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Human Resource & Skill Requirement Study for Indian Mining Sector

Study Report

Skill Council for Mining Sector (SCMS)

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Executive Summary

Background

Skill Council for Mining Sector (SCMS) had mandated Deloitte Touché Tohmatsu India LLP (DTTILLP) to undertake a **Human Resource and Skill requirements study for Indian Mining Sector over the period 2014-17 and 2017-22.** The study focused on identifying the workforce and skill requirement for mining sector over the 8 year period (2014-22). The approach for the study was consultative and participatory in nature, engaging and interacting sconsistently with key stakeholders through extensive primary interactions, aided by focused secondary research – utilizing various reports & publications, prior experience and other sources available in the public domain. The methodology adopted for undertaking the study involved extensive desk research and primary interactions with various central/ state government departments, industries/ industry associations, government and private training partners/ educational institutes, students, employees and Labor Unions relevant for mining sector. Structured and semi-structured questionnaires were used during primary interaction with various stakeholders.

The project methodology comprised of four distinct phases – (i) Design (ii) Survey (iii) Estimate (iv) Finalize. Design phase focused on finalizing the project objectives, survey plan, sampling plan, data collection tools, identification of stakeholders for survey, timelines and milestones of the assignment. The field survey across the identified sample of stakeholders and states was done in the 2nd phase of the study. In the 3rd phase the focus was to assess and analyse the data collected through primary interactions across various stakeholder groups and secondary research to estimate skilling requirements in the Mining sector; the report/ findings of the study was shared with SCMS subsequently. In the Finalize phase, the final report was submitted based on the feedback received.

Overview of Indian Mining Sector

India currently produces 89 minerals under different groups such as fuel minerals, metallic minerals, non-metallic minerals, atomic minerals and minor minerals. The Mining Industry in India is broadly classified into following four sub sectors:

1. **Prospecting & Exploration:** Companies engaged in providing architectural, engineering & related services, surveying & mapping, laboratory & on-site testing, and specialized design services.
2. **Core Mining:** Companies engaged in mining of minerals by underground, auger mining, strip mining, culm bank mining and other surface mining.
3. **Associated Services:** Companies primarily engaged in providing support services required for the mining and quarrying of minerals.
4. **Mineral Beneficiation:** Companies primarily engaged in smelting iron ore and steel scrap to produce pig iron in molten or solid form, in extracting alumina, and in smelting, refining, rolling, drawing, extruding and alloying non-ferrous metals.

Indian Mining sector registered a CAGR of 2.6% during the 9 year period 2004-05 to 2013-14 and contributed ~1.9% (1.07 lakh crore) to the national GDP in 2013-14. India's total value of mineral production (excluding oil and natural gas) is contributed by 11 key mining states, namely Rajasthan with a share of 12.9% followed by Odisha (11.16%), Andhra Pradesh[1] (9.39%), Chhattisgarh (6.75%),

[1] Combined data for Andhra Pradesh and Telangana

Jharkhand (6.80%), Gujarat (6.00%),Madhya Pradesh (4.82%), Assam (4.75%), West Bengal (3.78%), and Uttar Pradesh (2.70%) in 2013-14[2].

The sector is regulated by the Mines and Minerals (Development & Regulation) Amendment Act, 2015 which is the guiding act for development and management of mines in India. Additionally, acts and regulations such as Mines Act, 1952; Coal Mines (Special Provisions) Act (2015), Right to Fair Compensation & Transparency in Land Acquisition and Rehabilitation & Resettlement Act (2013); Environment protection Act (1986), Forest Conservation Act (1980); Labor Laws, etc. also govern the mining industry in India.

The ***key strengths*** of the mining sector in India includes: ***(a) vast availability of mineral deposits*** (India currently produces 89 minerals), **(b)** ***high production of minerals and metals globally*** (in 2012, India ranked 3rd in the world in production of coal & lignite; 3rd in Chromite production, 5th in Iron ore, 6th in Bauxite; in terms of metal production, the country ranked 3rd in Zinc (slab) and 4th in Steel (crude/ liquid) production[3]), ***(c) high degree of self-sufficiency in key minerals for domestic consumption*** (India is wholly self-sufficient in minerals such as Bauxite, Chromite, Limestone, Zinc etc.) ***(d) encouraging policies/ regulatory framework*** (such as long lease period and 100% FDI in exploration, mining, mineral processing and metallurgy under automatic route for all non-fuel and non-atomic minerals) and ***(e) availability of fiscal incentives*** (such as concessions on export profits from specified minerals and ores).

The ***Mining sector in India however is faced with several challenges presently***. The sector is underperforming over last few years (reduced contribution to Indian economy and ***negative YoY growth since 2012-14***). The commencement of mining operations in India require several mandatory clearances/ consents from multiple bodies/ agencies which, in many cases is a long drawn process. The Indian mining sector are presently levied ***multiple taxes*** which makes it as one of the highest taxed mining regime globally. The country presently has a ***low mineral exploration budget*** (USD 17 per square kilometre in 2013) as compared to other major mining economies across globe such as Australia (246 USD/ Km^2) and Canada (192 USD/ Km^2)[4]. The sector is also faced with inadequate transportation facilities and unregulated practices in small scale and unorganized mines.

Furthermore, the ***sector presently is faced with the pressure/ threat of depressed international commodity prices***. The depressed international commodity prices have an adverse effect on the Indian mining sector. The country has witnessed a decline in price of its key minerals; for instance the average sale price of Iron ore (below 55% Fe lumps) registered a decline of 31.8% in October, 2015 as compared to October, 2014. The sector is also anticipated to face pressure from non-fossil based resources. The future outlook of the sector also depends on improved social, developmental and environmental performance of mining organizations and greater acceptability of its projects amongst local community.

The ***rising domestic demand in India provides growth opportunities for the sector***. The Economist Intelligence Unit (EIU) forecasts real GDP growth in India at ~7.3% over the period 2015-20 which would be driven by growth in sectors such as manufacturing, power, construction and infrastructure. The growth of these sectors will have a direct positive impact on the growth of mining sector in India. Further, detailed exploration of the inferred and indicated geological reserves in India would aid in identification of new mineral bearing areas. The future opportunities for mining sector would also be realized by putting greater emphasis on underground mining, technological advancements in existing mining operations and skilling of existing workforce with respect to these technological changes.

The ***key drivers*** of sector competitiveness are expected to be: ***greater emphasis on exploration activities***, ***greater role of private players*** (private sector contribution was approximately 23% in the overall value of mineral production in 2012-13), better availability of transport infrastructure especially in mineral bearing areas (such as Dedicated Freight Corridors), ***emphasis on reducing the demand-supply gap of coal, enhanced productivity gains achieved through operational efficiencies*** and sustainable development of mining areas.

The country has immense potential for mining resources/ reserves and is among the top 10 global producers of many minerals. Given the availability of mineral wealth in India, the Ministry of Mines (GoI)

[2] *'Indian Mineral Industry at Glance 2012-13'*; Indian Bureau of Mines, Ministry of Mines, GoI
[3] Annual Report (2014-15), Ministry of Mines
[4] SNL Metals and Mining

has targeted to increase share of mining and quarrying sector in GDP from current 2% of GDP to 5% of GDP over the next 20 years which would require mining to grow at 10-12% per annum[5].

Employment Profile of Indian Mining Sector

The Indian Mining sector employed approx. 23.25 lakh people in 2011-12 across the organized and unorganized sectors (including self-employment) and accounted for around 0.5% of India's total workforce[6]. Based on National Industry Classification definitions (2008) and data from Central Statistical Organization[7], in 2011-12 Mineral Extraction sub-sector was the highest employer in mining sector accounting for ~89.3% of mining workforce engaged in core mining operations followed by 8.7% in Associated Services, 1.3% in Prospecting & Exploration and <1% in Mineral Processing & Beneficiation. Under Mineral Extraction, the majority of workforce (~66%) was engaged in extraction activities of dimensional stone, sand, clay and other minor minerals followed by Fuel Minerals (27%), Metallic Minerals (4%) and Non-Metallic (3%). The dimensional stone/ minor mineral industry is characterized as highly unorganized in comparison to other mineral categories.

Large proportion of mining in India is concentrated in relatively backward states[8] with low per capita income than national average such as Jharkhand, Rajasthan, Odisha, Chhattisgarh and Madhya Pradesh which constitutes ~54% of India's Mining sector GDP (2011-12) and ~37% of sectoral employment (2011-12). The states of Gujarat, Telangana, Andhra Pradesh & Maharashtra, which has higher per capita than the national average constitute ~25% of India's Mining sector GDP (2011-12) and ~22% of sectoral employment (2011-12).

Demographic and Workforce characteristics

Age of Mining Workforce: According to Deloitte survey (based on the sample of mining labor force surveyed), mining industry has a ***greater proportion of people (~80%) in younger age group (25-44 years)*** as compared to the overall employment across all sectors (about 57%) in similar age group.

Education Level: According to Deloitte survey[9], the sample of mining labor force covered has a greater proportion (~37%) of workers with Diploma/ ITI or trade certificates (short term/ medium term). However, mining courses are not being promoted as part of vocational education through ITI but as trade certificates by Mining Development Organizations (MDOs) on mining sites (through DGMS exams)[10].

Women Participation: According to DGMS, the average daily employment of women in mines in 2011-12 accounted for 4.4% (24,294 females) of the total mining workforce which is considerably less as compared to women labor force participation rate (22.5%) in India[11]. The key occupations of engagement in mining sector for women was reported as miners (mainly in extraction of Iron, Gypsum, Magnesite and limestone), loaders and clerical & supervisory staffs[12].

Migration: According to Deloitte survey, majority of workers are not attracted to migrate out of state in search of jobs in mining sector. However it is noteworthy that 20% of the mining workers surveyed reported to have migrated to other states from home state while 60% of mining workers reported to have migrated to other districts (within their state) to work in mining sector.

Mineral Extraction sub-sector employed 63% of migrants (from other states) out of the sample of mining labor force surveyed followed by Associated Services (25%), Prospecting & Exploration (9%) and Mineral Processing & Beneficiation (3%). This pattern was similar to existing workforce distribution by

[5] *'Development of Indian Mining Industry – The way forward'*, Federation of Indian Chambers of Commerce & Industry, October 2013

[6] Deloitte Analysis and Expert Interviews along with National Industry Classification (2008) definitions and data from Central Statistical Organization

[7] NSSO Report 2011-12, NIC-2008, Directorate General of Mines and Safety, Indian Bureau of Mines, Expert Interviews and Deloitte Analysis.

[8] The per capita GDP of these mineral rich states in India is lower than the national average. According to CSO, the per capita GDP (at constant price 2004-05) in 2013-14 for Jharkhand (INR. 28, 882), Rajasthan (INR 30,120), Odisha (INR 25,891), Chhattisgarh (INR 28,114) and Madhya Pradesh (INR 27,917) is lower than the national average of INR 39,904.

[9] Survey conducted as part of study which include coverage of key stakeholders such as industry, industry association, labour union, employees, government officials (central/ state) and education institutes covering 2,132 responses. It has to be noted that the survey results exclude companies under dimensional stones/ minor mineral category

[10] Report on Education, Skill Development and Labour Force 2013-14 Vol-III, Ministry of Labour & Employment, GoI

[11] Statistics of Mines in India Vol-I & II 2013, Directorate General of Mines and Safety, GoI

[12] Statistical Profile of Women and Labour 2012-13, Ministry of Labour and Employment, GoI

sub-sectors. According to the sample survey, migrants tend to settle in rural remote locations where extraction activities tend to occur, however few migrants tend to settle in semi-urban centers as mineral processing activities are more likely to be located in or near cities.

Education Infrastructure in Mining Sector

The mining related courses/ trades offered by education Institutes in India fall under following two categories – (i) ***Primary:*** Courses where the students are trained primarily for mining sector and (ii) ***Auxiliary:*** Courses which are non-exclusive to Mining Sector and students trained under it are available to be employed across other sectors with requirement of similar skills.

Currently in India, **most people with varying level of school education background or vocational training are non-exclusively available for Mining Sector, these students** can be absorbed across multiple sectors. **People with higher and technical education background can be exclusive as well as non-exclusive to the Mining sector** depending upon their specialization.

In 2014-15, ~2.18 crore students in India either dropped out at the school level (before completing higher secondary) or did not enrol for higher and technical education after completing higher secondary level. While some proportion of the school dropouts from this pool enrols for technical education, the majority of the resources is available to be employed across various sectors of the Indian economy (including Mining). Within the Mining Sector, this pool of resources would be typically employed at the NSQF levels 1 and 2 along with some basic functional/ statutory trainings. ***People with varying level of school education are employed as Mazdoors/ Helpers and Skilled Helpers in Mining sector.***

The ***vocational education institutes*** offering mining related courses in India comprise ***ITI's*** (Government & Private), **National Skill Development Corporation** (***NSDC) Training partners*** and ***Vocational Training Partners (VTPs)***. As on 19 February 2016, ***India has a total of 11,108 ITI's*** affiliated under NCVT which are offering courses that are relevant to the mining sector (Government: 1,699; Private:9,409)[13]. ***These ITIs currently offer 17 trades which meets multiple requirements of Mining sector***. However, the mining related trades offered by the ITIs in India are primarily non-exclusive to the sector and can be absorbed by other sectors as well. Within the mining sector, this pool of resources would be typically employed at the NSQF 3 & 4 catering to the requirements of 9 occupations. ***The key trades with highest seating capacity across the government and private ITIs are Fitter, Electrician, Welder, Mechanic (Motor Vehicle) and Machinist with total seating capacity of 16.96 lakh accounting for ~97% of total seating capacity in ITI's across mining related trades.*** In terms of vocational training intake capacity, majority of the key mineral bearing states in India have high annual intake capacity of **100 & above per lakh population** across ITI's offering mining related courses.States such as West Bengal (26), Chhattisgarh (65) and Gujarat (68), which are important mineral producing states in India, have low annual intake capacity of vocational training for mining related trades per lakh population.The training partners of NSDC also train students in mining related trades which are primarily non-exclusive to the sector such as fitter, welder, electrician etc.

In the year 2014-15, an incremental supply of ~**16.39 lakh students with higher and technical education qualification** (across various primary and auxiliary courses for mining sector) were added to the existing pool of workforce[14]. About 16-20 lakh people will be added each year to the mining sector with higher and technical education qualification (across various primary and auxiliary courses for mining sector) till 2022. The share of people coming out from primary courses in 2014-15 was **~0.3% while ~99.7% came from auxiliary courses.** People with higher/ technical education qualification are mainly **employed in Job Roles at NSQF levels 5, 6 & 7 in Mining Sector.** In terms of the distribution of AICTE approved higher education supply infrastructure for primary courses in mining sector in 2015-16, Telangana (38%) had the highest training capacity followed by Odisha (13%), Andhra Pradesh (7%), Maharashtra (6%) and Karnataka (6%). There are also some of the key mineral bearing states in the country.

The training and skill development activities in the Mining sector at the central level is primarily undertaken by the Ministry of Mines (along with its subordinate/ associate bodies such us GSI, IBM, JNARDDC etc.) and Ministry of Skill Development and Entrepreneurship (through its bodies such as NSDC). Various states have also identified skill development in mining sector as one of the key thrust

[13] https://ncvtmis.gov.in/
[14] AISHE 2013-14 & Deloitte Analysis

areas and developed initiatives towards the same. The Mines Vocational Training Rules framed in 1966 under the Mines Act of 1952 includes the provision for establishment of vocational training centres in mines and provides for initial, refresher and special training to mine workers. In view of this, the sector also sees considerable participation of public and private sector organizations in skill development activities.

Skill Gap Assessment

Indian mining industry employed ~23.86 lakh workers[15] in 2013-14 across the following four sub-sectors – Prospecting & Exploration, Mineral Extraction, Associated Services and Mineral Processing & Beneficiation. The overall employment in Mining Sector is estimated to increase to 26.45 lakh registering CAGR of 1.3% over the 8 year period 2014-2022 (as against the negative CAGR of 0.6% over the period 2005-14).

Incremental Human Resource Demand

The ***estimated incremental Human Resource demand in mining sector over the period 2014-22 is anticipated to ~2.59 lakh people.*** In terms of the share of Human Resource demand by mining sub-sectors, ***Mineral Extraction sub-sector is anticipated to employ highest share of incremental workers (~77.4%) followed by Associated Services (18.6%), Prospecting & Exploration (2.7%) and Mineral Processing & Beneficiation (1.3%).***

Within Mineral Extraction sub-sector (excluding minor minerals and dimensional stones), Fuel minerals are expected to account for ~59% of total incremental Human Resource demand followed by Metallic Mineral (31%) and Non-Metallic Minerals (10%). The sub-sectors Mineral Extraction, Prospecting & Exploration and Associated Services are expected to witness considerable skill up-gradation and in some cases replacement of current workforce. Mineral processing and Beneficiation activities are in nascent stage in India, and are expected to contribute least in terms of the incremental demand for workforce.

In terms of the share of incremental demand for workers across NSQF levels, the ***highest share of incremental Human Resource demand (~38.6%) is expected at NSQF level 04*** (i.e. Diploma/ ITI equivalent certificate holders). ***About 31.3% of incremental Human Resource demand is expected at NSQF level 01 & 02*** (i.e. school dropouts and pass outs who are not enrolled in higher/ technical education) followed by ~***14.0% incremental demand at NSQF level 05*** (i.e. Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders), ~***9.8% incremental demand at NSQF level 03*** (i.e. skill certification of medium term duration – 6 months to 1 year and short term – less than 6 months) and ~***6.3% of incremental demand at NSQF level 06 and above*** (i.e. Doctorate/ Post Graduate or equivalent degree holders).

In terms of the share of incremental demand for workers across geography, the ***highest share of incremental Human Resource demand (~12.7%) is expected from Jharkhand*** followed by Rajasthan (9.1%), Chhattisgarh (8.9%), Odisha (8.8%) and Madhya Pradesh (8.8%). ***The 13 key mining states of India[16] are anticipated to account for ~86% of the total incremental demand for workers over the period 2014-22.***

The key occupations projected to account for majority of the incremental demand for workers over the period 2014-22 are Loading & Hauling – Opencast (13.4%), Others in Mining Operations[17] (12.6%), Specialist Operations – Underground (8.6%), Loading & Hauling – Underground (7.2%) and Mechanical Services (7.1%).

[15] Human Resource demand has been projected by considering 2011-12 as baseline based on availability of data reported by CSO, Census of India, NSSO, IBM and DGMS for respective years.
[16] Includes Jharkhand, Rajasthan, Chhattisgarh, Odisha, Madhya Pradesh, West Bengal, Andhra Pradesh & Telangana, Karnataka, Tamil Nadu, Gujarat, Maharashtra and Goa
[17] Includes Mining Engineer, Geotechnical Engineer, Material Engineer, Reclamation Supervisor, Supervisor - Plant operations, Mining Supervisor, Mining Mate

Incremental Human Resource Supply

The estimated ***incremental Human Resource supply of workers (from Primary and Auxiliary sources) in Mining sector over the period 2014-22 is anticipated to be ~8.9 crore – however most of this incremental supply is a pool of Human Resource which is available for competing sectors across the economy as well***.

Women constitute ~25% of the total incremental supply of workforce (from Primary and Auxiliary sources) which is available to be employed across competing sectors[18]; however, their share in **Mining *Sector is expected to be ~5-7%[19]*** in line with the historical trends and absorption levels of industry observed.

In terms of the share of incremental supply of workers (from Primary and Auxiliary sources) across various NSQF levels, the ***highest share of incremental Human Resource supply (86.8%) is expected at NSQF level 01 & 02.*** About ***6.3% of the incremental Human Resource supply is expected at NSQF level 05*** followed by ***~4.5% incremental supply at NSQF level 04*** and ~***1.7% incremental supply at NSQF level 06 & above.*** Very small proportion of the overall incremental Human Resource supply (from Primary and Auxiliary sources) is expected at NSQF level 03. Based on historical trends of organized workforce in mining industry, ~10-14% of the existing supply is expected to participate in organized segment of the industry.

The supply of workers (from primary sources only) constitute only 0.92 lakh (i.e. ~0.1%) of the total incremental Human Resource supply over the period 2014-22. ***The highest share of the incremental supply of workers from Primary sources only (64.5%) is expected at NSQF level 05***. Approximately 7,100-7,600 diploma/ degree holders in mining relevant courses are anticipated per annum to participate in mining workforce by 2022. ***About 27% of the incremental supply of workers from Primary sources only is expected at NSQF level 04***. Approximately, 2,500-3,000 trade certificate holders (from DGMS) are expected to join mining workforce annually. These certificates are offered in trades such as Winding Engine Operator, Shot Firer/ Blaster, Foreman and Mining Sirdar. ***Approximately 8% of the incremental supply of workers from primary sources is expected at NSQF level 06 & above***: This entails that around 900-1,000 people per annum are expected from primary courses (which are exclusive to the sector) by 2022.

Incremental Human Resource Demand Supply Gap

The gap analysis conducted as part of the study provides a side-by-side comparison of HR demand and available supply at NSQF levels in line with the SCMS occupational matrix and study objective.

During the period 2014-22, the incremental demand-supply (from primary and auxiliary sources) gap of the sector is expected to be a surplus of ~8.88 crore. *However, this pool of workers is available across all competing industries. Also, this segment may or may not be adequately trained to work in mining industry set up at the time of induction, due to different orientation and industry backgrounds. Further, the workers engaged in mining sector at multiple Job Roles above NSQF level 3 are required to adhere to the statutory compliances of DGMS which makes it mandatory for them to undergo the statutory certification by DGMS without which worker engagement in industry is not allowed.*

According to the analysis, a deficit of 0.60 lakh people is expected in case of supply of workers from primary sources only at NSQF level 4 and above. The mining industry would strive to attract workers from auxiliary supply to address the anticipated deficit of people through appropriate skilling and knowledge development, use of technology innovation and improved productivity.

Table 1: Human Resource Demand Supply Gap by NSQF levels 04 & above (in lakh) - Mining's share of entrants for 17 occupations not including Mazdoor/ Skilled Helper, 2014–2022

Particulars	2014-17	2017-22	2014-22
Total Incremental Human Resource Demand (for all levels)	**0.93**	**1.65**	**2.59**
Incremental Human Resource Demand (level 4 & above)	**0.55**	**0.97**	**1.52**

[18] Deloitte Analysis
[19] Statistics of Mines in India Vol-I & II 2013, Directorate General of Mines and Safety, GoI; Statistical Profile of Women and Labour 2012-13, Ministry of Labor and Employment, GoI

Particulars	2014-17	2017-22	2014-22
NSQF level 06 & above (Doctorate/ Post Graduate or equivalent degree holders)	0.06	0.10	0.16
NSQF level 05 (Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders)	0.13	0.23	0.36
NSQF level 04 (Diploma/ ITI equivalent certificate holders)	0.36	0.64	1.00
NSQF level 03 and below (Skill certification of medium term duration – 6 months to 1 year and short term – less than 6 months, School dropouts and pass outs who are not enrolled in higher/ technical education)	*0.38*	*0.68*	*1.07*
Incremental Human Resource Supply	**0.36**	**0.56**	**0.92**
NSQF level 06 & above (Doctorate/ Post Graduate or equivalent degree holders)	0.03	0.04	0.07
NSQF level 05 (Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders)	0.24	0.36	0.60
NSQF level 04 (Diploma/ ITI equivalent certificate holders)	0.09	0.16	0.25
NSQF level 03 and below (Skill certification of medium term duration – 6 months to 1 year and short term – less than 6 months, School dropouts and pass outs who are not enrolled in higher/ technical education)	*Available Human Resource supply of 6.7 lakh workers for 17 occupation, all the relevant sectors*		
Incremental Human Resource Demand Supply Gap	**0.19**	**0.41**	**0.60**
NSQF level 06 & above (Doctorate/ Post Graduate or equivalent degree holders)	0.03	0.06	0.09
NSQF level 05 (Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders)	(0.11)	(0.13)	(0.24)
NSQF level 04 (Diploma/ ITI equivalent certificate holders)	0.27	0.48	0.75
NSQF level 03 & below	**To be sourced from competing sectors**		
*Assuming only Mining's share of entrants for 17 occupations excluding Mazdoor/ Skilled Helper i.e. NSQF level 04 & above			
Source: Deloitte Analysis			

- **Human Resource Deficit projected at NSQF level 6 & above** *(Doctorate/ Post Graduate or equivalent degree holders)*: *Deficit of ~1,000-1,100 professionals per annum is expected for specialized functions such as Geological Exploration, Exploration Drilling, Ore Pressing, Control Systems and Managerial Roles. This situation may be read in line with initiatives for mechanization of mines in near future.*
- **Human Resource Surplus projected at NSQF level 5** *(Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders): A surplus of ~3,000 professionals per annum is expected primarily for engineering, supervisory or plant operation functions. However, this segment is expected to undergo suitable refresher/ upskilling training to adequately skill them on key technological advancements such as DGPS systems, Underground carving, Aerial Survey etc.*
- **Human Resource Deficit projected at NSQF level 4** *(Diploma/ ITI equivalent certificate holders)*: *A shortage of ~9,300 workers per annum is expected for key Job Roles such as Drill Operator, Dumper, HEMM Maintenance operators, Shovel Operators , Surface Miner, Roof Bolter, SDL & LHD Operator, Shuttle Car, Conveyor, Dumper, Driller, Loader, Dozer/ Crawler, Shovel Operator etc. This shortage may be met either through upskilling the workers available at NSQF level 3 & below or attracting workers with similar skill set engaged in competing* sectors *and reskilling them in accordance with DGMS's statutory compliances. Certification and 'recognition of skills' of this group of workforce is required, to enable Mining Sector to attract new workers and retain current workers – so that gap between demand and supply does not widen.*
- **Human Resource demand projected at NSQF level 3 & below** *(Skill certification of medium term duration – 6 months to 1 year and short term – less than 6 months, School dropouts and pass outs who are not enrolled in higher/ technical education):* The expert interviews with education institutes and industry experts highlighted that the primary supply of Human Resources is available for NSQF levels 4 and above while generally no trade specific skill set is required at NSQF level 3 & below. Hence, this segment will necessarily have to attract the required workers from other competing sectors through Auxiliary Supply.

Key Challenges and recommendations

The table below provides the snapshot summarizing key issues & corresponding recommendations for each stakeholder. It is important for all stakeholders to work in close collaboration with each other in consultative manner, to achieve desired level of maturity in skill development ecosystem in Mining Sector.

Key Issues/ Challenges to be addresses	Key Recommendations
Skill Council for Mining Sector	
Need for developing Qualification Packs (QP's) & National Occupational Standards (NOS's) for new Job Roles (identified in present study) & existing Job Roles at higher NSQF level	• Create QP's & NOS's in association with industry for (i) *21 existing Job Roles at NSQF levels higher than 5 and (ii) 26 new Job Roles identified under the study*. • Associate & affiliate with training providers to offer training programs on the same. • Build on current study and set up a comprehensive Labor Market Information System (LMIS) and publish it for stakeholders.

Need for prioritizing training in occupations with high projected demand with respect to supply	*Occupations such as Loading & Hauling –Opencast & Underground, Specialist Operations – Blasting anticipated to witness high annual incremental demand of workers over the period 2014-22.*
	• SCMS to focus on offering suitable training programs across these key occupations and Job Roles:
	  • **Blasting**: *Explosives Handler, Shot Firer/ Blaster*
	  • **Loading & Hauling – *Opencast:*** *Dumper/ Tipper Operator, Loader Operator, surface miners*
	  • **Loading & Hauling – *Underground:*** *SDL & LHD Operator, Haulage Operator*
	  • **Specialist – *Underground Operations:*** *Timberman, Roof/ cable bolter*

Deficit of professionals projected at leadership positions (NSQF Levels 6 & above)	• Facilitate multi-disciplinary management development training programmes for existing workforce to take up leadership roles. The training activities may be similar to trainings as undertaken by Indian Institute of Coal Management (IICM).
Limited availability of courses in mining sector	• Collaborate with MSDE and DGT to include mining specific modules/ bridge courses in training pedagogy especially for following sub-sectors: ***Associated Services (Mechanical Services, Electrical Services and HSE Functions) and Mineral Extraction (Drilling & Cutting and Surveying).***
Limited awareness, and capacity of mining workforce in sustainable mining practices	• Promote awareness on sustainable mining practices amongst existing and entering workforce. • **Form a committee headed by CEO** to identify Job Roles and skills/ training requirement for sustainable mining practices. The findings may be presented as a Concept Note by the proposed committee in association with industry which can be presented to Board for further actions.

Need for holistic approach towards skill development	• Collaborate with multiple stakeholders to improve skill development ecosystem in mining sector
	  ○ Enter into MoUs with mining organizations/ associations to develop joint curriculum for training programs.
	  ○ Collaborate with respective SSCs of countries such as Australia and Canada for exchange of resources, processes, knowledge and technology.
	  ○ Collaborate with international bodies such as SkillsTech Australia (STA), Australia's centre for virtual mining SIMTARS to establish Centres of Excellences (CoEs) in Mining sector.

Key Issues/ Challenges to be addresses	Key Recommendations
	○ Identify global certifications of relevance; identify and collaborate with Personal Certifying Bodies (PCBs) & Certifying Bodies (CBs) to accredit individuals/ training partners for specific courses.
Central/ State Government	
Limited awareness, reach, acceptance of certification	• Bring uniformity in qualification across institutions and work with industry/ association to ensure the qualification framework is well recognized and accepted. • Facilitate integration of NSQF levels in recruitment rules of industry for employment of certified workers. • Enhance existing ***certification capacity of DGMS in terms of number and other trades***. • SCMS may be made part of skilling ecosystem along with DGMS.
Limited R&D and Technical Support for mining sub-sectors	• ***Identify 1-2 nodal technical institutes for each sub-sector*** to drive the agenda of sub-sector specific training, technical support and research and development. • ISM, Dhanbad or IIT, Kharagpur can be positioned as nodal institute for Mineral Extraction while Banaras Hindu University (BHU) could be a nodal institute for Prospecting & Exploration.
Training rules need to be reviewed in context of emerging technology	• ***Review Mines Vocational Training Rules, 1966*** in light of present/ upcoming technology, mechanization and research & development for mining industry.
Low perception about mining and related activities amongst youth/ women	• Make efforts to transform perception about mining sector and ***create awareness about the industry and related training programs, especially in mining clusters***. • Make efforts aimed at emphasising dignity of labour in Mining Sector – towards encouraging youth to choose mining oriented vocational trades.
Under-representation of women (<5%) in mining sector workforce	• Initiate a study under the aegis of 'Ministry of Mines' in partnership with SCMS aimed at understanding employment of women in Mining Sector at various Job Roles/ levels, and identifying possible Job Roles where gender parity may be improved on priority.
Regional and remote nature of employment	• Take measures to ensure closer co-operation between State Skill Development Missions (SSDM) and SCMS. • Key mining states in India to come up with district level skill requirements for the Sector in their annual plan. • SCMS to liaison with respective SSDMs of states to implement sector specific skill development activities.
Industry/ Industry Associations	

Limited industry-academia collaboration	• ***Incubate Mining Industry Institute Partnership Cell within prominent educational institutes in each mining cluster which would***
	  • Facilitate faculties/ students training/ orientation on the current trends of mining sector by practitioners.
	  • Promote ***Experiential Learning*** and ***Education Outreach***.
	  • Address industry's expectation mismatch.
	  • Provide mentorship and help to students in alignment of skilling to industry's need.

Limited collaboration of industry partners to promote and incentivize training	• Facilitate collaboration and optimal use of capital intensive resources/ establishments for training. • Share/ provide training resources (***abandoned mining sites, equipment, machinery and simulation centres***) within mining clusters for up-skilling/ fresh skilling similar to:

Key Issues/ Challenges to be addresses	Key Recommendations
	○ Leverage Corporate Skilling Centers scheme by MoSDE. ○ Institute of Natural Resources (INR) by Indian Institute of Skill Development (IISD) in association with Australian institutes at Gurgaon to offer simulated training for underground mining.
Limited availability of Simulation Training	*DGMS in 2011 recommended mining companies with opencast operations using HEMM to install simulator training for operators. For small mechanized mines, group vocational training centres to create common facility. However, there is a big gap in simulation training with limited companies providing training on simulators.* • Industry to consider using state of the art technique including simulation and 3D Virtual Reality system under skill development trainings to improve operating skills of the workers and reduce accidents at work place.
Limited opportunity for appropriate level of skilling for Mining Sector	• Sponsor candidates through CSR provision of Companies Act 2013. Undertake skill development initiatives with focus on activities mentioned under ***schedule VII (Companies Act, 2013) such as employment enhancing vocational skills and social business projects for livelihood enhancement***.
Lack of succession planning and knowledge-transfer initiatives	*Industry is anticipated to face deficit of professionals in leadership positions over the period 2014-22 (especially knowledge workers in Prospecting & Exploration and Mineral Beneficiation & Processing).* • Improve succession planning and knowledge-transfer initiatives by upskilling/ re-skilling skill employees with substantial experience in mining sector.
Low Preference for skilling/ up-skilling	• Adopt preferential recruitment or wage differential for applicants who are certified. • Prioritize and provide benefits to employees (permanent and contract) who opt for skill enhancement.
Training Providers	
Insufficient training capacity at Diploma/ ITI equivalent certificate level	*Deloitte study anticipates demand-supply gap of ~0.75 lakh workers with Diploma/ ITI equivalent certificate.* • Training providers to offer Diploma/ ITI equivalent training programs to fulfil likely shortage of workers. • Focus on ***training the operation of trade specific HEMM machineries and their Maintenance***. • Focus on ***key mining states of West Bengal, Chhattisgarh and Gujarat where there is low annual intake capacity (per lakh population) of vocational training for mining related trades***.
Limited availability of training programs focused on statutory roles in mining sector	• Focus on offering training programs for statutory positions in Mines such as ***Mining Overman, Mining Sirdar, Shot-firer. Haulage operators, Surveyors, Electrical/ Mechanical supervisors*** etc. • Design training curriculum incorporating certification requirements of respective positions by DGMS.
Need for designing/ updating training activities (skilling/ up-skilling) based on technological advancements	*Occupations such as Exploration Drilling, Geological Investigations, Geophysical Exploration and Health, Safety & Environment are anticipated to have low incremental Human Resource requirement over the period 2014-22 (Deloitte Study). However, they are anticipated to undergo major technological advancements with increased share of workers expected over next 8 year period.* • Training Providers to design training programs in line with technological advancements across these occupations. Indicative training requirements is provided in the full report.
Source: Primary interactions with stakeholders and Deloitte Analysis	

The detailed recommendations are provided in the full report.

1. Context

1.1 Background

The Skill Council for Mining Sector (SCMS), was set up in 2013 to develop skill competency standards and qualifications, benchmark it with national and international standards and to work with the mining industry in PPP mode. SCMS is promoted by FIMI, supported by Ministry of Mines and established according to the guidelines framed by the National Skill Development Council (NSDC) for the mining sector in India.

SCMS targets to up-skill and train 4.5 lakh workers in the mining sector over a period of next 10 years, including 50 thousand new workers; for this SCMS wishes to understand the skilling requirements for the Mining Sector.

In this backdrop, SCMS has commissioned the present Study for Indian Mining Sector to estimate the Human Resource and Skill Requirements for the Mining Sector of India over the period 2014-17 and 2017-22. Deloitte Touché Tohmatsu India LLP ("Deloitte") has been engaged as consultants for conducting this above study. The study covered the major mining clusters spread across India.

1.2 Objectives and Scope of Work

The core objective of the study is to ascertain the Human Resource and skill requirements for the mining sector of India for the period 2014-17 and 2017-22. The scope of work includes the following:

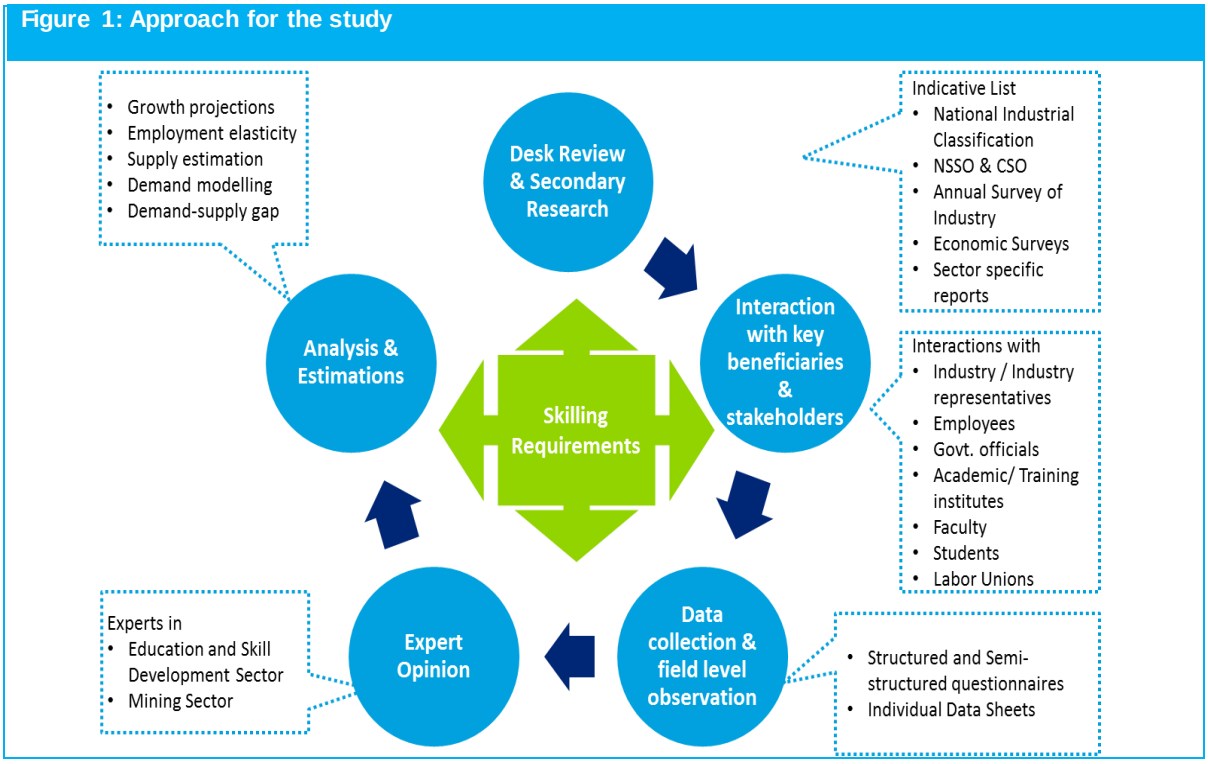
- Industry Overview
- Yearly update on the Mining Scenario from 2015-17 including SWOT analysis for the sector, specific to Human Resource
- Identification and mapping of Job Roles
- Skill Gap & Demand projection for the sector for 2014-17 and 2017-2022
- Identification of support infrastructure
- Recommendations for key stakeholders

2. Approach & Methodology

2.1 Project Approach

Our approach to this project was conceived in line with the objectives and scope of work as mentioned in the Terms of Reference (TOR) for 'Conducting Human Resource and Skill Requirements Study for Indian Mining Sector'. The study adopted a consultative and participatory approach, engaging and interacting with key stakeholders, collecting data and congregating factors through rigorous analysis in order to address the study requirements. The approach was significantly based on collaboration/ primary interaction with the key stakeholders. This was aided by focused secondary research – utilizing various reports & publications etc. which are available in the public domain.

Figure 1: Approach for the study



In line with the above, the approach for this study comprised the following:

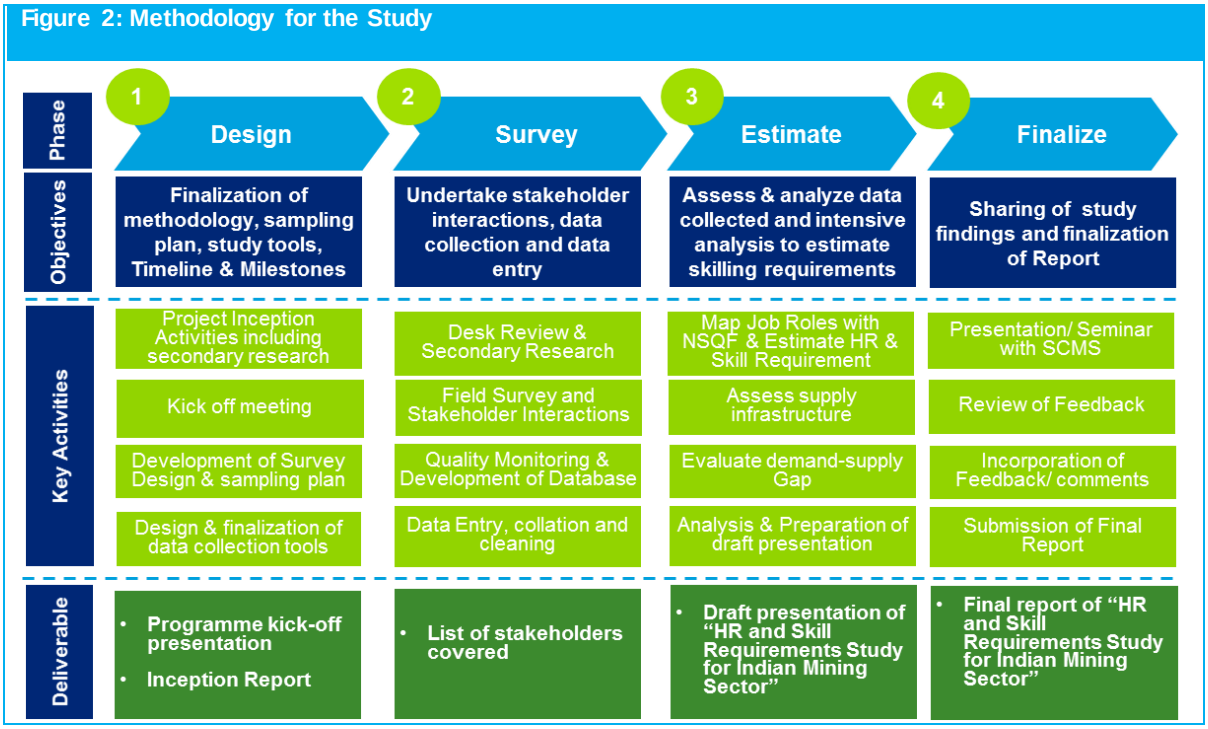
- **Inputs from Project Steering Committee and SCMS**: At the commencement of the exercise, the project engagement team interacted with the Project Steering Committee at SCMS by way of an inception presentation to better understand the objectives and the desired outcomes from the study. Regular interactions with SCMS also took place during various stages of the project with a view of ensuring close matching/ adherence to expectations.
- **Interactions with key stakeholders**: The study covered interaction with stakeholders across various categories such as key ministries/ departments at central and state level, central/ apex institutes related to mining sector, State Skill Development Missions, mining associations and organizations, faculty & students of the colleges offering mining related courses, Labor Unions etc. These stakeholder groups were interviewed for their inputs on various aspects of the mining sector.

- **Secondary Research and Desk Review**: Data collected from the above primary interactions was analysed in light of secondary data available in the public domain. Desk research and primary interactions were also complemented with opinion of subject matter experts from Mining sector.

2.2 Project Methodology

Based on our understanding of the scope of work and SCMS's suggestions, the project methodology for the study was designed to comprise four distinct phases as outlined in the figure below. Each of these phases has been explained in the subsequent sections.

Figure 2: Methodology for the Study



Phase 1: Design

The key activities during this phase included the kick-off meeting with SCMS on 9 September 2015, nomination of Mr. B. K Bhatia as single point of contact from SCMS for coordinating and addressing all project related activities/ issues, formation of Project Steering Committee and finalization of project scope. This phase also focused on development of the survey design, sampling plan and data collection tools. As part of the sampling plan, the key minerals (based on the total value of mineral production as well as the total share of employment in the mining industry) and mineral producing clusters in India were identified. The following table provides the list of key minerals and states identified across each category of minerals.

Table 2: List of key minerals and states identified

Category of Mineral	Key Minerals	Key States
Fuel Minerals	Coal, Lignite	Chhattisgarh, Jharkhand, Andhra Pradesh, Madhya Pradesh, West Bengal, Tamil Nadu, Telangana
Metallic Minerals	Iron Ore, Lead & Zinc, Bauxite, Chromite, Gold, Manganese	Chhattisgarh, Andhra Pradesh, Gujarat, Goa, Jharkhand, Karnataka, Odisha, Maharashtra, Rajasthan, Tamil Nadu
Non Metallic Minerals (excluding dimensional stones & minor minerals)	Phosphorite, Barytes, Dolomite, Limestone	Andhra Pradesh, Chhattisgarh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Telangana

Category of Mineral	Key Minerals	Key States
Minor minerals & Dimension Stones	Industrial minerals and minerals like building stones, ordinary clay, gravel, ordinary sand, limestone used for lime burning, boulders	Rajasthan, Chhattisgarh, Andhra Pradesh, Goa, Jharkhand, Delhi NCR, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu

The sample of demand side stakeholders that were covered in the survey (mining employers/ contractors, central/ apex institutes and mining associations and central/ state government officials in mining sector) was defined and identified for interactions across these mineral groups and states. Similarly, the sample of supply side stakeholders (educational institutes, faculty/ staffs and students) was defined and identified for interactions across these mineral groups and states. Additionally, the sample of employees and Labor unions operational in mining sector were defined and selected. In this phase identification and validation of new Job Roles across various sub-sectors of mining sector (in addition to the existing list as defined by SCMS) was done. In this step, 26 new Job Roles were identified and validated from various stakeholders.

Table 3: Sub-sector wise list of Job Roles identified

Sub-Sector	No. of Existing Job Roles	No. of New Job Roles
Prospecting & Exploration	2	5
Core Mining	26	10
Associated Services	9	7
Mineral Beneficiation	2	4
Mazdoor/ Helper	1	-
TOTAL	40	26

As the final step in this phase data collection tools for various stakeholder groups were designed. (The stakeholders covered as part of the study is provided in ***Annexure 01***. The study tools for all the stakeholders identified are provided in ***Annexure 02***.)

This phase culminated with the submission of the Inception Report which included the finalized scope of work, approach and methodology, survey design, sample size, study tools, list of stakeholders as well as final work plan with timelines for key milestones.

Phase 2: Survey

This phase focused on execution of the field survey wherein, the questionnaires were administered across all identified stakeholder groups by the field surveyors covering the target sample size. The following is the total sample of stakeholder groups covered during the field survey. A total, ~2,100 participants were covered through a mix of structured and semi-structured interactions.

Table 4: Summary of Stakeholder Interactions

	Stakeholder Category	Target Sample for the Study	Total Sample covered
DEMAND SIDE	Employers/ Mining Organizations	120	125
	Mining Workers	400	1,531
	Central/ Apex Organizations/ Mining Associations	14-15	33
	Labor Unions	-	14
SUPPLY SIDE	Educational Institutes	35	37
	Faculty	100	101
	Students	250-260	268
REGULATORS	State Government Departments	28-30	40
	TOTAL	**947-960**	**2,149**

The break-up of the mining organizations classified according to total employee strength (on company payrolls as well as outsourced) is as follows:

Table 5: Break-up of Mining Organizations in terms of employment

Employment Size	Total Sample covered
100 Employees & below	35
100-500 Employees	52
500-5,000 Employees	29
5,000 Employees & Above	9
TOTAL	**125**

As part of this phase, in depth review of the mining sector and each of the identified sub-sectors was conducted to develop better understanding of mining scenario, with specific focus of Human Resources, in India. It involved collection of primary information from mining companies, mining associations, mining workers, Labor Unions, various ministries, government departments and central/ apex institutes. Simultaneously in-depth secondary research was also conducted to validate findings from the field survey.

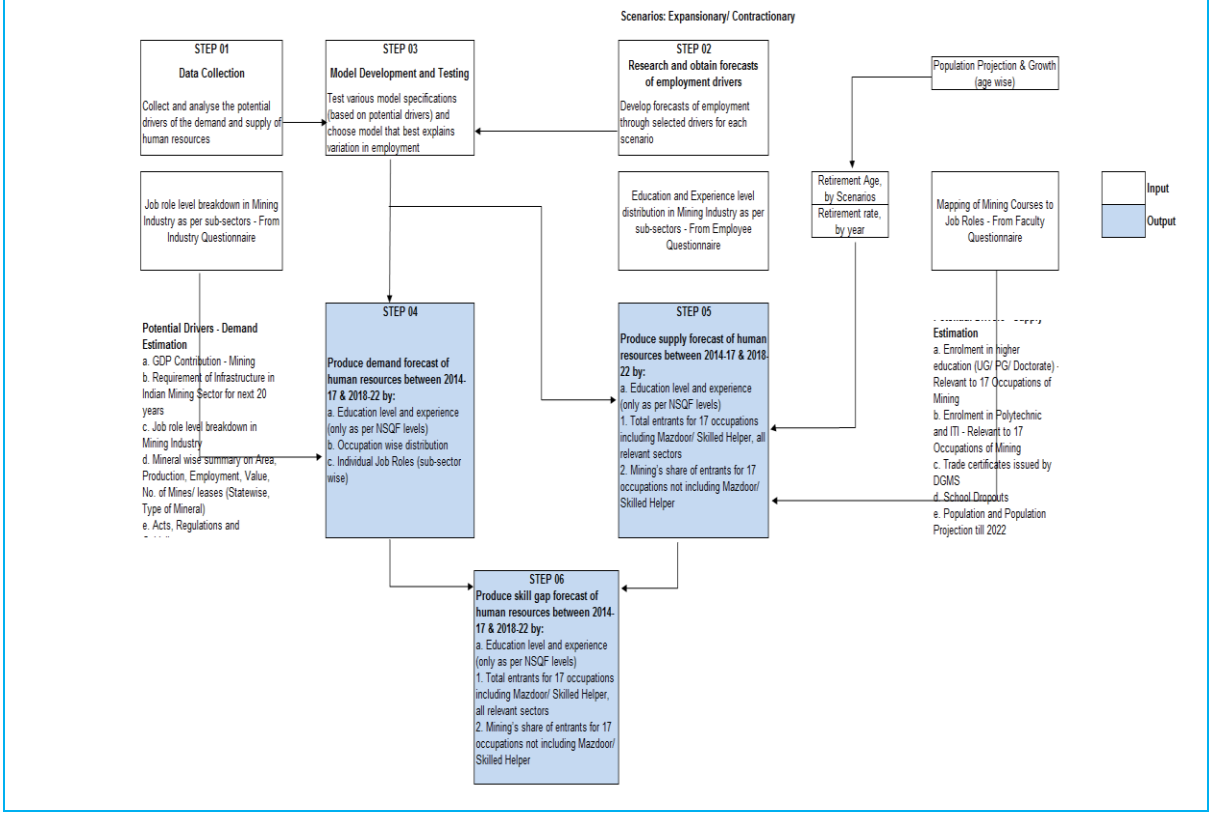
The data collected was entered in to a structured database, which was followed by data cleaning, validation and finalization for analysis.

Phase 3: Estimate

The organized data and information collected form primary as well as secondary sources was analyzed in detail for overall skilling requirements across the mining sector/ sub-sectors along with mapping of the current provision of supply infrastructure in the sector through both public and private institutes. A model was developed to make supply side and demand side projections and ascertain the gap.

The following is the methodology followed for estimation of the Human Resource and skill requirements vis-à-vis supply across various sub-sectors of mining over the period 2014-17 and 2017-22.

Figure 3: Methodology for estimation of Human Resource Demand and Supply in Indian Mining sector, 2014-22



This phase culminated with the presentation of a draft report on "Human Resource and Skill Requirement Study for Indian Mining Sector" which included an analysis based on the survey findings and presented the demand and supply of Human Resource across various mining sub sectors. Based on the study findings, detailed recommendations were also provided.

Phase 4: Finalize

The key activities in this phase include the preparation and finalization of the report, presentation of the study findings with SCMS Project Steering Committee, incorporation of the feedback received and finalization of the report. This phase culminates with the submission of the final report on 'Human Resource and Skill Requirements Study for Indian Mining Sector' to SCMS.

3. Overview of Indian Mining Sector

Mining is one of the core sectors that drive growth in the economy; though it make a minor contribution to India's Gross Domestic Product, it acts as a catalyst for the growth of core industries such as power, steel, cement, etc., which in turn, are critical for the overall development of the economy. India's overall economic performance has remained steady amid wavering global economic conditions over the last decade. Mining & Quarrying contributed around 1.9% of India's GDP in 2013-14. The sector registered an average growth rate of 2.6% from 2004-05 to 2013-14. However, it has witnessed negative growth of 1.7% from 2011-12 to 2013-14.

There is significant mineral potential for the growth of mining that still lies untapped in India. Historically, mining sector has struggled to leverage the potential due to three key factors i.e. regulatory and administrative procedures, inadequate infrastructure facilities and sustainability. These challenges have limited the overall investment in mineral extraction and exploration activities in India, as evident from very low proportion of FDI in mining sector – 0.83% of total FDI inflow of INR 1,340,231crores, from April 2000 to September 2015, i.e. INR 12,000 crores[20].

India currently produces nearly 89 minerals under different groups such as fuel minerals, metallic minerals, non-metallic minerals, atomic minerals and minor minerals. In India, 80% of mining is of coal while 20% is of various metals and other raw materials such as gold, copper, Iron, lead, bauxite and zinc concentrated majorly across Chhattisgarh, Odisha, Jharkhand, Madhya Pradesh, Rajasthan, Karnataka and Maharashtra. India with diverse and significant mineral resources is the leading producer of some of the minerals. India is the largest producer of mica blocks and mica splitting; ranks 3rd in the production of coal & lignite, 2nd in Barytes, 3rd in Chromite; 4th in Iron ore, 5th in Bauxite and 6th in manganese ore. The broad categories of minerals produced in India are as follows[21]:

1. **Fuel Minerals:** Fuel minerals are primarily useful for their calorific value; it comprising of Coal, Lignite, Petroleum and Natural Gas[22].
2. **Metallic Minerals:** Metallic minerals are those minerals that can be melted to make new products. It includes 10 minerals, it includes 4 minerals in total comprising of Iron Ore, Zinc, Chromite, Silver, Manganese, Bauxite, Copper, Gold, Lead and Tin.
3. **Non-metallic Minerals**: Non-metallic minerals are minerals that are not able to create new products after melting and are usually sedimentary rocks. It includes 21 minerals which comprises Limestone, Mica, Gypsum, Dolomite, Asbestos etc.
4. **Minor minerals**: It includes 54 minerals in total and comprises minerals like building stones, gravel, ordinary clay, ordinary sand, limestone used for lime burning, boulders, kankar, murum, brick earth, bentonite, road metal, slate, marble, stones used for making household utensils etc. In contrast to

[20] Department of Industrial Policy and Promotion – FDI Statistics June 2015.

[21] The broad definition of Mineral Category has been revised by Ministry of Mines on Feb 05, 2015 where 31 major minerals were classified as minor minerals. Based on this notification Non-Metallic category now includes 21 minerals instead of 52 and the minor minerals now includes 54 minerals instead of 23. The regulatory and administrative jurisdiction of minor minerals falls under the purview of State governments where these 31 minerals account for over 55% of the total number of leases and nearly 60% of total leased area. < http://pib.nic.in/newsite/PrintRelease.aspx?relid=115190 > accessed on Feb 08, 2016

[22] For the purpose of study atomic mineral, oil and natural gas has not been taken into consideration.

major minerals, the regulatory and administrative jurisdiction of minor minerals generally falls under the purview of state governments.

The study covered all the above mineral categories, however Petroleum & Natural Gas and see bed mining was not covered as part of this study. The study includes all phases of the mining cycle: prospecting & exploration, construction & development, extraction, processing & reclamation and closure & maintenance. In context of the study mining industry has been classified under 4 sub-sectors[23] – (a) Mineral Exploration, (b) Mineral Extraction, (c) Associate Services and (d) Mineral Processing & Beneficiation. This classification is based on study objectives and is in line with occupational matrix being currently followed by SCMS of the mining sector in India.

Map 1: Key Mineral in India based on value of production 2013-14

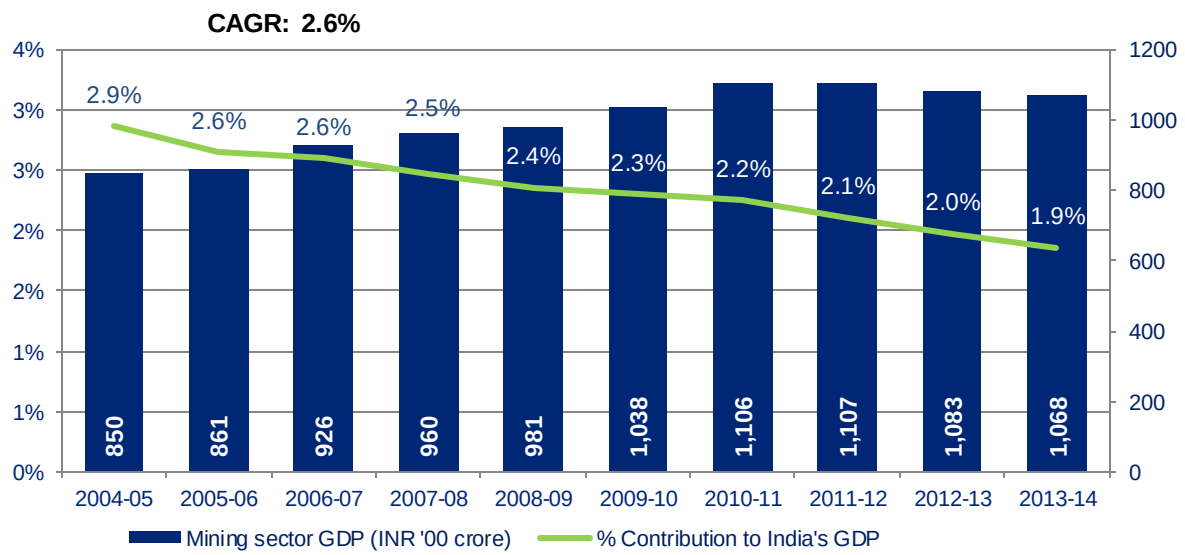
Source: Annual Report 2014-15, Ministry of Mines

[23] An extensive review of the primary activities in respective sub-sector along with International Standards of Australia and Canada have been adopted in order to develop an appropriate definitions.

3.1 Economic Profile

The mining sector in India has grown at a CAGR of 2.6% from INR 85,028 crore in 2004-05 to INR 1,06,839 crore in 2013-14. However the mining sector contribution to the national GDP has reduced from 2.9% to 1.9%, during the period 2004-05 to 2013-14.

Figure 4: Mining Sector GDP from 2004-05 to 2013-14 at constant prices (2004-05) in INR crore



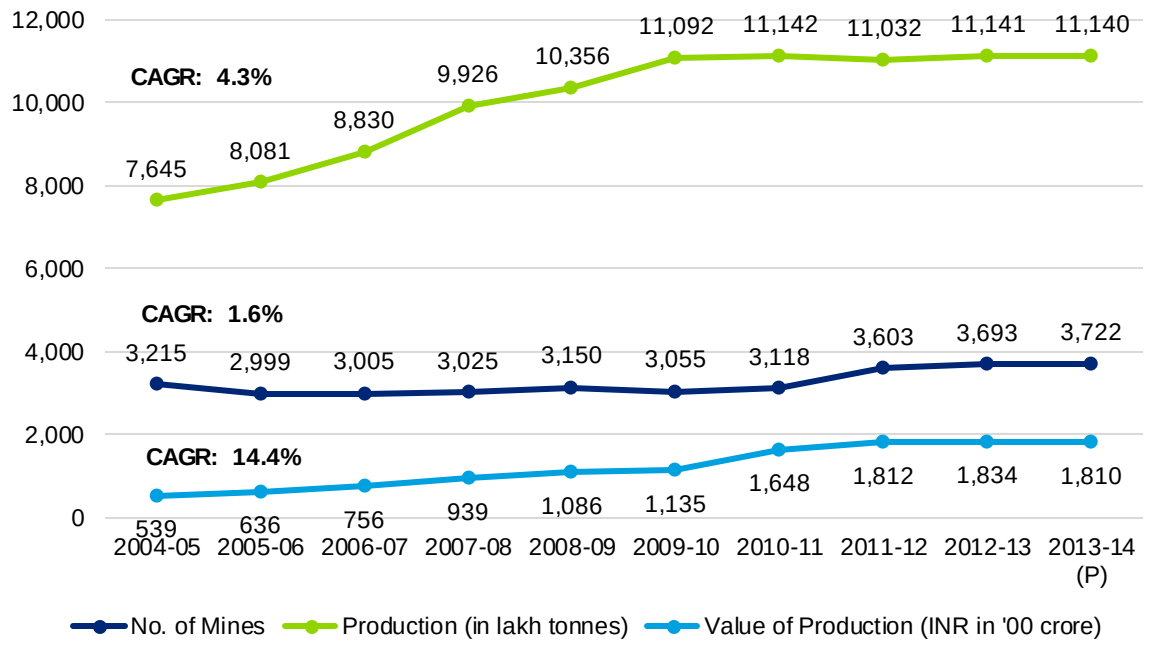
Source: Central Statistical Organisation (CSO) State Series (As on 31.7.2015)[24]

India produces a total of 89 minerals whose production value has grown at CAGR of 14.4% from INR 53,914 crore in 2004-05 to INR 1, 81,027 crore in 2013-14[25]. The quantity of mineral production in India has increase at CAGR of 4.3% from 765 million tonnes in 2004-05 to 1,114 million tonnes in 2013-14 while the number of mines has increased only at CAGR of 1.6% from 3,215 in 2004-05 to 3,722 in 2013-14.

[24] Central Statistical Organization has not published the GDP data for year 2014-15. In January 2015, CSO revised base year from 2004-05 to 2011–12. Also, changes were made in estimation methodology of Gross Domestic Product (GDP), henceforth the reported indicator is termed as Gross Value Added (GVA) as per revised methodology.

[25] *'Indian Mineral Industry- at a glance 2012-13'* - Indian Bureau of Mines; Annual Report 2014-15, Ministry of Mines, GoI

Figure 5: Number of Mines, Production Quantity and Production Values from 2004-05 to 2013-14



Source: 'Indian Mineral Industry at Glance 2012-13'; Indian Bureau of Mines; Annual Report 2011-15 Ministry of Mines, GoI
Note: The production and production value figures exclude the data on diamonds, atomic minerals, oil and natural gas.
P: Provisional E: Estimated

The country has immense potential for mining resources/ reserves and among the top 10 global producers of many minerals. See, Table 05.

Table 6: Contribution and Rank of India in World Production of Principal Minerals, 2013-14

Mineral Type	Production (in million tonnes)		Contribution (in percentage)	Global Rank of India
	World	India		
Fuel Mineral				
Coal	7,906	612	7.7	3rd
Metallic Mineral				
Iron ore	3,157	152	4.8	4th
Chromite	28.8	2.8	9.9	2nd
Bauxite	296	21.6	7.2	5th
Manganese ore	52.8	2.6	4.9	6th
Non-Metallic and Minor Minerals				
Barytes	8.4	1.1	13.5	2nd
Kyanite, Andalusite & Sillimanite	0.5	0.06	12.8	4th
Talc/ Steatite/ Pyrophyllite	9.3	1.1	11.6	2nd

Source: Annual report 2014-15, Ministry of Mines, Government of India

Mining sector can become a positive catalyst for improving livelihoods of the local populace, bringing in investment, jobs, wealth creation and government revenues. Given the availability of mineral wealth in India, the Ministry of Mines (GoI) has targeted to increase share of mining and quarrying sector in GDP from current 2% of GDP to 5% of GDP over the next 20 years. This requires mining to grow at 10-12% per annum[26].

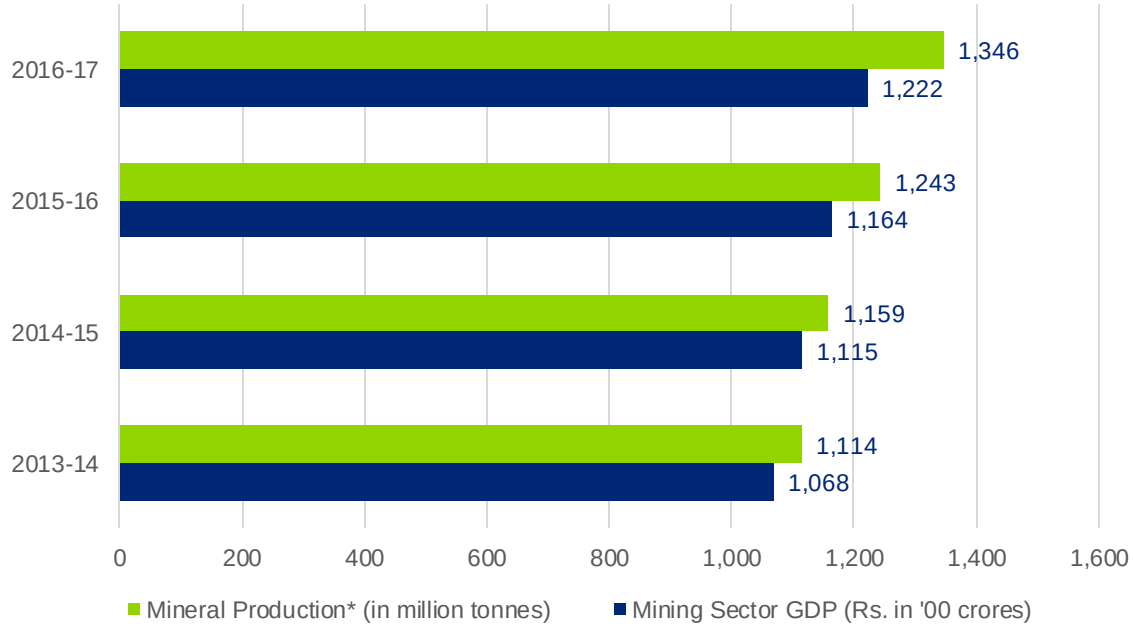
[26] *'Development of Indian Mining Industry – The way forward'*, Federation of Indian Chambers of Commerce & Industry, October 2013

In order to achieve the target set by the Government of India and unlock the huge potential offered by mining sector, the sector needs to be supported by on few important factors like enabling policies, focused projects, large investments and pool of skilled Human Resources.

Yearly Update on Mining Scenario from 2015-17

The Mining sector GDP contribute about INR 1,06,839 crore in 2013-14 which is anticipated to increase to 1,22,176 crore at a CAGR of 4.57% from 2013-14 to 2016-17 (against 2.57% from year 2004-05 to 2013-14); while the mineral production accounts for 1,114 million tonnes in 2013-14 which is expected to increase to 1,346 million tonnes in 2016-17 with a CAGR of 6.50% (against 5.5% from year 2004-05 to 2013-14). The mining sector is expected to contribute 1.8% to 2.1% to national GDP during the period of 2015-17.

Figure 6: Mining Scenario of India from 2014-17



*Excluding the production of diamonds, atomic minerals, petroleum and natural gas

Source: NSSO Report 68th round, NIC-2008, Directorate General of Mines and Safety (DGMS), Indian Bureau of Mines, Expert Interviews and Deloitte Analysis

3.2 Major Mining Clusters in India

India's total mineral production value (excluding oil and natural gas) is contributed by 12 key mining states, namely Rajasthan with a share of 12.9% followed by Odisha (11.16%), Andhra Pradesh[27] (9.39%), Chhattisgarh (6.75%), Jharkhand (6.80%), Gujarat (6.00%),Madhya Pradesh (4.82%), Assam (4.75%), West Bengal (3.78%), and Uttar Pradesh (2.70%) in 2013-14[28].

Out of 3,722 reported mines in 2013-14, 94% of mines in the country are concentrated in: Andhra Pradesh[7] having the highest number of reported mines (661) followed by Rajasthan (557), Gujarat (464), Madhya Pradesh (364), Tamil Nadu (354), Jharkhand (257), Karnataka (187), Chhattisgarh (202), Odisha (180), Maharashtra (163) and West Bengal (127). It is interesting to note that some states with a higher number of mines are low in production value of minerals; this is due to the lower value

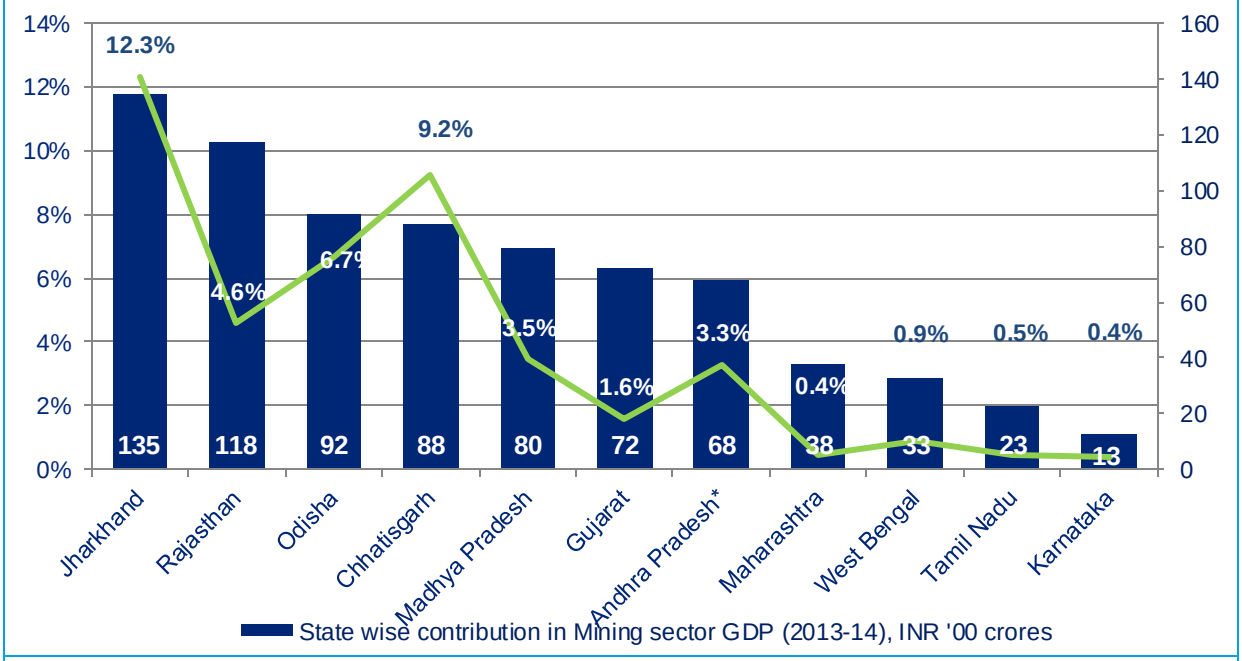
[27] Combined GDP data for Andhra Pradesh and Telangana

[28] *'Indian Mineral Industry at Glance 2012-13'*; Indian Bureau of Mines, Ministry of Mines, GoI

minerals mined in these states; for example, Tamil Nadu is one such state where low value minerals like Dolomite and Limestone mines are higher.

The figure 07 provides an understanding of the contribution of mining activity to the state economy. It may be noted that mining and quarrying sector in some relatively backward states contribute about significantly to the state economy; for example mining contributes for 12.3% to Jharkhand's state economy followed by Chhattisgarh (9.3%), Odisha (6.7%), Rajasthan (4.6%), Madhya Pradesh (3.5%) in 2013-14.

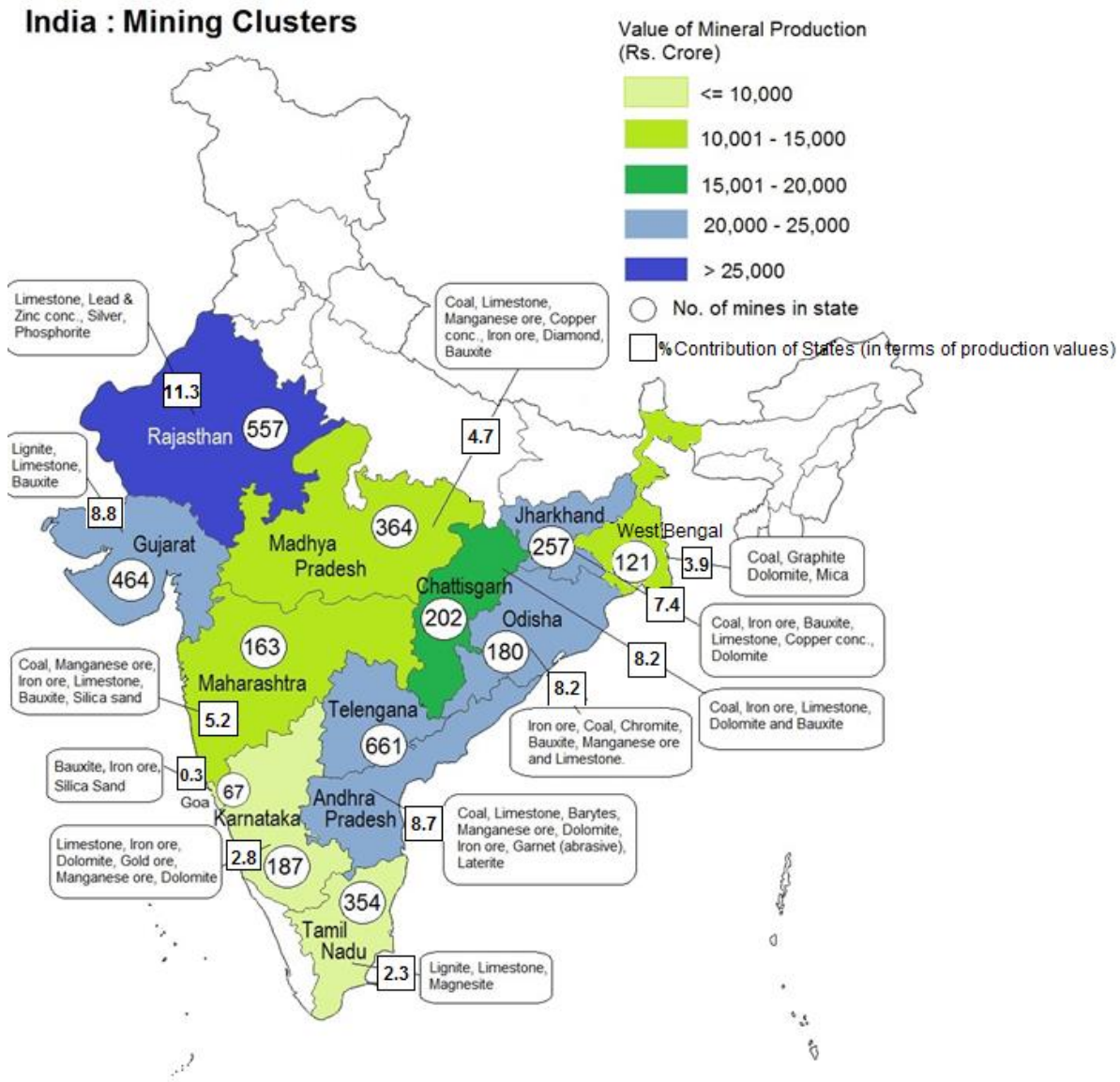
Figure 7: Contribution of Mining sector to State's GSDP in 2013-14



*Combined GDP data for Andhra Pradesh and Telangana

Source: Central Statistical Organisation (CSO) State Series (As on 31.7.2015)

Figure 8: Key Mining Clusters



Source: Annual Report 2014-15, Ministry of Mines

Under Fuel Mineral category (Coal and Lignite), Chhattisgarh is the leading state in 2013-14[29] with production of 127 million tonnes that contribute around 22.6% of country's production (of 602 million tonnes) followed by Jharkhand (20.1%), Odisha (20.1%) and Madhya Pradesh (13.6%).

Under Metallic Mineral category, Odisha is leading state in 2013-14 with production of 8.3 million tonnes that contribute ~49% of country's production (i.e. 171.34 million tonnes) followed by Chhattisgarh (19.8%) in 2013-14. The key highlights of few minerals under metallic category are given below:

- Odisha is leading producer of Iron ore in 2013-14 with 76 million tonnes that contribute around 55% of country's production (of 152 million tonnes) followed by Chhattisgarh (19.8%), Jharkhand (14.8%) and Karnataka (12%).

[29] Projected figures reported – Annual Report 2014-15, Ministry of Mines, GoI

- Odisha is leading producer of Bauxite in 2013-14 with 5.4 million tonnes that contribute around 35% of country's production (of 16.6 million tonnes) followed by Gujarat (32.4%), Jharkhand (10.5%) and Maharashtra (9.5%).
- Odisha is leading producer of Chromite in 2013-14 with 2.8 million tonnes that contribute around 90% of country's overall production (i.e. 3.12 million tonnes).

Under Non-Metallic and Minor Mineral category[30], Rajasthan is estimated to produce 57% of Non-Metallic minerals in the country followed by Gujarat (28%) and Andhra Pradesh (13.7%)

- Andhra Pradesh is leading producer of Limestone in 2013-14 with 61 million tonnes that contribute around 21.3% of country's production (i.e. 279 million tonnes) followed by Rajasthan (20.21%), Madhya Pradesh (13.24%), Tamil Nadu (8.60%), Gujarat (8.35%), Karnataka (7.70%) and Chhattisgarh (7.56%).
- Rajasthan is leading producer of Phosphorite/ rock phosphate in 2013-14 with 1,066 thousand tonnes that contribute around 77% of country's production (1,384 thousand tonnes) followed by Madhya Pradesh (10.2%).
- Rajasthan is leading producer of Phosphorite/ rock phosphate in 2013-14 with 1.06 million tonnes that contribute around 77% of country's production (1.38 million tonnes) followed by Madhya Pradesh (10.2%).
- Chhattisgarh is leading producer of Dolomite in 2013-14 with 2.59 million tonnes that contribute around 36.5% of country's production (7.1 million tonnes) followed by Andhra Pradesh (19.37%), Odisha (9.25%) and Karnataka (9.01%).

3.3 Role of sub-sectors

Prospecting & Exploration: This sub-sector comprises of organizations engaged in providing geological investigation, geophysical exploration, surveying, geoscience mapping and specialized design services. In India, these activities are primarily undertaken by Geological Survey of India (GSI), Mineral Exploration Corporation Limited (MECL), State Departments of Geology and Mines (DGM), Gujarat Mineral Development Corporation (GMDC), National Mineral Development Corporation (NMDC), Hutti Gold Mines Ltd. (HGML) and Singareni Collieries Company Ltd (SCCL). Refer, ***Annexure 03*** for exploration activities undertaken by respective organizations in 2012-13.

India has abundant availability of mineral resources; however, the exploration activities in India has not been to the desired extent. While, the total mineral potential area in India covers about 5.75 lakh sq. kms, a significant part of this area has not been explored in detail so far. India has more than 6, 60,000 million tonnes of mineral reserves and 29, 37,000 million tonnes of remaining resources[31].

GSI has started few programmes like the National Geochemical Mapping Programme (NGCM), National Geophysical Mapping Programme (NGPM), National Geomorphological and Lineament Mapping Programme to boost exploration activities in India. The focus of these programme are on key practices like Hyperspectral Mapping, Airborne Survey, Heli-borne Survey, Aeromagnetic Survey, Polar Studies and Marine & Coastal Surveys.[32]

[30] Principal minerals considered under Non-Metallic and Minor Minerals category are Agate, Apatite, Phosphorite, Asbestos, Ball Clay, Barytes, Calcite, Chalk, Clay (Others), Corundum, Diaspore, Dolomite, Dunite, Feldspar, Fireclay, Felsite, Fluorite (Graded), Fluorite (Conc.), Garnet (Abrasive), Graphite (R.O.M.), Gypsum, Iolite, Jasper, Kaolin, Kyanite, Sillimanite, Laterite, Limestone, Lime Kankar, Limeshell, Magnesite

[31] Indian Bureau of Mines, Ministry of mines

[32] Official website of Geological Survey of India < http://www.portal.gsi.gov.in > accessed on Feb 08, 2016.

Table 7: Mineral Wise Geological Potential Area in India

Mineral	Area (sq. kms.)
Diamond and precious stones	3,00,000
Base metals	1,81,150
Gold	1,02,809
Bauxite	32,520
Platinum group of elements	8,130
Manganese	6,000
Iron Ore	5,135
Manganese ore	4,600
Chromite	2,690
Tin and Tungsten	1,300
Source: Exploration and mining opportunities in India, Ministry of Mines, August 2015	

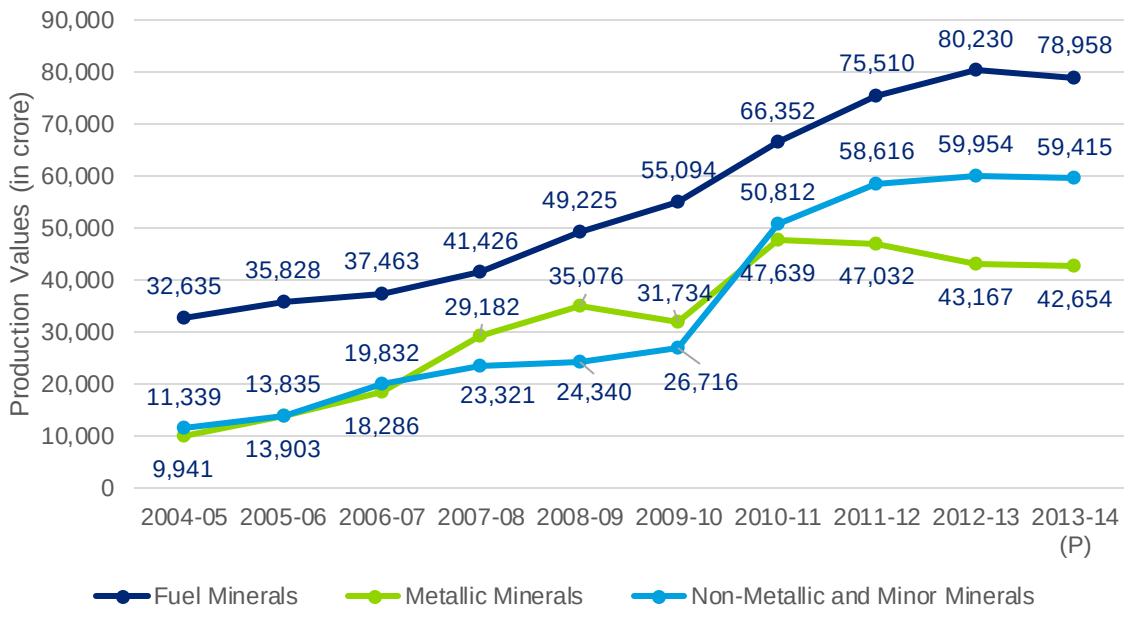
Mineral Extraction: This sub-sector comprises of organizations engaged in construction & development of sites, mining (surface, underground, strip, culm bank, auger and other mining activities), drilling, cutting, transportation and blasting activities for extraction of fuel, metallic, non-metallic and minor minerals.

In Mineral Extraction sub-sectornearly 44% of production value has been contributed by Fuel Mineral (excluding Oil and Natural gas) followed by Minor Mineral (30%), Metallic Mineral (21%) and Non-Metallic Minerals (4%) in the year 2013-14,. The Fuel Mineral production value has grown at CAGR of 10.3% from INR 32, 635 crore in 2004-05 to INR 78,958 crore in 2013-14 while the respective number of mines has grown at a CAGR of 0.1% from 571 in 2004-05 to 575 in 2013-14.

The production value of Non-Metallic & Minor Mineral has grown at CAGR of 20.2% from INR 11,339 crore in 2004-05 to INR 59,415 crore in 2013-14 while the respective number of mines has grown at a CAGR of 2.3% from 2,019 in 2004-05 to 2,484 in 2013-14.

While the production value of Metallic Mineral has grown at CAGR of 17.6% from INR 9,941 crore to INR 42,654 crore in 2013-14 while the respective number of mines has declined at a CAGR of 0.6% from 625 in 2004-05 to 595 in 2013-14.

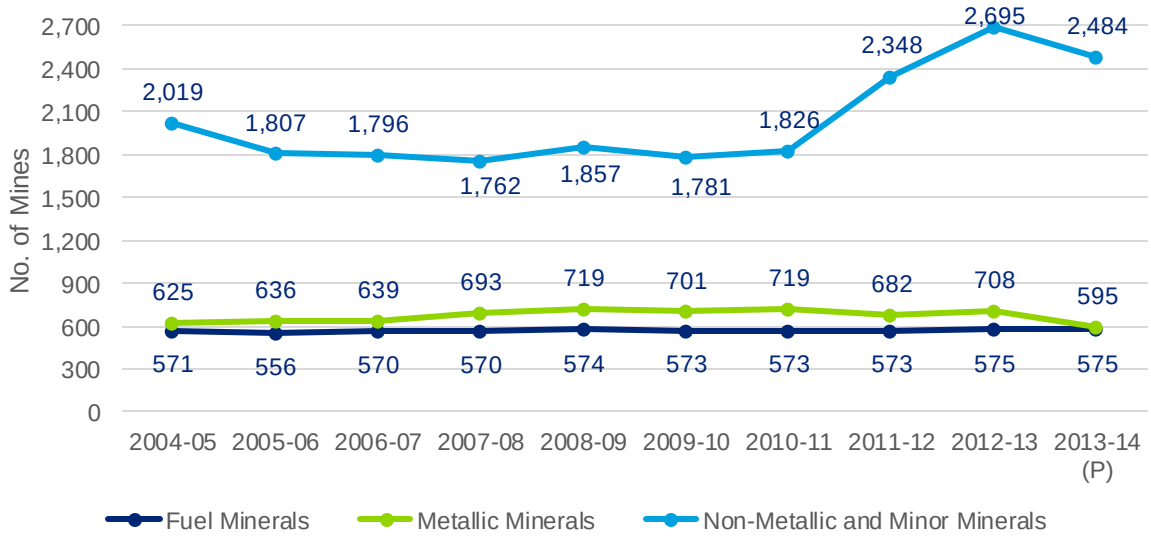
Figure 9: Production Values by Mineral Category from 2004-05 to 2013-14



Source: 'Indian Mineral Industry at Glance 2012-13'; Indian Bureau of Mines; Annual Report 2011-15 Ministry of Mines, GoI
Note: The production value figures exclude the data on atomic minerals, oil and natural gas.
P: Provisional

In 2013-14, nearly 54.1% of the mineral produced by quantity[33] in India belong to Fuel Mineral category followed by Metallic Mineral (28.7%) and Non-Metallic Mineral & Minor Mineral (17.2%); 68% of the mines belong to Non-Metallic & Minor Mineral category, followed by Metallic Mineral (16%) and to Fuel Mineral (16%). It is interesting to note that 14% of the mines in India contribute to 89% of mineral production.

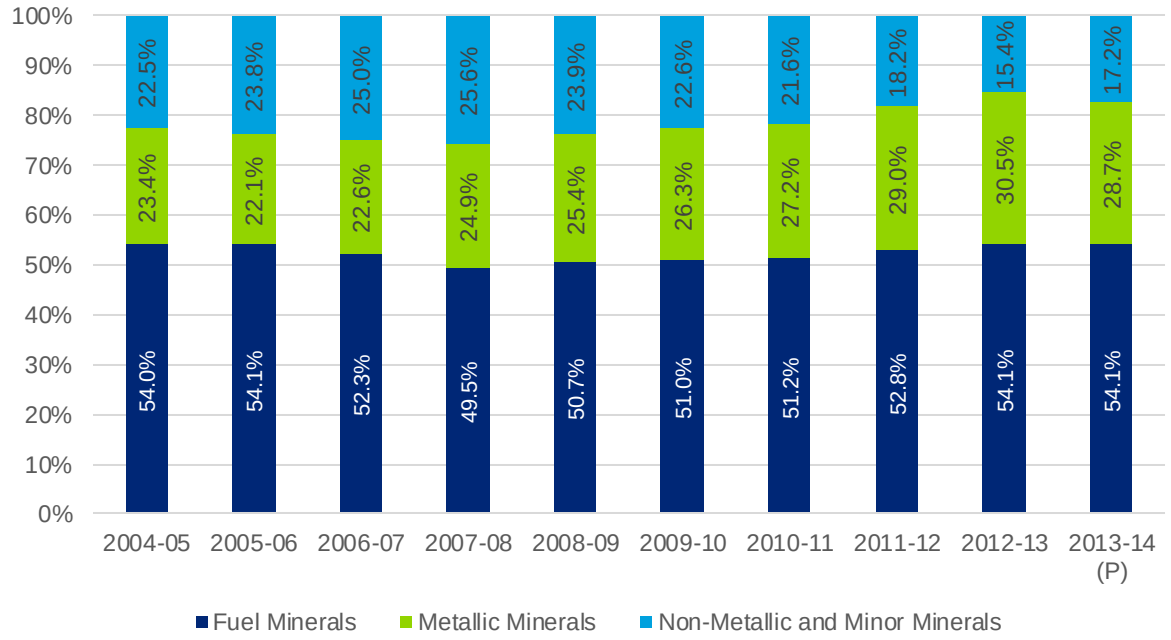
Figure 10: Number of Mines by Mineral Category from 2004-05 to 2013-14



Source: 'Indian Mineral Industry at Glance 2012-13'; Indian Bureau of Mines; Annual Report 2011-15 Ministry of Mines, GoI
P: Provisional

[33] Excluding the production of diamonds, atomic minerals, oil and natural gases

Figure 11: Category wise production of minerals 2004-05 to 2013-14



Source: Indian Bureau of Mines, Ministry of Mines

Note: Excluding the production data of diamonds, atomic minerals, oil and natural gases

Associated services: This sub-sector comprises of organizations engaged in providing health, safety and environment services, architectural, engineering and related services, support services (on a contract or fee basis); required for the mining and quarrying of minerals. The associated services are of the following nature:

- Information Technology services
- Equipment procurement with maintenance and repair contracts
- Emergency response and health services

Mineral Beneficiation: This sub-sector comprises of organizations engaged in ore dressing and beneficiating (treatment of raw materials such as washing or pulverizing) operations, whether performed at mills operated in conjunction with the mines or units which are away from mines (such as custom mills operated separately), chemical and laboratory testing.

The mineral processing division of the Indian Bureau of Mines (IBM) has been working in the mineral beneficiation field since 1960. The Modern Mineral Processing Laboratory, Pilot Plant and Analytical Laboratory Complex has been established with the assistance of United Nations Development Programme to enable the Indian mineral beneficiation industry with state of the art R&D centre at IBM, Nagpur. The R&D facilities of the Mineral processing division of the IBM is as below

Table 8: Research & Development facilities of the Mineral Processing Division at IBM

Unit	Location	Key Activities
Modern Mineral Processing Laboratory and Pilot Plant	Nagpur	• Ore Processing Laboratory for bench scale beneficiation studies • Mineral beneficiation Pilot Plant having capacity ranging from 0.5 to 2 tonnes/ hour • Chemical Analysis Laboratory • Mineralogical Laboratory • Physical Characterization Laboratory • Environmental Analysis Laboratory
Regional Mineral Processing Laboratory and Pilot Plant	Ajmer	• Ore Processing Laboratory and Pilot Plant • Chemical Analysis Laboratory • Mineralogical Laboratory
Regional Mineral Processing Laboratory and Pilot Plant	Bangalore	• Ore Processing Laboratory and pilot Plant • Chemical Analysis Laboratory including fire assay • Mineralogical Laboratory
Source: Indian Bureau of Mines		

Associated services: This sub-sector comprises of organizations engaged in providing health, safety and environment services, architectural, engineering and related services, support services (on a contract or fee basis); required for the mining and quarrying of minerals. The associated services are of the following nature:

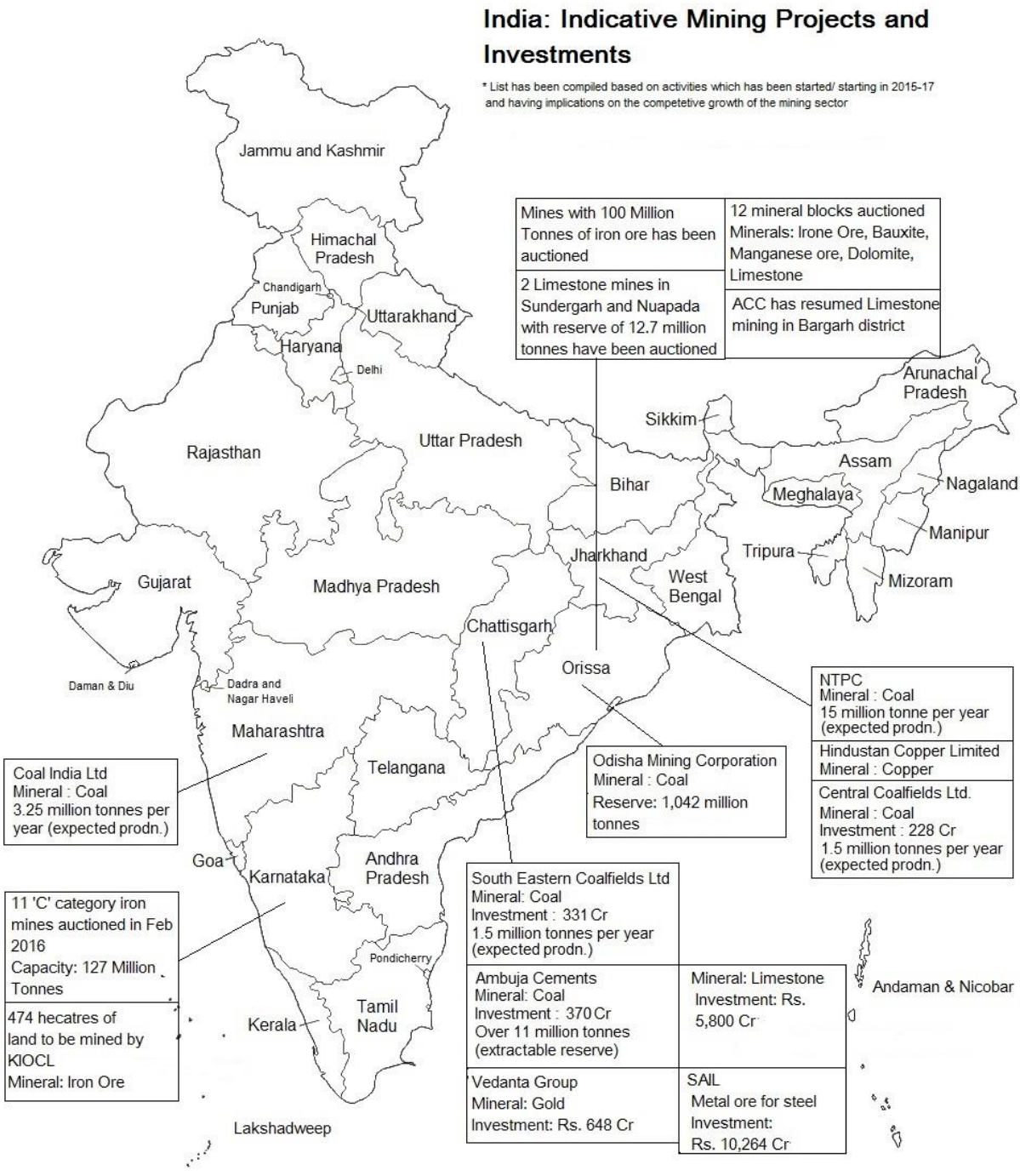
- Information Technology services
- Equipment procurement with maintenance and repair contracts
- Emergency response and health services

3.4 State wise Mining Projects & Investments

Mining rights are now allocated by e-auction and progress across various states as given in figure below. The key highlight of the mining projects and investment (started/ starting during 2015-17) is given below:

- Geological Survey of India (GSI) and Mineral Exploration Corporation Ltd (MECL) has been roped in by the state government of Odisha to carry out exploration work on the 12 identified mineral blocks.
- Coal India Limited's 3.25 MT capacity project started Maharashtra by Dec 2015.
- SECL proposes INR 331 crores investment for Mahamaya Open Cast Project in Chhattisgarh.
- Central Coalfields Ltd. (CCL) has got environment clearance for its INR 228 crore open cast mine to produce up to 1.5 million tonnes per annum in Jharkhand

Figure 12: Indicative list of Mining Projects and Investments (started/ starting during 2015-17)



Source: Primary Interactions with respective State Department of Geology and Mining, Industry and Industry Association

3.5 Regulatory Framework of Indian Mining Sector

Mines and Mineral development & regulation Act (MMDR) is the guiding act for development and management of mines in India. Apart from MMDR, various acts and regulations like mines act, right to fair compensation and transparency in land acquisition and rehabilitation & resettlement Act 2013, Forest conservation act 1980, Environmental & Safety Regulations, Labor Law, etc. which also govern

the mining industry'; a brief discription of the important acts/ rules/ policy and related aspects are given in this section.

1. Mines and Mineral Development and Regulation (MMDR) Act, 1957 & MMDR Amendment Act, 2015

This act stipulates the governing procedure for allocation of mining related licenses to the mines allocatee. An allocatee can receive rights for prospecting and mining mineral blocks, based on the exploration status of the deposit.

In 2015 the MMDR Act was amended, paving the path for allocation of mineral blocks through auction. The key amendments are as follows:

a. Mineral concessions to be granted only through auction.
b. Tenure of mineral concession increased from 30 years to 50 years. Thereafter the mining lease would be put up for auction.
c. Maximum area for which a prospecting license or mining lease may be granted

No person shall acquire in respect of any mineral or prescribed group of associated minerals in a state

I. One or more prospecting licenses covering a total area of more than 25 sq. kms.; or
II. One or more reconnaissance permit covering a total area of 10,000 sq. kms. The area granted under a single reconnaissance permit shall not exceed 5,000 sq. kms.
III. One or more mining leases covering a total area of more than 10 sq. kms; however relaxable in special situations.
IV. Any reconnaissance permit, mining lease or prospecting license in respect of any area which is not compact or contiguous; however relaxable in special situations.

d. Transfer of mineral concessions: The Bill states that the holder of a mining lease or prospecting license-cum-mining lease may transfer the lease to any eligible person, with the approval of the state government, and as specified by the central government. If the state government does not convey its approval within 90 days of receiving the notice, the transfer shall be considered as approved. No transfer shall take place if the state government communicates, in writing, that the transferee is not eligible. Only mineral concessions granted through auction will be allowed for transfer. Establishment of District Mineral Foundation (DMF) in the mining districts to address the grievance of the people affected by mining. The miner has to contribute to the DMF not exceeding 1/3rd of royalty.
e. Setting up of National Mineral Exploration Trust for promoting mineral exploration. This sum shall be 2% of royalty in the respective minerals.
f. Seamless transferability of concessions obtained through auctions so as to attract private investment and FDI.
g. Transition period of minimum 15 years for captive mines and 5 years for other mines has been kept; subsequent to completion of these periods, these mines will be auctioned.
h. Enables the allocation routes to public sector through reservation.

2. Coal Mines (Special Provisions) Act, 2015

According to this act:

a. Allocation of coal mines shall be done through e-auctions and a transparent bidding process.
b. This act has provision of commercial mining by the private players against previous act allowing private players to mine coal for captive purpose only.

3. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013

According to the act:

a. The act, gazette on 26 November 2013, aims at compensating the project affected people & stipulates the procedure and guidelines for acquiring land for industrial projects. Apart from those who lose their land, the act identifies those whose livelihoods are dependent on the land being acquired.

b. The act suggests conducting of Social Impact Assessment (SIA) in consultation with the Gram Sabha. Public hearing has been made mandatory for SIA study. It also stipulated consent from PAFs in case of PPP projects and private projects' land acquisition through the government.

c. Other salient features of the Act includes following points:

I. Total compensation for the land acquired should include – market value of the land, value of the assets attached to the land and solatium of 100% of market value. Minimum compensation for land equals to four times the original market value determined in rural area whereas it will be at-least twice the market value in Urban area.

II. Minimum R&R entitlements for land owners

III. Subsistence allowance of INR 3,000 per month per family for 12 months

IV. Employment to be given to 1 member of affected family; if employment is not offered then a sum of 5 lakh rupees to be given along with offer of shares up to 25% of the compensation amount

V. Annuity of INR 2,000 per month per family to be provided for 20 years in lieu of employment

VI. Constructed house to be provided

VII. 1 acre of land to each family if land is acquired for an irrigation project (other compensation value to be deducted accordingly)

VIII. One time resettlement allowance of INR 50,000.

IX. Minimum R&R entitlement for livelihood losers

X. Subsistence allowance of INR 3,000 per month per family for 12 months

XI. Employment to be given to 1 member per affected family; if employment is not offered then a sum of 5 lakh rupees to be given along with one time resettlement allowance of INR 50,000

XII. INR 2,000 per month per family as annuity for 20 years in lieu of employment

d. The Act has provision of constituting a National Monitoring Committee for rehabilitation and resettlement to review the implementation of the RR scheme. It also speaks of constituting central/ state land acquisition and rehabilitation and resettlement dispute settlement authority for speedy disposal of disputes relating to land acquisition, payment of compensation and RR schemes etc.

e. The Act has also provision for constitution of Land Acquisition Authority and Tribunal at national and state level in line with other sectoral regulators and tribunals such as IRDA, SEBI, and TDSAT etc. This will go a long way in ensuring lawful implementation of all provisions of the Act by the interested parties and requiring bodies.

4. Environment protection Act, 1986

a. Every mining or mineral beneficiation project has to acquire approval of Ministry of Environment and Forest (MoEF) or State Pollution Control Board (based on capacity of the plant). Approval process involves one season, except monsoon, data collection on SOx, NOx, contaminants in surface and underground water including assessment of biological oxygen demand, flora & fauna etc. An assessment is done by a NABET/QCI accredit environment consultant on expected status of air, noise and water pollution by the project and its mitigation measures. The

project proponent has to seek public opinion by conducting public hearing and the issues raised by the public have to addressed in the final 'Environment Impact Assessment' cum 'Environment Management Plan' report.

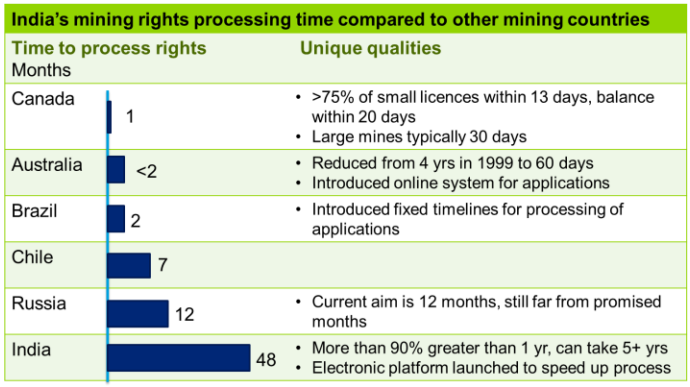
b. The final proposal by the project proponent is presented in front of Environment appraisal committee appointed by MoEF who recommends for project implementation.

5. Forest Conservation Act, 1980

a. If a mining or beneficiation project falls under notified forest area, then the project proponent has to acquire approval from forest department and finally from MoEF for mining the area.

b. It involves, valuation of forest in the area and payment of compensation equal to Net Present Value' (NPV) of forest, payment for compensatory afforestation along with purchase of alternate land for compensatory afforestation. The task of collecting money and administering reforestation is done by State Compensatory Afforestation Fund Management and Planning Authority (State CAMPA).

Several mining projects have been delayed for many years owing to delay in regulatory clearances and logistical issues. While countries like Australia takes just two months to process mining right, in India it may take more than 4 years to get mining rights. A number of projects have been stalled due to land acquisition. A report by FICCI on development of Mining Industry, 2013 – way forward mentions that **only 60% of proposed mining projects have got Forest Clearance during last 17 years**.



6. FDI Policy

c. The government has allowed up to 100% FDI in exploration, mining, mineral processing and metallurgy under the automatic route for all non-fuel and non-atomic minerals including diamonds and precious stones.

d. Mining and mineral separation of titanium bearing minerals and ores, its value addition and integrated activities fall under the government route of foreign direct investment up to 100%.

e. FDI in coal mining is allowed for captive consumption only.

Impact: Due to inordinate delays in regulatory clearances in mining projects and absence of commercial mining of coal by private players have been a great deterrent to FDI. India has not been able to attract substantial FDI in mining sector, so far – less than 1% of the FDI in attracted by the mining sector currently.

7. Taxes

A transparent and simple fiscal regime along with moderate tax structure is important for attracting investment in the sector. However, Indian mining sector is amongst the highest taxed in the world, with effective tax of about 60%; the effective tax in other countries ranges between 35-40% (China-32%, Russia-35%, Australia-39%, Chile-40% and Canada-35 %)[34].

[34] Respective official website of Australia, China, Chile, Canada and Russia

Table 9: Taxes applicable for Coal mining in India

S#	Types of Tax	Value
1.	Corporate Tax[35]	32.445%-42.024% of PBT
2.	Royalty	14% of Notified Price
3.	Contribution to DMF	30% of Royalty for Captive mines allocated before Jan 2015 10% of Royalty for mines allocated after Jan 2015
4.	Contribution to NMET	2% of Royalty
5.	Excise	1% (Non Cenvatable)+ 5% (Cenvatable)
6.	Clean Energy Cess	INR 400/ Tonne
Source: Exploration and Mining Opportunities in India (August 2015), Ministry of Mines GoI		

8. Land acquisition, Rehabilitation & Resettlement

Land acquisition, Rehabilitation & Resettlement has been one of the most controversial subject in the Indian Industry. One the examples is the hurdles faced by POSCO in setting up its plant in Odisha. The project got delayed by more than 7 years due to resistance from local population and on account of environment & forest rights issues. In 2013 POSCO scrapped another project in Karnataka because of delays in regulatory clearances. Another example of LARR related issues is proposed Bauxite Mine of Vedanta in Odisha. Majority of mining projects face delays of several years to start mining on the identified mining sites in India. Even public sector companies have been facing delay in land acquisition despite enabling acts like Coal Bearing Areas Act (CBA).

Recently enacted Right to fair compensation and transparency in land acquisition, rehabilitation & resettlement act 2013 has kept several provisions (as mentioned earlier) to ensure proper rehabilitation and compensation to project affected people. The MMDR amendment act, provisions allocation of a 30% or 10% of Royalty (District Mining Foundation) for development of the districts around mines/mining clusters. However, it is a noteworthy that most of the mining clusters have been contributing money to Government in form of Royalties and other taxes but paradoxically the districts near & around mining clusters invariably are having low Human Development indices in the country.

One of the biggest challenges in the mining sector is land acquisition. A number of projects are stalled due to delay in public hearing and land acquisition. The procedure suggested for land acquisition may take more than 3.5 years by a land acquirer to receive assent of the administrator/ collector. Subsequent to enactment of the land acquisition act, the cost of projects have gone up drastically impacting financial viability of many projects.

3.6 SWOT Analysis

3.6.1 Strengths

1. **Vast mineral deposits:** India is endowed with huge availability of minerals. India currently produces 89 minerals which are categorized in four segments – Fuel-related minerals like Coal and Lignite (4), Metallic minerals like Copper, Iron ore and Bauxite etc. (10), Non-metallic minerals like Limestone, Rock Phosphate, Barytes, Dolomite and Gypsum etc. (21) and Minor minerals like Granite, Marble, Sandstone and Slate etc. (54). As on April 01, 2014, around 301.6 Billion Tonnes of geological resources of coal have been estimated in India, up-to the maximum depth of 1,200 m[36]. The total mineral resources estimated by GSI as on 2014 for other key minerals were Iron

[35] The corporate tax rate for an Indian company is 32.445% w here taxable income exceeds INR 10 million. For a foreign company, the corporate tax rate is 42.024% w here income exceeds INR 10 million. For an Indian company, the CIT rate of 32.445% is the basic rate 30% plus a 5% surcharge on basic rate, plus a 2% Education Cess on total tax (i.e. tax computed using basic rate including surcharge) and a 1% Secondary and Higher Education Cess on total tax.
[36] Geological Survey of India

Ore (14.12 Billion Tonnes), Limestone (89.86 Billion Tonnes) and Lignite (43.25 Billion Tonnes). In terms of availability of geological potential area, the Geological Survey of India (GSI) has identified 0.57 million sq. kms. as Obvious Geological Potential (OGP) area for minerals in the country based on the geological data mapping of around 98% of the total mappable area (~3.15 million sq. km) in India, on 1:50,000 scale till March, 2013[37].

2. **One of the leading producers of minerals and metals globally:** India is presently one of the major producers of minerals. In 2012, it ranked 3rd in the world in terms of production of Coal & Lignite. In the same year, it ranked 2nd in Barytes and Talc/ Steatite/ Pyrophyllite production, 3rd in Chromite, 4th in Kyanite, Andalusite & Sillimanite, 5th in Iron ore, 6th in Bauxite, and 7th in Manganese ore production. In terms of metal production, the country ranked 3rd in Zinc (slab) production, 4th in Steel (crude/ liquid) and 8th in Aluminum production.
3. **High degree of self-sufficiency in key minerals for domestic consumption:** India is largely self - sufficient in terms of production of major minerals like Coal, Aluminum, and Iron etc. India is wholly self-sufficient in minerals such as Bauxite, Chromite, Limestone & other calcareous minerals and metals such as Copper (refined) and Zinc. Despite high degree of self-sufficiency, some amount of special quality/type of minerals (such as Iron ore) and metals/Ferro-alloys are imported to meet the specific requirement of the industry.
4. **Encouraging policies:** The government allows Foreign Direct Investment (FDI) up-to 100% in exploration, mining, mineral processing and metallurgy under the automatic route for all non-fuel and non-atomic minerals including diamonds and precious stones. As on September 2015, the metallurgical industry is one of the top 10 sectors in India in terms of attracting highest FDI equity inflows[38]. The cumulative FDI equity inflows in the metallurgical industry in India over the period April, 2000-September, 2015 was USD 8.69 billion and accounted for around 3% of the total cumulative amount of FDI equity inflows over the same period. The key international players having invested in the Indian Metallurgical industry includes Rio Tinto (Australia), Vedanta Resources (UK) etc. India also offers high lease period for mining operations. The mining lease for minerals such as Coal and Lignite in India is granted for a maximum of 30 years and a minimum of 20 years and could be renewed for a period not exceeding 20 years. For all minerals other than Coal, Lignite and atomic minerals, mining leases are be granted for a period of 50 years. This is greater than the maximum lease period of mining economies such as Canada and Australia which allows a maximum lease period (including renewal) of 42 years.
5. **Wide range of fiscal incentives:** The government of India offers wide range of fiscal incentives to the mining players operational in exploration and mining activities. Around one-tenth of the expenditure on prospecting, extraction and production of certain minerals during five years ending with the first year of commercial production is allowed as a deduction from the total income. The export profits from specified minerals and ores are eligible for certain concessions. The capital goods imported for mining under the Export Promotion Capital Goods (EPCG) scheme qualify for concessional customs duty subject to certain export obligations.

3.6.2 Weaknesses

- **Underperformance of sector over last few years:** The Indian mining sector is underperforming over the last few years in terms of the economic contribution to GDP. The sectoral contribution of mining and quarrying sector to India's GDP decreased from 2.9% in 2004-05 to 1.9% in 2013-14. The sector registered a negative year on year growth rate over last two years (2012-14) as compared to a CAGR of approximately 4% over the period 2009-12. The performance of the mining

[37] Ministry of Mines; http://mines.nic.in/
[38] Department of Industrial Planning & Promotion (DIPP)

sector presently is limited by challenges faced on regulatory and administrative procedures, inadequate infrastructure facilities and sustainability.

- **Regulatory challenges in clearances & land acquisition:** The mining industry in India is well regulated, however the mining companies face a number of challenges in complying with the norms. As per the Mines and Minerals (Development & Regulation) Amendment Act (2015), the holder of a mining lease or prospecting license-cum-mining lease may transfer the lease to any eligible person, with the approval of the state government, and as specified by the central government wherein only mineral concessions granted through auction will be allowed for transfer. However, the transfer the lease is a difficult procedure. The requisite number of approvals/ licenses required before commencement of mining operations in India is a long drawn process with multiple agencies involved. For instance, a private limited company intending to start a business in Chhattisgarh with proposed investment of less than 10 crore and proposed employment size of 50 or more, and would not be involved in import and export of goods would require around 13 licenses to start mining operations. Few of the mandatory clearances required for commencement of any exploration or mining related operations in India are:

Table 10: Key clearances required before commencement of mining operations in India

S#	Name of the Clearance/ Approval	Name of the Approving Department/ Agency
1	Environment Clearance	Ministry of Environment, Forest & Climate Change
2	Forest Clearance	
3	Wildlife Clearance	
4	Title of the land	Revenue Department
5	Explosive License	Petroleum & Explosives Safety Organisation (PESO)
6	Pollution Clearance	Pollution Control Board
7	Mining Plan	Indian Bureau of Mines

The mandatory environment and forest clearances involves various levels leading to delay in project disposition. According to the Economic Survey, 2013-14, the mining sector has around 40 infrastructural projects stalled primarily due to lack of environmental clearances. Such delays in execution of the project often increases the overall cost of the project.

Land acquisition is also one of the major challenges faced by the exploration and mining companies in India. The procedure suggested for land acquisition under the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act may take more than 3.5 years by a land acquirer to receive assent of the administrator/collector. Provisions like compensating the land owners equal to 4 times the market prices of land and property & provisions of R&R would lead to increase in cost of acquisition of land for mines. These challenges limit the overall participation in the mining and exploration activities in India.

The allocation of mineral concession and blocks in India also faced the challenge of non-transparency and uncertainty. In an effort to improve the governance in the sector, the Mines and Minerals (Development & Regulation) Amendment Act (2015), introduces auction mechanism for allocation of mining concessions. The coal block allocation in India faced criticism in past when Supreme Court, in its judgement of August 2014, declared that “all 218 coal blocks allocated between 1993 and 2010 are illegal”. The Mines and Minerals (Development and Regulation) Amendment Act, 2015 aims at increasing the transparency in allocation of mines for 10 minerals such as Iron ore, Bauxite etc. by auctioning it through competitive bidding process. The block allocation has been recently done for minerals such as Coal, Iron Ore, Bauxite, Manganese, Dolomite, Limestone, Gold etc.

- **Multiple/ high tax structure:** The Indian mining sector in India are presently levied multiple taxes such as mineral royalty, contribution to District Mineral Foundation (DMF) & National Mineral Exploration Trust (NMET), CSR expenditure etc. This makes the Indian mining industry as one of

the highest taxed mining regime globally. It also limits the incentives for private and well as foreign investors to invest in development of technology and innovation in mining projects.

- **Inadequate transport infrastructure facilities:** Majority of the mining areas in India are located in remote locations and may not be developed fully without developing suitable transport infrastructure. Development of sufficient transport infrastructure in mining areas is essential for timely and cost effective evacuation of minerals – the competitiveness of the sector depends greatly on this. Special emphasis needs to be given on linking transport infrastructure in mineral rich states. Given the anticipated demand of key minerals including such as Coal, Iron Ore anticipated in the Twelfth Plan period, the currently inadequate transport infrastructure especially in mineral bearing areas such as Jharkhand, Chhattisgarh and Orissa require considerable attention. The existing railway connectivity in most of the key mining states is inadequate for future freight capacity and needs considerable capacity addition for the anticipated volume of minerals and metals to be transported.
- **Low investment in exploration activities:** The Geological Survey of India (GSI) has identified 0.57 million sq. km. as Obvious Geological Potential (OGP) area for minerals[39]. However, a considerable share of the Obvious Geological Potential area is yet to be fully explored. The mineral exploration budget of India is presently low as compared to the other major mining economies across the globe. In comparison to Chile's exploration budget of 1,202 USD/ Km^2; India had an exploration budget of USD 17 per square kilometer in 2013[40]. The mineral exploration budget of India is also considerably lesser than the corresponding budget of foremost mining countries such as Australia (246 USD/ Km^2) and Canada 192 USD/ Km^2).
- **Unregulated practices in small scale and unorganized mines:** The Mining Sector in India faces the challenge of unregulated mining, especially in small scale and unorganized mines. Unregulated mining results in direct loss of revenue for the government; the key features of unregulated mining include unscientific and unregulated practices like over-extraction of mineral ores/ removal of additional ores from overburden dumps, mining in officially closed mines and illegal transportation/ selling/ export of ore. The Mines and Minerals (Development & Regulation) Amendment Act (2015) includes measures for controlling the issue of illegal mining by trial and penalties for such mining.

3.6.3 Opportunities

- **Rising domestic demand:** The Economist Intelligence Unit (EIU) forecasts real GDP growth in India at approximately 7.3% over the period 2015-20 which would be supported by subsequent growth in the manufacturing, power, construction and infrastructure sectors. The mining sector directly/ indirectly provides raw materials to these sectors, and growth of the above sectors will have a direct positive impact on the growth of mining sector in India. The key drivers likely to aid in increased domestic demand for mineral sector in India is provided below:
    a. By 2030, India is projected to have the highest population in the world. During the period 2015–2030, India's population is projected to increase by 17% (or 217 million people), reaching 1.53 billion people by 2030[41]. The increase in demography of the country would also necessitate expansion of the existing availability of infrastructure, power etc.
    b. The National Manufacturing Policy (2011) aimed at increasing the manufacturing sector growth to 12-14% over the medium term toward increasing the sector's contribution to at least 25% of the national GDP by 2022 (as against the share of 15% in 2013-14). The success of 'Make in

[39] Mines.nic.in
[40] SNL Metals and Mining
[41] UN, 2015, medium fertility projections

India' program launched by the Government of India is also expected to positively impact the manufacturing sector in India.

c. The Ministry of Steel aims to increase the current steel production capacity of India from 100 million tonnes per annum in 2013-14 to 300 million tonnes per annum by 2025-26 which would entail huge investment in the sector.
d. The construction sector in India is expected to benefit from expenditure on infrastructure through programmes such as National Highway Development (NHDP) and PMGSY/ Bharat Nirman etc.
e. Government of India, in 2014, has announced its commitment to achieve 24x7 electricity supply for all by 2019[42].Large scale economic activity required for the same is expected to increased direct/ indirect demand for the mining sector.

- **Detailed exploration of geological reserves in India:** Out of the total Coal reserves of 301.6 billion tonnes in 2014, only 125.9 billion tonnes have been proved. Around 58% of the reserves are either indicated or inferred for which detailed exploration activities would be required. Similarly, out of the total Lignite reserves of 43.2 billion tonnes in 2014, around 86% is either indicated or inferred. The detailed exploration of the indicated or inferred mineral reserves would help in identification of new mineral bearing areas in future.
- **Greater focus on Underground Mining:** Historically, opencast mining has been undertaken more extensively in India as compared to underground mining. Approximately 9% of India's total coal production in 2013-14 was from underground mines[43]. The industry however aims to reach a total coal production of 30 per cent from underground mines by 2030. Similarly, there is a pressing demand for shift towards underground mining for other minerals as well such as Zinc, Chromite and Copper. The restricted availability of near surface reserves extracted through opencast mining is likely to be exhausted in future. Besides the limited availability of near surface reserves, the open cast mining also leads to greater degree of land degradation, environmental pollution and reduced quality of mineral. Considering the emergent obstacles in land acquisition and environmental/ forest clearances, greater efforts need to be made to increase the share of underground mineral production in future. The movement towards underground mines will have positive implications for the environment and is likely to reduce the adverse impact on environment.
- **Greater use of Technology:** The productivity gains in the mining sector would be achieved through greater use of innovative practices and technology in the sector especially in areas such as deep seated mining, deep drilling and extraction of metals from low grade ores, mine closure processes and sustainable mining. The sector would benefit by making best use of technology such as 2D/3D Seismic Survey Technology, hydrostatic drilling, geophysical loggers, GPS/ GPRS based vehicle tracking system, satellite based surveillance to monitor land reclamation & plantation etc. The use of airborne geophysical Surveys would help in identifying and probing mineral deposits at depths located as deep as 300 m. The industry would also benefit from adoption of digital data to facilitate real-time tracking, surveillance, traffic management, environmental monitoring, maintenance and asset management etc.
- **Skilling of workforce with respect to technological change:** With technological advancements, the skill set of the existing mining employees would require sufficient skill up-gradation. The mining organizations would benefit from training the existing employees to work as multi-disciplinary professionals.

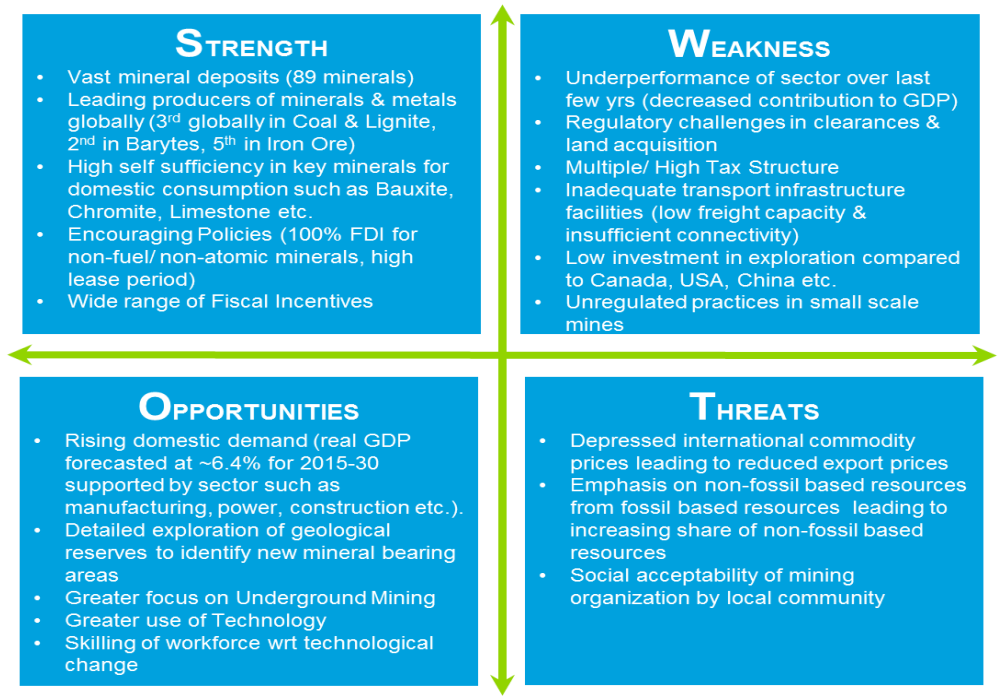
[42] Forum of Regulators, 2014
[43] Ministry of Coal

3.6.4 Threats

- **Depressed international commodity prices:** The international commodity prices are at historically low level with the mining sector stakeholders having no direct control over the same. China which used to be one of the biggest users of base metals internationally, is pulling back on imports of metals and minerals with a slowdown in its economy. This slowdown has resulted in a drop in demand globally as China accounted for the biggest uptake of many minerals till recent. The global prices have reduced considerably for minerals such as Iron ore, Coal, and Lead leading to reduced prices. The Economist Intelligence Unit (EIU) projects reduced GDP growth of China – at 4.8% by 2020, this should mean suppressed industrial production in China resulting in relatively lower consumption of minerals. The depressed international commodity prices have an adverse effect on the Indian mining sector as well; the country has witnessed a decline in the price of its key minerals. The average London Metal Exchange (LME) price of Aluminium in India was USD 1,526 per tonne in December, 2015, a decrease of 17% as compared to the December, 2014 rate of USD 1,830 per tonne[44]. Similarly, the average sale price of Iron ore (below 55% Fe lumps) registered a decline of 31.8% in October, 2015 as compared to the October, 2014. The considerable decline in commodity prices are affecting the bottom line of mining organizations and in few cases impelling mine closures.
- **Emphasis on non-fossil based resources from fossil based resources:** In its bid to reduce the emissions intensity of GDP by 33% to 35% by 2030 from 2005 levels[45], the country plans to increase the share of non-fossil based power generation capacity to 40% of installed electric power capacity by 2030. The key renewable energy-related policies in India supporting this vision includes the 'Strategic Plan for New and Renewable Energy' and 'National Solar Mission'. India currently targets a cumulative renewable energy installed capacity of 175 GW by 2022 (100 GW solar, 60 GW wind 10 GW biomass and 5 GW small-scale hydro). Further, the Renewable Purchase Obligations (RPO) legally mandate a percentage of electricity to be produced from renewable energy sources. In view of this, the Ministry of Power, in April 2015, announced that every new coal-fired power plant would necessarily be accompanied by a renewable power plant of at least 10% of the generating capacity (IEEFA, 2015). Although coal would remain the critical component of the energy sector in India, its slated to witness transformation over the next 1½ decade with an increasing share of non-fossil based power generation.
- **Social acceptability of mining projects to operate in local community:** The competition for scarce resources in terms of land, power, water, rehabilitation etc. often spur issues between the mining projects and the local community. The future outlook of the mining sector also depends on the improved social, developmental, and environmental performance of the mining organizations and greater acceptability of the organization amongst the local community. The mining sector organizations need to focus on better sustainable development of their mining areas. Inability to deliver the same may result in opposition from the local community which ranges from considerable delays in project implementation to even the abandonment of the project in the identified mineral bearing are

[44] Exchange rate assumed at 1 dollar=INR 65
[45] Paris Summit 2015 – India's Intended Nationally Determined Contribution

Figure 13: SWOT Analysis of Indian Mining Sector



3.7 Key Drivers of Sector Competitiveness

- **Emphasis on exploration activities:** The Geological Survey of India (GSI) has conducted geological data mapping of around 98% of the total mappable area (~3.15 million sq. km) in India, on 1:50,000 scale till March, 2013. Based on this, GSI has identified 0.57 million sq. km. as Obvious Geological Potential (OGP) area for minerals[46]. Around 150 mineral belts with potential mineral zones / deposits have been identified till date within the OGP domain. However, a considerable share of the OGP area is yet to be fully explored. With greater recovery of mineral resources available near surface (up to vertical depth of around 100 m), the future outlook of mining industry would largely depend on locating new mineral deposit areas for near surface as well as deep seated deposits. The areas identified for geological potential needs to be explored in detail through advanced and sophisticated exploration methods/ techniques on the basis of conceptual studies. States such as Andhra Pradesh & Telangana (23%), Rajasthan (18%) and Karnataka (14%) which have higher share of the OGP areas may be focused upon for detailed exploration. As per the proposed National Mineral Exploration Policy[47], the Geological Survey of India (GSI) is expected to take up National Airborne Geophysical Mapping Project (NAGMP) covering 8 lakh sq. kms. Including the Obvious Geological Potential (OGP) area. The project would aid in identification and mapping of reserves of rare earth and other strategic minerals in India.

  As highlighted in the previous section, the present mineral exploration budget of India is also considerably low in comparison with the major mining countries across the globe and needs to be suitably increased. It is important to augment the mineral exploration activities by greater budgetary allocation for increased exploration activity in the country. The National Mineral Exploration Trust is also expected to provide impetus to the exploration activities in India. The private sector

[46] Mines.nic.in
[47] The draft exploration policy is out for discussion and is in the public domain

participation in exploration is also anticipated to increase in future in view of exclusive Reconnaissance Permits.

- **Greater role of private sector:** The National Mineral policy, 2008 envisages private sector to be at the forefront of mineral production. However, the public sector continues to play a dominant role in the mineral production. The value of mineral production (excluding atomic minerals and minor minerals) by Public Sector was approx. 67% of the overall value of mineral production in 2012-13[48]. The share of Public Sector in the total value of fuel minerals was 75%, while in metallic and non-metallic minerals during the year it was 39% and 28% respectively. The public sector accounted for 91% of the total production of Coal and Phosphorite/ Rock Phosphate each and 87% of the total production of Tin concentrate. The minerals which were wholly mined by the public sector in 2012-13 includes copper ore & its concentrate amongst metallic minerals and diamond, fluorite, selenite & Sulphur in case of non-metallic minerals. The future growth in mining sector should be realized largely through greater participation of private sector in mineral production. The provision of transferability of mineral concessions obtained through auctions under the Mines and Minerals (Development & Regulation) Act (2015), if executed properly, is expected to be an enabler in attracting greater private investment and Foreign Direct Investment.
- **Advances in Technology:** The competitiveness of Indian mining sector in future would depend largely on its ability to adopt innovative practices and technology in the sector. The use of advanced technology would be especially required in activities such as deep seated mining, deep drilling, extraction of metals from low grade ores, mine closure processes and sustainable mining. Going forward, the production in the sector would improve by making best use of technology such as 2D/3D Seismic Survey, hydrostatic drilling, geophysical loggers, GPS/ GPRS based vehicle tracking system, input crushing & conveying system, satellite based surveillance to monitor land reclamation & plantation and processes such as E-Auction, E-Procurement of goods and services. The use of airborne geophysical Surveys would help in identifying and probing mineral deposits at depths located as deep as 300 m. The industry would also benefit from adoption of digital data to facilitate real-time tracking, surveillance, traffic management, environmental monitoring, maintenance and asset management etc.
- **Development of transport Infrastructure facilities:** The Twelfth Five Year Plan lays great importance on development of infrastructure to enable growth of the economy. The existing network of roads, railway and waterways needs to be sufficiently augmented in view of high forecast of freight movement enabled by manufacturing, power, mining and construction sector. To enable suitable infrastructure facilities, the government foresees infrastructure spending of around USD 1 trillion in five years through 2017. Additionally, the chronic bottlenecks in infrastructure development needs to be suitably improved through revival of the stalled projects. Currently, the share of railways in transportation of coal in the country is approx. 52% followed by the other modes of transportations such as Roads (27%) and others (21%). The coal movement by railways is expected to increase to 58% in 2016-17 according to the 12th five year plan. This will involve the creation of adequate rail facilities in the mineral bearing areas. The notable railway infrastructure projects proposed during the 11th plan were the Tori–Shivpur– Katholia rail link in North Karanpura coalfield, the Bupdevpur Baroud rail link connecting coal blocks in Mand Raigarh coalfield, the Jharsuguda–Barpalli railway line in IB valley coalfield and the Sattapalli–Bhadrachalam rail link. The proposed Tori– Shivpuri line was cleared by the Ministry of Environment & Forests with certain conditions and is under construction. Similarly, Singareni Collieries Company (SCCL) has agreed to fund railways to implement the Sattapalli–Bhadrachalam link project on turnkey basis. The 12th five year plan also suggests establishment of feeder lines across potential coalfields for improving rail movement of coal. Additionally, the government is planning to commission two Dedicated Freight Corridors

[48] Indian Bureau of Mines (IBM), 2013-14

(DFCs) on the Western and the Eastern routes by March 2017. The Dedicated Freight Corridors on the Western and the Eastern routes involves construction of 3,338 kms. of dedicated freight lines to mainly transport coal and steel. The development of logistics infrastructure such as Dedicated Freight Corridors (DFCs) would ensure timely and cost effective evacuation of minerals.

The government also plans to expand the port capacity at major ports which would enable the movement of minerals such as Coal and Iron. The implementation of these projects along with the ones which are currently stalled would positively impact the mineral transport infrastructure in the country.

- **Emphasis on reducing demand-supply gap of coal:** The Fuel minerals coal & lignite accounted for 41% of the total production of major minerals (excluding petroleum and natural gas) in 2012-13. Coal is one of the most important minerals in India in terms of demand and production. The total demand of coal (coking and non-coking) in the year 2013-14 was around 769.69 million tonnes; however the total coal production was approx. 585.77 million tonnes leading to significant demand – supply gap. This gap between demand and supply of coal (coking and non-coking) was met by imports wherein the share of imports in the total domestic coal demand was around 21.9% in the year 2013-14.

  According to the estimates of the Ministry of Coal, the total Coal demand in the country is anticipated to reach 980.50 million tonnes in the terminal year of the Twelfth Plan (2016-17). Around 75% of the total coal demand by 2016-17 is expected to arise from power sector (including that from captive power plants). The share of the steel sector is expected to be 6.85% of the projected demand and the shares of cement and sponge Iron sectors are expected to be 4.8% and 5.1% respectively and balance 7.9% is estimated to be consumed by the brick and others sectors. This necessitates improvement of the existing production capacities in order to avoid dependence on imports. The gap between the domestic demand and the supply of coal has made it imperative for the country to supplement domestic production with increased public and private sector participation.

- **Enhanced productivity gains**: With the availability of limited price differentiation, the Indian mining sector struggles with high cost and low production yields. The existing mining organizations are increasingly striving to achieve operational efficiencies in their current operations. The mining organizations need to optimize their present operating costs and capital allocation for sustainability of their mining businesses. Timely application of innovative practices in various aspects of mining; exploration, surveying, opencast and underground technologies are required to improve productivity. The future strategy of mining organizations would largely be to enhance productivity gains through operational efficiencies based on adoption of innovation and advanced technology, enabling them to aim for near zero waste mining (including extraction of associated minerals) and extraction of deep seated mineral reserves. The future outlook of the mining sector would depend considerably on gaining efficiencies in the existing processes and adopting newer/ advanced methods of mining.

- **Ensuring Availability of Financial Resources:** Since prospecting and exploration is a high risk venture, access to “risk funds” from capital markets and venture funds would facilitate in bringing more participation in the same. The future investments in prospecting and exploration activities would depend on formulation of suitable scheme for taking full advantage of the High Technology Reconnaissance cum Exploration License (HTREL) in consultation with the major financial institutions in India such as SEBI, RBI etc.

- **Sustainable development of mining areas:** The future outlook of the mining sector would largely depend on greater acceptability of the organization amongst the local community. The Ministry of Mines’ Sustainable Development Framework (SDF) report (2011) recognizes that most mining districts in the country are also the poorest and in recent decades, mining activities have resulted

in little local benefit. The success of the mining organizations in future would greatly depend on improving the social and environmental conditions of the local community through implementation of suitable schemes. The effective closure of the mines would also be very important in future with greater requirement of services such as Environment Management & Monitoring and Resettlement & Rehabilitation.

Recognizing the need for sustainable development of mining areas, the Mines and Minerals (Development & Regulation) Amendment Act (2015) keeps a provision of allocating money to the District Mineral Fund (around 10% or 30% of royalty) for development of the people living near mines. Additionally, Companies Act, 2013 also makes is mandatory for a company to spend at-least 2% of PAT on Corporate Social Responsibility.

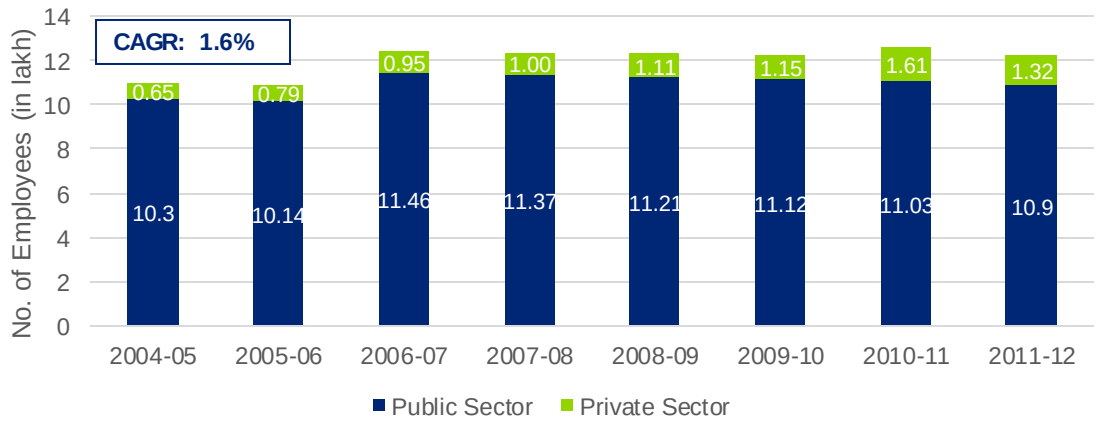
4. Employment Profile of Mining Sector

4.1 Current employment in Mining sector

According to the Census 2011, out of the total population of 121 crore in India, the working age population (between 15-59 age group) is about ~73 crore, constituting nearly 60.3% of the total population. Based on the labor force participation rate and the worker participation rate, the workforce in 2011 is estimated to be 64% of the working age population, i.e. ~47 crore; while mining industry employs 0.5% of India's workforce in 2011-12 i.e. ~23.3 lakh people[49]. This includes employment in the public/ private establishments i.e. organized sector and employment in the unorganized sector including self-employment.

India produces a total of 89 minerals whose production value has grown at CAGR of 14.4% from INR 53,914 crore in 2004-05 to INR 1, 81,157 crore in 2011-12. The overall mineral production in India has increase at CAGR of 5.4% from 765 million tonnes in 2004-05 to 1,114 million tonnes in 2013-14 while the employment in organized sector (including major public and private industries) has grown from at a CAGR of 1.6% from 10.95 lakh in 2004-05 to 12.22 lakh 2011-12[50]. Public sector companies play a dominant role in mineral production and employment; in 2011-12, public sector companies accounted for 67% of production value and 90% of employment (employment in organized sector); while private sector largely consisting of proprietary or partnership ventures, which mostly operate small mines and have more propensity to have manual mining operations, make a much small contribution in terms of employment.

Figure 14: Employment of Organized Sector in Mining and Quarrying (in lakh), 2004-05 to 2011-12



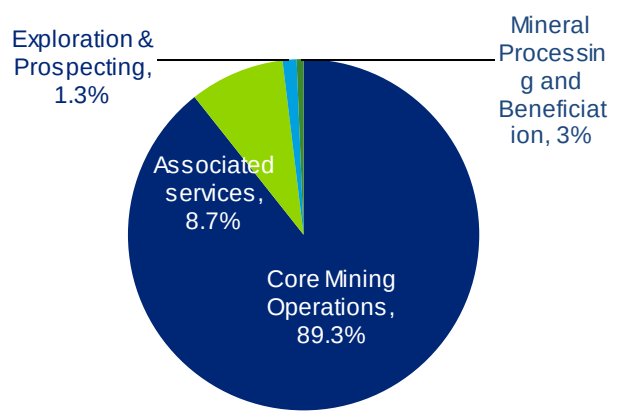
Source: Indian Labor Statistics 2012 and 2013, Ministry of Labor and Employment

[49] Deloitte Analysis and Expert Interviews along with National Industry Classification (2008) definitions and data from Central Statistical Organization

[50] *'Indian Labour Year Book 2011 and 2012'* - Ministry of Labour and Employment, GoI

According to NIC-2008, the mining and quarrying sector has been classified into 5 industry sub-divisions (industry code): Mining of Coal and Lignite (05), Extraction of Crude Petroleum and Natural Gas (06)[51], Mining of Metal Ores (07), Other Mining and Quarrying (08), Support activities for other mining and quarrying (099). The employment coverage in this report is in accordance with industry classification given in ***Annexure 04***. The industry classification division 06 on extraction of crude petroleum & natural gas and division 0721 on mining of uranium and thorium ores are not considered, in line with the scope of the study.

Figure 15: Distribution of Employment by Sub-Sectors in 2011-12

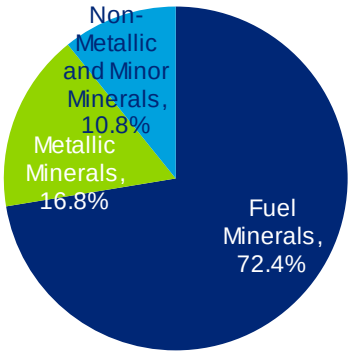


Source: Deloitte Analysis, 2016

Based on National Industry Classification (2008) definitions and data from Central Statistical Organization[52], In 2011-12 Mineral Extraction sub-sector is found to be the highest employer in mining sector with about 89.3% of mining workforce engaged in core mining operations followed by 8.7% in Associated Services (i.e. mining support and supply services), 1.3% in Prospecting & Exploration (i.e. mineral exploration) and less than 1% in Mineral Processing & Beneficiation (i.e. primary ore processing). Under Mineral Extraction, the majority of workforce (about 66%) is engaged in extraction activities of dimensional stone, sand, clay and other minor minerals followed by Fuel Minerals (27%), Metallic Minerals (4%) and Non-Metallic (3%). However, it is noteworthy that dimensional stone/ minor mineral industry is characterized as highly unorganized in comparison to the other mineral categories.

According to DGMS in 2011-12, 72.4% of mine workers are engaged in Fuel Minerals followed by Metallic Minerals (16.8%), Non-Metallic and Minor Minerals (10.8%) based on returns submitted in line with Mineral Conservation and Development Rules 1988 – covering average daily employment reported by mines excluding the Minor Minerals, oil, natural gas and atomic minerals.

Figure 16: Distribution of mine workers (non-executive category) in 2011-12



Source: Directorate General of Mines and Safety, 2011-12

[51] Atomic minerals, extraction of oil and natural gas has not been included as part of the study.

[52] NSSO Report 2011-12, NIC-2008, Directorate General of Mines and Safety, Indian Bureau of Mines, Expert Interviews and Deloitte Analysis.

Table 11: Employment in the Mining Industry and its Prominent Sub-Sectors, 2011–2012

S. No.	Sub-Sector as per ToR	Definitions as per SCMS's Occupation Matrix	Employment (in lakh)
1	**Prospecting & Exploration**	***Natural Resource Management***	**0.29**
2	**Mineral Extraction**	***Core Mining operations***	**20.77**
2.1	Fuel minerals	*Coal & Lignite Mining (Opencast & Underground) excluding Petroleum and natural gases*	*5.60*
2.2	Metallic Minerals	*Non-Coal Mining (Opencast & Underground)*	*0.85*
2.3	Non-Metallic Minerals		*0.55*
2.4	Minor Minerals/ Dimensional Stones	*Dimensional stones/ Quarrying of sand, clay and other minor minerals*	*13.76*
3	**Associated Services**	***Environment, Health & Safety, Engineering and Allied Services etc.***	**2.03**
4	**Mineral Processing & Beneficiation**	***Primary ore processing, instrumentation and control systems***	**0.14**
Total			**23.25**

Source: NSSO Report 68th round, NIC-2008, Directorate General of Mines and Safety (DGMS), Indian Bureau of Mines, Expert Interviews and Deloitte Analysis

4.2 Share of states in total employment of the sector

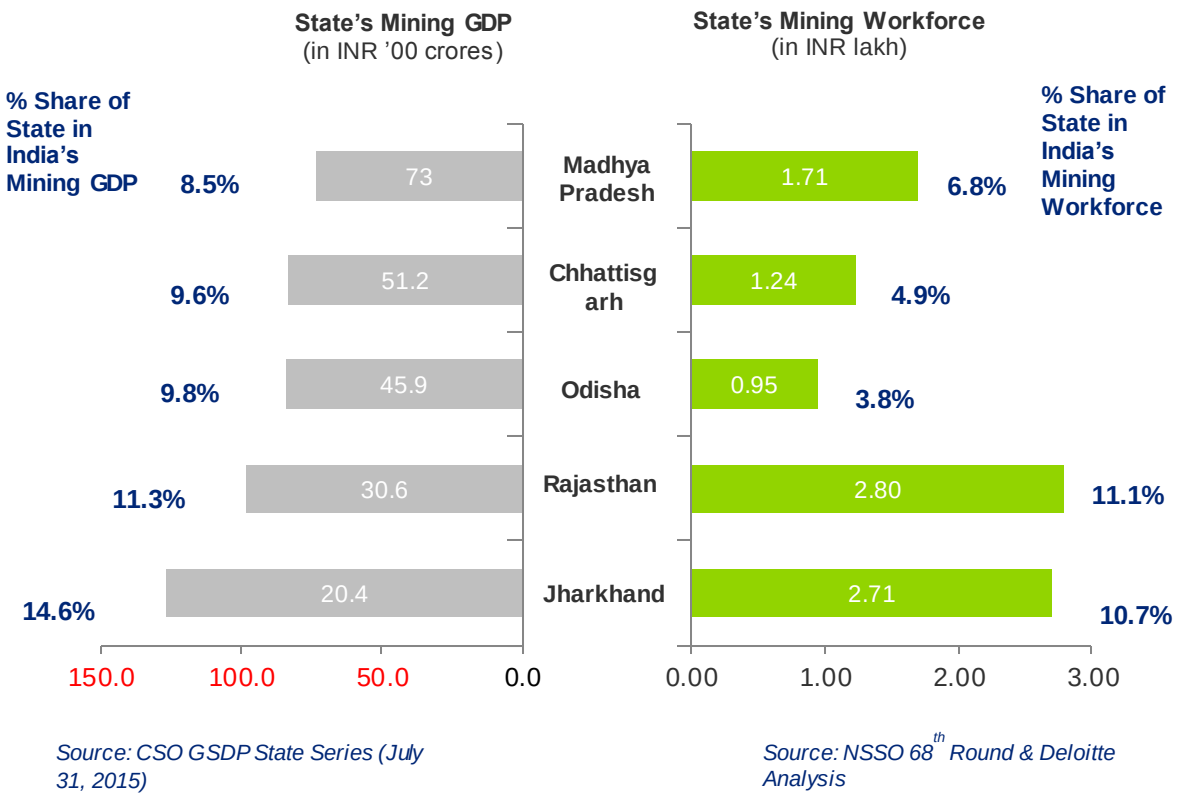
Large proportion of mining in India is concentrated in relatively backward states[53] with low per capita income than national average such as Jharkhand, Rajasthan, Odisha, Chhattisgarh and Madhya Pradesh which constitutes ~54% of India's Mining sector GDP (2011-12) and ~37% of sectoral employment (2011-12). The states of Gujarat, Telangana, Andhra Pradesh & Maharashtra, which has higher per capita than the national average constitute ~25% of India's Mining sector GDP (2011-12) and ~22% of sectoral employment (2011-12).

In contrast, the mineral rich states in other countries such as Australia have leveraged their mineral wealth to propel their state GDP higher than the national average.[54] During the primary interaction with key stakeholders it has been found that the supply of skills in backward states is bound to be limited unless it is catalyzed/ ensured through dedicated sponsorships. It was pointed by stakeholders that in many cases, people find it difficult to relocate from other states for mining jobs - especially relocation to backward states/ districts; for instance it would be difficult to move skilled workforce available in other parts of the country to the mineral rich but relatively backward state.

[53] The per capita GDP of these mineral rich states in India is lower than the national average. According to CSO, the per capita GDP (at constant price 2004-05) in 2013-14 for Jharkhand (INR 28, 882), Rajasthan (INR 30,120), Odisha (INR 25,891), Chhattisgarh (INR 28,114) and Madhya Pradesh (INR 27,917) is lower than the national average of INR 39,904.

[54] *'Unlocking the Potential of the Indian Minerals Sector - Strategy Paper 2011'*, Ministry of Mines, GoI

Figure 17: Share of States to Mining GDP and Employment 2011-12



Source: Central Statistical Organisation (July 31, 2015) and NSSO Report 68th round

According to Directorate General of Mines Safety (DGMS) in 2011-12, the prominent geographical distribution of employees by mineral category is as follows:

- **Fuel Mineral (Coal & Lignite):** 80% of employment is engaged across the states of Jharkhand (25.9%), Andhra Pradesh (17.9%), West Bengal (15.4%), Madhya Pradesh (12.4) and Chhattisgarh (8.9%).
- **Metallic Mineral:** 88% of employment is engaged across the states of Odisha (42.2%), Karnataka (16.5%), Jharkhand (12.8%), Goa (9.5%) and Chhattisgarh (6.8%)
- **Non-Metallic Mineral:** 65% of employment in is engaged across the states of Rajasthan (30.5%), Madhya Pradesh (13.7%), Odisha (10.7%) and Andhra Pradesh (9.4%)

4.3 Demographic and workforce characteristics

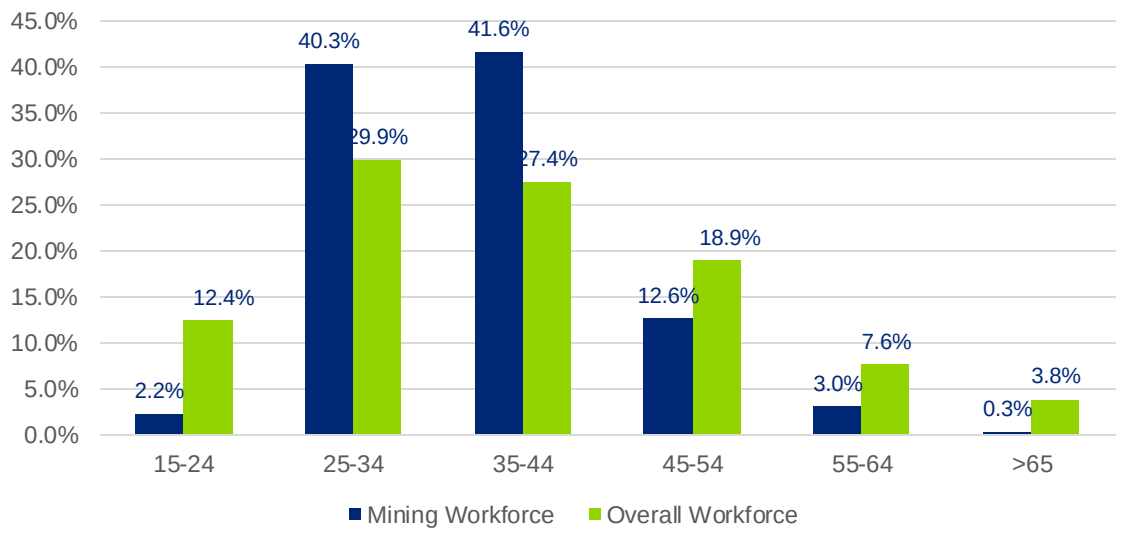
4.3.1 Ageing of Mining Workforce

The working age population (15-59) of India is 73 crore, constituting 60.3% of total population in 2011. This is expected to increase to 89 crores[34] (i.e. 62.3% of population) by 2022. However, the proportion of population in 2022 for the age group of 0-14 years is expected to decrease (from 30.7% in 2011 to 27.6% in 2022)[34] while portion of population for more 59 year is expected to increase (from 9% in 2011 to 10.1% in 2022)[55]. The below figure shows the age distribution of the mining labor force relative to the

[55] Deloitte Analysis, Census 2011 and Population Projection Report of India & States from 2001 to 2026, Office of Registrar General and Census Commissioner

overall workforce in India. The sample survey[56] indicated that mining industry has a greater proportion of workforce in the age groups 25-44 years – about 80%; compared to overall workforce (about 57%) in the same age group. While a smaller proportion of workforce in older age groups (55-64 years) – about 3.3% is participating in mining sector compared to overall workforce (about 11.4%) in the same age group. In the next decade, as the existing workforce continues to age, the majority of younger people are anticipated to take higher level of responsibilities in the respective mining occupations. This should demand industry's attention on upskilling/ re-skilling of existing labor force for higher level job roles.

Figure 18: Age Group distribution in Indian Mining, 2011



Source: Census 2011, NSSO Report 68th Round and Deloitte Survey 2015

4.3.2 Retirement

A relatively small proportion of older workforce means that retirements are low, but are anticipated to increase in mining over the next decade as about 15.9% of the current workforce is with age above 45 years. Deloitte's sample survey indicated that roughly 3% of the labor force will be eligible to retire in the next decade and 0.3% of workers are currently eligible to retire. During expert interviews, it was highlighted that though retirees hold extensive technical knowledge in multiple mining occupations but due to new technology advancement in the sector this skillset may not be required in many cases. Hence the situation in respect to retiring workforce is unlikely to be of significant disadvantage to the Mining Sector.

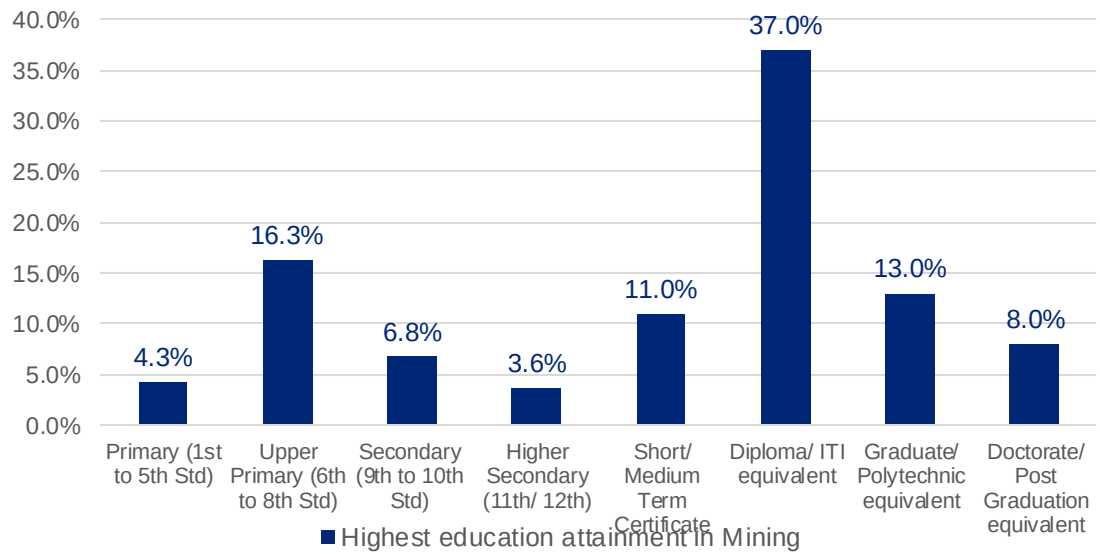
4.3.3 Education

The educational background of the sample covered in the survey indicates that 37% of mining workforce are having Diploma/ ITI equivalent qualifications followed by Higher Secondary or below (31%), Graduate/ Polytechnic equivalent (13%), Trade Certificates i.e. Short/ Medium Term Certificates (11%) and Doctorate/ Post Graduation equivalent (8%). The educational profile in mining industry is similar to the overall education level of the population (aged 15 years and above) however it differs slightly in a few areas. According to the survey, the mining labor force has a greater proportion of workers with

[56] Survey conducted as part of study which includes key stakeholders such as industry, industry association, labour union, employees, government officials (central/ state) and education institutes. It has to be noted that the survey results exclude companies under dimensional stones/ minor mineral category

Diploma/ ITI or trades certificates (short term/ medium term certificates); however in India such workforce at the entry level is not trained to the desired extent. It is noteworthy that only 6.8% of the population (aged 15 years and above) are reported as received/ receiving vocational training out of which about 4% acquired/ were acquiring vocational training from informal systems[57]. Similarly, the percentage of mining workers with a higher education is more than the percentage of population (aged 15 years and above) with higher education.

Figure 19: Proportion of Mining Workforce by Highest Level of Educational Attainment



Source: Deloitte Survey and Expert Interviews, 2015

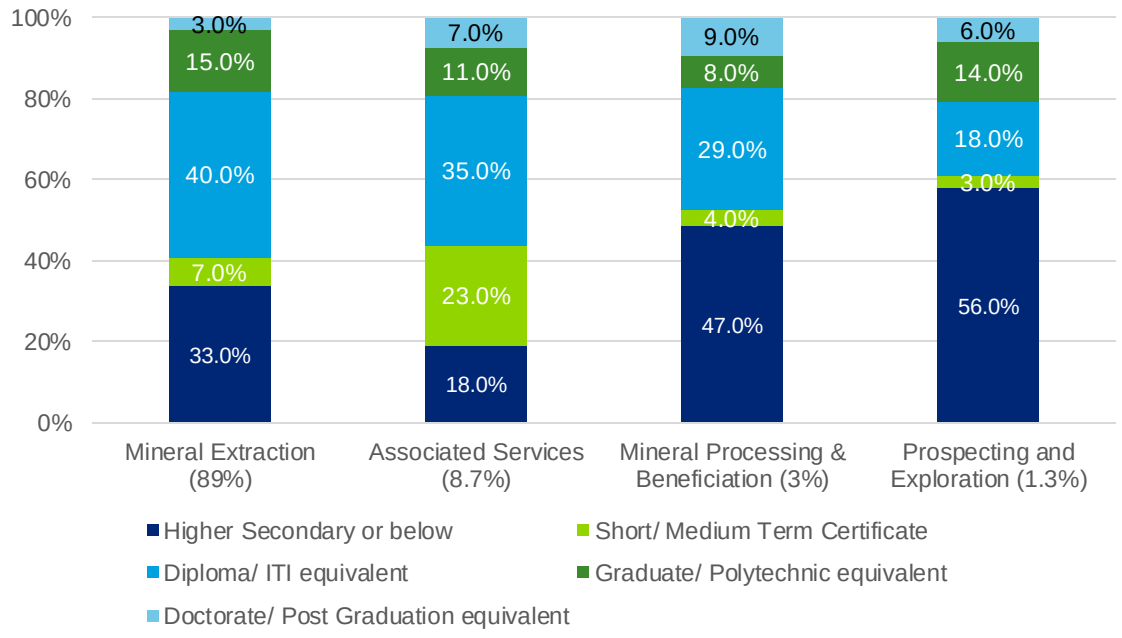
The survey indicated that in respect to participation of workers with higher education, 9% of mining workforce engaged in Mineral Processing & Beneficiation having Doctorate/ Post Graduate equivalent qualifications followed by Associated Services (7%) and Prospecting & Exploration (6%).

The recognition of skills is increasing for the workforce in mining sector which enables worker's mobility. Therefore, greater proportion of new workers/ entrants are understand the value of certification in an economy that increasingly values credentials and utilizes them as a key factor in selection and recruitment processes. The survey indicated that 40% of the mining labor force engaged in Mineral Extraction activities having Diploma/ ITI equivalent qualification followed by Associated Services (35%), Mineral Processing & Beneficiation (29%) and Prospecting & Exploration (18%)

It was learned from stakeholders that the many mineral extraction activities are carried out in far-flung areas, necessitating hiring of mine workers locally. Workers are inducted into various mining occupations through trade specific training programs/ orientation conducted at mining sites. Majority of workers are found to be schools dropouts, who are suitably trained and equipped with required skill set according the guidelines laid down by DGMS, Mine Coal Act, 1957; Minor Mineral Concession Rules, 1962; and Mines Vocation Training Rules, 1966. The survey indicated that 56% of mining workers engaged in Prospecting & Exploration having education qualification of higher secondary or below (including the ones with no schooling) followed by Mineral Processing & Beneficiation (47%), Mineral Extraction (33%) and Associated Services (18%).

[57] Report on Education, Skill Development and Labour Force 2013-14 Vol-III, Ministry of Labour & Employment, GoI

Figure 20: Highest Level of Educational Attainment in Mining Workforce by Mining Sub-Sectors



Source: Deloitte Survey 2015

Note: The percentage mentioned in the bracket specify the sub-sector wise share of employment.

The recent economic and regulatory shifts[58] have led to certain degree to mismatch between industry needs and the numbers of students supplied at different NSQF levels through education programs. During expert interactions, it has brought forth that the education/ skilling for the mining sector has not been effective in matching the growth/ technology advancement in various areas of the mining sector. Moving forward, it will become increasingly important for mining industry and education sector to better coordinate their efforts and ensure they are closely aligned.

4.3.4 Women Participation

According to DGMS in 2011-12, the average daily employment of women in mines only account for 4.4% (i.e. 24,294 female worker) of mining workforce which is well below the women's labor force participation rate (which is 22.5%) in India[59].

The share of women employment was reported as 3.05% in Coal mining while 7.25% in non-coal minerals mining where majority of female workers (about 70%) were employed in above ground mines while rest (30%) are engaged as clerical & supervisory staff. The prime occupations of engagement for women has been reported as miners (mainly in extraction Iron, Gypsum, Magnesite and limestone) and loaders[60].

During the primary interaction it was found that majority of women employed in the Mining Sector are school dropouts and are engaged in Job Roles of Helper, Loader, Excavator Operator, Wire saw Operator, Jumbo drill Operators and Ore processing operators (majority of Job Roles from NSQF level 1-4). It was mentioned by the industry that women are being trained in trade specific programs (in accordance with the guidelines of DGMS and vocational training rules 1966), where women are inducted as Helper and subsequently moved to higher level of responsibilities within occupations.

[58] See, key trends in Incremental Human Resource Demand Section

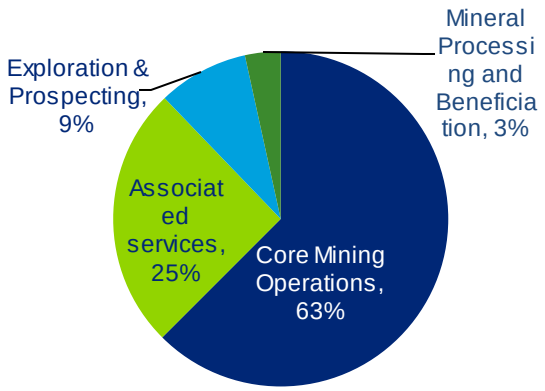
[59] Statistics of Mines in India Vol-I & II 2013, Directorate General of Mines and Safety, GoI

[60] Statistical Profile of Women and Labour 2012-13, Ministry of Labour and Employment, GoI

4.3.5 Migration

The sample survey indicates that majority of the workers are not attracted to migrate out of state in search of jobs in mining sector. It implies the necessity and requirement to focus of suitable skilling of workers in the state where mining is prominent – this should enhance the absorption capacity in respect to mining workforce for gainful work within the state. However it is noteworthy that 20% of the mining workers surveyed reported, that they have move to the other states from home state while 60% of the mining workers moved to other districts (within their state) to work in mining sector.

Figure 21: Proportion of Migrant (to other states) employed by Mining Sub-Sector



Source: Deloitte Survey, 2015

The Mineral Extraction sub-sector employed 63% of migrants (from other states) followed by Associated Services (25%), Prospecting & Exploration (9%) and Mineral Processing & Beneficiation (3%). This pattern is similar to existing workforce distribution by sub-sectors. It was also found through sample survey that migrants tend to settle in rural remote location where extraction activities tend to occur however few migrants tend to settle in semi-urban centers as mineral processing activities are more likely to be located in or near cities.

4.3.6 Occupation

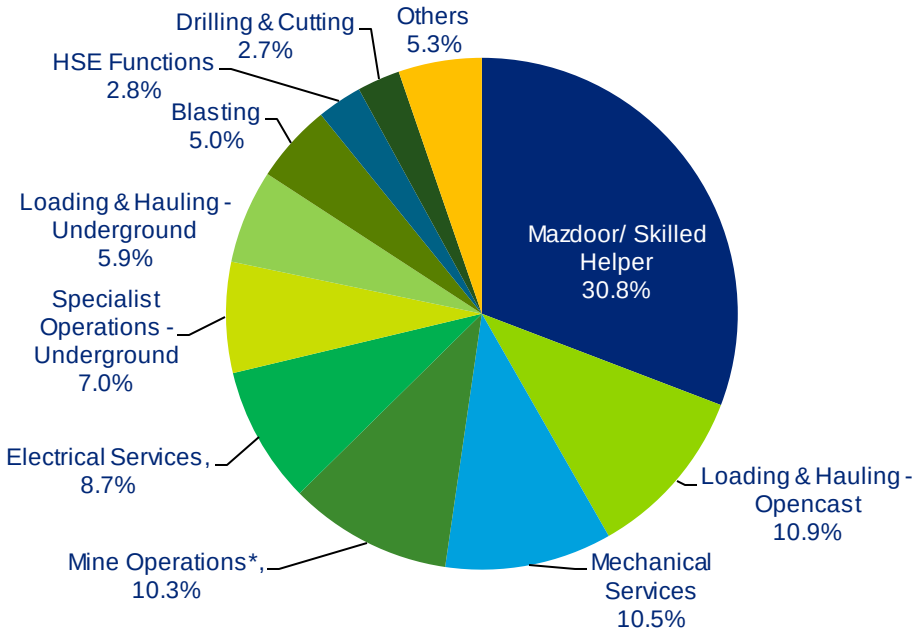
The occupational break-up of Mining Sector has 17 different mining occupations. Skill Council for Mining Sector (SCMS) has identified/ published 40 Job Roles grouped under these 17 occupation categories ranging from NSQF level 1 to 4 based on the occupational matrix[61].The job roles in occupation matrix has been updated from existing 40 to 66 across NSQF level 1-7.

Based on the survey and stakeholder interviews, Mineral Extraction sub-sector is found to be the highest employer in mining sector with about 64% of mining workforce engaged in these operations followed by 26% in Associated Services (i.e. mining support and supply services), 7% in Prospecting & Exploration (i.e. mineral exploration) and 3% in Mineral Processing & Beneficiation (i.e. primary ore processing)[62].

[61] See, Annexure 02 - Discussion Agenda – Industry for mapping of all job-roles as per NSQF levels and sub-sectors which is updated during course of study.

[62] This reported figures and composition of occupations in this section excludes the companies working on Dimensional Stone/ Minor Minerals

Figure 22: Distribution of Mining Workforce by Occupation



Note: *1.This includes job roles such as Senior Mining Engineer, Senior Geotechnical Engineer, Mining Engineer, Geotechnical Engineer, Mining Engineer, Material Engineer, Reclamation Supervisor, Supervisor - Plant operations Mining Supervisor and Mining Mate

2. The others includes occupations categories - Exploration Drilling, Geological Investigation, Mine Surveying, Resource Management, Ore Processing, Instrumentation & Control Systems, Specialized Technicians including Sampler (QA/QC) and Geophysical Exploration

3. It excludes the w orkers engaged in dimensional stone/ minor minerals.

Source: Deloitte Sample Survey, 2015

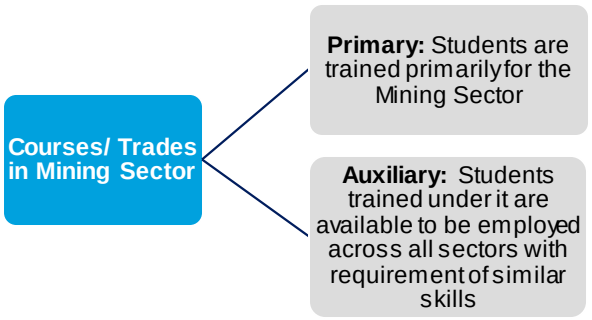
The survey reported that about 30.8% of the mine workers are engaged as Mazdoor/ Skilled helper across all the sub-sectors. Under Mineral Extraction about 42% of the workforce is primarily engaged in occupations of Loading & Hauling (Opencast), Mine Operations, Specialist Operation (Underground), Loading & Hauling (Underground), Blasting and Drilling & Cutting while under Associated Services about 22% of the workforce is engaged primarily in occupations of Mechanical Services, Electrical Services and Health, Safety & Environment (HSE) Functions.

During primary interaction with key industry experts it has been found that for some occupations (like Geophysical Exploration, Mechanical/ Electrical Services etc.) within the industry, there is a large pool of available workers — but mining does not attract enough of them to meet current need; while there are few occupations (like Surveying, Geological Investigation, Instrumentation & Control Systems etc.) where the mining sector faces fierce competition from the manufacturing, construction and electricity, gas & water supply sectors — all in need of workers with similar skills, knowledge and experience. If competition for specific occupations increases on account of overall economic growth, difficulty in respect to getting the above workers from existing labor pool will increase – externally from other sectors and internally within the industry where in some cases mining employers also competing against each other for human resource.

5. Education Infrastructure in Mining Sector

The mining related courses/ trades offered by the education Institutes in India fall under the following two categories – (i) ***Primary:*** These are the courses where the students are trained primarily for the mining sector and (ii) ***Auxiliary:*** These are the courses which are non-exclusive to the Mining Sector and the students trained under it are available to be employed across other sectors with requirement of similar skills. Currently in India, **most people with varying level of school education background or vocational training are non-exclusively available for the Mining Sector, these students** can be absorbed across multiple sectors. **People with higher and technical education background can be exclusive as well as non-exclusive to the Mining sector** depending upon their specialization.

Figure 23: Category of courses/ trades offered by Educational Institutes in Mining Sector in India



The following table provides the distribution of education level across various NSQF levels.

Table 12: Distribution of Education level across various NSQF levels

NSQF Level	Education Level	Indicative Job Roles
NSQF level 6 & above	**Higher Education** (Doctorates/ Post Graduate equivalent)	Geophysicist, Mining Economists, Remote Sensing Specialist
NSQF level 5	**Higher Education** (Graduate/ Advanced Diploma equivalent)	Mining Engineer, Material Engineers, Mining Geologist, Mineral Processing Engineers
NSQF level 4	**Vocational Education** (ITI/ Skill Certification; Statutory Certification)	Banksman, Mine Electrician, HEMM Operators, Dewatering Pump Operator,
NSQF level 3	**Vocational Education** (ITI)	Explosives Handler, Sampler, Timberman, Mechanic/ Fitter
NSQF level 1 & 2	**School Education** (Below X, people with no education background can also join; preferable to have basic counting & numeracy skills)	Mazdoors/ Helpers, Skilled Helpers

Source: Skill Council for Mining Sector; Deloitte Analysis

In terms of NSQF levels, the Human Resource for Job Roles for NSQF level 1 to 4 in the Mining Sector is fulfilled by people from Auxiliary courses/ trades - these **are mostly non-exclusive to the Mining Sector** and the Mining Sector face competition from other sectors with requirement of similar skills for

attracting Human Resource who are trained in Auxiliary courses/ trades. The Mining Sector at higher NSQF levels require people from primary as well as auxiliary courses/ trades depending upon their specialization.

5.1 School Education

India had 15, 16,892 schools with total enrolment of ~25.95 crore students in the year 2014-15[63]. In the same year, the total count of students who either dropped out at the school level (before completing higher secondary level) or did not enroll for higher and technical education after completing higher secondary level was ~ 2.18 crore[64]. While some proportion of this pool would enrol for technical and higher education, the majority of the resources is available to be employed across various sectors of the Indian economy (including Mining).

Within the mining sector, people with school education background (without any formal skill development training or certification) are typically employed at the NSQF levels 1 and 2. This pool entering mining sector primarily go through 'On the Job' skill development along with some basic functional & statutory trainings. **2 of 66 Job Roles** in Mining sector employ workers with varying level of school education.

5.2 Vocational Education

The vocational education institutes offering mining related courses in India comprise Industrial Training Institutes (ITIs) (Government & Private), NSDC Training Partners and Vocational Training Partners (VTPs). These vocational education institutes offer Auxiliary trades/ courses in mining sector which are non-exclusive to the sector and the students trained under it can be absorbed by other sectors as well such as Civil Engineering, Electrical Engineering etc.

As on 19 February 2016, India has a total of 11,108 ITI's affiliated under NCVT which are offering mining related courses, of which 1,699 are Government ITIs and 9,409 are private ITIs[65].

Table 13: Industrial Training Institutes (ITIs) in India, 2015-16

Educational Infrastructure	Number of Institutes	Number of Courses Offered	Total Intake Capacity	Total Students Trained	Capacity Utilization
Government ITI's	1,699	14	3,07,713	2,38,823	77.6%
Private ITI's	9,409	15	14,41,251	10,98,074	76.2%
Source: Ministry of Skill Development and Entrepreneurship					

The state wise distribution of ITI's and seating capacity has been provided in ***Annexure 05***. These Industrial Training Institutes currently offer 17 trades *(Data Entry Operator, Driver Cum mechanic, Electrician, Fireman, Fitter, HR Executive, Information Communication Technology, Machinist, Mechanic – Mechatronics, Mechanic – Motor Vehicle, Mechanic – Tractor, Operator Advanced Machine Tools, Pump Operator, Safety Operator, Surveyor and Welder – DA, Welder – GMAW & GTAW)* which meet multiple requirements of Mining sector; however this trained workforce may contribute to many other sectors as well. It may be noted that the mining related trades offered by the ITIs in India are primarily non-exclusive to the sector and can be absorbed by other sectors as well such as manufacturing, construction, power and relevant service sectors. Within the mining sector, this pool of resources is typically employed at NSQF 3 & 4 catering to the requirements of 9 occupations.

[63] School Education in India Flash Statistics, U DISE 2014-15
[64] U DISE 2014-15 & Deloitte Analysis
[65] https://ncvtmis.gov.in/

Table 14: Key Job roles in Mining Sector which absorbs students with ITI education

Occupation	NSQF Level wise Training Capacity	
	NSQF Level 3	NSQF Level 4
Drilling & Cutting	-	0.02%
Loading & Hauling – Opencast		
Loading & Hauling – Underground		
Electrical Services	-	53.97%
HSE Functions	-	0.11%
Instrumentation & Control Systems	-	0.02%
Loading & Hauling – Opencast	-	0.84%
Mechanical Services	32.21%	11.09%
Mine Surveying	-	0.80%
Others in Mining Operations	-	0.94%
Source: Ministry of Labor & Employment, Skill Council for Mining Sector, Deloitte Analysis		

At **NSQF level 3, the relevant training capacity in ITI's is under the Mechanical Services Occupation** (for Job Role such as Fitter). At NSQF level 4, the highest relevant training capacity in ITI's is under the Electrical Services Occupation (for Job Role such as Electrician) followed by Mechanical Services[66]. *The ITI pass-outs with at least 1 year experience in Mining Sector can also move to NSQF level 5 as Mining Mate after clearing DGMS skill certification exam*.

The major courses offered in the ITIs and their capacity in the country is provided in the figure below:

Figure 24: Major courses offered in Government ITIs and their capacity in India, February 2016

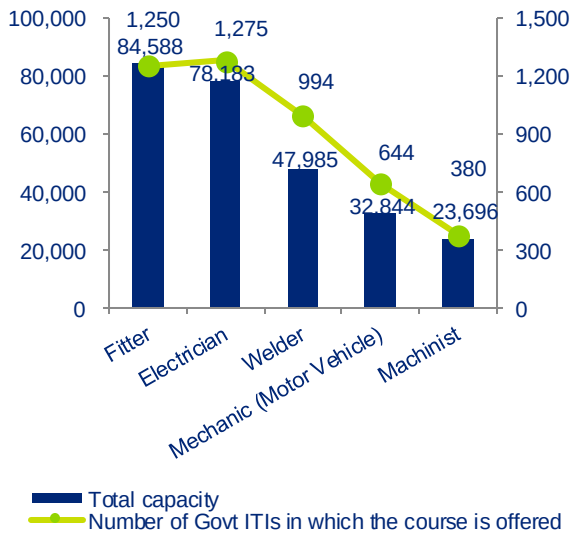
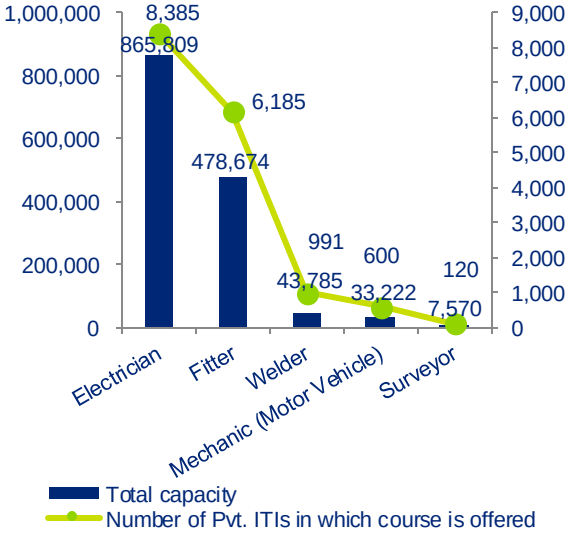


Figure 25: Major courses offered in Private ITIs and their capacity in India, February 2016



Source: Ministry of Labor & Employment, Deloitte Analysis

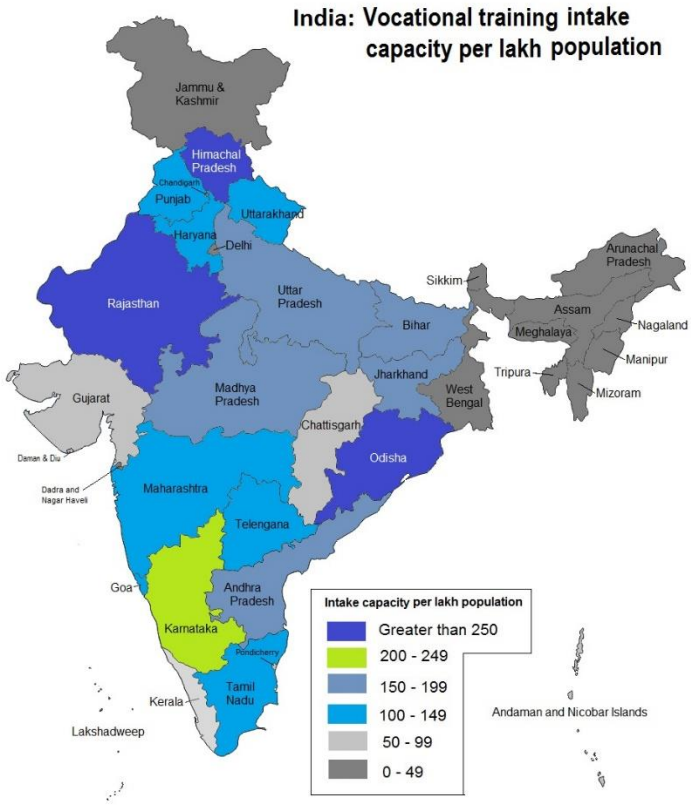
The key trades with highest seating capacity across the government and private ITIs are ***Fitter, Electrician, Welder, Mechanic (Motor Vehicle) and Machinist with total seating capacity of 16.96 lakh accounting for ~97% of total seating capacity in ITI's across mining related trades. These key 5 trades fulfil the requirement of Mechanical Services & Electrical Services Occupations primarily at NSQF level 3 & 4. Majority of the supply for these key 5 trades is from private ITI's (84%).***

[66] The mapping of the courses of ITI's with respective Occupations in Mining sector is done on the basis of the Occupational matrix as defined by SCMS

The following figure indicates the annual intake capacity amongst the ITIs offering mining related courses (government and private) per lakh population across all the states of India in February, 2016. It may be noted that majority of the key mineral bearing states in India have high annual intake capacity of **100 & above per lakh population** across ITI's offering mining related courses.

Rajasthan (363) has the highest annual intake capacity in ITI's for mining related courses per lakh population followed by **Odisha (322), Himachal Pradesh (292), Karnataka (203) and Jharkhand (183)**. However, states such as **West Bengal (26), Chhattisgarh (65) and Gujarat (68)** which are also key mineral producing states have low annual intake capacity of vocational training for mining related trades per lakh population.

Figure 26: Distribution of Annual Intake Capacity in Mining related trades offered by ITIs across India, February 2016



Source: Deloitte Analysis

NSDC Training Partners – The existing training partners of the National Skill Development Corporation (NSDC) currently train students in the trades which are primarily non-exclusive to the sector such as fitter, welder, electrician etc. and can be absorbed by other sectors as well.

5.3 Higher Education

The mining related courses offered by the higher and technical education Institutes in India are ***Primary*** (such as Mining Engineering) as well as ***Auxiliary*** (such as Civil Engineering, Electrical Engineering etc.). In the year 2014-15, an incremental supply of ~**16.39 lakh students with higher and technical education qualification (**across various primary and auxiliary courses for mining sector) would be added to the existing pool of workforce[67]. About 16-20 lakh people will be added each year to the mining sector with higher and technical education qualification (across various primary and auxiliary courses for mining sector) till 2022. The share of people coming out from primary courses in 2014-15 was **~0.3% while the remaining ~99.7% came from auxiliary courses.**

People with higher/ technical education qualification are mainly **employed in Job Roles at NSQF levels 5, 6 & 7 in Mining Sector;** the following table provides the share of students available across various Occupations and NSQF levels in India in 2014-15.

[67] AISHE 2013-14 & Deloitte Analysis

Table 15: Share of students with higher/ technical education qualification available across various Occupations and NSQF levels, 2014-15

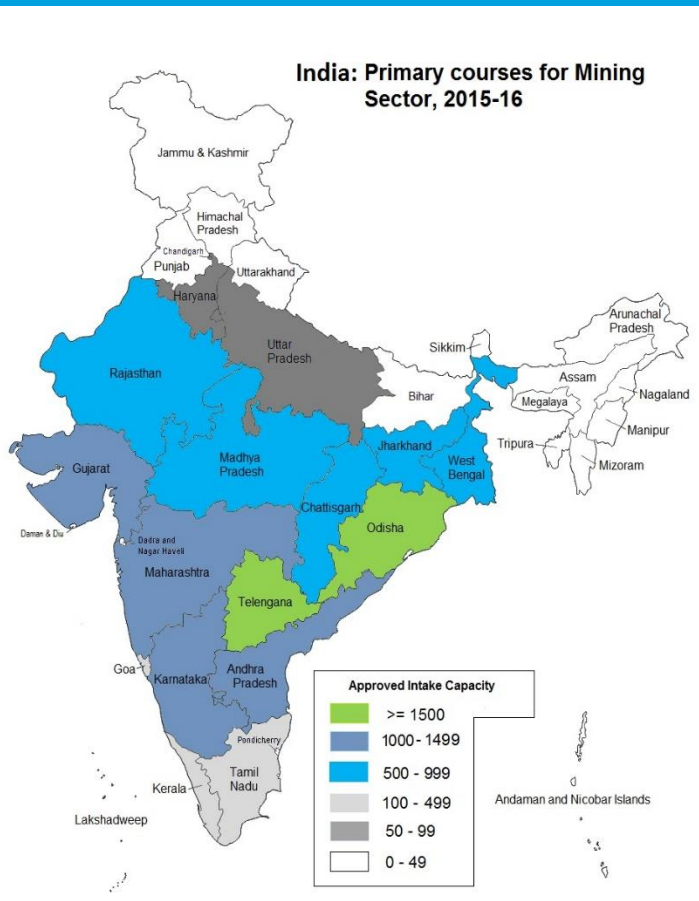
Occupation	NSQF Level wise Students Available			
	NSQF Level 5	NSQF Level 6	NSQF Level 7	NSQF Level 8-10
Electrical Services	18.44%	-	-	Movement to these NSQF levels typically happen through career progression
Geological Investigations	0.07%	-	-	
Geophysical Exploration	0.01%	-	-	
HSE Function	0.08%	-	0.02%	
Instrumentation & Control System	-	1.86%	-	
Mechanical Services	12.05%	-	-	
Mine Surveying	7.05%	-	-	
Ore Processing	0.16%	-	-	
Others in Mining Operations	0.26%	-	-	
Resource Management	3.94%	-	1.25%	
Others which support all occupations	54.81%	-	-	

Source: AISHE 2013-14 & Deloitte Analysis

Students with higher & technical education background in Mining sector cater to the ***requirements of 10 occupations***. At the higher NSQF levels 6 & 7, people with higher/ technical education background are typically required for Jobs Roles across occupations such as ***Instrumentation & Control System, HSE Function & Resource Management.***

In terms of the AICTE approved institutes; there were a total of **6,596 colleges in the academic year 2015-16 which offered mining related courses**. A total of 245 AICTE approved colleges offered Primary courses which are oriented for the mining sector, while 6,592 colleges offered Auxiliary courses which are non-exclusive to the sector and can be absorbed by other sectors as well. The approved annual intake capacity in mining related courses across these AICTE approved institutes in 2015-16 was around 28.55 lakh (**Primary: 0.19 lakh) and Auxiliary: 28.36 lakh).**

Figure 27: Distribution of training capacity for AICTE approved Primary courses, 2015-16



Source: AICTE; Deloitte Analysis

About 60% of this training capacity falls under the diploma category followed by courses at graduation

level (39%). The training capacity for post-graduation courses which are non-statutory but exclusive to the sector across the existing AICTE institutes is less than 1%. The state-wise distribution of AICTE approved institutes offering mining related courses (primary and auxiliary) is provided in ***Annexure 06***. In terms of the distribution of AICTE approved higher education supply infrastructure for primary courses in mining sector in 2015-16, Telangana (38%) had the highest training capacity followed by Odisha (13%), Andhra Pradesh (7%), Maharashtra (6%) and Karnataka (6%). These are also some of the key mineral bearing states in the country.

5.4 Training and Skill Development Initiatives in Mining Sector

The Mining sector in India is gradually transforming with greater emphasis laid on reconnaissance and exploration activities, underground mining, mechanization of current operations, zero waste mining/ mining of associated minerals etc. This involves skilling of the existing workers on newer skills and technology as well as suitably training the incremental Human Resource who will be entering mining sector in near future.

The available pool of Human Resource for the Mining Sector needs to be sufficiently trained and skilled to meet specific requirements of the sector. Skill development is an effective way to improve the efficiency of work force towards better productivity. Education & skill development has been emphasized as one of the top priority sectors in the 12th Five Year Plan and has gained a significant place in national as well as state plans.

In view of the demand of skilled workforce anticipated by the Mining Industry and in alignment with the Government of India's target of skilling, skill development in Mining Sector will not only enhance productivity and safety at work place, but more importantly will make the workforce ready to adapt to the new technologies and processes being used in the sector. The skill development activities undertaken by various stakeholders in Mining Sector are outlines below:

Figure 28: Key areas of skill development activities in Mining sector by various stakeholders

Central Government	State Government	Mining Industry

• Ministry of Mines (MoM) & Ministry of Skill Development & Entrepreneurship (MoSDE) in now one of the key ministries for skill development in Mining sector.
  • **Sponsor vocational training** & long duration induction level training programs through associate & subordinate bodies of both ministries such as GSI, IBM, NSDC etc.
  • Ensures mapping of curriculum to QP-NOS for standardized training delivery.
  • Signed MoUs to execute skill development activities in Mining Sector.
	• Skill development identified as a thrust area by majority of states in India.
	  • **Industrial Policies of key mining states** provides for establishment of sector specific institution & facilities to impart vocational skills.
	  • Provides financial assistance for setting up of specialized skill development centers.
	  • Support to specialized skill development in collaboration with other entities.
	  • Provides training on safety aspects in collaboration with DGMS.
		• Train people in accordance with Mines Vocational Training Rules framed in 1966 under Mines Act of 1952
		  • **Manage vocational training centres catering to their individual mines/ group of mines.**
		  • Provide for initial, refresher & special training.
		  • Provide safety training to all workers.
		  • Run special training institutes for staff at higher NSQF levels (such as Gurukul by MECL); provides management training to executive employees.
		  • Companies also skill people as part of CSR budget.

Source: Respective w ebsites of Ministries, state government departments and Mining companies

Some of the key training and skill development initiatives at the centre and state level is provided below:

5.4.1 Central level skill development initiatives in India

Ministry of Mines

The Sustainable Development framework of the Ministry of Mines, under the principle of community engagement, benefit sharing and contribution to socio-economic development, provides for the mining companies to develop CSR programmes focused on developing a sustainable future for the communities in their mining areas[68]. These CSR programmes should suitably focus on capacity building and skill development of the youth to facilitate their employment, support local businesses and open new avenues of employment for the locals.

In July 2015, the Ministry of Mines (MoM) entered into an MoU with Ministry of Skill Development and Entrepreneurship (MSDE) to implement skill development in mining sector by effectively training, assessing, certifying and placing the skilled workforce in the rapidly changing mining sector. MSDE through Directorate General of Training (DGT) and National Skill Development Corporation (NSDC) will be responsible for the following tasks:

- Selection of appropriate ITIs, ATIs, RVTIs, NSDC training partners to execute the skill training
- Mapping of curriculum to QP-NOS for standardized training delivery through ITIs, ATIs, RVTIs, NSDC training partners
- Ensuring assessment and certification conducted by NCVT or relevant NSDC approved sector skill council
- Provide a pathway to existing and retired employees of PSUs to work as Assessor or Trainer

India also initiated a collaboration with Australia's centre for virtual mining SIMTARS (Safety in Mines Testing and Research Station) for skill development. The focus would be on developing training centres to considerably improve productivity and minimize mine and plant accidents. More than six centres in each of the large mining states especially in East India are proposed in collaboration with SIMTARS and ISM Dhanbad.

Geological Survey of India

The Geological Survey of India (GSI) imparts training in different disciplines of earth science and other scientific, technical and administrative subjects to the officers and staffs of GSI, state Directorate of Geology & Mining (DGM), officers from other organizations including trainees from foreign countries through the Geological Survey of India Training Institute (GSITI) at Hyderabad, 6 Regional Training Institutes (RTIs) at Lucknow, Jaipur, Nagpur, Hyderabad, Kolkata and Shillong and 12 Field Training Centres (FTIs) at Aishmuqam, Saketi, Bimtal, Zawar, Kuju, Aizawl, Raipur, Sukinda, Kothagudem, Chitradurga, Vajrakarur and Salem. The GSITI also conducts long duration induction level training programs (Orientation Course).

During the year 2014-15, 69 training programs were completed by GSI till December, 2014. A total of 1,277 persons were trained (GSI: 1,030; State DGMS: 122; Other Organizations: 100; Foreign countries: 25)[69].

Indian Bureau of Mines

One of the developmental functions of the Indian Bureau of Mines is to provide training facilities for Human Resource development and develop required technical expertise/skill for workforce in the mineral industry. It imparts technical training to technical and non-technical officials of IBM and the persons and agencies engaged in Mining industry. During the year 2014-15 up to December, 2014, 13

[68] Sustainable Development Framework, Ministry of Mines, Final Report 2011
[69] Annual Report, 2014-15, Ministry of Mines

training programmes were conducted by IBM which were attended by 233 IBM personnel and 184 industry personnel.

Directorate General of Mines Safety (DGMS)

Identifying the need for safety education to enable mine workers to face challenges of mining, the Mines Vocational Training Rules were framed in 1966 under the Mines Act of 1952. These rules includes the provision for establishment of vocational training centers in mines and provides for initial, refresher and special training to mine workers, payment to trainees during the training period, appointment of training officers, instructors and proper training aids and equipment. The Mines Vocational Training Rules are directed towards appropriate training of the workforce in mining activities to minimize the fatal accidents in mines and promote work safety. DGMS ensures that the workforce training guidelines mentioned in the Mines Vocational Training Rules is complied with – through mine inspections by DGMS inspecting officers.

According to the recommendations of 11th conference on Safety in Mines, DGMS (held in July 2013)) provides for state of the art technique including simulation and 3D Virtual Reality system for general skill development programmes undertaken for training of operators and all other associated staffs. Companies such as Singareni Collieries Company Limited, Vedanta and Tata Steel are using simulation for training of its operators.

Ministry of Skill Development and Entrepreneurship (MSDE)

The Ministry of Skill Development and Entrepreneurship (MSDE) is responsible for co-ordination of the skill development efforts across sectors in the country, building the vocational and technical training framework, skill up-gradation and reducing the gap between demand and supply of skilled workforce. The various skill development schemes currently offered by the Ministry includes the Pradhan Mantri Kaushal Vikas Yojana (PMKVY), UDAAN, PMKVY etc. The Ministry is aided by the National Skill Development Agency (NSDA), National Skill Development Corporation (NSDC), National Skill Development Fund (NSDF) and respective Sector Skill Councils (SSCs) for implementation of various skill development initiatives.

The Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is the flagship outcome-based skill training scheme of the Ministry of Skill Development & Entrepreneurship (MSDE). PMKVY is aiming to offer 24 lakh Indian youth meaningful, industry relevant, skill based training. Under this scheme, the trainees are offered financial reward and a government certification after successful completion of the training and assessment.

The Ministry of Skill Development & Entrepreneurship also entered into an MoU, in 2015, with the Ministry of Mines and Ministry of Steel wherein MSDE will ensure identification of relevant Quality Packs – National Occupational Standards, aligned with the National Skills Qualification Framework levels for various job roles in these sectors and set standards and quality assurance process to facilitate implementation of the projects agreed under the MoU. The ministries will facilitate identification and optimal utilization of existing training infrastructure, maximizing the apprenticeship training in PSUs in coordination with Directorate General of Training (DGT), as permitted under the amended Apprentices Act. This partnership will be implemented through the DGT and NSDC.

The MSDE and Coal India Limited have also signed a Memorandum of Agreement, in 2015, to impart skill training to 1.7 lakh people over a period of 2 years according to the National Skill Qualification Framework. The Ministry also plans to undertake **'Recognition of Prior Learning (RPL)' for around 5 lakh workers in the mines and coal sector**. RPL is a platform to provide recognition to the informal learning or learning through work to get equal acceptance as the formal levels of education.

National Skill Development Corporation (NSDC)

The National Skill Development Corporation, under the Ministry of Skill Development & Entrepreneurship, currently fund its network of training providers to train students in the trades which are primarily non-exclusive to the sector such as fitter, welder, electrician etc. and can be absorbed by other sectors as well. NSDC is also facilitating the Pradhan Mantri Kaushal Vikas Yojana (PMKVY) by the MSDE which facilitated skilling of students (non-exclusive to the Mining Sector)

NSDC has also recently entered into an MoU with Kudremukh Iron Ore Company Ltd. (KIOCL) wherein both parties would develop a joint curriculum for skill development programs in mining & steel sector. KIOCL will provide the requisite infrastructural facilities to NSDC to develop and function Skill Development Centers (SDCs) in the vicinity of company Pellet Plant unit and Blast Furnace unit at Mangalore, Karnataka. NSDC through its network of training partners will train, assess and certify the students.

Skill Council for Mining (SCMS)

The Skill Council for Mining Sector (SCMS), promoted by the Federation of Indian Mineral Industries (FIMI) and supported by Ministry of Mines was established to develop skill competency standards and qualifications in Mining sector, benchmark it with national and international standards and to work with the mining industry in PPP mode.

SCMS aims at training and up-skilling approximately 4.50 lakh people for mining industry including 50 thousand new inductees to make them employable within a period of ten years. The other key objectives of SCMS includes (i) Develop National Occupational Standards (NOS) for mining industry (ii) Develop skill competency standards and qualifications requirements aligned to the needs of mining industry and statutory requirements.(iii) Initiate skill cataloguing for mining industry and create comprehensive 10-year skill development plan for catalogued skills in the mining industry (iv) Establish a Labor Market Information System (LMIS) (v) Standardize the processes of affiliation & accreditation and participate in these processes and (vi) Identify and create a pool of trainers, assessors and training providers

As on April 28, 2016, a total of 50,874 students have been enrolled and trained by the Mining Sector Skill Council under PMKVY Scheme, out of which 17,633 students have been certified[70]. In terms of 'Recognition of Prior Learning (RPL)', the Skill Council for Mining sector received a target of 10,000 candidates for RPL under the PMKVY scheme. Also, under SCMS, a project to certify 25 persons engaged in handling heavy earth moving equipment in a mine in Hospet is under way wherein the cost incurred on the same will be met by the industry[71].

Table 16: Total students enrolled & Trained by Mining Sector Skill Council under PMKVY Scheme, 28 April 2016

S#	State	Total Students Enrolled & Trained	Total Students Certified
1	Madhya Pradesh	23,946	7,864
2	Rajasthan	8,047	1,590
3	Bihar	7,215	3,857
4	Uttar Pradesh	2,840	1,254
5	Jharkhand	2,676	425
6	Haryana	1,513	1,013
7	Maharashtra	1,035	427
8	Odisha	973	456

70 pmkvyofficial.org
71 NSDA, Notes on proceedings of RPL Workshop 16th Feb, 2015

S#	State	Total Students Enrolled & Trained	Total Students Certified
9	Assam	693	-
10	Gujarat	659	93
11	Chhattisgarh	372	186
12	West Bengal	295	34
13	Chandigarh	200	166
14	Punjab	128	106
15	Himachal Pradesh	111	99
16	Andhra Pradesh	94	-
17	Nagaland	77	63
	TOTAL	**50,874**	**17,633**
Source: pmkvyofficial.org			

5.4.2 Skill development approach/ initiatives in Mining sector across various states

Skill development is identified as a thrust area by majority of the states in India. The following table provides the skill development approaches/ initiatives adopted by few states in the mining sector.

Table 17: Key Skill Development initiatives in Mining Sector across various states

S#	State	Key Skill Development initiatives in Mining Sector
1	Goa	– The Goa Group Vocational Training Centre is an organization under the jurisdiction of Directorate of Mines Safety, Goa Region, Margao imparting vocational and safety training to mine workers. The Group Centre was established in the year 1974 under the Mines Vocational Training Rules 1966, to cater to the need of the mining industry in Goa. It has trained a total 210 workers in 2013 in the mining sector.
2	Gujarat	– The Gujarat Industrial Policy, 2015 highlights that establishment of sector specific institution to impart vocational skills in emerging sectors of mining would be supported by the Government of Gujarat. – The Gujarat government introduced the scheme of financial assistance for setting up of specialized skill development centers in mining sector since 2009-till date. – Gujarat Mineral Development Corporation (GMDC) signed MOU to set up a Centre for Excellence in mining sector covering safety and automation aspects with NRE Coke Limited and University of Wollongong, Australia. – Commissionerate of Geology & Mining, Government of Gujarat and Stone Technology Centre, Jaipur entered into MOU for setting up an International Research Centre for Stone at Ambaji.
3	Jharkhand	– The Jharkhand Industrial Policy, 2012 identifies the development of skilled manpower for the use of industry and trade as a thrust area. The state government would make an endeavor to promote private sector investment for skill development through market driven approach. It provides for

S#	State	Key Skill Development initiatives in Mining Sector
		establishment of specialized Industrial Training Institutes (ITIs) at locations having heavy concentration of specialized workmen
4	Karnataka	– The Government of Karnataka promotes the society Karnataka German Multi Skill Development Centre (KGMSDC) in collaboration with the Government of India and with the technical support of German International Services (GIZ-IS). The society has established Karnataka German Technical Training Institute (KGTTI) across 5 locations in Karnataka – Bengaluru, Gulbarga, Belgaum, Hubli and Mangalore and offers courses such as Advanced Welding, Electrical & Electronics which are relevant for the mining sector.
5	Odisha	– The Government of Odisha supports DATAM EDU in collaboration with SkillsTech Australia (STA), NSDC and the Mining Industries to run the Indian Institute of Mining and Trade skills The target audience of the group are students in the age group (16 – 19) for certification courses offered by DATAM EDU, students who are 10th, 11th and 12th pass outs and economically weaker sections of the society, self-employed entrepreneurs, potential and prospective professionals, rural Indian youth (II –Tier , III – Tier cities).
6	Rajasthan	– The Rajasthan Mineral Policy, 2015 identifies skill development as one of the key focus areas of the mining sector in the state and aims the following: • Organize national/ international level training programmes through renowned institutes • Start a 3 yr. diploma course in Chittorgarh. • Start 6 month courses in existing ITI's for dumper, dozer, and excavator operators. • Insist organizations for development of a vocational training cum skill development centre in mining areas and operate it on voluntary basis on no profit no loss model • Collaborate with the Mines Safety Department and IBM to conduct training programmes on mine safety improvement and prevention of mineral wastages for miners, labourers, technicians etc. working in mines – Rajasthan State Mines & Minerals Limited, a Government of Rajasthan enterprise maintains a vocational training centre at Phosphate SBU which caters to the needs of various training activities regarding safety and occupational health for the employees. It also observes safety week every year at different units under the aegis of Director General of Mines Safety (DGMS).
Source: Respective state government w ebsites		

5.4.3 Public/ Private sector skill development initiatives in India

The Mines Vocational Training Rules framed in 1966 under the Mines Act of 1952 includes the provision for establishment of vocational training centers in mines and provides for initial, refresher and special training to mine workers. In view of this, the sector also sees considerable participation of public and private sector organizations in skill development activities as part of their CSR or commitment towards sustainable development.

According to the Annual Report, 2012 of DGMS, the progress of vocational training in coal mines during the year 2012 was reported to be as follows.

Table 18: Progress of vocational training in key Coal mine companies, 2012

S#	Name of the Company	No. of VT Centres	Basic Training		Refresher Training		Special Training Provided	Total Training Provided
			Required	Provided	Required	Provided		
1	Singareni Collieries Company Limited (SCCL)	9	5,318	5,318	12,765	12,765	6,390	24,473
2	South Eastern Coalfields Limited (SECL)	25	0	3,891	9,360	10,593	5,073	19,557
3	Eastern Coalfield Limited (ECL)	21	1,873	2,983	12,748	10,432	4,832	18,247
4	Bharat Coking Coal Limited (BCCL)	12	539	539	8,448	9,900	4,068	14,507
5	Western Coalfields Limited (WCL)	12	3,268	3,268	7,675	8,443	2,218	13,929
6	Mahanadi Coalfields Limited (MCL)	5	3,224	3,224	3,930	3,555	1,362	8,141
7	Central Coalfield Limited (CCL)	12	1,664	1,664	5,405	5,405	562	7,631
8	Neyveli Lignite Corporation (NLC)	1	1,897	1,897	2,670	2,739	1,626	6,262
9	TATA	2	486	505	1,686	1,619	2,031	4,155
10	Northern Coalfields Limited (NCL)	1	0	354	385	132	2,385	2,871
11	Gujarat Mineral Development Corporation (GMDC)	1	805	805	241	227	57	1,089
12	North Eastern Coalfield Limited (NECL)	2	0	287	332	359	137	783
13	Gujarat Industries Power Company Limited (GIPCL)	1	390	390	33	33	0	423
14	Steel Authority of India Limited (SAIL)	3	1	1	433	195	133	329
15	Jharkhand State Mineral Development Corporation Limited (JSMDC)	1	15	15	32	40	10	65
16	Rajasthan State Mines & Minerals Limited (RSMM)	1	59	59	0	0	0	59
	TOTAL	**109**	**19,539**	**25,200**	**66,143**	**66,437**	**30,884**	**122,521**

Source: Annual Report, 2012, DGMS

According to the Annual Report, 2012 of DGMS, the progress of vocational training in major non-coal mines during the year 2012 was reported to be as follows.

Table 19: Progress of vocational training in major non-coal mine companies, 2012

S#	Name of the Company	No. of VT Centres	Basic Training		Refresher Training		Special Training Provided	Total Training Provided
			Required	Provided	Required	Provided		
1	TATA	4	3,214	3,214	1,000	986	2,790	6,990
2	Oil & Natural Gas Corporation (ONGC)	3	4,222	2,712	515	1,187	2,348	6,247
3	Manganese Ore India Limited (MOIL)	6	618	1,136	1,171	1,326	1,805	4,267
4	Hindustan Zinc Limited (HZL)	4	55	1,524	266	962	1,590	4,076
5	National mineral Development Corporation (NMDC)	4	1,355	1,349	745	739	1,689	3,777
6	Steel Authority of India Limited (SAIL)	8	328	324	1,016	1,753	584	2,661
7	Hindustan Copper Limited (HCL)	4	768	768	817	864	517	2,149
8	Indian Rare Earths Limited (IRELs)	3	604	556	493	648	662	1,866
9	Oil India Limited (OIL)	1	0	1,047	0	252	271	1,570
10	Uranium Corporation of India Limited (UCIL)	3	242	242	743	698	310	1,250
11	Odisha Mining Corporation Limited (OMC)	8	1,287	184	888	909	40	1,133
12	Gujarat Mineral Development Corporation (GMDC)	1	805	805	241	227	57	1,089
13	Hutti Gold Mines Company Limited (HGMCL)	1	0	250	478	353	49	652
14	ACC Limited	8	178	178	192	217	239	634
15	Bharat Aluminium Company Ltd. (BALCO)	1	2	247	142	142	22	411
16	National Aluminium Company Limited (NALCO)	1	345	345	62	62	0	407
17	MML	3	112	132	433	222	39	393
18	Rajasthan State Mines & Minerals Limited (RSMM)	4	228	228	10	10	0	238
19	CCIL	1	6	6	0	0	0	6
	TOTAL	**68**	**14,369**	**15,247**	**9,212**	**11,557**	**13,012**	**39,816**

Source: Annual Report, 2012, DGMS

Mineral Exploration Corporation Limited (MECL)

The Mineral Exploration Corporation Limited provides training on exploratory drilling for mineral exploration and other infrastructure civil engineering projects through its training institute "Gurukul". The training programs are conducted on Mineral Resource Estimation, 3 D modelling and Exploration of base metals Iron Ore, Coal and Lignite. These training programs are open for participation from all central/ state governments, PSUs, autonomous institutes and private companies. MECL recently signed an MOU with the National Skill Development Fund (NSDF) and National Skill Development Corporation (NSDC) under the Ministry of Skill Development & Entrepreneurship (MSDE). Under this tripartite agreement, MECL will contribute its CSR funds to support project for skilling around 200 persons in one or more of its operational areas.

Coal India Limited

Coal India has established an Industrial Training Centre KGITC, Uttamarayanpur in Birbhum district of West Bengal for conducting suitable training of the under privileged and BPL section of the people in different trades in order to create a pool of resources to cater to the need of Human Resources across different industries, especially in mining sector. Coal India Limited (CIL) currently owns 26 technical & management training institutes and 102 Vocational Training Institutes Centres (VTIC)[72]. These VTICs provides for technical training through basic courses, refresher courses and specialized courses to the CIL workforce to meet the shortage of skilled manpower. All the 8 subsidiaries of CIL also has management training centers to provide management training to the CIL employees. Further, the Indian Institute of Coal Management (IICM) operating under the CIL conducts multi-disciplinary management development programmes. Some of the skill training activities of the select subsidiaries of Coal India are as follows:

Table 20: Key Skill Development initiatives by select subsidiaries of Coal India Limited

S#	Name of the Subsidiary	Skill Development initiatives
1	Mahanadi Coalfields Limited (MCL)	MCL provides training programmes through in-house training centres: Management Training Institute (MTI), Burla; Belpahar Training Institute (BTI), Belpahar and Mining, Engineering and Excavation Training Institute (MEETI), Talcher and 5 vocational training centres.
2	Northern Coalfields Limited (NCL)	As a part of CSR activity, NCL runs the "Kaushal" programme to skill the unemployed and Below Poverty Line population of rural Singrauli and Sonebhadra regions. NCL provides vocational training programmes through organizations like 1. Central Board of Workers' Education 2. MP Fishery Department 3. Vehicle Training Institutes 4. Sewing and Embroidery Training Institutes.
3	South Eastern Coalfields Limited (SECL)	SECL has four main Training Institutes viz., Management Development Institute (Bilaspur), Central Excavation Training Institute (Gevra), Basic Engineering Training Institute (Korba) and Regional Training Institute (Bisrampur), where various training programmes are organized successfully. Also, Vocational Training Centres are also run by SECL to impart basic and need based special training to SECL workforce. SECL HRD also organizes various career development programmes
4	Western Coalfields Limited (WCL)	WCL trains its existing employees and new entrants across workers and supervisory training institutes, management development institutes and 12 vocational training centres as per the modules circulated by DGMS.
Source: Respective w ebsites		

Select private sector initiatives in Skill Development

Tata Steel: Tata Steel established a Group Vocational Training Centre in Joda in 1976 which caters to the training needs of Joda Group of Mines (Joda East Iron Mine, Khondbond Iron Mine, Joda West

[72] Coal India

Manganese Mine, Malda Manganese Mine and Bamebari Manganese Mine). These Mines are located in & around Joda within 20 km radius. The Group Vocational Training Centre at Joda caters to the training needs of the employees of the Mines division, contract Labors and employees' wards. It also provides vocational training facility to the students from various engineering colleges. Tata Steel also sponsors candidates from its operational areas for Diploma Course in institutes such as Nettur Technical Training Foundation (NTTF), Murbad in Mumbai and J N Tata Technical Education Centre (JNTTEC), Gopalpur. The sponsored candidates in 2012-13 also included girls from mining locations such as Joda[73]. In Odisha the Company inaugurated a new training centre 'Prerana' to impart Modular Employable Skills to youth from relocated families[74].

Jindal Steel & Power Limited (JSPL): It provides vocational training in to all new entrants. The training focuses on theoretical aspects, refresher, audio-visual and practical training (on the job and feedback test). These trainings are provided to employees on roll as well as the contractual workers. The Safety, Health and Environment (SHE) team at the mining locations provide safety trainings to the internal as well as external staffs. JSPL received the award for best CSR activities in the mining during 3rd National Seminar on Odisha State Safety Conclave.

Century Cement: The organization provides vocational training to the youth to enable them for self-employment. The mining related trades offered by Century Cement is primarily non-exclusive to the sector (such as Diesel Mechanic, Welding etc.) and can be absorbed by other sectors as well such as manufacturing, construction, power and relevant service sectors. Till date 1,429 students have been trained in different trades in the Vocational Training Center of Century Cement[75].

Vedanta: Vedanta runs the Sesa Sterlite Technical School (STS) in Goa on an old Iron ore mine in Sanquelim under the community development foundation. The mining related trades offered by Vedanta is primarily non-exclusive to the sector (such as Machinist, Fitter, Electrician etc.) and can be absorbed by other sectors as well such as manufacturing, construction, power and relevant service sectors. The trades offered by the school are affiliated with the National Council of Vocational Training, New Delhi through the Directorate General of Employment & Training (DGET). Vedanta also opened a new Technical School at Panchwadi, South Goa in August 2011, with 48 students in three trades – Electrician, Fitter and Diesel Mechanic. STS Panchwadi is affiliated with the State Council of Vocational Training from the State Department of Craftsmen Training, Government of Goa. Vedanta has also established a Mining Academy in Rajasthan to support employees with enhanced underground mining skills. It also offers Technical Act Up which is a structured programme for those who are technically highly proficient.

Bharat Aluminium Company Limited (BALCO): BALCO (which is a group company of Vedanta), in partnership with IL&FS Skill Development Corporation has established a state of the art Skill School namely Vedanta IL&FS Skills School in October 2010 in Chhattisgarh in the vicinity of BALCO plant. It is a centralized skill school and currently offers courses such as Fitter, Welder and Electrician which are important for mining sector. The skills school provides for facilities, resources, transportation, uniforms and work placements, while training is delivered by experts from the Chhattisgarh State Skills Development Corporation (SDC).

National Aluminium Company Limited (NALCO): NALCO signed an MOU with the National Skill Development Fund (NSDF) and National Skill Development Corporation (NSDC) to contribute 5% of the CSR funds (~ INR 1.3 crores) towards contribution to Skill India Mission. All programs undertaken under this agreement will be aligned to the National Skills Qualification Framework (NSQF). NSDC will implement the project through its Training Partner network and Sector Skill Councils. The proposed

[73] Tata Steel Sustainability Report, 2013
[74] ibid.
[75] http://www.centurycement.co.in/Social.html

fund will be used for skilling of youth and women in operational areas, up skilling and certification of persons through the Recognition of Prior Learning (RPL) program in close collaboration with the Skill Council for Mining Sector (SCMS) and the Indian Iron & Steel Sector Skill Council (IISSSC). Under the agreement, NALCO, NSDC and SCMS will also work together to evaluate the creation and development of centres of excellence in Odisha and vocational education in schools adopted by NALCO.

6. Skill Gap Assessment

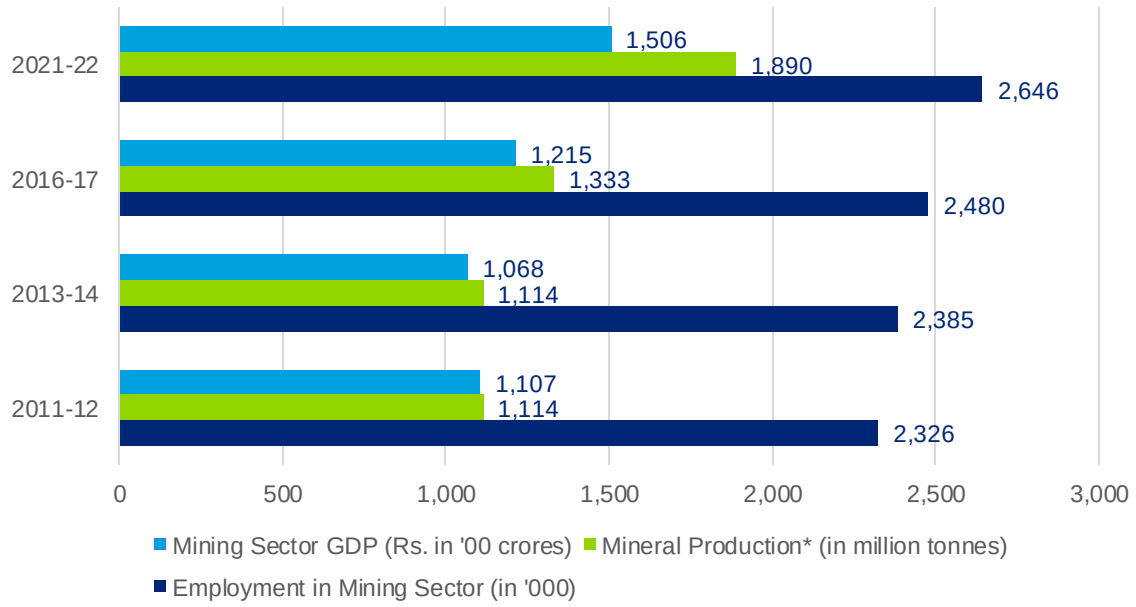
6.1 Incremental Human Resource Demand

The Human Resource demand is projected by considering 2011-12 as baseline, based on availability of data reported by CSO, Census of India, NSSO, IBM and DGMS for respective years. In line with the objective of the study the economic scenario was assessed, especially in respect to the demand for Mining Workforce. This demand has been presented, in accordance with the TOR, for the 8 years period: 2013-17 and 2017-22.

The Mining sector GDP contribute about INR 1, 06,839 crore in 2013-14 which is anticipated to grow at a CAGR of 4.39% to 1, 37,084 crore by 2021-22 (against 2.57% from year 2004-05 to 2013-14) while the mineral production accounts for 1,114 million tonnes in 2013-14 which is expected to increase to 1,890 million tonnes by 2022 with a CAGR of 7.23% (against 5.5% from year 2004-05 to 2013-14).

The Indian mining industry employs nearly 23.86 lakh workers in 2013-14 across Prospecting & Exploration, Mineral Extraction, Associated Services and Mineral Processing & Beneficiation – this is expected to increase to 26.45 lakh (i.e. additional incremental demand of 2.59 lakh people) with CAGR of 1.3% from 2013-14 to 2021-22 (against a negative CAGR of 0.6% from year 2004-05 to 2013-14)[76]. Some of the key trends in Indian Mining Industry which could play an important role in the growth of mining and quarrying sector in next 8 years are:

Figure 29: Current and Projected Mining Sector in GDP & Employment in India



*excluding the production of diamonds, atomic minerals, petroleum and natural gas

Source: NSSO Report 68th round, NIC-2008, Directorate General of Mines and Safety (DGMS), Indian Bureau of Mines, Expert Interviews and Deloitte Analysis

[76] According to Directorate General of Mines & Safety and Indian Bureau of Mines, the mineral production (quantity) has grown by 46% from 765 million tonnes in 2004-05 to 1,114 in 2013-14 while employment has decreased by 2.5%;

- **Thrust on Exploration:** India has abundant availability of mineral resources; however, the exploration activities in India has not been to the desired extent. While, the total mineral potential area in India is about 5.75 lakh sq. kms, a significant part of this area has not been explored in detail so far. The amended MMDR Act of 2015 creates a new category of mining license i.e. the prospecting license-cum-mining lease, which is a two stage-concession for the purpose of undertaking prospecting operations (exploring or proving mineral deposits), followed by mining operations. This is in line of the government's efforts to expand the Mining Sector, including bringing private investment in the mineral exploration sector, helping exploration activities to pick up pace. This should lead to a large impetus on exploration activities.
  - *According to Ministry of Mines, the New Mineral Exploration Policy hope to encourage private investment of INR 400-500 crores per annum for exploration activities.*[77]
  - *Realizing the need for exploration, the State Government of Odisha has come out with a dedicated policy on mineral exploration where Central government agencies like Geological Survey of India (GSI) and Mineral Exploration Corporation Ltd (MECL) are being roped in by the state to carry out exploration work on the 12 identified mineral blocks.*
- **Lease Period/ Area Extension:** Under the MMDR Act, 1957, a mining lease was granted for a maximum of 30 years and could be renewed for a period not exceeding 20 years. Under the amended MMDR Act of 2015, the lease period for all minerals other than coal, lignite and atomic minerals, shall be granted for a period of 50 years. Also, under the amended act, there is a provision where central government may permit extension of the allocated mine area. The leases could cover a far larger area of 100 sq. kms. instead of 10 sq. kms. These changes should lead to significant long term investments by public sector/ private miners leading to increased employment.
- **E-auction of notified and other minerals:** According to the amended MMDR act 2015, for the purpose of granting a mining lease in respect of any notified mineral in such notified area, the State Government shall award the leases, through e-auction by a method of competitive bidding.[78]

This could potentially eliminate delay, bring the government its fair share of the value of minerals and attract private investment. The government proposes to start with minerals such as Iron ore, manganese, bauxite and limestone that occur more or less on the surface and account for 85% of India's mineral production. In line of the above, mining rights are now allocated by e-auction and following is the progress across some of the states:

- *Ministry of Steel and Mines has conducted auction of 82 blocks (out of 166) of Iron ore and bauxite in November 2015.*
- *Department of mines and geology, Government of Karnataka has set out e-auction of 11 out of 15 'C' category leases in Ballari and Chitradurga districts in February 2016 which will be handed over by end of March 2016 to successful bidders. These 11 mines together have around 127 million tonne (MT) of Iron ore reserves.*[79]
- *Department of Mines, Government of Odisha is set to auction 2 limestone mines in Garramura (in Nuapada district) and Khatkurbahal (in Sundargarh district). One Iron ore block at Ghoraburahani-Sagasahi East at Sundargarh district is also set for auction.*[80]

[77] Business Standard September 2015 <http://www.business-standard.com/article/news-ians/82-blocks-up-for-minerals-auction-in-november-tomar-115092201124_1.html> accessed on Feb 22, 2016

[78] Mines and Minerals Development and Regulation (MMDR) Amendment Act 2015

[79] Financial Express Dec 05, 2015 <http://www.financialexpress.com/article/economy/karnataka-to-e-auction-leases-for-11-c-category-mines-in-february-2016/173645/> accessed on Feb 22, 2016

[80] Primary Interaction with Department of Mines & Geology, Government of Odisha

- *Government of Gujarat has recently auctioned 5 limestone blocks – Mudhvay Sub-block A, Mudhvay Sub-block B, Mudhvay Sub-block C, Mudhvay Sub-block D and Goyla Block in December 2015.*

- **Vision 1 billion tonne Coal Production by 2020:** In line of the government's Make in India campaign, Coal India Limited (CIL) envisages to more than double the coal production in India by 2020 from the production level of 494.23 million tonnes in 2014-15. This would lead to growth in terms of employment across CIL subsidiaries[81]. The production targets of subsidiaries are as follows – Mahanadi Coal Field Limited (250 million tonnes), South Eastern Coal Field Limited (240 million tonnes), Eastern Coal Field Limited (62 million tonnes), Central Coalfields (133 million tonnes), Northern Coalfields (110 million tonnes), Western Coalfields (60 million tonnes) and Bharat Coking Coal Limited (53 million tonnes)[82]. In line with this Coal India has decided to add 25,000 workers over the next five years while three times as many workers employed by the CIL subsidiaries are scheduled to retire during this period, a move that is expected to double CIL's productivity per employee and reduce cost of production by about 10%.

According to CIL, its subsidiaries will strive for greater mechanization and increased outsourcing of coal production following the retirement of a large chunk of workers. This is expected to significantly boost productivity.

- CIL's efficiency in terms of productivity is just about one-third of Australia's.[83]During 2012-13, Australia produced 425 million tonnes of coal with 1.55 lakh employees including outsourced workers while Coal India produced around 452 million tonnes with 3.65 lakh directly employed workers and about 65,000 outsourced workers. With the reduction in CIL's workforce, this gap in productivity is expected to reduce.

- **Coal Washing – A step towards Quality Improvement**[84]: An inter-ministerial committee (IMC) has proposed CIL to set up 15 new washeries (6 coking coal with production capacity of 18.6 million tonnes per year and 9 non coking coal with production capacity of 79 million tonnes per year) by 2018 with a total production capacity of 97.6 million tonnes along with reject-based power plants so that rejects can be consumed in the same place, eliminating the need to transport the same over long distances. This should be an important factor for growth in mineral processing and beneficiation sub-sector.

- **Steel Authority of India Limited (SAIL) to increase its production capacity to 50 MTPA by 2025**[85]**:** According to Ministry of Mines, SAIL is aiming to increase the production capacity from 13.8 million tonnes per annum to 50 million tonnes per annum (MTPA) by 2025. In line of this special emphasis will be given on research & development work, plant modernization and availability of raw materials.

- **Scope for Improving Labor Productivity**[86]**:** Coal mining in India is having poor employee productivity. The output per miner per annum in India varies from 150-2,650 tonnes as compared to an average of about 12,000 tonnes in US. However, mining industry is witnessing a trend towards

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[81] However, according to Directorate General of Mines & Safety, the fuel mineral production (quantity) has grown by 46% from 413 million tonnes in 2004-05 to 610 in 2013-14 while employment has decreased by 11%.

[82] The mines/ projects to produce 908. 1 million tonnes has been identified so far. *'Road Map for Enhancement of Coal Production- 2020'*; Coal India Limited

[83] Economic Times March 2014 < http://articles.economictimes.indiatimes.com/2014-03-26/news/48594900_1_workmen-coal-india-coal-production > accessed on Feb 22, 2016

[84] At present, CIL operates 17 coal washeries with a total capacity of 39.4 million tonnes per year. Out of these, 13 are coking coal washeries with a total capacity of 24.90 million tonnes per year, while 4 are non-coking coal washeries with a total capacity of 14.50 million tonnes per year.

[85] Press Information Bureau, Ministry of Steel < http://pib.nic.in/newsite/PrintRelease.aspx?relid=117912> accessed on Feb 08, 2016

[86] Primary Interaction with Industry Experts

using newer and bigger machinery, where employment for mining machinery operators is expected to grow significantly across mining sub-sectors. This trend will contribute significantly in overcoming the productivity deficit.

6.1.1 Incremental Demand by Mining Sub-Sectors

The incremental demand of 2.59 lakh people in the Mining Sector from 2013-14 to 2021-22 is broken down by industry sub-sector, providing the precise levels of demands in this section. The key highlights of the incremental demand for Human Resources are as follows:

- The Mineral Extraction sub sector of mining industry is anticipated to employ the highest share of incremental workers (~77.4%) over the period 2014-22, where 0.59 lakh workers (excluding minor minerals and dimensional stones) are expected by 2022 – across Fuel Mineral (59%), Metallic Mineral (31%) and Non-Metallic Minerals (10%)
- The sub sectors ***Prospecting & Exploration*** and ***Associated Services*** (which employ large numbers of knowledge workers and professionals) is likely to have incremental requirement for ~0.54 lakh workers over the period 2014-22. These two sub-sectors are also expected to witness considerable skill upgradation and in some cases replacement of current workforce. The technology advancement like differential global positioning system (DGPS) survey in exploration and greater use of new underground techniques, such as block caving may lead to mechanization/ major shift in mining operations in the near future.
- Mineral processing and Beneficiation activities are in nascent stage in India, however these activities are expected to increase to contribute ~1.3% of incremental demand which are in line with proposed establishment of washeries and ore processing units by few industries like Coal India and Essar.
- The share of Mineral Extraction sub-sector is anticipated to witness reduced pattern of employment in the overall mining workforce (11.9% change from the previous pattern of workforce distribution in respect to incremental workforce); this is largely on account of the trend for using newer and bigger machinery –employment for mining machinery operators is expected to grow significantly across mining sub-sectors.

Table 21: Incremental Human Resource demand by Prominent Sub-Sectors (in '000), 2014–2022

S #	Sub-Sector	Employment (2013-14)	2014-17	2017-22	2014-22	%Share Incremental Demand 2014-22	% Change Over 2013-14
1	**Prospecting & Exploration**	31.3 (1.3%)	2.4	4.5	**6.9**	2.7%	1.4%
2	**Mineral Extraction**	2,125.5 (89.3%)	**73.6**	**128.8**	**202.3**	77.4%	-11.9%
2.1	Fuel minerals	569.2	13	22.3	**35.3**		
2.2	Metallic Minerals	89.9	6.5	11.9	**18.4**		
2.3	Non-Metallic Minerals	56.6	2.1	3.7	**5.7**		
2.4	Minor Minerals/ Dimensional Stones	1,409.9	52	90.9	**142.9**		
3	**Associated Services**	213.7 (8.7%)	16.6	30.6	**47.2**	18.6%	9.9%
4	**Mineral Processing & Beneficiation**	15.5 (0.6%)	1.2	2.2	**3.4**	1.3%	0.7%
Total		**2,386.1**	**93.8**	**166.1**	**259.8**		

Source: NSSO Report 68th round, NIC-2008, CSO, Directorate General of Mines and Safety (DGMS), Indian Bureau of Mines, Expert Interviews and Deloitte Analysis

6.1.2 Incremental Demand by NSQF levels

The incremental demand of 2.59 lakh people in the Mining Sector from 2013-14 to 2021-22 is broken down by NSQF (National Skill Qualification Framework) levels in line with the occupational matrix defined by SCMS; providing a clear understanding of Human Resource requirements at different NSQF levels.

Table 22: Incremental Human Resource demand by NSQF levels (in '000), 2014–2022

NSQF Level	Description as per SCMS's Occupation Matrix	Employment 2013-14	2014-17	2017-22	2014-22	%Share Incremental Demand 2014-22
NSQF level 6 & above	*Doctorate/ Post Graduate or equivalent degree holders*	130.4 (5.5%)	5.8	10.4	**16.3**	6.3%
NSQF level 5	*Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders*	343.9 (14.4%)	13.1	23.2	**36.3**	14.0%
NSQF level 4	*Diploma/ ITI equivalent certificate holders*	942.6 (39.5%)	36.3	64.1	**100.4**	38.6%
NSQF level 3	*Skill certification (incl. DGMS certification) of medium term duration – 6*	201 (8.4%)	9.2	16.4	**25.6**	9.8%

NSQF Level	Description as per SCMS's Occupation Matrix	Employment 2013-14	2014-17	2017-22	2014-22	%Share Incremental Demand 2014-22
	months to 1 year and short term – less than 6 months					
NSQF level 1 & 2	*School dropouts and pass outs who are not enrolled in higher/ technical education*	768.3 (32.2%)	29.4	51.9	**81.3**	31.3%
Total		**2,386.1**	**93.8**	**166.1**	**259.8**	
Note: The NSQF levels are defined based on education and experience levels of human resource demand in line with the occupational matrix for mining sector						
Source: NSSO Report 68th round, NIC-2008, CSO, Directorate General of Mines and Safety (DGMS), Indian Bureau of Mines, Expert Interviews and Deloitte Analysis						

The key highlights of the incremental demand for human resources are as follows:

- The ***highest share of (38.6%) of incremental Human Resource demand is expected at NSQF level 04*** (i.e. Diploma/ ITI equivalent certificate holders). The majority of this segment is anticipated to participate primarily in mineral extraction activities with specific skills to operate trade specific tools and machineries.
- ***About 31.3% of incremental Human Resource demand is expected at NSQF level 01 & 02*** (i.e. school dropouts and pass outs who are not enrolled in higher/ technical education). A large proportion of this demand would be for employment across various sub-sectors for Labor intensive roles. This segment is expected to be primarily engaged Mineral Extraction, however in may be noted that the relative share of this workforce in Mineral Processing & Beneficiation and Prospecting & Exploration is high. Also, in line with lack of natural sand reserves, urbanisation, local legislation and environmental constraints have made the extraction of natural sand and gravel an expensive activity, therefore market of manufactured sand is emerging in India. This should have an effect on the extent of sand mining across India. However manufactured sand segment is expected to have employment opportunities in low mechanised job roles such as crushers and washers.
- ***About 14% of incremental Human Resource demand is expected at NSQF level 05*** (i.e. Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders). The demand at this NSQF level is anticipated across all sub-sectors in supervision, coordination and entry level managerial functions.
- ***About 9.8% of incremental Human Resource demand is expected at NSQF level 03*** (i.e. (i.e. skill certification of medium term duration – 6 months to 1 year and short term – less than 6 months). Associated/ support services and mineral processing/ beneficiation activities would require a larger proportion workers who are in trained for such specialized technician roles.
- ***A small proportion (6.3%) of incremental Human Resource demand is expected at NSQF level 06 and above*** (i.e. Doctorate/ Post Graduate or equivalent degree holders). The demand of such knowledge workers and professionals is anticipated primarily in Prospecting & Exploration and Associated Services.

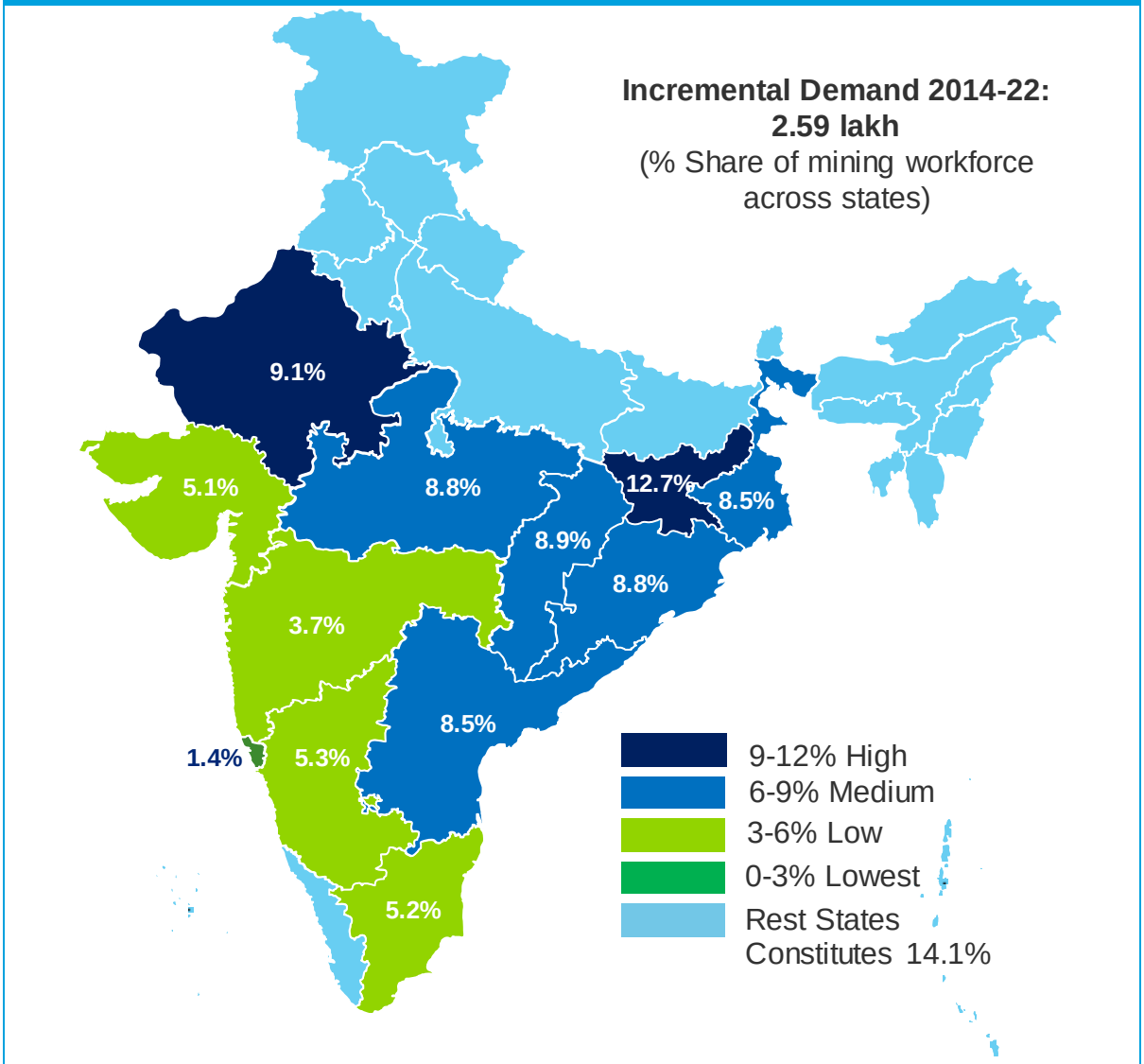
6.1.3 Incremental Demand by Geography

The key highlights of the incremental demand for human resources across geography is as follows:

- **Highest Share of Incremental Demand:** Jharkhand (12.7%) constitutes highest share of incremental demand of 2.59 lakh followed by Rajasthan (9.1%).
- **Medium Share of Incremental Demand:** Chhattisgarh (8.9%) constitutes highest share of incremental demand in this segment followed by Odisha (8.8%), Madhya Pradesh (8.8%), West Bengal (8.5%) and Andhra Pradesh & Telangana (8.5%).
- **Low Share of Incremental Demand:** Karnataka (5.3%) constitutes highest share of incremental demand in this segment followed by Tamil Nadu (5.2%), Gujarat (5.1%) and Maharashtra (3.7%).
- **Lowest Share of Incremental Demand:** Goa (1.4%) and the remaining of the Indian states (14.1%) constitutes the remaining incremental demand.

Further details on geography wise distribution of incremental human resource demand is provided in ***Annexure 07.***

Figure 30: Geographical Distribution of Incremental Demand 2014-22



Source: NSSO Report 68th round, NIC-2008, Directorate General of Mines and Safety (DGMS), Indian Bureau of Mines, Expert Interviews and Deloitte Analysis

6.1.4 Incremental Demand by Occupation

The occupational break-up of the Human Resource demand is based on 17 mining occupations in line with the SCMS Occupational Mapping. The occupational break-up mentioned in this section also covers mazdoor/ helper and skilled helper. These are cross occupational categories across sub-sector and NSQF levels. The key highlights of incremental demand for each occupation is given in the table below.

Table 23: Incremental Human Resource demand by Occupation (in '00), 2014–2022

S. No.	Occupation	Employment 2013-14	% Share of Employment in 2013-14	2014-17	2017-22	2014-22	%Share Incremental Demand 2014-22
Prospecting & Exploration							
1	Exploration Drilling	55	0.23%	4	7	11	0.4%
2	Geological Investigation	49	0.21%	3	6	10	0.4%
3	Resource Management	30	0.13%	2	4	6	0.3%
4	Geophysical Exploration	3	0.01%	1	2	3	0.1%
Mineral Extraction							
5	Loading & Hauling – Opencast	3,649	15.29%	126	221	347	13.4%
6	Others in Mining Operations*	3,444	14.43%	119	209	328	12.6%
7	Specialist Operations – Underground	2,334	9.78%	81	141	222	8.6%
8	Loading & Hauling – Underground	1,976	8.28%	68	120	188	7.2%
9	Blasting	1,664	6.97%	58	100	158	6.1%
10	Drilling & Cutting	904	3.79%	31	55	86	3.3%
11	Mine Surveying	253	1.06%	9	15	24	0.9%
Associated Services							
12	Mechanical Services	833	3.49%	65	119	184	7.1%
13	Electrical Services	684	2.87%	53	98	151	5.8%
14	HSE Functions	225	0.94%	18	32	50	1.9%
Mineral Processing & Beneficiation							
15	Ore Processing	39	0.16%	3	6	9	0.3%
16	Instrumentation & Control Systems	23	0.10%	2	3	5	0.2%
17	Others in Mineral Processing and Beneficiation**	18	0.08%	1	3	4	0.1%
Others – All Sub Sectors							
18	Mazdoor/ Helper	6,322	26.50%	240	424	664	25.6%
19	Skilled Helper	1,356	5.68%	53	95	148	5.7%

* Mining Engineer, Geotechnical Engineer, Material Engineer, Reclamation Supervisor, Supervisor - Plant operations, Mining Supervisor, Mining Mate

**Mineral Processing Engineer, Electronics & Instrumentation Engineer, Supervisor Plant Operations

Source: NSSO Report 68th round, NIC-2008, CSO, Directorate General of Mines and Safety (DGMS), Indian Bureau of Mines, Expert Interviews and Deloitte Analysis

~52% of incremental HR demand anticipated for occupations under Mineral Extraction sub-sector followed by ~15% for occupations under Associated Services; ~2% for occupations under Prospecting

& Exploration and Mineral Processing & Beneficiation sub-sectors; ~31% across Mazdoors/ helpers & skilled helpers. More details on Job Role level breakdown of human resource is given in ***Annexure 08.***

- **About ~52% of incremental demand is anticipated for the occupations under Mineral Extraction sub-sector** (excluding Mazdoor/ Skilled Helper), the occupational break-up is as follows: Loading & Hauling – Opencast miners (13.4%), Other personnel engaged in professional and supervisory roles (12.6%), Specialist Operations – Underground (8.6%), Loading & Hauling - Underground miners (7.2%), Blasting (6.1%), Drilling & Cutting (3.3%) and Mine Surveying (0.9%). The key Job Roles in demand (excluding Mazdoor/ Helper and Skilled Helper) are:
  - *Mining Supervisor*
  - *Supervisor - Plant operations*
  - *Dumper*
  - *Explosives Handler*
  - *Mining Engineer*
  - *SDL & LHD Operator*
  - *Surface Miner*
  - *Roof Bolter*
- **About ~15% of the incremental demand is expected for the occupations under Associated Services** (excluding Mazdoor/ Skilled Helper) - Mechanical Services (7.2%), Electrical Services (5.8%) and HSE Functions (1.9%). The Job Roles under these categories are found in many different industries and the mining industry accounts for a small share of total employment in these occupations. The key Job Roles in demand (excluding Mazdoor/ Helper and Skilled Helper) are:
  - *Technicians – Electrical*
  - *Mechanical Engineer*
  - *Mine Electrician*
  - *Mechanic/ Fitter*
  - *Electrical Engineer*
- **A small proportion (2%) of incremental demand is expected for occupations under Prospecting & Exploration and Mineral Processing & Beneficiation sub-sectors** (excluding Mazdoor/ Skilled Helper) - Geological Investigation (0.4%), Exploration Drilling (0.4%), Ore Processing (0.3%), Resource Management (0.3%), Instrumentation & Control system (0.2%) and Geophysical Exploration (0.1%) are expected over the period of next 8 years. The key Job Roles in demand (excluding Mazdoor/ Helper and Skilled Helper) are:
  - *Driller*
  - *Sampler*
  - *Ore Processing Operator*
  - *Instrumentation Technician*
  - *Mineral Processing Engineer*

6.2 Incremental Human Resource Supply

During primary interaction with key experts it has been highlighted that the proportion of the available Human Resource supply entering into mining and quarrying sector varies, depending on how specific an occupation is to the mining industry. For example, the mining industry attracts approximately 1% of workers in HR and accounting/ financial roles but attracts about 12-15% workers in supervisors, coordinators and foremen roles; while almost 85-90% of the of the workers in other mining roles.

In line with the objective of the study, the Human Resource supply is projected for across NSQF levels from three main sources: school dropouts, Diploma/ ITI or trade specific certificate and university degree holders. The projection takes into account the annual supply of workers in relevant occupations working in competing industries and historic trends of the flow of workers from these occupations into the mining industry.

It was found that for some occupations (like Geophysical Exploration, Mechanical/ Electrical Services etc.) there is a large pool of available workers — but mining does not attract enough of them to meet its requirements. While there are few occupations (like Surveying, Geological Investigation, Instrumentation & Control Systems etc.) where the mining sector also faces fierce competition from the manufacturing, construction and electricity, gas & water supply sectors – all in need of workers with similar skills, knowledge and experience. As competition for specific occupations increases, pressures on the existing labor pool are heightened externally from other sectors and internally within the industry where mining employers compete against each other for Human Resource.

The subsequent section covers Human Resource Supply available to all the sectors (including mining) which are similar/ relevant for mining (in terms of 17 occupation categories) during 2014-22 that is termed as Primary and Auxiliary Supply[87] while the immediate section covers share of total entrants to 17 occupation specific to mining industry that is termed as Primary Supply.

Indian Mining sector anticipated to have an incremental supply (Primary and Auxiliary Supply) of ~8.9 crores people considering supply for 17 occupations for all relevant sectors while Primary Supply (mining courses only) constitute 0.1% of total supply i.e. 0.92 lakh

6.2.1 Incremental Primary and Auxiliary Supply

The incremental supply of 8.9 crores people are further broken down by NSQF levels, revealing different levels of supply in table given below. It may be noted that ***Women constitute about 25%*** of the incremental supply of workforce[88]; however, women's share in mining ***sector is expected to be around 5-7%***[89] in line with the observed historical trends and absorption levels of industry. The key highlights of the incremental supply for Human Resources are as follows:

Key highlights of incremental Human Resource supply over the period 2014-22:

- The ***highest share of incremental Human Resource supply (86.8%) is expected at NSQF level 01 & 02*** (i.e. school dropouts and pass outs who are not enrolled in higher/ technical education). This pool of resource will be available to be employed across various sectors of the Indian economy (including in the Mining Sector) at Labor intensive roles such as Mazdoors and Skilled Helpers.

[87] Total entrants for 17 occupations including Mazdoor/ Skilled Helper for all relevant sectors

[88] Deloitte Analysis

[89] Statistics of Mines in India Vol-I & II 2013, Directorate General of Mines and Safety, GoI; Statistical Profile of Women and Labour 2012-13, Ministry of Labour and Employment, GoI

Table 24: Incremental Human Resource supply by NSQF levels (in lakh) - Total entrants for 17 occupations including Mazdoor/ Skilled Helper, all relevant sectors, 2014–2022

Particulars	2014-17	2017-22	2014-22	% Share of Incremental Supply
a. Total entrants for 17 occupations including Mazdoor/ Skilled Helper, all relevant sectors* (Primary + Auxiliary Supply)	**394.04**	**497.05**	**891.09**	
NSQF level 06 & above (Doctorate/ Post Graduate or equivalent degree holders)	6.4	8.8	15.2	1.7%
NSQF level 05 (Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders)	22.5	33.7	56.2	6.3%
NSQF level 04 (Diploma/ ITI equivalent certificate holders)	14.7	25.2	39.9	4.5%
NSQF level 03 (Skill certification of medium term duration – 6 months to 1 year and short term – less than 6 months)	2.5	4.2	6.7	0.8%
NSQF level 01 & 02 (School dropouts and pass outs who are not enrolled in higher/ technical education)	348.0	425.2	773.1	86.8%

* Human Resource Supply available to all the sectors (including mining) which are similar/ relevant for mining i.e. Primary and Auxiliary Supply

**Assuming the historical rate of enrolment in respective courses and participation rate in mining sector for each occupation per year i.e. Primary Supply

Source: Deloitte Analysis

- ***Very small proportion of incremental Human Resource supply is expected at NSQF level 03*** (i.e. skill certification of medium term duration – 6 months to 1 year and short term – less than 6 months). This includes the students trained by ITIs of course duration of 1 year, trainings provided by NSDC partners and other vocational training providers. This pool is available to all the competing industries with requirement of similar knowledge, skill and experience levels. The Human Resource for key Job Roles such as Sampler, Mechanic, and Fitter etc. will be hired from this pool of available workers.
- ***About ~4.5% of the overall incremental Human Resource supply is expected at NSQF level 04*** (i.e. Diploma/ ITI equivalent certificate holders). This pool of Human Resource is primarily non-exclusive to the sector and can be absorbed by other competing industries which require similar knowledge, skill and experience levels. The Human Resource for key Job Roles such as Drill Operator, Blaster, Dumper, HEMM Maintenance operators etc. will be hired from this pool of available workers.
- ***About 6.3% of the incremental Human Resource supply is expected at NSQF level 05*** (i.e. Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders). This pool of Human Resource will be primarily available to all the competing industries with requirement of similar knowledge, skill and experience levels. The Human Resource for key Job Roles in mining sector such as Mining Engineer, Mining Mate, and Supervisor – Plant Operations etc. will be recruited from this pool of available workers.
- ***About 1.7% of the incremental Human Resource supply is expected at NSQF level 06 & above*** (i.e. Doctorate/ Post Graduate or equivalent degree holders***)***. This pool is also available to all the competing industries with requirement of similar knowledge, skill and experience levels. The specialist occupations such as Geological Exploration, Geological Investigation, Mineral Processing and HSE functions would be fulfilled by this pool of Human Resource. Also, the staffs at the managerial roles would be recruited from this pool of resources.

