC: Coalition for Urban Transitions.

Mendiratta, P., & Gupt, Y. (2015, March 10). Private Returns to Education in India bu Gender and Location: A Pseudo-Panel Approach. *Arthaniti 12*, pp. 48-69.

Ministry of Housing and Urban Affairs. (2017). *Public Private Partnership Models for Affordable Housing.*

Ministry of Housing and Urban Affairs. (2019). *Annual Report 2018-2019.*

Ministry of Housing and Urban Poverty Alleviation. (2015). *Pradhan Mantri Awas Yojana - Housing for All (Urban) Scheme Guidelines.*

Ministry of New and Renewable Energy. (2018, December 10). Year End Review 2018-MNRE. Delhi: Press Information Bureau.

Mitra, A. (2019). Retrurns to Education in India: Capturing the heterogeniety. *Asia & the Pacific Policy Studies/ Volume 6, Issue 2*.

Mitra, A. (2019). Returns to education in India: Capturing the heterogeneity. *Asia and the Pacific Policy Studies*, 151-169.

MoFPI. (2014). *Task Force for Cold-chain Projects: Ministry of Food Processing Industries (MoFPI).*

Nanda, P. K. (2019, July 06). *Live Mint*. Retrieved from https://www.livemint.com/budget/news/budget-2019-education-sector-gets-94-854-crore-research-gets-leg-up-1562338619002.html

NCCD-NABCONS. (2015). *All India Cold-chain Capacity Assessment- Status and Gaps.*

NHB. (2014). *All India Cold Storage Capacity and Technology- Baseline Study.*

Nishith Desai Associates. (2018). *Investment in Education Sector.*

NITI Aayog. (2018). *Strategy for New India @75.*

NITI Aayog: Government of India. (19 December, 2018). Strategy for New India @2022.

NorthStar. (n.d.). *http://www.northstar-consulting.co/ip-foods-beverage.html*. Retrieved from Food and Beverages: http://www.northstar-consulting.co/ip-foods-beverage.html

Pandit, V., & Tamhan, T. (2017). *Impact investing: Purpose-drive finance finds its place in India.* McKinsey.

Pillay, A. (2019, August 19). *NTPC plans to spend Rs 20,000 cr on 5,000-Mw ultra mega solar park in Kutch*. Retrieved from Business Standard: https://www.business-standard.com/article/companies/ntpc-plans-to-spend-rs-20-000-cr-on-5-000-mw-ultra-mega-solar-park-in-kutch-119081900992_1.html

Press Information Bureau, Government of India, Ministry of Finance. (2018, October 11). *World Bank's Humna Capital Index released*. Retrieved from https://pib.gov.in/Pressreleaseshare.aspx?PRID=1549460

PTI. (2019, April 03). *Economic Times*. Retrieved from https://economictimes.indiatimes.com/jobs/e-waste-sector-will-create-half-million-jobs-in-india-by-2025-ifc/articleshow/68708339.cms

PwC. (2012). *India: Higher education sector Opportunities for Foreign Universities.*

Raghuram, G. (2018). *Improving Logistics in India: The Swift Way.* IIM Bangalore.

Rajan, A. T., Koserwal, P., & Keerthana, S. (2014). The Global Epicenter of Impact Investing: An Analysis of Social Venture Investments in India . *Journal of Private Equity*.

Raman, S. (2019, January 25). *What Budget 2019 can do to raise India's plummenting quality of school education*. Retrieved from IndiaSpend: https://www.indiaspend.com/what-budget-2019-can-do-to-raise-indias-plummeting-quality-of-school-education/

Ravi, S., Gustafasson-Wright, E., Sharma, P., & Jones, I. (2019). *The Promise of Impact Investing in India.* New Delhi: Brookings Institution India Center.

Sandhu, K. P.-H. (2017). Between Hype and Veracity: Privitization of Municipal Solid Waste Management and its Imapcts on the Informal Waste Sector. *Waste Management*, 545-556.

Sarangi, G. (2018). Green Energy Finance in India: Challenges and Solutions. *ADBI Working Paper*.

Shree Shubham Logistics. (n.d.). Retrieved from Shree Shubham Logistics: https://www.ssll.in/RSWC.php

Sikdar, S. (2019). Rate of Return to Education in India: Some Insights. *NIPFP Working Paper Series No. 270*.

Sree Ram, R. (2018, December 26). *India renewable energy sector awaits a reboot*. Retrieved from Live Mint: https://www.livemint.com/Money/gczJsMignHqSXYg3F7iexI/India-renewable-energy-sector-awaits-a-reboot.html

Swaminathan, M. (2018). How Can India's Waste Problem See a Systemic Change? *EPW*.

Tariyal, P. (2016). Industry Specific Multipliers to Identify Key Industries of Indian Economy. *Global Journal of Human Social Science: Economics*.

TeamLease. (2018). *Indian Logistics Revolution - Big Bets, Big Jobs.*

Tilak, J. B. (2010, May 24). *The Hindu*. Retrieved from thehindu.com: https://www.thehindu.com/opinion/lead/Public-private-partnership-in-education/article16303142.ece

UNICEF. (2015). *The Investment Case for Education and Equity.* New York: UNICEF.

Watkins, K. (2015, July 7). *Why education is essential for growth*. Retrieved from World Economic Forum: https://www.weforum.org/agenda/2015/07/why-education-is-essential-for-growth/

WDRA. (2015). *Report on warehousing in India Study commissioned by the Warehousing Development and Regulatory Authority.* National Institute of Public Finance and Policy.

World Bank. (2017, September 26). World Bank warns of 'learning crisis' in global education .

ANNEX A

Sector	Name of Expert	Organisation
Urban/Housing	Shashanka Bhide	NCAER
Urban/Housing	D B Gupta	NCAER
Cross-sectoral	Dr. Poonam Munjal	NCAER
Housing	Ashvin Iyengar	Mahindra Housing
Urban/Housing	Ramesh Ramanathan	Janaagraha & Janalakshmi Finance Services & Janaadhar Urban Affordable Housing
Agriculture	Soujanya Krishna	Agriculture specialist, IFC
Education	Anurag Behar	Azim Premji Foundation
Renewable Energy	Arunavo Mukerjee	Tata Clean Tech
Cross-sectoral	Dhiraj Mathur	Partner, PWC
Renewable Energy	Dhruba Purkayastha	Climate Policy Initiative
Renewable Energy	Anjali Garg	Energy specialist, IFC
Cross-sectoral	Jun Zhang	Country Head-India, IFC
Cross-sectoral	Reuben Abraham	IDFC Head of Foundation
Cross-sectoral	Priyavrat Bhati	Centre for Science and Environment
Cross-sectoral	Mr Nagarajan	Formerly at the Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC)