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Human Resource and Skill Requirements in the
**Building, Construction and
Real Estate Services** Sector (2022)

– A Report



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Human Resource and Skill Requirements in the Building, Construction Industry and Real Estate Services

Study on mapping of human resource skill gaps in
India till 2022

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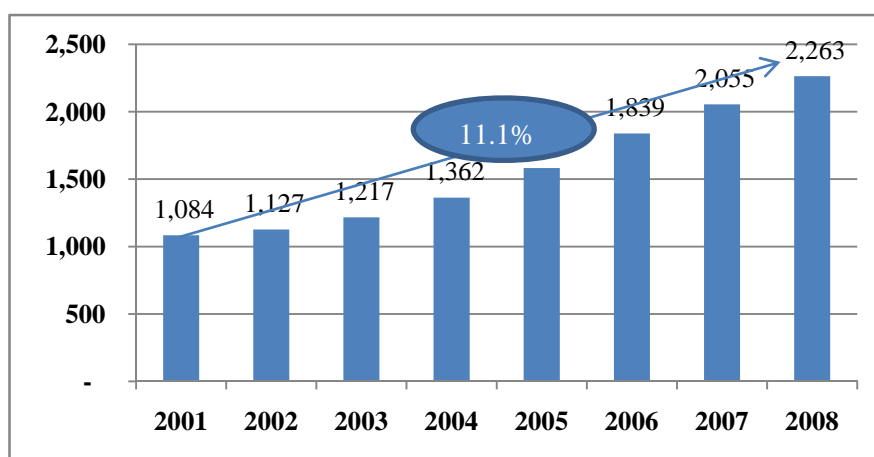
Environment Scanning and Competitiveness of Construction Industry

1.1. Industry size and Growth of Construction Industry

The size of the Construction industry is around Rs. 2.1 trillion¹ in 2008. The Construction sector in India is the second largest economic activity after agriculture and provides employment to about 33 million people. India's Construction industry has grown at a Compounded Annual Growth Rate (CAGR) of about 11.1% over the last eight years on the back of massive infrastructure investment and rapid rise in housing demand. Foreign Direct Investment (FDI) inflow into the sector during 2007-08 is estimated to be around Rs. 240 billion. Spending on infrastructure sectors such as ports, power plants and roads is projected at more than Rs. 2.5 trillion annually for the next six years, and will require 92 million man years of labour².

Construction investment accounts for around 52.4% of the Gross Fixed Capital Formation in India. Investments in Construction have a positive domino effect on supplier industries, thereby contributing immensely to economic development. The Construction sector has strong linkages with various industries such as cement, steel, chemicals, paints, tiles, fixtures and fittings. While in the short term it serves as a demand booster, in the long term it contributes towards boosting the infrastructure capacity.

Figure 1: Industry size and growth of Construction GDP at constant prices (Rs. billion)



Source: Economic Survey 2008-09 and IMAcS analysis

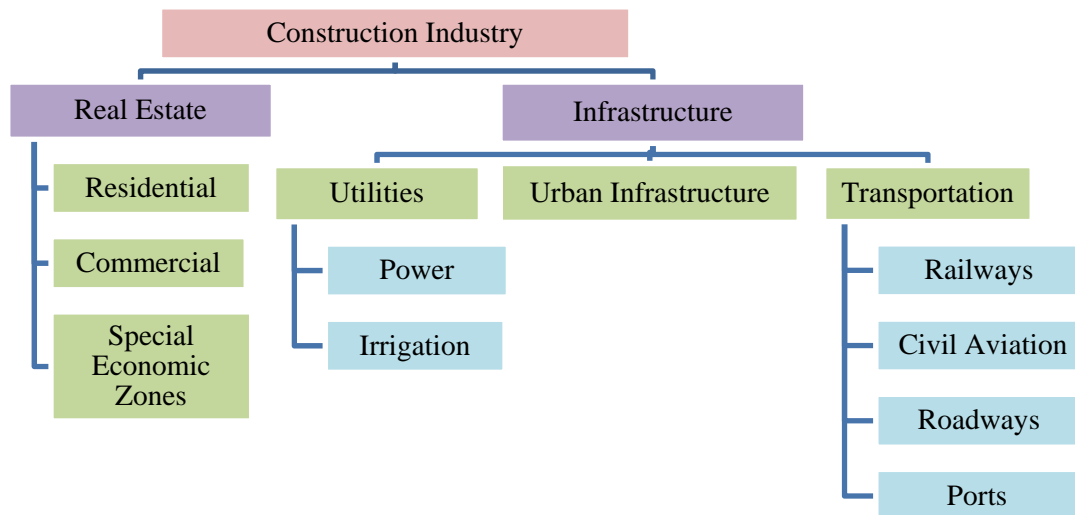
² Construction Industry Development Council

1.2. Industry Segmentation

Construction sector can be broadly classified into 2 sub-segments:

- 1) Real estate (Residential, Commercial/Corporate, Industrial and Special Economic Zones (SEZs))
- 2) Infrastructure (Transportation, Urban development, Utilities)

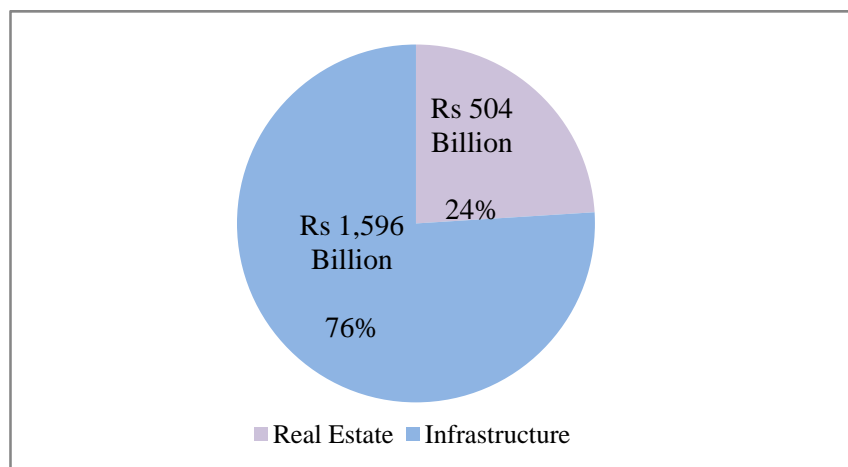
Figure 2: Indian Construction Industry Landscape



Source: IMAcS analysis

The Real Estate segment contributes around 24% to the Construction GDP of India while Infrastructure segment contributes around 76%.

Figure 3: Share of Real Estate and Construction by GDP contribution

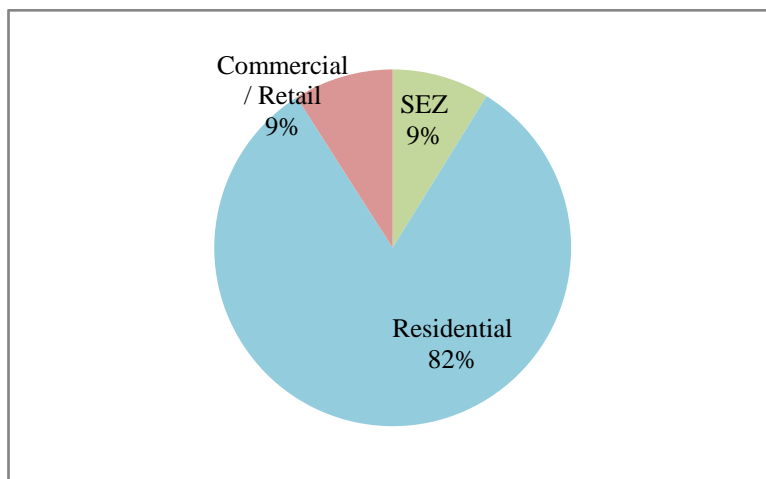


Source: Economic Survey 2007-08, IMAcS analysis

1.3. Real Estate Sector

In terms of GDP contribution, Real Estate sector is estimated at around Rs. 504 billion in 2007-08. The market size of the Indian real estate sector is estimated to be around Rs. 2,643 billion in 2007-08. The sector has been growing at a CAGR of 12%. It is constituted of the Residential, Commercial and real estate activities of Special Economic Zones.

Figure 4: Real Estate Segments

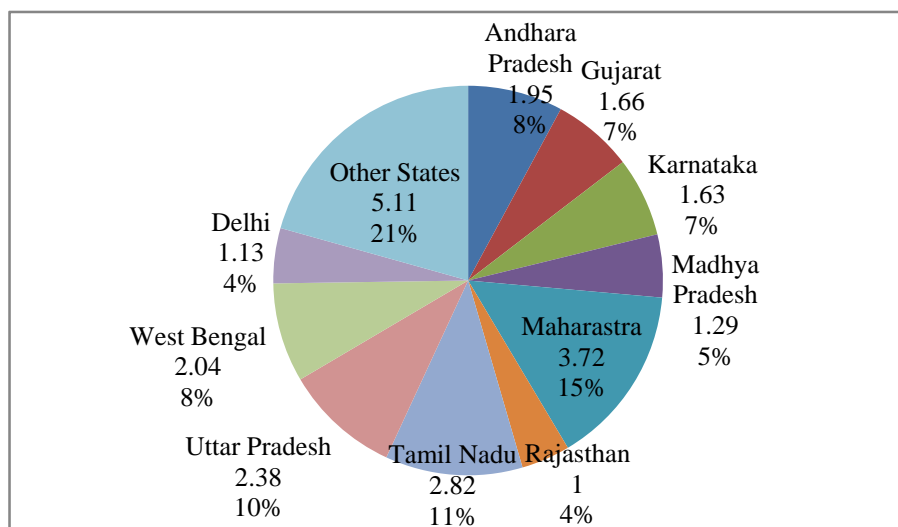


Source: I-Sec Research, Ministry of Commerce and Industry, IMAcS analysis

1.3.1. Residential

At around Rs. 2,171 billion, the housing sector is estimated to grow at 12% in the long term. Demand for housing is estimated to be around 4.8 million houses per year over the Eleventh Five Year Plan period. In addition to the need for new housing tenements, the demand is also likely to be fuelled by the housing shortages already prevalent in several states. The shortage of housing across several states, as illustrated in the graph below, amounts to about 25 million houses in the period of the Eleventh Five Year Plan.

Figure 5: Housing Shortage by State over the Eleventh Five Year Plan (million houses (% of share of various states))



Source: Planning Commission Working Group on Urban Housing, 2007

1.3.2. Demand drivers for Residential Sector

Favourable demographics - The demographics work strongly in favour of the Indian Construction industry. India is the second highest populated country in the world after China. India's estimated population as of March 2008 is 1.14 billion, while the average age of Indians is 26 years. The demographic profile indicates that India's working population forms around 61% of the total population. India is and will remain one of the youngest countries in the world for some time. The strong economic growth led to sharp income generation, which led to rise in middle class segment. India currently has around 260 million persons in the middle class segment. This segment's rising purchasing power and propensity to consume is expected to drive and support a robust growth rate of the economy in the coming years. The middle class along with robust macro-economic scenario and changing demographic profiles has a major role to play in the growth and emergence of the Construction industry in India.

Urbanisation and Migration - The decadal growth rate of urban population (20% between 1991-2001) in India is higher than the rural population (18% during the same period). Average annual rate of change (AARC) of the total population in India during 2000-2005 is estimated at 1.41% with 2.81% for urban and 0.82% for rural sectors. AARC for urban areas by 2025 will increase to 2.25% whereas the AARC for rural population will decline to -0.4% showing a clear shift of population from

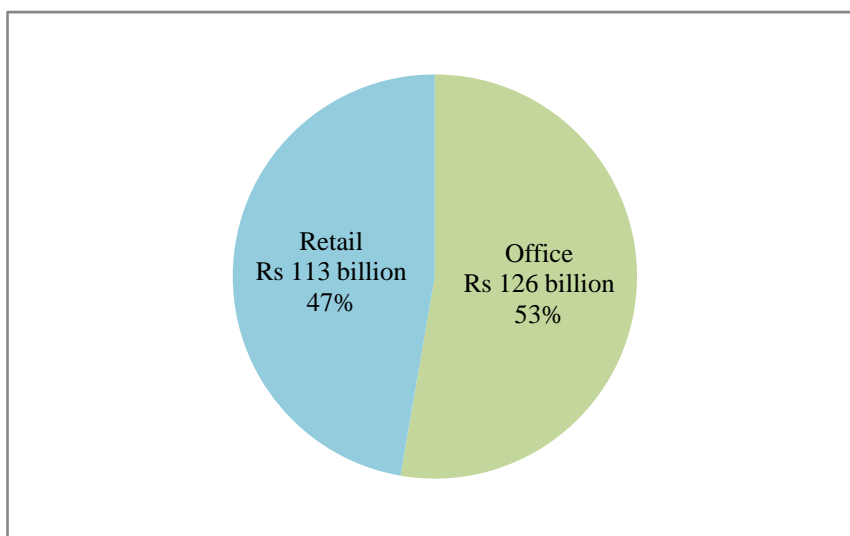
rural to urban areas³. The average household size has been estimated by the National Sample Survey Organisation as being around 4.47 in urban areas and only 67% of the houses are pucca units.

Though there is a slump in real estate activity in the last one year, investment over the long term will be primarily led by housing, which is expected to account for nearly 90% of the total real estate sector.

1.3.3. Commercial/Retail Construction

The rapid growth of the Indian economy has had a significant impact on the demand for commercial property to meet the needs of business, by way of offices, warehouses, hotels and retail shopping centres. Growth in commercial office space requirement is led by the burgeoning outsourcing and information technology (IT) industry and organised retail. For example, IT and ITES alone is estimated to require 150 million square feet across urban India by 2010. Similarly, the organised retail industry is likely to require an additional 220 million square feet by 2010⁴.

Figure 6: Size of Commercial/Retail Construction

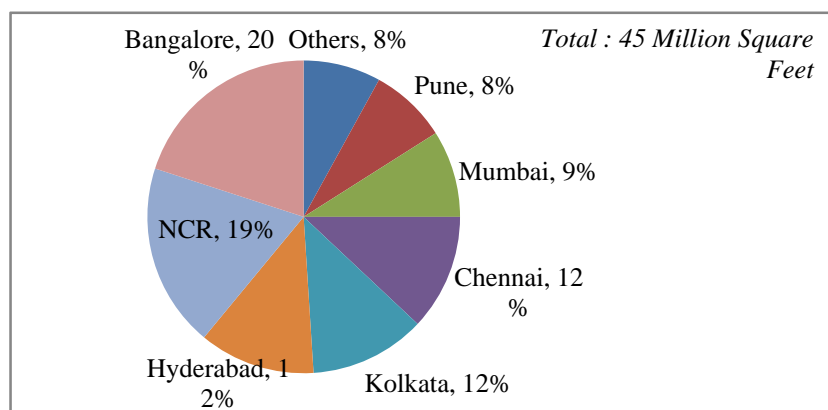


Source: I-Sec Research, Ministry of Commerce and Industry, IMaCS Analysis

³ Planning Commission – Working group on Urban Housing for the 11th Five Year Plan

⁴ Source: India Brand Equity Foundation (IBEF)

Figure 7: Commercial Office Space Absorption by location, 2007



Source: IBEF

1.3.4. Demand drivers for Commercial/Retail Sector

The following are some of the demand drivers in the Commercial/Retail Sector:

- Sharp growth in organised retailing – Organised retail, which is expected to grow at over 25% in the next few years, is likely to drive demand in the commercial real estate sector. Growth in IT/ITES sector at 30% annually - The investments in commercial Construction are expected to grow faster than investments in housing mainly due to the spurt in office space construction driven by IT/ITES industry.

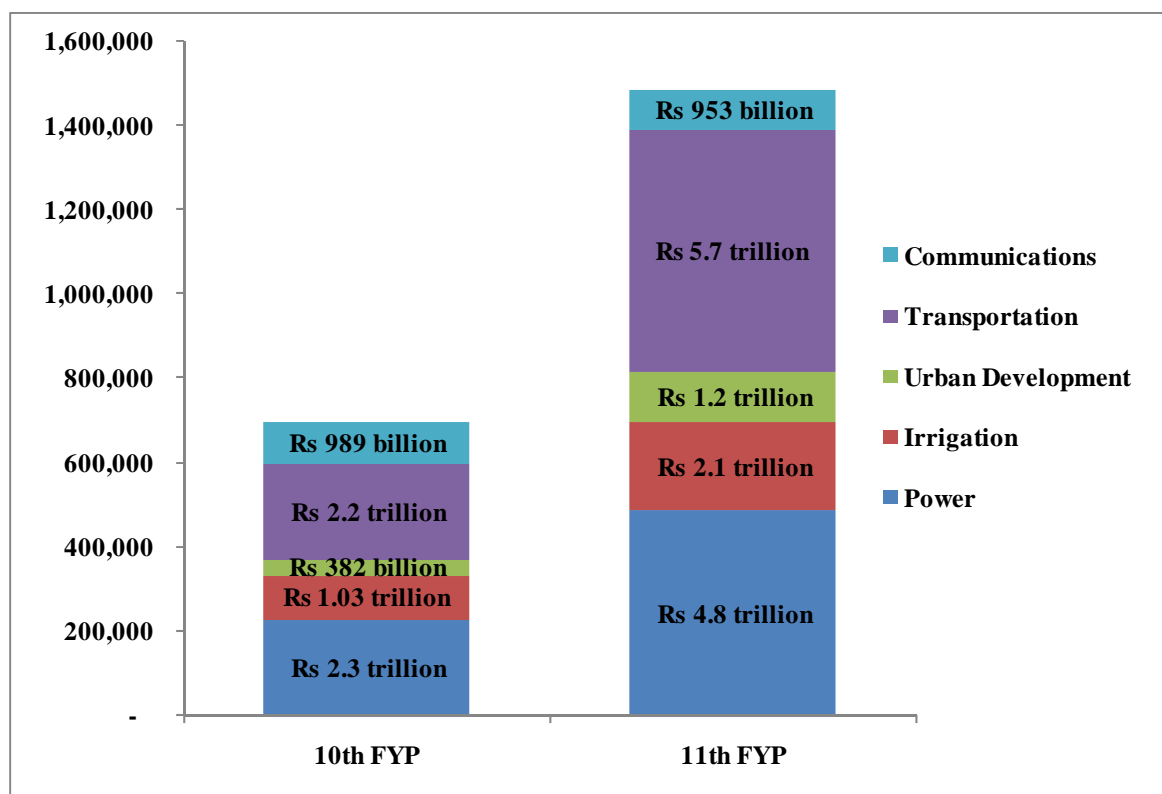
1.3.5. Special Economic Zones

Over the next five years, growth in investments in Indian Industry will be driven by strong capacity additions, led by strong growth in demand and high existing operating rates. Special Economic Zones (SEZs) will be at the forefront of this growth. About 315 SEZs which have been notified as of now, of which about 202 belong to the IT/ITES Sector.

1.4. Infrastructure

With the government's focus on infrastructure development along with the active participation of the private sector, this segment is growing rapidly. The Power, Irrigation, Transportation including Roadways, Railways, Airports and Ports, Urban Development and Communications sectors have witnessed investments of Rs. 6.9 trillion over the Tenth Five Year Plan (10th FYP) and will witness around Rs. 14.8 trillion in the Eleventh Five Year Plan (11th FYP).

Figure 8: Distribution of Outlay in Infrastructure Segments in Tenth and Eleventh Five Year Plans



Source: Economic Survey 2007-08

India's infrastructure is set to improve rapidly with an estimated CAGR of 15%. Public spending would continue to dominate this sector. The Government of India projects that for the economy to grow at 9% per annum over the Eleventh Plan period the Gross Capital Formation⁵ in the infrastructure should increase from 5% of GDP at the start of the Tenth Plan to around 9% at the end of the Eleventh Plan. The central government would contribute 37%, the state governments 32% and the private sector would contribute 31% of the total investments in infrastructure for the next five years.

1.4.1. Roads

Roads occupy an eminent position in India's transportation as they carry nearly 65% of freight and 85% of passenger traffic in the country. The Government of India in the Tenth Plan provided for an outlay of Rs.595 billion for development of roads. The largest highway project ever undertaken in the country is being implemented by the National Highways Authority of India (NHAI). Phase I and II of the National Highways Development Project (NHDP) envisaged 4/6 laning of about 14,279

⁵ Measure of the net new investment by enterprises, government and households in the domestic economy in fixed capital assets, during an accounting period

kilometres of National Highways at a total estimated cost of Rs. 650 billion (at 2004 prices). These two phases consist of the Golden Quadrilateral, the North-South & East-West Corridors, port connectivity and other projects. The upgradation of 12,109 km of existing national highways has been approved by the Government under NHDP Phase-III at an estimated cost of Rs. 806 billion.

The Government has also approved six-laning of 6,500 km of NHs comprising 5,700 km of the Golden Quadrilateral and balance 800 km of other sections of NHs under NHDP Phase-V at a cost of Rs. 412 billion. The Government has approved construction of 1,000 km of expressways with full access control on new alignments at a cost of Rs. 166 billion under NHDP Phase-VI and the construction of ring roads including improvement of NH Links in cities, grade separated intersections, flyovers, elevated highways, underpasses and service roads at a cost of Rs. 166 billion under NHDP Phase-VII.

One of the physical targets for state infrastructure in the Eleventh Five Year Plan is the construction of a core network would include expressways, four-laned roads, strengthened pavements, and pavements with good riding quality, bypasses, bridges, etc. for a length of about 71,500 km, with a financial outlay of about Rs. 80,000 crore covering the states. This network could be based on the 'corridor concept', such that a commercial vehicle can cover about 500 km on this network in one day (800 km or more on expressways) with adequate road safety.

Rural roads would also be an important thrust area The Government of India has launched the Pradhan Mantri Gram Sadak Yojana (PMGSY) which aims to provide good all-weather road connectivity to unconnected habitations.

1.4.2. Airports

India has 125 airports. Of these, 11 are designated as international airports. Airports Authority of India (AAI) has taken up the development of infrastructure in the country through the PPP model. Joint Ventures formulated for the modernisation of Delhi and Mumbai airports, and development of greenfield airports at Bangalore and Hyderabad are cases in point. AAI has also drawn an action plan to develop and modernise 35 non-metro airports. An investment of about Rs. 400 billion is projected for the development of airports during the Eleventh Five Year Plan.

1.4.3. Railways

The premier transport organisation of the country, the Indian Railways is the largest rail network in Asia and the world's second largest. However there is a need to upgrade facilities to meet the growing rail transportation needs. The proposed investment in railways over the eleventh five year plan is Rs. 2.8 trillion. PPP projects are estimated to account for 9% of total investment over the period to ramp up infrastructure in 22 metropolitan city stations, increase terminal capacity by 43% and construct 2,700 km of rail lines.

The Tenth Five Year Plan document had envisaged construction of Dedicated Freight Corridors (DFCs) on selected trunk routes. This has since been given effect to with the announcement of construction of DFCs separating freight traffic from passenger traffic on trunk routes. The proposal for capacity augmentation through construction of DFCs along the highly saturated freight routes is a part of the new long-term strategy to provide premium services in freight and passenger travel.

A Western Corridor of 1,469 km will connect Jawaharlal Nehru Port to Dadri and Tughlakabad in the North. An Eastern corridor of 1,232 km will connect Ludhiana to Sonnagar via Dadri and Khurja, thus facilitating transfer from one corridor to another. The Eastern corridor will further get extended to Kolkata region to connect the proposed deep-sea port. The estimated cost of construction of both these corridors is expected to be around Rs. 372 billion and it is likely to take about five years for completion of these corridors and have a spill-over beyond the Eleventh Plan.

1.4.4. Ports and Shipping

There are 12 Major Ports and 185 Minor Ports along India's 7,517 km long coastline. 100% FDI under the automatic route is permitted for all port development projects. PPP is seen by the Government as the key to improve the existing facilities. This sector would see Rs. 1 trillion investments on shipbuilding and port infrastructure development within the next 5 years.

The Eleventh Plan outlay for the shipping sector is Rs. 1,000 crore at 2006–07 prices. The sector is also expected to generate IEBR⁶ amounting to Rs. 12,285 crore at 2006–07 prices. In addition, the budgetary support for ship-building and repairs is Rs. 150 crore (Rs. 170 crore at current price). The IEBR for this sector is Rs. 550 crore at 2006–07 prices.

The total projected outlay for the Eleventh Plan for the Department of Shipping (including Ports) is Rs. 43,874 crore at 2006–07 price (Rs. 49623 crore at current price) which includes Rs. 4465 crore of

⁶ Internal & Extra Budgetary Resources

Gross Budgetary Support at 2006–07 price (Rs. 5,050 crore at current price) and Rs. 39409 crore of IEBR at 2006–07 price (Rs. 44573 crore at current price).

The Indian shipbuilding industry is centred around 27 shipyards comprising 8 public sector (6 yards under Central Government and 2 under State Governments) and 19 private sector shipyards. The shipyards between them have 20 dry docks and 40 slipways with an estimated capacity of 2,81,200 Dead Weight Tonnage (DWT). A major share of this capacity is held by the 8 public sector yards and only Cochin Shipyard Limited (1,10,000 DWT) and HSL (80,000 DWT) have the required infrastructure to build large vessels.

India's share in the world shipbuilding market has increased from an insignificant 0.1% in the beginning of Tenth Plan to 1.3% in 2006. On the export front, one public sector shipyard, that is Cochin Shipyard Ltd (CSL), and three private sector shipyards, viz., ABG, Bharti, and Chowgule performed remarkably well during the Tenth Five Year Plan period and were able to get export orders. The Indian Shipbuilders Association has estimated that the industry can grow at a rate of more than 30% and this momentum can be maintained for the next 10 years to reach a level of 5 million DWT order book for the Eleventh Five Year Plan as against 1.3 million DWT for the Tenth Five Year Plan.

1.4.5. Urban Infrastructure

India's total urban population is around 285 million, which is 30% of India's population. There has been significant growth of the urban population over the past decade and the trend is expected to continue. This warrants an urgent up-scaling and up-gradation of urban infrastructure. This sector is expected to be the second-largest contributor to infrastructure investments after roads.

Table 1: Urban Population in India

Year	1981	1991	2001
Number of metro cities (population-1 million +)	12	23	35
Population (million)	42	70	108
Percentage of total urban population	26	32	38

Source: Report of the Steering Committee on Urban Development, 11th FYP, Planning Commission of India

Urban Infrastructure covers basic civil services such as water supply, sewerage, solid waste management and urban transportation. Water supply and sanitation projects alone offer scope for

annual investment of Rs. 294 billion. Urban infrastructure investments will get a boost from the Jawaharlal Nehru Urban Renewal Programme (JnNURM). The programme was started in 2005-06 to enable sustainable urban infrastructure development of 63 mission cities. Under this scheme, the programme receives Rs. 500 billion as central assistance and Rs. 500 billion from state governments and urban local bodies. Rs. 3.3 trillion was allotted under the City Development Plans scheme. Some other notable schemes for urban development include the Rs. 28 billion sub-mission on infrastructure development scheme and the Rs. 11.7 billion additional central scheme. Currently, 100% foreign direct investment (FDI) under the automatic route is allowed in townships, housing, built-up infrastructure and construction-development projects. Urban transport development is currently supported by the National Urban Transportation Policy (NUTP).

1.4.6. Utilities (Power and Irrigation)

India has a power generation capacity of 122 GW. The sector has been growing at a Compound Annual Growth Rate of 4.6% over the last four years. India has the fifth largest electricity generation capacity in the world. The Ministry of Power has formulated a blueprint to provide reliable, affordable and quality power to all users by 2012. This calls for an investment of Rs. 3.7 trillion in the next five years.

The gross electricity requirement by the end of the Eleventh Plan projected by the Planning Commission Working Group on Power is 1,038 Billion Unit (BU) and peak demand estimation is 1,51,000 MW. To fulfil the estimated electricity demand requirement, the Working Group recommended the capacity addition programme initially of 78,530 MW and updated at 78,577 MW during the Eleventh Plan.

Table 2: Total Power Generation Capacity in India

Source	Central	State	Private	Total
Hydro	9685	3605	3263	16553
Thermal	26800	24347	7497	58644
Nuclear	3380	0	0	3380
Total	39865	27952	10760	78577

Source: Planning Commission, 11th Five Year Plan

The emphasis of the Central Government to improve irrigation facilities in the country through programmes such as Bharat Nirman, Accelerated Irrigation Benefit Programme (AIBP), and state-level initiatives will be the main driver of investments in the irrigation sector. The plan outlay under the Tenth Plan for irrigation sector was Rs. 922 billion. There is a renewed emphasis on this front

with states like Andhra Pradesh drawing ambitious plans. Increased focus on irrigation is evident from the fact that the Tenth Plan irrigation outlay was 50% more over the Ninth Plan. Investment in irrigation in the Eleventh Plan is projected to increase to Rs. 2,533 billion from Rs.1,115 billion spent in the Tenth Plan⁷.

Apart from the above, Government spending on infrastructure activities for defence and other specialised construction would also be a demand driver for the sector.

1.4.7. Demand drivers for Infrastructure Sector

- Economic growth would be around 7% CAGR over next decade
- Increased domestic investments and foreign direct investment in sectors such as communications
- Government policies with a thrust on developing infrastructure and increased government spending on transportation, urban development and utilities.

1.5. Key Risk Factors for Construction Industry

- *Manpower Shortages* - Although the construction industry employs 33 million people, second only to the agricultural sector, the incremental workforce requirement is around four million people per year over the next seven years to sustain the current growth rate. The construction industry is set to face a challenge in terms of sourcing manpower. Adding to this problem is the shortage of contractors.
- *Procedural and Legal Vulnerability* - Development projects entail clearances and permissions from various government departments. Delays are tedious and vary from state to state depending on local laws. Hence this adds to overall complexities of transaction, increasing the need for local expertise in each market.
- *Low project risk, but high payment receivable risk* - The project risk for a contractor is low, due to low financial commitments. Most construction projects are executed on a cash contract basis and are funded and managed by the owner/sponsor. The number of construction projects with equity participation by contractors is limited to a few projects.. Payment security concerns are high, and they depend on the credit profile of the client. Usually outstanding payments and retention money payable to the contractor are delayed, as these payments are made after the entire construction activity and project period is completed. This may affect the smaller players in the industry.

⁷ Planning Commission, Government of India

- *Infrastructure Bottlenecks* - Infrastructure is a cause of concern in majority of cities across the country as recent infrastructure developments have been slow and has not kept in pace with the development. Inadequate power, absence of drinking water, electricity failure, traffic congestion and pollution are common features across the major cities in India. On the basis of current plans, electricity generating capacity will rise by 6% annually over the period 2007 to 2012, double the rate of the past five years and the second largest absolute increase in capacity in the world. However, this is still well below the likely growth rate of GDP. Power shortage could be an impediment to construction activities in the future.
- *High level of fragmentation* - The industry is highly fragmented, as the entry barriers are low due to less fixed capital requirements. It is estimated that in 2004, over 3 million construction entities (including housing contractors) existed, of which only around 28,000 were registered. However, there is more fragmentation in the housing segment than the industrial/infrastructure segment, as the unorganised sector accounts for 75% of the same. Furthermore, the industrial/infrastructure sector requires far more technical expertise and it is difficult for smaller players in the unorganised sector to compete effectively.
- *Title clearances for SEZs are invariably delayed* - Title clearance in India is a complicated process in the absence of a central database of properties. This also adds to the costs and delays in a project.
- *Delays in land acquisition*: Delays in land acquisition is a major source of project delays and escalating project costs. This is applicable to large infrastructure projects such as SEZs, power plants, and others.
- *Delays in Master Plan / Development Plan Review and Implementation* - Experience of implementing the Master Plans has not been encouraging because of weak data base, financial constraints, lack of resource mobilization, over ambitious plan proposals, lack of integration between spatial planning proposals with economic development plans and inadequate legislative support and enforcement.
- *Frequent and expensive reconstruction* - The maintenance requirement of the high density corridor of NHs under construction and post implementation support is provided by NHAI. However, the non-NHDP NH sections, which are maintained by State PWDs, are poorly managed, primarily because the funds made available to them for maintenance are well short of the requirement as per norms.

1.6. Market Structure of Construction Industry

The Construction industry is highly fragmented, as the entry barriers are low due to less fixed capital requirements. Reportedly, in 2004, over 3 million construction entities (including housing contractors) existed, of which only around 28,000 were registered⁸.

However, there is more fragmentation in the housing segment than the industrial/infrastructure segment, as the unorganised sector accounts for 75% of the same. Furthermore, the industrial/infrastructure sector requires far more technical expertise. Around 96% of construction companies are classified as small and medium enterprises.

1.7. Major Players

Post independence, in the First Five Year Plan, construction of civil works was allotted nearly 50% of the total capital outlay. The first professional consultancy company, National Industrial Development Corporation (NIDC), was set up in the public sector in 1954. Subsequently, many architectural, design engineering and construction companies were set up in the public sector (Indian Railways Construction Limited (IRCON), National Buildings Construction Corporation (NBCC), Rail India Transportation and Engineering Services (RITES), Engineers India Limited (EIL), etc.) and private sector (M N Dastur and Co., Hindustan Construction Company (HCC) etc.).

The Indian Construction industry comprises of about 200 firms in the corporate sector. In addition to these firms, there are about 1,20,000 class-A contractors registered with various government construction bodies. There are thousands of small contractors, which compete for small jobs or work as sub-contractors of prime or other contractors.

The major players in the construction industry are:

- Companies such as L&T, Unitech, GMR Infrastructure, HCC, Gammon, Jaypee group, Jaiprakash associates, BL Kashyap etc. which undertake large infrastructure projects.
- Companies such as IVRCL, Nagarjuna, L&T, DLF, Omaxe etc. involved in the construction of flyovers, pipelines, apartments and housing/office spaces.
- Companies such as DLF, Purvankara, Raheja and others are engaged in the construction of residential and office space.

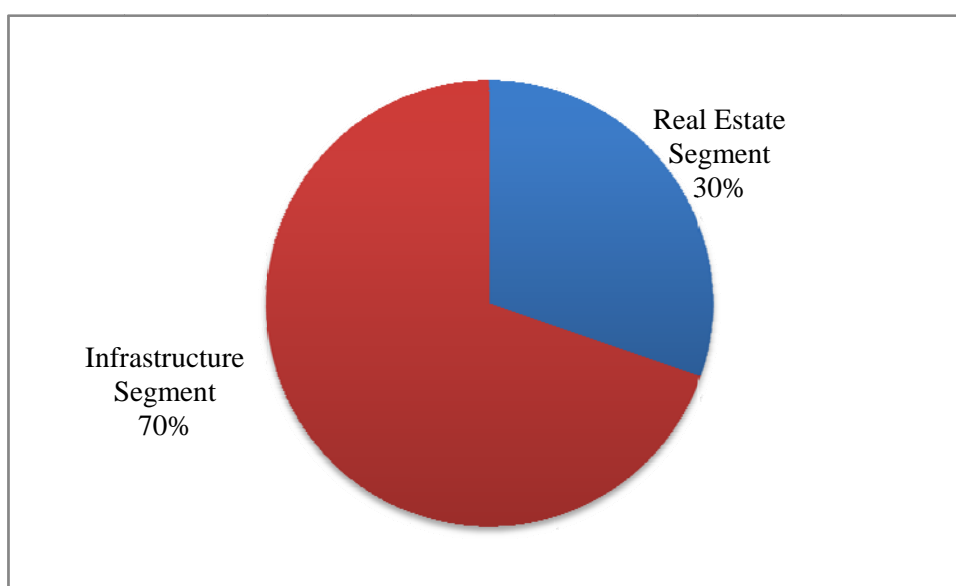
⁸ Planning Commission – Eleventh Five Year Plan

2. Human Resource and Skill Requirements in the Building, Construction and Real Estate Sector

2.1. Current employment pattern across various functional and educational levels

The Building, Construction and Real Estate sector in India currently employs around 33 million persons. Around 30% of these are employed in the Real Estate segment, while the remaining 70% is employed in Infrastructure segment.

Figure 9: Breakup of employment in Building, Construction and Real Estate sector in India



Source: Economic Survey 2007-08, CREDAI, Primary Research and IMAcS analysis

It was estimated by the Planning Commission that the Construction industry employed 31.46 million personnel in 2005.

Table 3: Employment in Indian Construction Industry

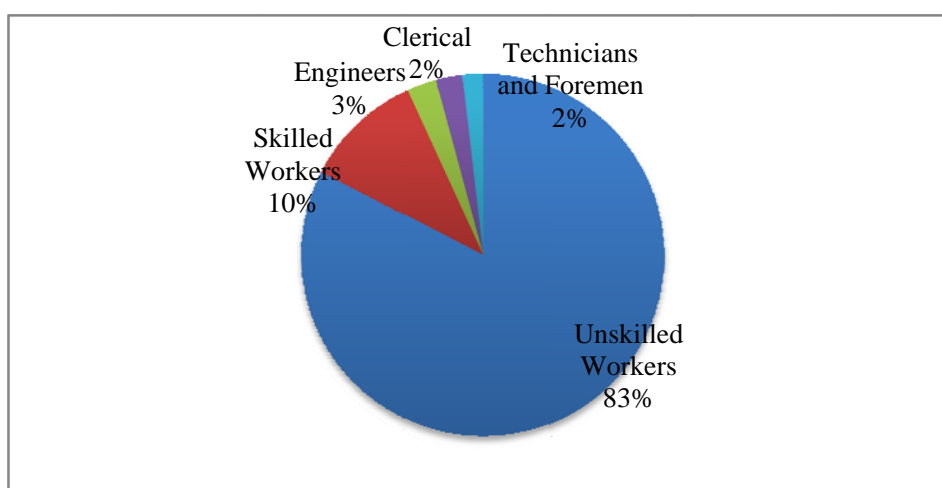
Occupation	Numbers employed in 1995 (in 000's)	Numbers employed in 2005 (in 000's)
Engineers	687	822
Technicians and Foremen	359	573
Clerical	646	738
Skilled Workers	2241	3267

Occupation	Numbers employed in 1995 (in 000's)	Numbers employed in 2005 (in 000's)
Unskilled Workers	10,670	25,600
Total	14,600	31,000

Source: Report of the Working Group on Construction for the 11th Five Year Plan, Planning Commission, Government of India

The bulk of the workforce at around 82.5% constitutes unskilled workers, 10% constitutes the skilled workers and the rest is constituted by engineers, technicians, foremen and clerical staff.

Figure 10: Breakup of employment in Building, Construction and Real Estate sector in India – education wise



Source: Report of the Working Group on Construction for the 11th Five Year Plan, Planning Commission, Government of India and ImaCS analysis

2.1.1. Functional distribution of human resource

During our interaction with the industry as part of our Primary Research, we analysed the proportion of workforce at various functional levels across different sectors. As seen in the table below, a significant proportion of the workforce is involved in the core operations (i.e. at the construction site). Further, this proportion is similar across the Real Estate and Infrastructure segments.

The following table presents the functional distribution of persons across those personnel employed by the project developer (it does not include construction workers, who form the largest portion of the workforce as shown later), as these persons are typically employed on a contract basis.

Table 4: Functional distribution of human resources in Building, Construction and Real Estate sector in India (persons employed directly by builder/developer)

	Function	Distribution
Operations	Project Managers	2 - 3%
	Engineers / Supervisors	23 - 25%
	Foremen (shuttering, steel, concrete, finishing, etc.)	8 - 10%
	Accounts / Billing / Stores	7 - 8%
	Planning	1 - 2%
	Surveying	1 - 2%
	Quality / Lab	3 - 4%
	Safety	5 - 6%
	Support functions (mechanics, electricians, security, etc.)	9 - 10%
	Projects (design, overall planning & scheduling, procurement, etc.)	15%
HR, Admin, Finance, Communications, IT	15%	

Source: Primary Research and IMAcS analysis

The personnel employed in these functions and the amount of labour personnel required, will depend on the type of construction (high-rise / low-rise building, industrial plant / residential building, property footprint, etc).

2.1.2. Distribution of human resources by education level

The following table represents the education-wise composition of Construction personnel across various segments of the building, construction and real estate sector in India. As seen, most of the persons employed in this sector are those with minimal education.

Table 5: Distribution of human resource by education level across the industry

Educational Qualification	Distribution
Ph. D/ Research/ CA/MBA/etc.	1%
Engineers	2%
Diploma or equivalent certification by other agencies	2%
ITI and other vocational courses	13%-14%
10th Standard or below	81%

Source: Primary Research and IMaCS analysis

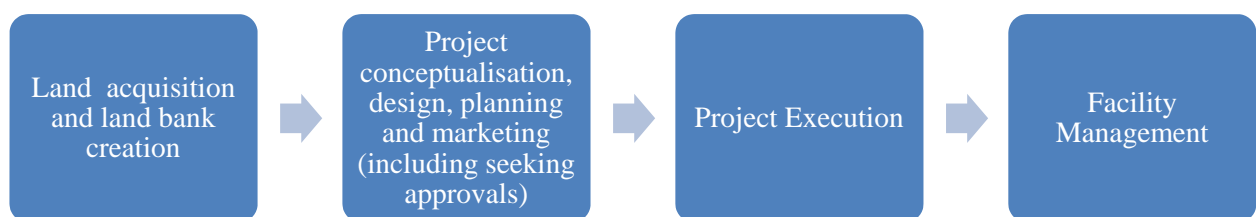
Those constituting the skilled talent pool span across various trades/professions such as the following:

- Crane operators
- Electricians
- Welders
- Masons
- Plumbers
- Carpenters.

2.2. Value Chain of activities in Construction

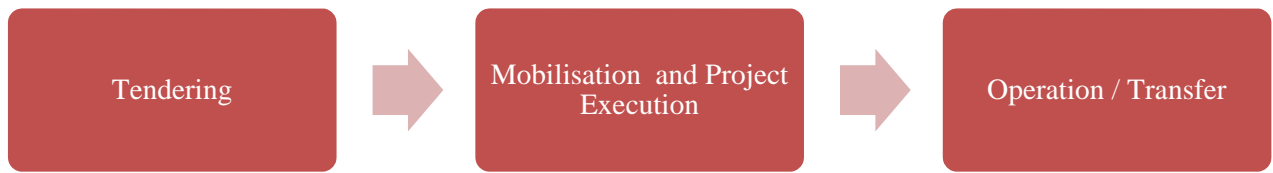
The value chain within the Real Estate segment can be represented as below:

Figure 11: Value chain within the Real Estate segment



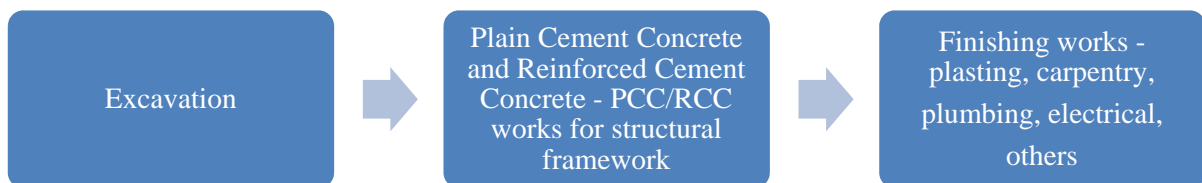
The value chain within the Infrastructure segment can be represented as below:

Figure 12: Value chain within the Infrastructure segment



We shall specifically focus on activities in the Project Execution stage. The activities in the Project Execution stage are as below:

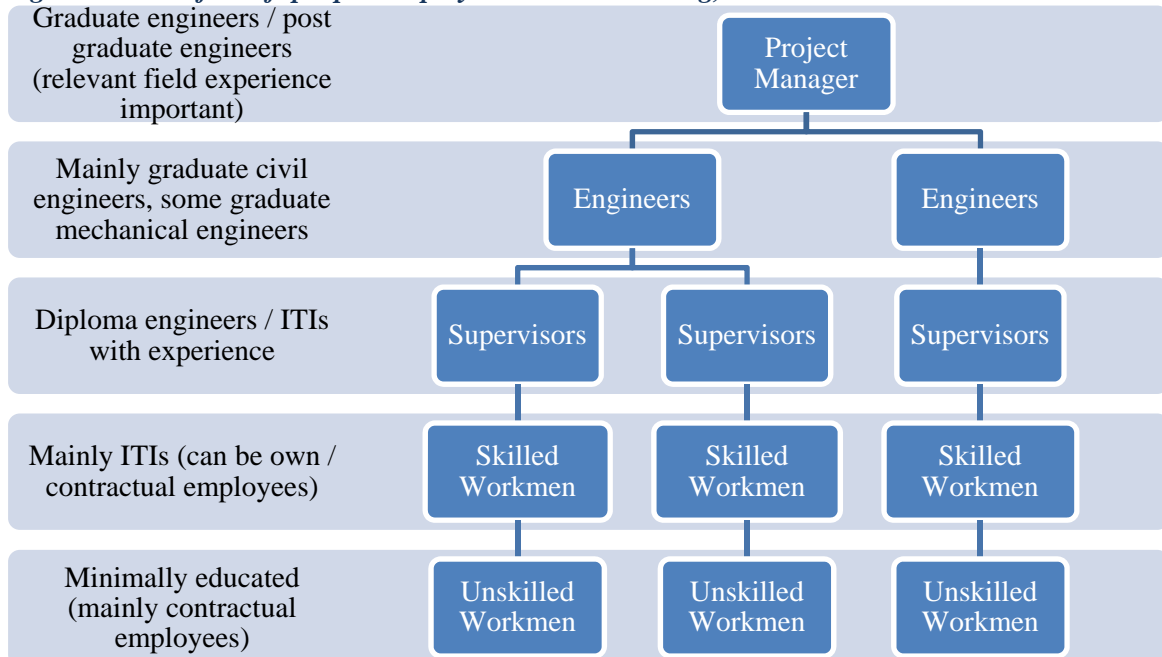
Figure 13: Activities in the Project Execution stage



2.3. Profile of people employed

The profile of the people employed in the Real Estate segment and Infrastructure segment at the field level, i.e. on the construction site is similar and the following figure illustrates this profile:

Figure 14: Profile of people employed in the Building, Construction and Real Estate Sector



2.4. Skill requirements and skill gaps

We have profiled the skill requirements and skill gaps at three broad levels:

- Skill requirements and gaps common to the Construction and Real Estate segments
- Skill requirements and gaps specific to the Real Estate segment
- Skill requirements and gaps specific to the Infrastructure segment.

Note: Skill gaps indicated here are indicative/illustrative of industry and not exhaustive. They will vary from person to person

2.4.1. Skill requirements and gaps common to Building, Construction, and Real Estate sector

Table 6: Skill requirements and skill gaps common to the Building, Construction and Real Estate Sector

Level	Skills required	Skill gaps
Project Manager (of 3 to 4 years experience)	<ul style="list-style-type: none"> ▪ Ability to manage costs, quality and ensure on-time delivery of project ▪ Ability to highlight issues, if any, to the senior management and ensure their resolution so as not to compromise on cost, quality and time ▪ Sufficient knowledge of the local language to be able to communicate with contractors and labourers ▪ Ability to maintain project site documents ▪ Basic understanding of hydraulics electrical knowledge and piping ▪ Ability to effectively manage contractors and ensure that contract specifications are being met ▪ Ability to understand technical drawings and thus the project design ▪ Ability to ensure compliance to construction approvals and laws and understand legal 	<ul style="list-style-type: none"> ▪ Inadequate knowledge of planning and scheduling software ▪ Inadequate project management skills ▪ Difficulty in controlling time overrun and cost overrun ▪ Poor project management and resource estimation skills ▪ Insufficient orientation towards project costing, efficient inventory management and adhering to deadlines

Level	Skills required	Skill gaps
	<p>issues associated with the industry</p> <ul style="list-style-type: none"> ▪ Basic knowledge of construction equipment ▪ Strong task orientation, trouble shooting to resolve issues, high integrity and energy levels ▪ Basic computer skills and ability to work on MS Excel ▪ Strong networking and liasoning skills ▪ Ability to manage inventory and ensure appropriate usage ▪ Ability to plan and effectively deploy the available resources (man, machine, material) ▪ Ability to ensure that safety and health norms are adhered to ▪ Strong oral and written communication skills to be able to communicate effectively with Head Office, contractors, architects, laborers etc. ▪ Ability to control the finances of the project, including expenditure monitoring and reporting ▪ Advanced knowledge on project costing and project management tools like PERT and CPM – includes good computer skills ▪ Ability to articulate project objectives to team members, coordinate and motivate the site team 	<ul style="list-style-type: none"> ▪ Lack of communication and team building skills ▪ Insufficient ability to manage multiple contractors and resolve conflicts
<p>Engineers / Supervisors</p>	<ul style="list-style-type: none"> ▪ Ability to communicate and implement safe practices, such as ensuring that a net is laid while working in a pit with loose soil ▪ Ability to ensure minimal machine downtime and avoid breakdowns – say, for batching plants, transit mixers, etc. ▪ Ability to appropriately allocate work to semi-skilled and unskilled workmen 	<ul style="list-style-type: none"> ▪ Civil engineers hired for this role usually do not have sufficient ability to develop and comply to a Preventive Maintenance schedule ▪ Inadequate orientation to develop and adhere to safety

Level	Skills required	Skill gaps
	<ul style="list-style-type: none"> ▪ Ability to effectively communicate with semi-skilled and unskilled workmen and articulate project objectives to all ▪ Ability to understand and take instructions from project managers ▪ Ability to supervise and ensure quality of work ▪ Ability to maintain a high level of integrity ▪ Ability to manage skilled and unskilled workmen and resolve disputes as and when they arise ▪ Ability to create a sense of trust among the semi-skilled and unskilled workmen so that they approach the engineer / supervisor in case of any issues ▪ Ability to understand, speak, and know the local language and also understand its nuances ▪ Knowledge of construction equipment and their functions and the ability to ensure that the equipment is maintained as per standards ▪ Good written and oral communication skills ▪ Understanding of legal issues associated with the industry ▪ Ability to manage conflicts and stress ▪ Overall execution and management of the project allotted ▪ Ability to schedule preventive maintenance activities and undertake breakdown maintenance 	<ul style="list-style-type: none"> norms at construction site ▪ Lack of communication and team management skills ▪ Incomplete knowledge of tendering processes ▪ Insufficient writing skills in English and documentation skills ▪ Incomplete understanding of risks associated with a project such as time/cost over-runs as well as legal aspects ▪ Lack of coordination skills ▪ Poor time management skills ▪ Poor planning and scheduling skills, including skills for estimating manpower and material ▪ Insufficient orientation towards project costing, functionality of equipment and their maintenance ▪ Insufficient ability to resolve conflicts ▪ Few students willingly take up Civil Engineering courses at the diploma and degree

Level	Skills required	Skill gaps
		<p>levels and it is thus difficult to fill up these seats with good students – many students who take up this course do so because they do not get admission to other preferred courses – hence the quality of students who pass out from the degree and diploma courses has room for improvement</p> <ul style="list-style-type: none"> ▪ Engineers are required to be on-site – there is resistance to travelling and staying in remote locations ▪ Many do not know / understand the native language of skilled / unskilled workmen – need to be deputed on a project based on language skills ▪ Inadequate planning skills ▪ Inadequate practical industry exposure
Skilled workmen	<ul style="list-style-type: none"> ▪ Ability to coordinate with unskilled workmen ▪ Ability to operate key equipment such as cranes, especially tower crane operations, and also mechanisms for loading and unloading of cranes ▪ Ability to work at heights (for high rise buildings, especially in the case of crane operators) ▪ Ability to deliver quality output ▪ Need to be adept in their own trades – e.g. plastering, painting, plumbing, etc. 	<ul style="list-style-type: none"> ▪ Inadequate knowledge of construction specific areas - such as lining, leveling, and finishing skills in carpentry ▪ Availability of these personnel is an issue - it may be necessary to import people with relevant skills from Middle East/South East Asian countries/ China, etc. ▪ Lack of knowledge of basic

Level	Skills required	Skill gaps
	<ul style="list-style-type: none"> ▪ Knowledge of construction specific areas – such as while carpentry is a generic course which is taught, there is a need for carpenters engaged in the Construction industry to be aware of lining, leveling, and finishing skills ▪ Need to understand machine operations and basic machine troubleshooting ▪ Ability to comply with safety and quality measures ▪ Need to have basic knowledge of construction engineering 	<ul style="list-style-type: none"> machine operation – appropriate operation of cranes – lifting and placing ▪ Inadequate ability to understand instructions of supervisors/engineers.
Unskilled workmen	<ul style="list-style-type: none"> ▪ Ability to perform the operations of excavation, carrying, cutting, helping of mason, mixing, spreading of stones, packing ▪ Ability to be involved in and perform manual labour intensive work – thus need to be medically fit ▪ Need to have an orientation towards safety requirements and basic workplace practices (reporting to work on time, etc.) ▪ Need to be able to move material as required – using carts / manually, and thus also need to be physically strong ▪ Ability to take instructions from skilled workmen / supervisors / engineers and execute them appropriately ▪ Material preparation / Concrete mixing 	<ul style="list-style-type: none"> ▪ Very little safety orientation ▪ Inadequate workplace skills – discipline, cleanliness, etc. ▪ Inability to follow simple instructions ▪ Low job loyalty - very prone to leaving one construction company and joining another

Source: Primary research and IMaCS analysis

Skill requirements and gaps specific to individual segments over and above what is common across these two segments are detailed below:

2.4.2. Skill gaps common to the Real Estate

Table 7: Skill gaps specific to the Real Estate segment

Function	Level	Skills required	Skill gaps
Land acquisition and land bank creation	Experienced personnel	<ul style="list-style-type: none"> ▪ Ability to liaison with land owners, government bodies, village authorities, property dealers, etc. to identify sources of land ▪ Ability to study legal papers and check the property accordingly ▪ Ability to understand and comply with local Government procedures related to land procurement ▪ Strong liaisoning and negotiation skills – i.e. the ability to maintain good relations with local and controlling authorities ▪ Strong written and oral communication skills to be able to interact with different land owners (private/Government) ▪ Ability to understand overall dimensions of land, the topography, etc. including aspects like requirement for roads/pathways, pavements, resulting wastage etc ▪ Purchase of land after rate negotiation 	<ul style="list-style-type: none"> ▪ Civil engineers hired for this role usually lack knowledge about relevant government procedures and clearances ▪ Lack of aptitude to write good basic investment proposals in English language ▪ Personnel are not very articulate while liaisoning .
	Entry Level personnel	<ul style="list-style-type: none"> ▪ Basic legal knowledge ▪ Basic ability to understand contracts and agreements ▪ Ability to understand suitability of land for construction purposes, i.e. the ability to assess the land on technical parameters such as 	<ul style="list-style-type: none"> ▪ Inadequate legal knowledge ▪ Inadequate networking skills

Function	Level	Skills required	Skill gaps
		<p>available supply of water, electricity, access by road for delivering construction material, etc.</p> <ul style="list-style-type: none"> ▪ Ability to maintain good relations with local and controlling authorities ▪ Basic understanding of the real estate market in terms of drivers of land prices, means of acquisition, etc. 	
<p>Project conceptualisation, design, planning and marketing (including seeking approvals)</p>	<p>Experienced personnel</p>	<ul style="list-style-type: none"> ▪ Ability to define the project theme and key features, narrow in on the target set of customers, understand/perceive their requirements, design the layout accordingly keeping in mind functionality, architectural and aesthetic aspects and frame the marketing and sales strategy ▪ Appropriate selection of land from the land bank for the project under consideration – for example, a land closer to the main centre of a city may be selected for a mall ▪ Ability to liaison with architects (in case architects are sub-contracted by the company) ▪ Ability to undertake the detailed design and engineering and shortlist and select vendors for borewells, earth filling, construction, development works, landscaping, horticulture, etc. ▪ Ability to correctly estimate the 	<ul style="list-style-type: none"> ▪ Inadequate ability to plan out large scale projects – including high rises, large housing complexes, infrastructure projects.

Function	Level	Skills required	Skill gaps
		<p>module-wise/function-wise costs and hence correctly estimate the total project cost</p> <ul style="list-style-type: none"> ▪ Ability to estimate correct project timelines ▪ Ability to decide strategic parameters such as whether the property will be leased/whether it will be an outright sale, what the optimum mix of lease v/s sale will be for commercial properties ▪ Ability to market the property with future owners/tenants through ads, hoardings, tie-ups with property dealers, corporate tie-ups, etc. ▪ Knowledge of property markets and relevant government procedures and clearances ▪ Ability to initiate technical and legal formalities with statutory authorities for sanctions so as to ensure uninterrupted progress of work when project execution starts, i.e., coordinate and seek clearances/ approvals from the required urban development authorities, Government bodies, Pollution Control Board, and other stakeholders as deemed necessary ▪ Ability to understand legal contracts and sign deals with contractors 	
	Entry Level personnel	<ul style="list-style-type: none"> • In-depth architectural knowledge • In-depth civil / construction 	<ul style="list-style-type: none"> ▪ Inadequate knowledge of Project Management skills and Project

Function	Level	Skills required	Skill gaps
		<p>knowledge</p> <ul style="list-style-type: none"> • Project management skills, including the use of project management software • Knowledge of costing • Knowledge of commercials – taxes, duties etc. • Ability to understand survey techniques • Ability to prepare working drawings, • Knowledge of lab testing methodologies, safety procedures and ISO requirements for Health, Safety & Environment 	<p>Management software like MS Project / Prima Vera, etc.</p> <ul style="list-style-type: none"> ▪ Lack of practical knowledge of construction technologies / methodologies e.g. plastering, piling, water proofing, use of machines, understanding of pre-fab structures and dos and don't of construction ▪ Lack of exposure to survey techniques, Lab testing methodologies, Quality Control and Quality Assurance ▪ Lack of knowledge of safety procedures and ISO requirements for Health, Safety & Environment
Facility Management	Experienced personnel	<ul style="list-style-type: none"> ▪ General administration and logistics, after the facility has been occupied, including house keeping, security, front office, power back up, etc ▪ Ability to conduct regular preventive maintenance and as- 	<ul style="list-style-type: none"> ▪ Incomplete understanding of maintenance services ▪ Inadequate customer orientation and interaction skills

Function	Level	Skills required	Skill gaps
		<p>required breakdown maintenance of civil, electrical and mechanical installations</p> <ul style="list-style-type: none"> ▪ Knowledge and proficiency in handling maintenance of services like plumbing, elevators, auditorium services, fire fighting and associated services ▪ Ensuring availability of utilities such as water, electricity, etc. ▪ Ability to negotiate with and manage vendors and contractors, including ensuring their payments ▪ Ability to have an orientation towards customer service 	<ul style="list-style-type: none"> ▪ Inadequate understanding of AMC ▪ Inadequate documentation skills ▪ Insufficient of managing people involved in delivering services
	Entry Level personnel	<ul style="list-style-type: none"> ▪ Ability to undertake operations and maintenance activities ▪ Coordination with multiple agencies and vendors ▪ Ability to mobilize resources as and when required ▪ Ability to handle complaints from inhabitants and ensure timely resolution ▪ Ability to keep track of complaints received ▪ Ability to have an orientation towards customer service 	<ul style="list-style-type: none"> ▪ Inadequate orientation towards customer service ▪ Inadequate ability to multitask and coordinate with multiple agencies and vendors

2.4.3. Skill gaps specific to Infrastructure

Table 8: Skill gaps specific to the Infrastructure segment

Function	Level	Skills required	Skill gaps
Tendering	Experienced personnel	<ul style="list-style-type: none"> ▪ Identification of tendering opportunities for infrastructure creation, i.e. the ability to identify potential business opportunities ▪ Ability to prepare technical proposals to suitably cover requirements indicated in the bid document ▪ Ability to estimate man-hours needed for the project, number of sub-contracted personnel required, number of labourers required, etc. ▪ Ability to estimate technological requirements – capital equipment needed, cranes required ▪ Ability to understand the tendering process and techno-commercial analysis of projects, including potential commercial pitfalls, if any ▪ Ability to prepare appropriate cost estimates when bidding for projects - project costing skills ▪ Ability to understand technical specifications of a bid and convert the same into material requirements ▪ Ability to network with colleagues outside the company 	<ul style="list-style-type: none"> ▪ Inadequate techno-commercial orientation ▪ Insufficient knowledge of legal issues ▪ Not very articulate while presenting or liasoning ▪ Poor communication skills, oral as well as written

Function	Level	Skills required	Skill gaps
		so as to be appraised of leads as they come up	
	Entry level personnel	<ul style="list-style-type: none"> ▪ Ability to understand the tendering process and techno-commercial analysis of projects ▪ Ability to maintain a strong network ▪ Ability to undertake basic costing of projects ▪ Ability to coordinate with various departments for detailing tenders accurately ▪ Broad understanding of construction techniques and projects in construction ▪ Ability to undertake basic resource estimation of projects ▪ Ability to understand tender documents bidding requirements ▪ Basic understanding of legal and contractual aspects 	<ul style="list-style-type: none"> ▪ Inadequate understanding of detailed planning of projects ▪ Inadequate knowledge of costing ▪ Inadequate ability to maintain a strong network ▪ Inadequate understanding of legal and contractual aspects ▪ Inadequate tender-writing skills

2.5. Emerging trends in skill requirements

Some of the emerging trends in human resource and skill requirements in the Building, Construction and Real Estate Industry in India are as below⁹:

- **Technology and Mechanisation:** India's Construction industry has advanced with respect to batching plants, plastering techniques, etc. It is also expected that the level of mechanisation in the building, construction and real estate industry in India would further increase. For example, the slab-to-slab time, i.e. the time between the laying of two consecutive slabs in erecting a building which was earlier 18 to 20 days has now come down to 10 to 12 days and even 7 to 8 days in some cases; this is further expected to go down to 4 to 5 days till 2022, and is primarily due to the use of *modular structures*, *pre-fabricated parts* and *pre-cast parts*. For example, an RCC column which takes 10 to 12 days to build on-site can be replaced by steel girders which can be built in a factory in 5 to 6 days; this also enables parallel processing.
- **Reduction in proportion of unskilled workforce needed:** With the increasing use of technology and with the level of mechanisation increasing, the proportion of unskilled workmen needed at a construction site is expected to reduce¹⁰. Taking the same example of the concrete column ahead, a large number of workmen performing varied tasks for building the column (such as pouring, carpentry, fitting, etc.) are required. With the changeover to steel girders, lesser number of personnel are required; and those required will be mainly for the assembly operation.
- **Increasing trend of facility management:** The trend towards facility management is comparatively new to India. This is expected to increase, and an increasing number of developers are expected to provide facility management services at an additional cost, including the entire gamut of activities – security services, plumbing services, gas pipe services, food stores within the residential complex, television cable services, electrical services, etc), maintenance service, etc. This trend is expected to generate employment for such set of people; an estimate is that for a 20-storey residential building, around 5 facility management personnel will be required¹¹. About 2 persons may be required per floor in a commercial set-up. This will be driven by demand in the IT space, and in the IT and other SEZ space.

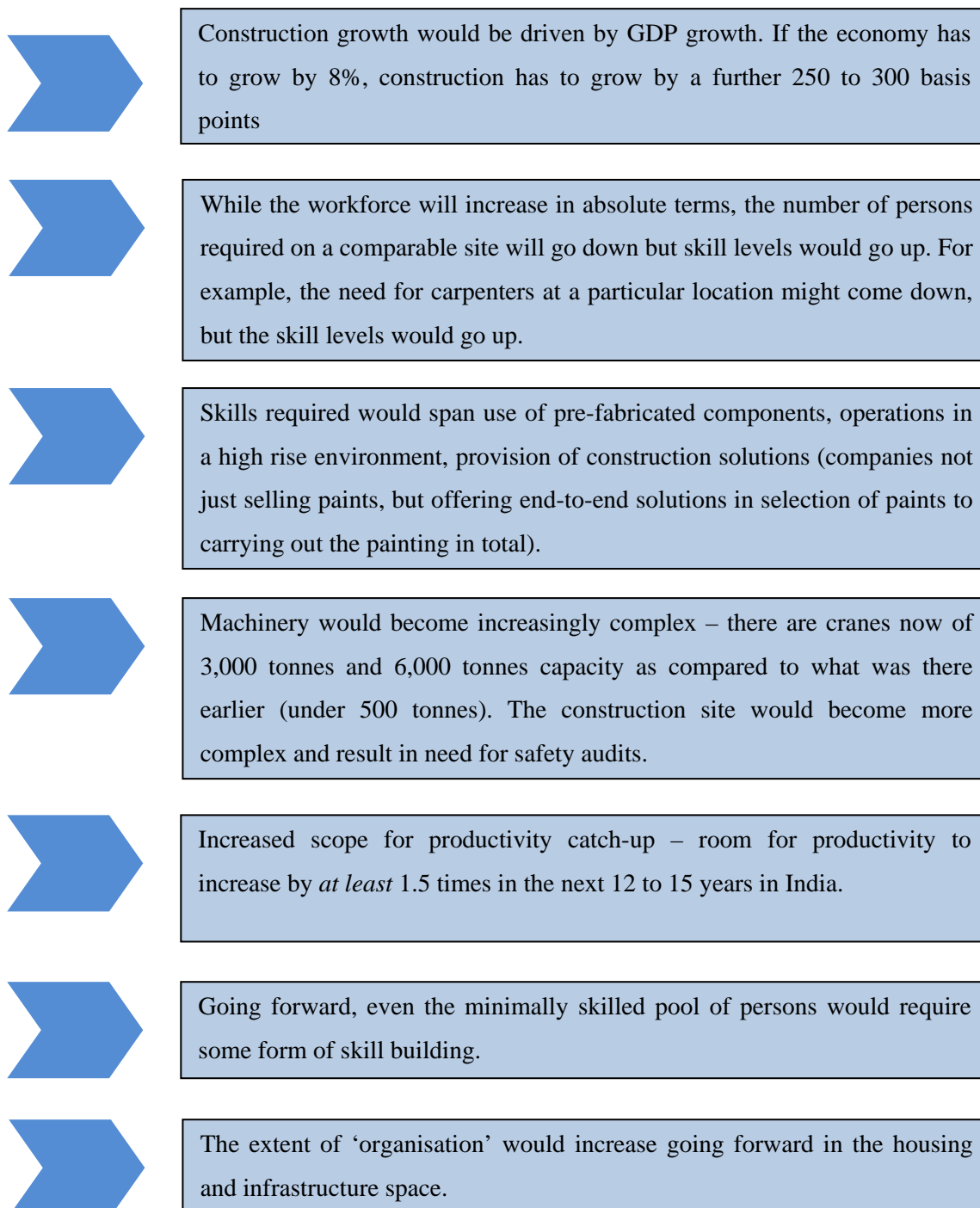
⁹ Documented based on inputs received in the Primary Research

¹⁰ Absolute numbers will increase given the increase in number of projects etc.

¹¹ Based on Primary Research

A profile of emerging trends which would drive human resource and skill requirements is illustrated below:

Figure 15: Emerging trends driving human resource and skill requirements



2.6. Profile of Investments and Projected Industry Size

Given the skill requirements outlined in the earlier section, it is also necessary to forecast the human resource requirement required in the Infrastructure and Real Estate sector. The first step is to forecast the industry size.

In this section, we will analyse the profile of investments planned in each of the sectors and arrive at the projected industry size.

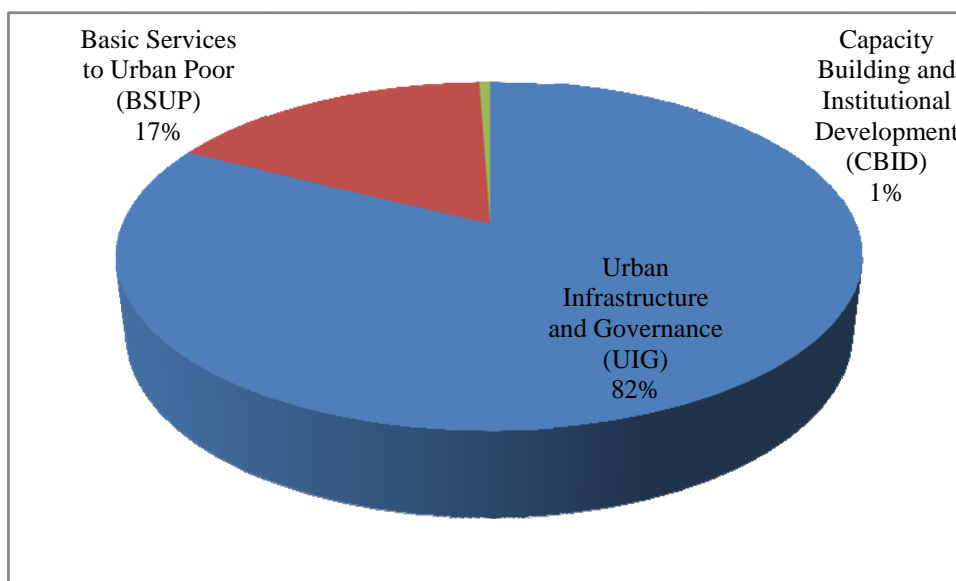
2.6.1. JnNURM

According to India's Census in 2001, more than 285 million people (27.8% of the total population) live in urban areas. With this large base, which is growing at the rate of around 2.7% annually, India has the world's second largest urban population. Given the current trends in population growth and migration, India's urban population is estimated to reach 575 million by 2030. Consequently, the Jawaharlal Nehru National Urban Renewal Mission (JnNURM) was set up to encourage reforms and fast track planned development of identified cities. Focus is to be on efficiency in urban infrastructure and service delivery mechanisms, community participation, and accountability of Urban Local Bodies (ULBs)/Parastatal agencies towards citizens. The current list of 65¹² cities under JnNURM together host around 120 million residents, which constitutes 42% of all urban residents in the country, or 12% of total Indian population.

For the 65 cities identified under the JnNURM, the total investments are expected to be over Rs. 3,35,000 crore directed towards Urban Infrastructure and Governance (UIG), Basic Services to Urban Poor (BSUP) and Capacity Building and Institutional Development (CBID). Of these investments in Urban Infrastructure and Governance (UIG) account for over 80% of the total investments under the JnNURM, as below:

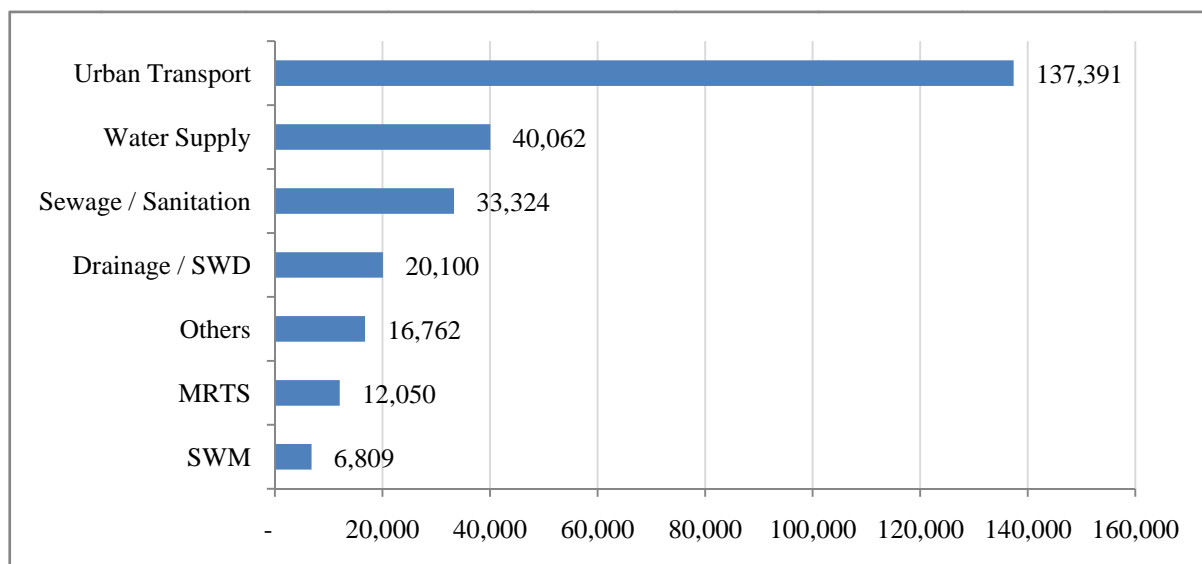
¹² Including inputs on addition or deletion of cities/ UAs/towns, the total number of cities under the JNNURM will remain around 60 – the figure of 63 cities has recently been revised to 65 cities.

Figure 16: Investment planned under JnNURM totalling Rs. 3,35,000 crore



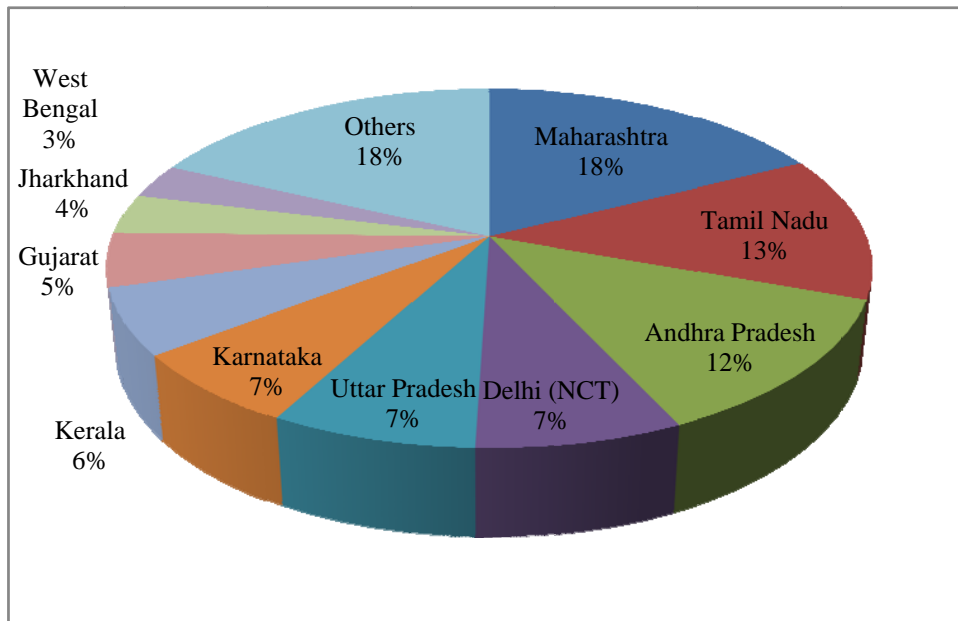
As part of Urban Infrastructure and Governance, investments are being made under the heads of Urban Transport, Water Supply, Sewage/Sanitation, Drainage/Solid Waste Disposal, MRTS, and Solid Waste Management. Of these, the investments in Urban Transport, Water Supply, Sewage /Sanitation account for about 80% of the total investments under the JnNURM, with Urban Transport alone accounting for over 50%, as seen below:

Figure 17: Investments under various heads of JnNURM (Rs. crore)



With respect to the states, investments in Maharashtra, Tamil Nadu, Andhra Pradesh, Delhi, Uttar Pradesh, Karnataka, Kerala, Gujarat, Jharkhand and West Bengal account for over 80% of total investments under the JnNURM, as seen below:

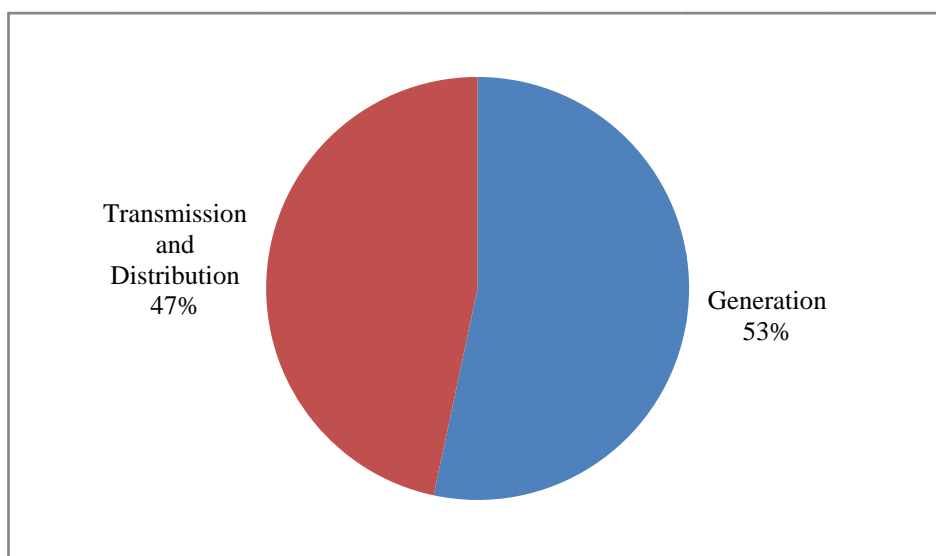
Figure 18: State-wise investments under JnNURM



2.6.2. Power

The total installed capacity of power currently in India is over 1,50,000 MW. This is expected to increase to over 3,18,000 MW by 2021-22. Hence additional capacity of about 1,68,000 MW will be needed. For this, it is expected that about Rs. 7,07,500 crore will be needed for Generation and about Rs. 6,19,000 crore will be needed for Transmission and Distribution, as seen below:

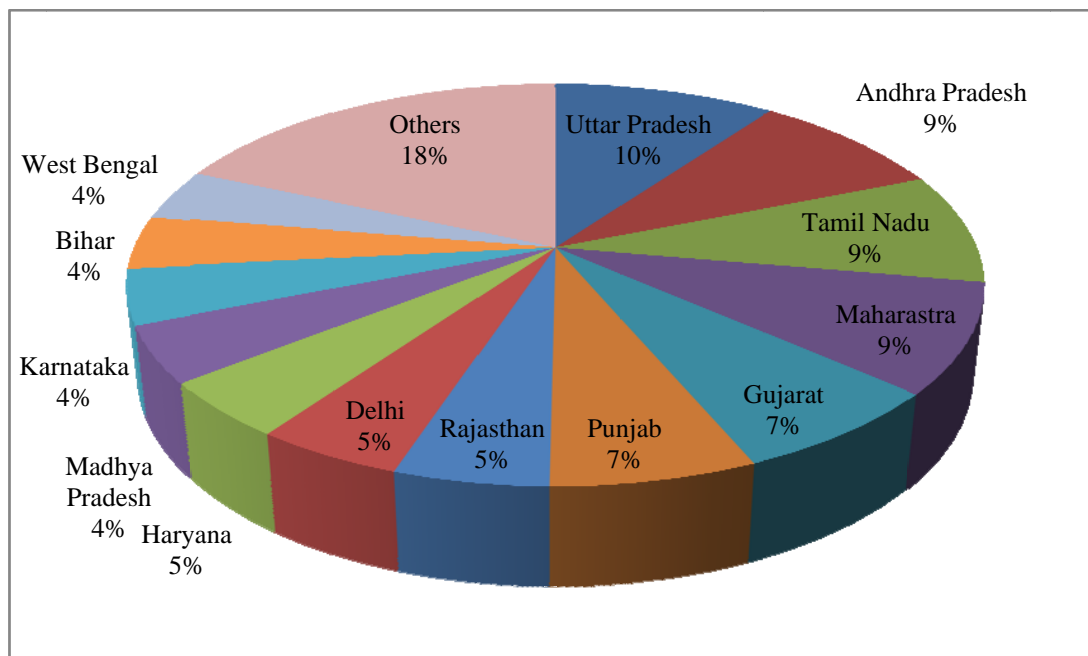
Figure 19: Investments in Power Generation, Transmission and Distribution up to 2021-22 (Rs. crore)



The infrastructure for Transmission and Distribution needs to be set up in each state based on the additional capacity required in that state. The investments in power Generation cannot be attributed to

the state which has the demand, since the power need not be generated at the same location where it is needed. Thus, while the state-wise breakup of investments for Transmission and Distribution are as seen below, investments in power generation cannot be attributed to particular states.

Figure 20: State-wise investments in Transmission and Distribution



2.6.3. Ports

India currently has 12 major ports and 187 minor ports. In 2007-08, major ports accounted for about 70% (519 million tonnes) of the total port traffic in India, while minor ports accounted for the remaining 30% (220 million tonnes).

As regards investments going ahead, the investments in minor ports will account for about 50% of the total investments in ports.

2.6.4. Airports

India has a total of 125 airports and currently all 125 airports are owned and operated by the Airports Authority of India (AAI). The Government aims to attract private investment in aviation infrastructure, as seen in the cases of privatisation of the Delhi and Mumbai airports as well as the new international airports at Bangalore and Hyderabad. The latest status of airports that have been commissioned/granted approval/are under consideration is as below:

Table 9: Airports commissioned / granted approval / under consideration

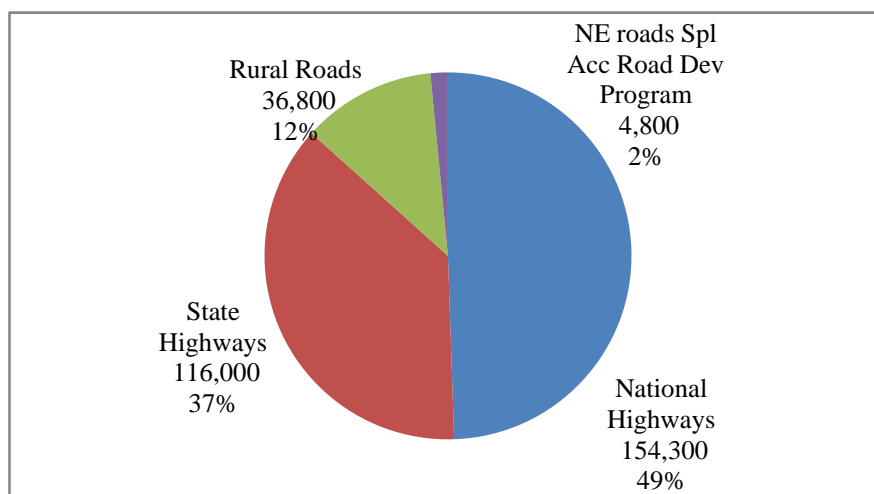
Name	State	Status
Bangalore International airport	Karnataka	Commissioned
Hyderabad International airport	Andhra Pradesh	Commissioned
Mopa airport	Goa	Approval Granted
Navi Mumbai International airport	Maharashtra	Approval Granted
Kannur airport	Kerala	Approval Granted
Bijapur airport	Karnataka	Approval Granted
Simoga airport	Karnataka	Approval Granted
Hassan airport	Karnataka	Approval Granted
Gulbarga airport	Karnataka	Approval Granted
Sindhudurg Airport	Maharashtra	Approval Granted
Dabra Airport	Madhya Pradesh	Approval Granted
Durgapur Airport	West Bengal	Approval Granted
Greater NOIDA international airport	Uttar Pradesh	Under Consideration
Chakan international airport	Maharashtra	Under Consideration
Karaikal airport	Puducherry	Under Consideration
Jhajjar airport	Haryana	Under Consideration
Ludhiana	Punjab	Under Consideration
Paladi-Ramsinghpur	Rajasthan	Under Consideration
Bharuch	Gujarat	Under Consideration
Rameswaram	Tamil Nadu	Under Consideration
Itanagar	Arunachal Pradesh	Under Consideration

2.6.5. Roads

India has an extensive road network of 3.3 million km – the second largest in the world. Roads in India carry about 65% of the freight and 80% of the passenger traffic. The Government of India plans to spend about Rs. 50,000 crore per annum on road development over the next five years. Road projects in India consist of the National Highways that are being constructed under 7 phases of the

National Highway Development Project (NHDP), State Highways, Rural Roads and the North East roads Special Accelerated Road Development Program, the investments in which are as below:

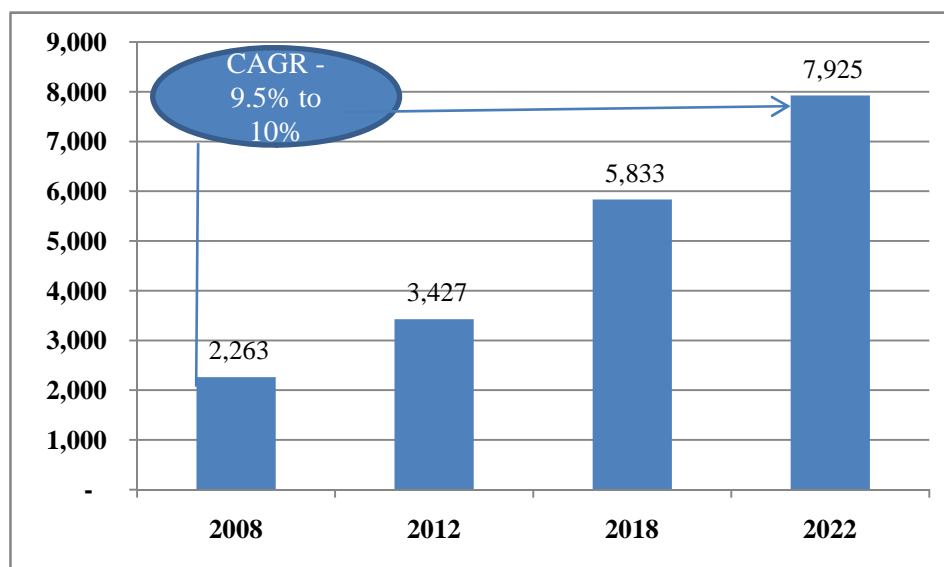
Figure 21: Planned Investments in Roads in the Eleventh Five Year Plan (Rs. crore)



2.6.6. Projected Size of the Infrastructure and Real Estate sector¹³

Given these investments, we forecast that the real GDP of the Building, Construction and Real Estate sector to grow at a CAGR of 9.5% to 10% till 2022, in real terms. The GDP economy of Construction would be about Rs. 8,000 billion in constant prices at 2022.

Figure 22: Projected Real GDP of Construction sector (Rs. billion)



Source: IMAcS analysis

¹³ Our overall approach to macro-economic modeling and forecasting is explained in a separate annexure

While Real Estate (including housing and commercial) would account for 30% of the activity, the rest of the infrastructure activity (70%) would be shared across the following areas in the proportion indicated below.

Table 10: Share of economic activity estimated in the Infrastructure segment

Sector in Infrastructure	% of economic activity
Electricity	32.4%
Road and Bridges	15.3%
Telecommunication	12.6%
Railways (including MRTS)	12.7%
Irrigation	12.3%
Water Supply and Sanitation	7.0%
Ports	4.3%
Airports	1.5%
Others	1.9%

Source: Planning Commission's Tenth and Eleventh Five Year Plan and IMaCS analysis

2.7. Projected Human Resource Requirements

2.7.1. Projected human resource requirements across sectors¹⁴

Based on the growth expected in the Infrastructure and Real Estate sectors, it is expected that about 83 million persons would be employed in the Construction sector by 2022. The incremental human resource requirement between 2008 and 2022 is expected to be about 47 million. The sector-wise composition will be as follows:

Table 11: Projected human resource requirement between 2008 and 2022 (in '000s)

	2008	2012	2018	2022	Incremental
Infrastructure	25,177	33,868	48,280	58,289	33,111
Real Estate	10,790	14,515	20,692	24,981	14,191
Total	35,968	48,383	68,972	83,270	47,302

Source: IMaCS analysis

¹⁴ Our overall approach to macro-economic modeling and forecasting is explained in a separate annexure

2.7.2. Projected human resource requirements - education-wise and skill-wise

Given the profile of human resource employed (as detailed previously), we expect that the following composition of human resource would be required till 2022 from the perspective of the educational background. *It should be noted that while the sector will continue to employ a large portion of human resource with a relatively lower education profile (as compared to, say, a typical manufacturing set-up), the skill levels would need to be continually upgraded even to those with minimal education.*

Table 12: Incremental human resource requirement – education-wise (in ‘000s) between 2008 and 2022

	Ph.D/ Research/ Design	Engineers	Diploma	ITI and other vocationally trained	Other graduates	CA/ MBA/ etc.	10th standard and below/ dropouts
Infrastructure and Real Estate	473	946	946	5,953	473	473	38,038
Incremental human resource requirement				47,302			

Source: IMaCS analysis

The profile of people employed would span different areas related to their function and/or trade as illustrated below. This also details the human resource requirement across the skilled workforce¹⁵.

Table 13: Incremental human resource requirement across the workforce (including skilled workforce) between 2008 and 2022 (in ‘000s)

Profile of people	Incremental Requirement
Project Managers and Engineers	473
Supervisors	473
Foremen	946
Crane operators	7
Electricians	473
Welders	473

¹⁵ **Note on Methodology of Estimation of Incremental Requirement:** The a incremental human resource requirement has been calculated based on a) the investments in the Eleventh Plan Period and projected investments into various sectors, b) the amount of man-days required for completion of projects in sectors such as Road, Rail, Power, etc. for a specific investment size, and c) estimates on productivity increase. The GDP growth and size of construction and real estate services have been projected based on econometric modelling.

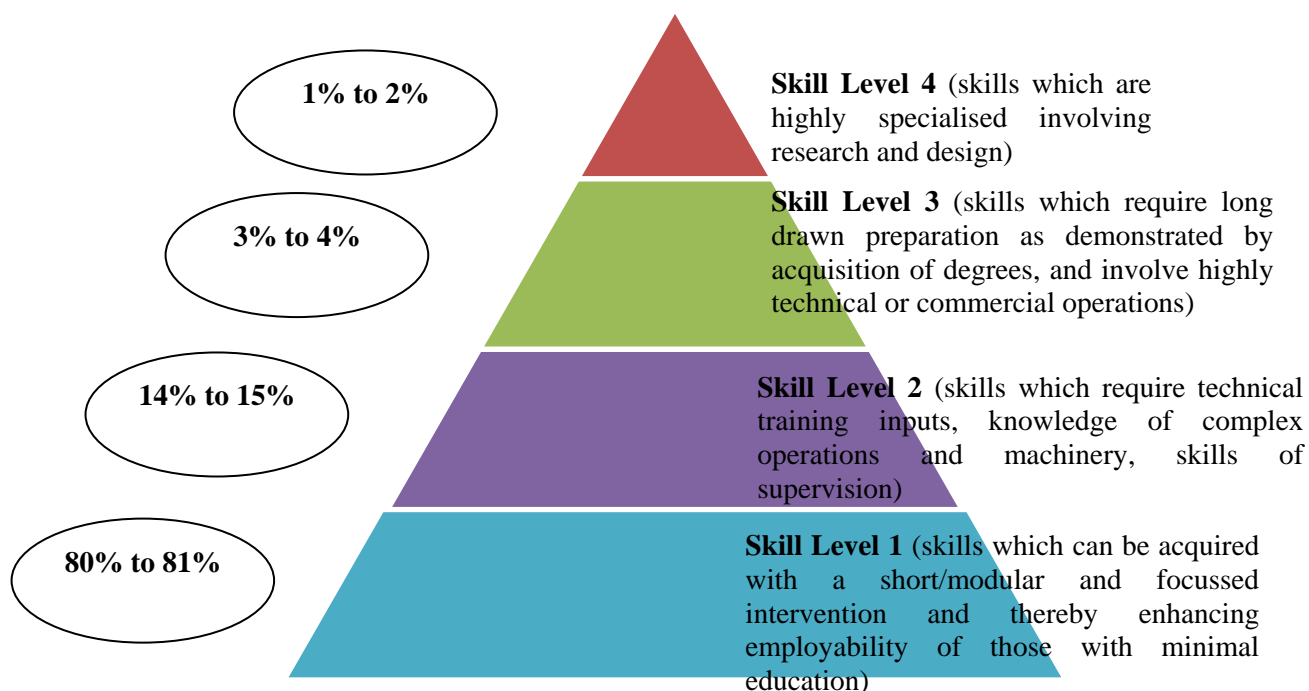
Profile of people	Incremental Requirement
Bar Benders	1,419
Masons ¹⁶ (see footnote)	1,419
Plumbers	1,183
Carpenters	1,892
Surveyors	47
Others (including Quality, Glazing workers, painters, equipment operators)	459
Minimally Educated	38,038
Total	47,302

Source: IMAcS analysis

2.7.3. Skill Pyramid

The above profile of the workforce can be viewed in the form of the Skill Pyramid.

Figure 23: Skill Pyramid for the Construction industry



Source: Primary Research and IMAcS analysis

It is to be noted that, while a large proportion of the workforce falls in the lower portion of the pyramid, there would be skill building required at a workplace and construction-site level. *This being said, the Skill Level 2 would be area where substantial skill building efforts would be needed (to*

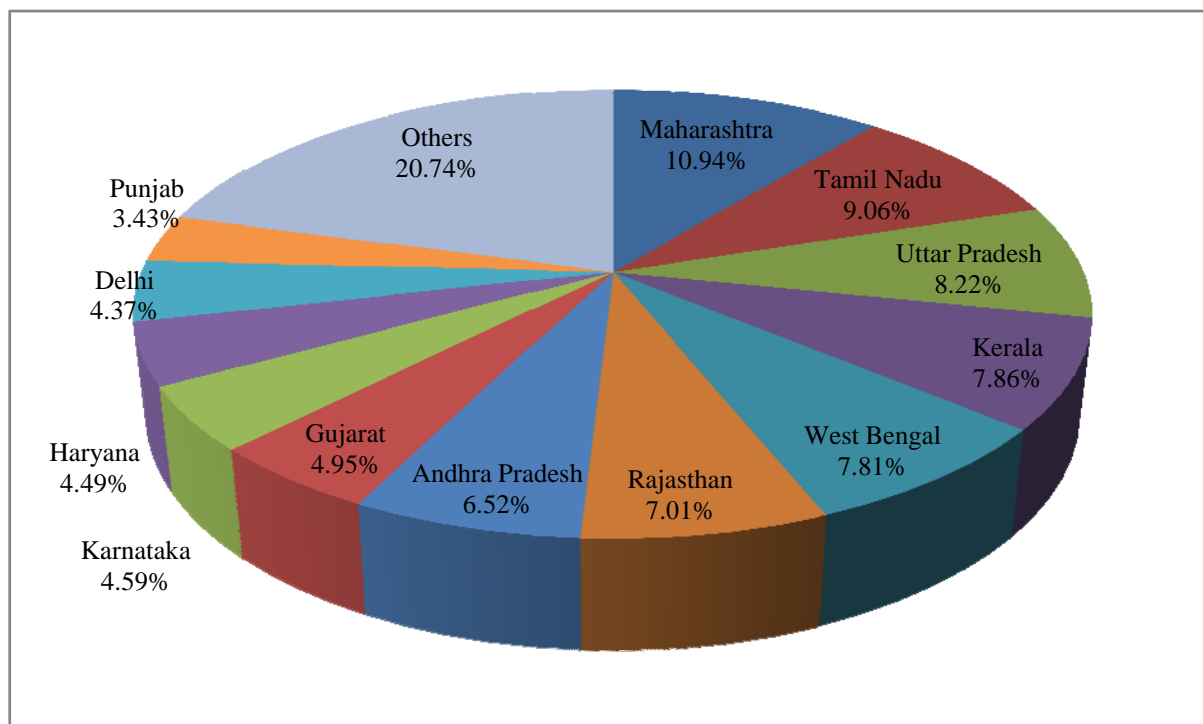
¹⁶ Masons include different types of masons such as stonework masons, tiling masons, plastering masons, polishing masons

satisfy the requirement for carpenters, electricians, welders, operators, plumbers, and others in this category).

2.7.4. Regions and sectors that would drive employment activity

Currently, industry inputs reveal that apart from human resource native to a particular region, there is an ‘import’ of human resource from states such as Orissa, West Bengal, and Bihar, especially at the ‘minimally skilled’ levels. Given that are large requirements, it is necessary that capability be built at a local level among both the skilled and unskilled workforce. In that context, it is necessary to examine where a substantial portion of the employment activity would happen in the middle to long term. Our analysis reveals that a large portion of the employment would be in Maharashtra, Tamil Nadu, Delhi and areas in Uttar Pradesh and Haryana neighbouring Delhi, apart from Rajasthan and other southern states.

Figure 24: States that would drive employment activity



Source: NSSO, Industry inputs, IMaCS analysis

The major sectors that would drive employment in the Construction sector are in the Real Estate, Electricity, and Roadways segments.

Table 14: Major segments where persons would be employed in Construction (in '000s) till 2022 – total and incremental human resource requirement

Activity	Total Requirement in 2022	Incremental requirement between 2008 and 2022
Real Estate - Housing and Buildings	24,981	14,191
Electricity	19,717	11,201
Road and Bridges	8,947	5,082
Railways (including MRTS)	7,745	4,400
Irrigation	10,681	6,068
Water Supply and Sanitation	6,061	3,443
Ports	2,551	1,449
Airports	889	505
Others	1,698	964
Total	83,270	47,302

Source: Primary Research and IMAcS analysis

In summary, it is observed that substantial skill building is required at the skilled workforce level to build capacity. This would stem from modular courses of anywhere between 3 months to 8 months duration in areas such as *carpentry, plumbing, operations, and others detailed above*. It is also required to examine models in which such skills can be delivered to the skilled and minimally educated workforce near to construction sites.

This report has been prepared by **ICRA Management Consulting Services Limited (IMaCS)**.

IMaCS is a multi-line management and development consulting firm headquartered in India. It has an established track record of over 15 years in consulting across various sectors and countries. IMaCS has completed over 950 consulting assignments and has worked in over 30 countries across the globe. Through the process of carrying out several assignments over the last decade and half, IMaCS has accumulated considerable analytical and consulting expertise, backed by the following capabilities:

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