- Based on the historical trends of organized workforce in mining industry about ~10-14% of the existing supply is expected to participate in organized segment of the industry.

6.2.2 Increment Primary Supply

Key highlights of incremental Human Resource supply exclusive to mining sector over the period 2014-22:

- ***About ~8.4% of the incremental Human Resource supply is expected at NSQF level 06 & above*** (i.e. Doctorate/ Post Graduate or equivalent degree holders***)***: About 900-1,000 people per annum are expected from primary courses (which are exclusive to the sector) by 2022.
- ***About 64.5% of the incremental Human Resource supply is expected at NSQF level 05*** (i.e. Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders): About 7,100-7,600 diploma/ degree holder in mining relevant courses are anticipated per annum to participate in mining workforce by 2022.
- ***About ~27.1% of the overall incremental Human Resource supply is expected at NSQF level 04*** (i.e. Diploma/ ITI equivalent certificate holders). About 2,500-3,000 trade certificates (from DGMS) holders are expected to join only mining workforce annually. These certificates are offered in trades such as Winding Engine Operator, Shot Firer/ Blaster, Foreman and Mining Sirdar.

Table 25: Incremental Human Resource supply by NSQF levels (in lakh) - Mining's share of entrants for 17 occupations excluding Mazdoor/ Skilled Helper, 2014–2022

Particulars	2014-17	2017-22	2014-22	% Share of Incremental Supply
a. Total entrants for 17 occupations including Mazdoor/ Skilled Helper, all relevant sectors* (Primary + Auxiliary Supply)	**394.04**	**497.05**	**891.09**	
b. **Mining's share of entrants for 17 occupations excluding Mazdoor/ Skilled Helper **** (Only Primary Supply)	**0.36**	**0.56**	**0.92**	
% Share of Mining Industry Oriented Entrants for 17 Occupations	**0.09%**	**0.11%**	**0.10%**	
NSQF level 06 & above (Doctorate/ Post Graduate or equivalent degree holders)	0.03	0.04	0.07	8.4%
NSQF level 05 (Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders)	0.24	0.36	0.60	64.5%
NSQF level 04 (Diploma/ ITI equivalent certificate holders)	0.09	0.16	0.25	27.1%
* Human Resource Supply available to all the sectors (including mining) which are similar/ relevant for mining i.e. Primary and Auxiliary Supply **Assuming the historical rate of enrolment in respective courses and participation rate in mining sector for each occupation per year i.e. Primary Supply				
Source: Deloitte Analysis				

6.3 Incremental Human Resource Demand Supply Gap

Understanding the gaps between Human Resource (HR) demand and available supply is important, as it may facilitate informed decisions/ targeted strategies & initiatives to fill the anticipated gaps. In this respect, the gap analysis conducted as part of the study provides a side-by-side comparison of HR demand and available supply as NSQF levels in line with the SCMS occupational matrix and study

objective. Indian mining industry needs to attract Human Resource of similar skill, knowledge and experience levels from competing industries, therefore the gap has been analyzed while keeping these aspects into consideration.

6.3.1 Human Resource Demand and Primary & Auxiliary Supply Gap

Table 26: Incremental Human Resource Demand Supply Gap (in lakh) - Total entrants for 17 occupations including Mazdoor/ Skilled Helper, all relevant sectors, 2014–2022

NSQF level	2014-17	2017-22	2014-22
Incremental Human Resource Demand	0.93	1.65	2.59
Incremental Human Resource Supply			
a. Total entrants for 17 occupations including Mazdoor/ Skilled Helper, all relevant sectors*	394.04	497.05	891.09
Incremental Demand Supply Gap			
a. Total entrants for 17 occupations including Mazdoor/ Skilled Helper, all relevant sectors*	(393.11)	(494.40)	(888.50)
* Human Resource Supply available to all the sectors (including mining) which are similar/ relevant for mining i.e. Primary and Auxiliary Supply **Assuming the historical rate of enrolment in respective courses and participation rate in mining sector for each occupation per year i.e. Primary Supply			
Source: Deloitte Analysis			

The key highlights of HR incremental demand supply gap as given in the table above are as follows:

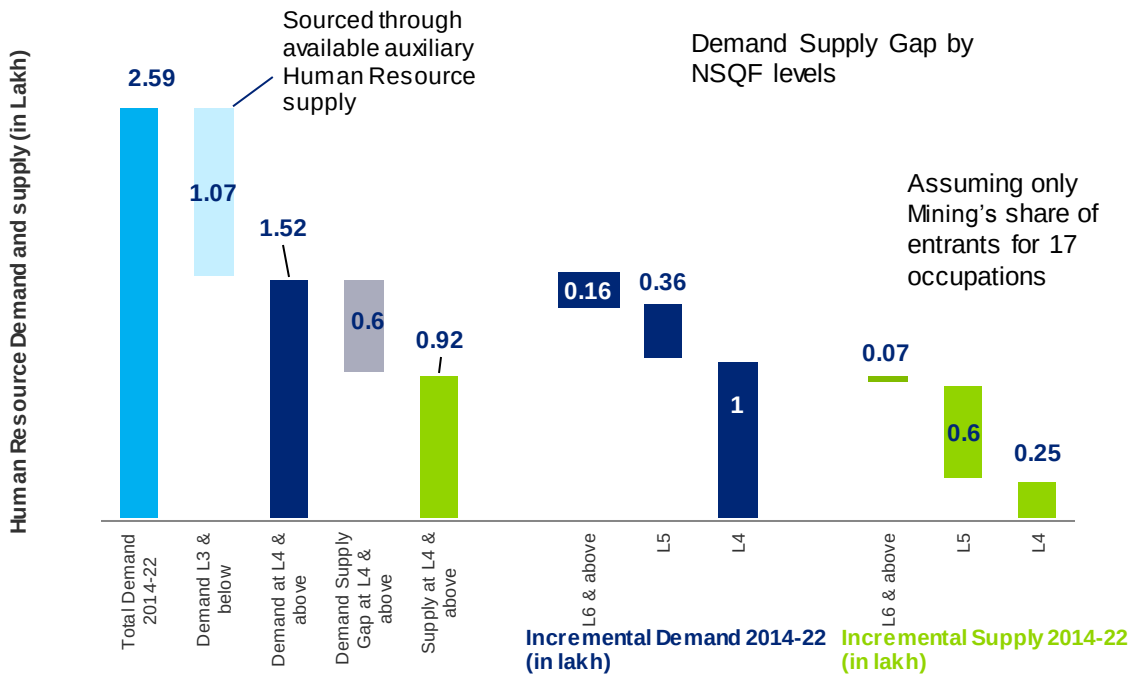
- **Human Resource Surplus in case of Primary and Auxiliary Supply** *(Total entrants for 17 occupations including Mazdoor/ Skilled Helper, all relevant sectors): A large pool of Human Resource is available during 2014-22. The mining industry must attract new entrants from this pool into mining careers (i.e. carve out a larger slice of the pie). However, it has to be noted that this pool is available across all the competing industries as well this segment may or may not be adequately trained to work in mining industry set up, at the time of induction, due to different orientations and industry backgrounds.*
- **Large pool doesn't necessarily mean to be skilled enough as per DGMS Guidelines in case of Auxiliary Supply:** *It is noteworthy to mention that workers engaged in mining at multiple Job Roles above NSQF level 3 are required to adhere to DGMS compliances. This require workers to undergo through examinations (conducted by DGMS) and a statutory certification without which worker engagement in industry is not allowed.*

Since total entrants for 17 occupations including Mazdoor/ Skilled Helper for all relevant sectors is much larger pool therefore subsequent section on skill gap has been presented by considering primary supply into consideration. However, auxiliary supply would complement the total available Human Resources.

6.3.2 Human Resource Demand and Primary Supply Gap

The Human Resource deficit of 0.60 lakh people is expected in case of primary supply available at NSQF level 4 & above. There simply aren't enough people in the talent pool to meet the industry's needs during 2014-22. In such cases, the mining industry must strive to attract the workers from auxiliary supply to make the best possible use of talent (e.g., through appropriate skilling and knowledge development, use of technology innovation and improved productivity).

Figure 31: Incremental Human Resource Demand Supply Gap (in lakh) – Mining's share of entrants for 17 occupations excluding Mazdoor/ Skilled Helper, 2014–2022



Source: Deloitte Analysis

NSQF Levels

The key highlights of the incremental demand-supply gap at each NSQF level for Human Resources are as follows:

- **Human Resource demand at NSQF level 3 & below could be sourced through Auxiliary Supply (**Total entrants for 17 occupations including Mazdoor/ Skilled Helper, all relevant sectors): During the expert interviews with education institutes and industry experts it was highlighted that the primary supply of Human Resources is available for NSQF levels 4 and above while generally no trade specific skill set is required at NSQF level 3 & below hence these segment will necessarily have to be attract the required workers from other competing sectors.
- **Human Resource Deficit at NSQF level 4** (Diploma/ ITI equivalent certificate holders): *A shortage of about ~9,300 workers per annum is expected for the key Job Roles such as Drill Operator, Dumper, HEMM Maintenance operators, Shovel Operators , Surface Miner, Roof Bolter, SDL & LHD Operator, Shuttle Car, Conveyor, Dumper, Driller, Loader, Dozer/ Crawler, Shovel Operator etc. This shortage may be met through upskilling the workers available at NSQF level 3 & below or attract the workers with similar skill set engaged in competing* sectors and reskill them in accordance with DGMS's statutory compliances. *Certification and 'recognition of skills' of this group in the mining workforce is required, to better enable Mining Sector to attract new workers and retain current workers – so that the gap between demand and supply does not widen.*
- **Human Resource Surplus at NSQF level 5** *(Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders): A surplus of about ~3,000 professionals per annum is expected for primarily the engineering, supervisory or plant operation functions. However, this segment is found to be inadequately skilled, especially in respect of changing needs due to new technology (DGPS systems, Underground carving, Aerial Survey etc.). Therefore, refresher/ upskilling trainings of this section of workforce is required.*

- **Human Resource Deficit at NSQF level 6 & above (Doctorate/ Post Graduate or equivalent degree holders)**: *A deficit of about ~1,000-1100 professionals per annum is expected for specialized functions such as Geological Exploration, Exploration Drilling, Ore Pressing, Control Systems and Managerial Roles. This situation may be read in line with initiatives for mechanization of mines in near future.*

Table 27: Human Resource Demand Supply Gap by NSQF levels 04 & above (in lakh) - Mining's share of entrants for 17 occupations not including Mazdoor/ Skilled Helper, 2014–2022

Particulars	2014-17	2017-22	2014-22
Incremental Human Resource Demand	**0.93**	**1.65**	**2.59**
Incremental Human Resource Demand (level 4 & above)	0.55	0.97	1.52
NSQF level 06 & above (Doctorate/ Post Graduate or equivalent degree holders)	0.06	0.10	0.16
NSQF level 05 (Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders)	0.13	0.23	0.36
NSQF level 04 (Diploma/ ITI equivalent certificate holders)	0.36	0.64	1.00
NSQF level 03 and below (Skill certification of medium term duration – 6 months to 1 year and short term – less than 6 months, School dropouts and pass outs who are not enrolled in higher/ technical education)	*0.38*	*0.68*	*1.07*
Incremental Human Resource Supply	**0.36**	**0.56**	**0.92**
NSQF level 06 & above (Doctorate/ Post Graduate or equivalent degree holders)	0.03	0.04	0.07
NSQF level 05 (Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders)	0.24	0.36	0.60
NSQF level 04 (Diploma/ ITI equivalent certificate holders)	0.09	0.16	0.25
NSQF level 03 and below (Skill certification of medium term duration – 6 months to 1 year and short term – less than 6 months, School dropouts and pass outs who are not enrolled in higher/ technical education)	*Available human resource supply of 6.7 lakh workers for 17 occupation, all the relevant sectors*		
Incremental Human Resource Demand Supply Gap	**0.19**	**0.41**	**0.60**
NSQF level 06 & above (Doctorate/ Post Graduate or equivalent degree holders)	0.03	0.06	0.09
NSQF level 05 (Bachelor's/ Advanced Diploma (Polytechnic) equivalent degree holders)	(0.11)	(0.13)	(0.24)
NSQF level 04 (Diploma/ ITI equivalent certificate holders)	0.27	0.48	0.75
NSQF level 03 & below	To be sourced from competing sectors		

*Assuming only Mining's share of entrants for 17 occupations excluding Mazdoor/ Skilled Helper i.e. for NSQF level 04 and above

Source: Deloitte Analysis

The industry could face loss of professionals in important leadership positions during 2014-22 — as the leadership pipeline is observed to be thin. The mining sector can explore a number of initiatives to address these losses, including leadership development and training programs, succession planning, identifying and grooming high-potential employees for leadership, and incorporating leadership development in early career stages or even facilitating the same in education programs.

6.4 Qualitative Skill Gaps

Based on our analysis and considering factors like growth and employment potential, the following qualitative skill gaps have been highlighted across various occupations of the Mining Sector.

Table 28: Occupation wise key Qualitative Skill Gaps

S#	Sub-Sector	Occupation	Qualitative Skill Gaps
1	Prospecting & Exploration	Exploration Drilling	• Use of casing extractor, ventilation drilling, mobile long hole drilling • Exploration of base metals
2		Geological Investigation	• Systematic Geological mapping, Geopositioning and exploration technologies • Differential global positioning system (DGPS) survey, 2D/3D Seismic Survey Technology, Mineral Resource Estimation • Planning, designing, development and supervision of geological data acquisition • Analysis and preparation of geological engineering reports
3		Geophysical Exploration	• Use of geophysical loggers • Airborne geophysical survey and magnetic data acquisition • Grade Engineering
4		Resource Management	• Resource estimates and feasibility studies using computer modelling and geostatistical software • Geographic Information Systems (GIS) such as MapInfo and ArcGIS • Use of structural logs • Aeromagnetic Data Processing
5	Mineral Extraction	Blasting	• Explosives and fragmentation technologies, Controlled blasting techniques, use of hybrid bolts • Appropriately storing, transporting and handling explosives used for blasting in mines. • Safety procedures and guidelines for mining operations as prescribed by DGMS. • Basic maintenance on explosive van vehicle to ensure the safety systems in the vehicle are functional.
6		Drilling & Cutting	• Advanced drilling engineering and operations including hydrostatic drilling

S#	Sub-Sector	Occupation	Qualitative Skill Gaps
			• Basic maintenance on the machines to ensure safety systems in the vehicle are functional.
7		Loading & Hauling - Opencast	• HEMM operation and basic maintenance on the machines to ensure safety systems in the vehicle are functional. • Low Grade Mining
8		Loading & Hauling - Underground	• HEMM operation and basic maintenance on the machines to ensure safety systems in the vehicle are functional. • 3D-Geological Modelling • Use of inspection cameras, polymer ducts • Underground caving and Block caving • Optimum energy efficiency in ventilation system
9		Mine Surveying	• Construction of reference grid, transfer of geometric elements of construction plan to actual site, check on fulfilment of the planned ratio of geometric elements during installation of hoisting devices and reinforcing of mineshafts, assign the direction of mine workings, execution surveys, and prepare mining documentation for exploitation of deposits. • Record mining enterprise's production process and compile drawings for mine documentation. • Determine the extent the mineral extraction during mine closure and update mine documentation diagrams
10		Specialist Operations - Underground	• HEMM operation and maintenance • Underground telecommunication (signalling for carrying men and material; operating of winders for movement of men and material) • Use of Lunar module • Cavity Monitoring System (CMS) • Maintenance of safe & healthy working environment
11		Others* (Mining Engineer, Geotechnical Engineer, Material Engineer,	• Research and project management • Building 3D model of mine workings and plan development schedules in advance • Improving capital productivity • Reducing energy use

S#	Sub-Sector	Occupation	Qualitative Skill Gaps
		Reclamation Supervisor, Supervisor - Plant operations, Mining Supervisor, Mining Mate etc.)	• Change management.
12	Associated Services	Electrical Services	• Installation, maintenance and repair of electrical equipment and systems • Evaluation and testing of electrical and electronic equipment and systems
13		HSE Functions	• Occupational health & safety standards • Environment monitoring & knowledge of ecological/ carbon footprint and emissions • Sustainable mining practices such as mine site closure & rehabilitation, waste management • Restoration of eco-systems - Vegetation, terrain, soil conservation, Groundwater, flora and fauna research, effluent/ water treatment, rain water harvesting, treatment of mine water, closed water circulation system etc.
14		Mechanical Services	• Repair and fabrication of metallic parts • Knowledge of machine operations and ensure that the safety systems in the vehicle are functional. • Diagnosis, repair, maintenance & overhaul of machines and equipment • Research, design and development of machinery and systems
15	**Mineral Processing & Beneficiation**	Instrumentation & Control Systems	• Ore grinding monitoring using continuous image analysis • Improving recovery rates
16		Ore Processing	• Ore RFID tags • Geo-metallurgy • Mineral/metal extraction from low grade ores • Improving recovery rates

S#	Sub-Sector	Occupation	Qualitative Skill Gaps
			• Removing process waste
17		Others in Mineral Processing and Beneficiation (Mineral Processing Engineer, Electronics & Instrumentation Engineer, Supervisor Plant Operations etc.)	• Mineral/metal extraction from low grade ores • Ore grinding monitoring using continuous image analysis
18	Others – All Sub sectors	Mazdoors/ Helpers/ Skilled Helpers	• Basic mining operation • Occupational health & safety standards
Source: Deloitte Analysis			

7. Recommendations for Skill Development in Mining sector

This section provides suggestions and recommendations for four key stakeholders – Skill Council for Mining Sector (SCMS), Central/ State Government, Industry and Industry Associations in mining sector and Skill Development Institutes. It is important for all stakeholders to work in close collaboration with each other in a consultative manner, to achieve the desired level of maturity in the skill development ecosystem in Mining Sector.

Mining specific skill development is a shared responsibly of both the government as well as industry. Recognition of Prior Learning (RPL) is the key instrument for up-skilling and certification of the in-service workforce and can help to map the existing skills in the sector. RPL process includes pre-assessment, skill gap training and assessment, leading to certification of the skill in an individual which will be at par with the formally trained workers. It will provide both horizontal and vertical path ways to an individual for acquiring additional skills for better livelihoods. RPL will help in creating a database skill wise, region wise, skill shortages for identifying programmes to mitigate the same.

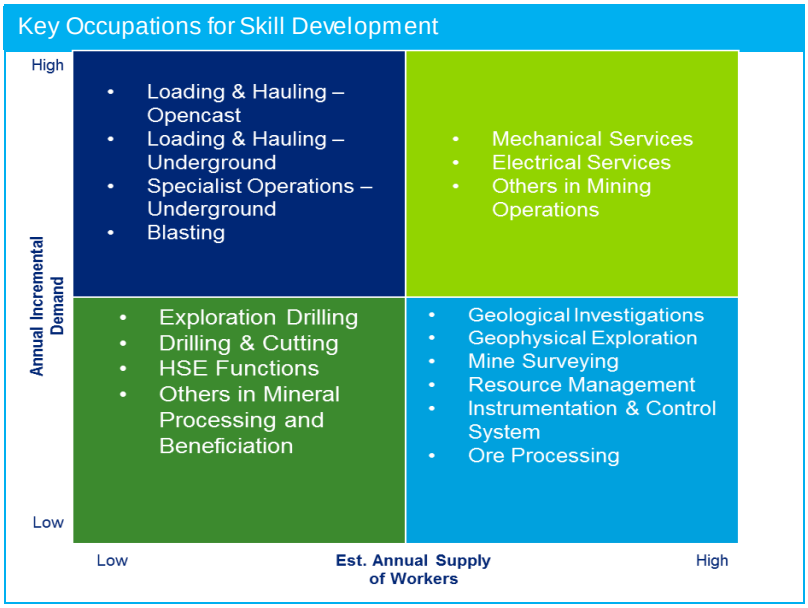
Industry needs to be closely involved in providing job opportunities to skilled workforce and integrate NSQF levels in recruitment rules to provide employment to certified peoples. It should actively participate in the designing curricula and standards for skill training courses and also contribute as guest faculty. Industry should tie-up with suitable training partners for relevant trades for supply of skilled workforce and improve their placement opportunities. The table below provides key issues and corresponding recommendations suggested for each stakeholder.

Table 29: Key Challenges and Recommendations

Key Issues/ Challenges	Key Recommendations
Skill Council for Mining Sector	

Need for developing QP's and NOS's for new Job Roles (identified during the present study) & existing Job Roles at higher NSQF level in mining sector	**Develop QP's & NOS's**
	• Skill Council for Mining Sector (SCMS) should create the Qualification Packs (QP's) & National Occupational Standards (NOS's) in association with industry for the following:
	  • *21 existing Job Roles at NSQF levels higher than 5*
	  • *26 new Job Roles identified under the study*
	• Once the QP's and NOS's for these 47 Job Roles are finalized, the SCMS should associate & affiliate with training providers to offer training programs on the same.
	• Also, SCMS should build on the current study and set up a comprehensive Labor Market Information System (LMIS) and publish it for stakeholders. The LMIS will help provide good quality concurrent understanding on the training needs in the sector.

Key Issues/ Challenges	Key Recommendations

Need for prioritizing training in occupations with high projected demand with respect to supply from the present study	**Facilitate skill training under occupations anticipated to have high demand of workers over the period 2014-22**
	
	According to the Deloitte study, occupations such as Loading & Hauling – Both Opencast & Underground, Specialist Operations –Blasting, use of surface miners, High capacity Hauling equipment are anticipated to witness high annual incremental demand of workers over the period 2014-22.
	
	• SCMS may focus to offer suitable training programs across these occupations to address the anticipated demand of skilled workers.
	
	 
	
	• The following are the key Job Roles across these occupations which are anticipated to witness high incremental demand over the period 2014-22:
	  • Blasting: *Explosives Handler, Shot Firer/ Blaster*
	  • Loading & Hauling – *Opencast: Dumper/ Tipper Operator, Loader Operator, surface miners*
	  • Loading & Hauling – *Underground: SDL & LHD Operator, Haulage Operator*
	  • Specialist – *Underground Operations: Timberman, Roof/ cable bolter*

Deficit of professionals projected at leadership positions	**Focus to train people for leadership positions** *Deloitte Study anticipates a deficit of professionals in leadership positions (NSQF Levels 6 & above) within mining sector over the period 2014-22.* • SCMS can facilitate multi-disciplinary management development training programmes for the existing workforce to take up the leadership roles.

<table>
<tr><th>Key Issues/ Challenges</th><th>Key Recommendations</th></tr>
<tr><td></td><td>
This may be similar to the training activities for leadership positions as undertaken by the Indian Institute of Coal Management (IICM).
</td></tr>
<tr><td>Limited availability of courses in mining sector</td><td>
Collaborate with MSDE and DGT to include mining specific modules in training courses
SCMS should collaborate with the Ministry of Skill Development and Entrepreneurship (MSDE)/ Directorate General of Training (DGT) to include mining specific modules/ bridge course in mining relevant courses. This should be undertaken especially for the following sub-sectors: Associated Services (Mechanical Services, Electrical Services and HSE Functions) and Mineral Extraction (Drilling & Cutting and Surveying).
</td></tr>
<tr><td>Limited awareness, and capacity of mining workforce in sustainable mining practices</td><td>
Awareness generation & capacity building of workforce in sustainable mining practices

There is a need to build capacity of workers in mining industry in fields such as strategic planning, investigation of new methods for mining and exploration, environmental management, community affairs and Human Rights legislation, contracts, mine funding and fiscal/ regulatory policy.
SCMS should promote awareness on sustainable mining practices amongst existing and entering workforce of mining sector.
It should form a committee headed by a CEO to identify the Job Roles and skills/ training requirement for sustainable mining practices. The committee may be tasked to prepare a Concept Note of its findings in association with industry which can be presented to the Board for further actions.
The Concept note should include the following key areas:

<table>
<tr><th>S#</th><th>Indicative Areas covered</th><th>Broad Objectives</th></tr>
<tr><td>1</td><td>Health, Safety & Environment</td><td>• Improve occupational health, safety and environmental performance of mining workers
• Environment Management around mining operation area and measuring the industry’s ecological footprint.
• Managing mine closures in diversity of mining environments and involving large range of minerals</td></tr>
<tr><td>2</td><td>Socio-economic development</td><td>• Develop understanding of impact of mining operations on local community,
• Building relationship with local community
• Provide measures to positively contribute towards social development</td></tr>
<tr><td>3</td><td>Others</td><td>• Legislation, fiscal & regulatory policies
• Community affairs & human rights
• Mine funding, contracts, legal requirements</td></tr>
</table>
</td></tr>
</table>

Key Issues/ Challenges	Key Recommendations
	• The key Green Job Roles which would be required for sustainable mining practices in Indian Mining Sector are Soil Conservation Technician, Environmental Public Relations Specialist, and Energy Manager.

Need for holistic approach towards skill development	**Focus on collaborating with various stakeholders for improving training in mining sector:**
	• SCMS should collaborate with multiple stakeholders to improve the skill development ecosystem in mining sector. Following are few indicative areas of collaboration:
	  ○ Enter into MoUs with mining organizations/ associations to develop joint curriculum for skill development programs in Mining sector incorporating latest trends and technological changes.
	  ○ Collaborate with respective SSCs of countries such as Australia and Canada for exchange of resources, processes, knowledge and technology.
	  ○ Collaborate with international bodies such as SkillsTech Australia (STA), Australia's centre for virtual mining SIMTARS to establish Centres of Excellences (CoEs) in Mining sector.
	  ○ Identify global certifications of relevance; then identify and collaborate with Personal Certifying Bodies (PCBs) & Certifying Bodies (CBs) to accredit individuals/ training partners for specific courses based on the standards set by SCMS.
	  ○ Collaborate with training providers to Identify and facilitate optimal utilization of the existing training infrastructure.
	  ○ Collaborate with industry to facilitate maximising the apprenticeship training in PSUs in coordination with Directorate General of Training (DGT).

Central/ State Government	
Limited awareness, reach, acceptance of certification	**Expediting formation of National Board for Skill Development Certification** • Government should bring uniformity in qualification across institutions and also work with industry/ industry association to ensure that the qualification framework is well recognized and accepted. Industry should integrate NSQF levels in their recruitment rules for employment of certified workers. • The National Board should decide the mode of examination and certification in line with DGMS Guidelines for mining sector for certification under 17 occupations identified by SCMS. • DGMS issues ~2,500-3,000 statutory certificates per year for trades such as Manager, Surveyor, Overman/ Foreman, Sirdar/ Mate, Shot firer/ Blaster and Winding Engine Driver under Coal and Metalliferous category. However, ***certification capacity need to***

Key Issues/ Challenges	Key Recommendations
	be enhanced in terms of number and other trades. SCMS may be made part of skilling ecosystem along with DGMS.
Limited Research & Development and Technical Support for mining sub-sectors	**Identify nodal technical institutes for each sub-sector** • ***1-2 sub-sector specific nodal technical institutes should be identified*** for each sub-sector and given responsibility to drive the agenda of training, technical support, research and development for the sub-sector. • For instance ISM, Dhanbad or IIT, Kharagpur can play a role of nodal institute for Mineral Extraction Sub-Sector while Banaras Hindu University (BHU) could be a nodal institute for Prospecting & Exploration.
Training rules need to be reviewed in context of emerging technology	**Review training rules in context of contemporary/ emerging technology** • **Mines Vocational Training Rules, 1966 need be reviewed** in light of present/ upcoming technology, mechanization and research & development for mining industry.
Low perception about mining and related activities among youth/ women	**Government should make efforts to transform perception about mining** *The Deloitte study suggested that Mining as a profession has limited popularity.* • Effort should be made to improve the image and ***create awareness about the industry and related training programs, especially in mining clusters***. This will help in attracting quality Human Resources for the mining sector – this is especially important as the mining sector competes with other sectors which have requirement of similar skills. • The efforts should be aimed at emphasising dignity of labour in the Mining Sector – towards encouraging youth to choose mining oriented vocational trades. *The Deloitte study also suggests that women are hugely under represented (presently less than 5% of women are part of the mining work force).* • A specific study is required for understanding women participation in the Mining Sector. This study may be conducted under the aegis of 'Ministry of Mines' along with SCMS. This study should aim at understanding employment of women in Mining Sector at various Job Roles/ levels, and identifying possible Job Roles where gender parity may be improved on priority. Specific recommendations on hindrances faced by women and corresponding facilities & support required need to be identified.

Key Issues/ Challenges	Key Recommendations
Regional and remote nature of employment	**Need for Closer co-operation between State Skill Development Missions (SSDM) and SCMS** • The key mining states in India should come up with district level skill requirements for the Mining Sector in their annual plan. • SCMS should liaison with the respective SSDMs of each state to implement the skill development activities under Mining Sector. • A closer cooperation between SSDMs and SCMS may be provided an initial thrust through conferences between SSDMs and SCMS in each of the key mining states, where key aspects in respect to skilling of mining workforce may be discussed.
Industry/ Industry Associations	

Limited industry-academia collaboration	**Industry should foster and nurture strong linkages with education institutes**
	• Industry body should undertake measures to ***incubate a Mining Industry Institute Partnership Cell within prominent educational institutes in each mining cluster.*** The partnership cell could:
	  ◦ Facilitate faculties/ students training/ orientation on the current trends of mining sector by practitioners.
	  ◦ Promote ***Experiential Learning*** and ***Education Outreach***.
	  ◦ Address industry's expectation mismatch.
	  ◦ Provide mentorship and help to students in alignment of skilling to industry's need.

Limited collaboration of industry partners to promote and incentivize training	**Industry should collaborate among themselves to promote and incentivize training**
	• Industry body should facilitate collaboration and optimal use of capital intensive resources/ establishments for training.
	• Network of mining establishments may share/ provide training resources (***abandoned mining sites, equipment, machinery and simulation centres***) within mining clusters for up-skilling/ fresh skilling similar to:
	  ◦ Leverage Corporate Skilling Centers scheme by MoSDE.
	  ◦ Institute of Natural Resources (INR) by the Indian Institute of Skill Development (IISD) in association with Australian institutes at Gurgaon to offering simulated training for underground mining[90].

Key Issues/ Challenges	Key Recommendations
	○ Industry may use their existing specialization/ capacity of training in various occupations to provide training support to other industry players. For e.g. MECL conducts training on exploration drilling for other companies through industrial tie-ups.
Limited availability of Simulation Training	*DGMS though a circular in 2011 recommended all mining companies having opencast operations using HEMM to install simulator training for operators. For small mechanized mines, the group vocational training centres to create common facility in infrastructure for simulator training.* *The simulator has different training lessons for new, experienced and out-of-touch operators, supervisors and trainers.* *However, there is a big gap in simulation training, although presently companies such as Singareni Collieries Company Limited, Vedanta and Tata Steel presently providing training on simulators.* • Mining industries may consider using state of the art technique including simulation and 3D Virtual Reality system under skill development trainings to improve operating skills of the workers and reduce accidents at work place.
Limited opportunity for appropriate level of skilling for Mining Sector	**Assistance for training workforce through CSR provisions** • Industry body may sponsor candidates through CSR provision of Companies Act, 2013. • Skill development initiatives in the mining clusters where activities mentioned under ***schedule VII such as employment enhancing vocational skills and social business projects for livelihood enhancement*** could be undertaken.
Lack of succession planning and knowledge- transfer initiatives	***Improve succession planning and knowledge- transfer initiatives*** *According to Deloitte Analysis, Industry is anticipated to face deficit of professionals in leadership positions over the period 2014-22 (especially knowledge workers in Prospecting & Exploration and Mineral Beneficiation & Processing).* • Therefore, employee with substantial experience in mining sector should be upskilled/ re-skilled for taking up leadership/ managerial roles. This will help in Succession Planning as well as enable the workforce to plan a longer career in the mining industry.
Low Preference for skilling/ up-skilling	**Phased approach towards promoting skilling of workforce** • Preferential recruitment or wage differential for applicants who are certified should be adopted as the way forward. • Industry may prioritize and provide benefits to employees (permanent and contract) who opt for skill enhancement.

Key Issues/ Challenges	Key Recommendations
Training Providers	
Insufficient training capacity at Diploma/ ITI equivalent certificate level	**Emphasise on providing training at Diploma/ ITI equivalent certificate level** *According to Deloitte study, the incremental demand of workers with Diploma/ ITI equivalent certificate is projected to be highest (~1 lakh) across all education categories over the period 2014-22.* *However, the supply of workers over the same time frame across this category is anticipated to be ~0.25 lakh, thereby indicating a demand-supply gap of ~0.75 lakh workers.* • The training providers will need to offer suitable Diploma/ ITI equivalent certificate training and certification programs to address and fulfil the anticipated shortage of manpower in this segment. • The training program for this segment should primarily **focus on developing specific skills to operate trade specific HEMM machineries and tools and their Maintenance** (such as Dumper, Shovel, Surface Miner, Roof Bolter, SDL & LHD, Shuttle Car, Conveyor, Loader, Dozer/ Crawler etc.). • These training programs should specially be **offered across key mining states of West Bengal, Chhattisgarh and Gujarat** where there is a ***low annual intake capacity*** (per lakh population) of vocational training for mining related trades. ○ The private players intending to provide training in mining sector may establish new vocational training centres in these states.
Limited availability of training programs focused on statutory roles in mining sector	**Focus on training programs for statutory positions in mines** *Currently, there is very limited training offered by the training providers for the statutory roles as defined for mining operations by DGMS.* • The training providers should focus to offer training programs for the statutory positions required in Mines such as **Mining Overman, Mining Sirdar, Shot-firer. Haulage operators, Surveyors, Electrical/ Mechanical supervisors** etc. • The training curriculum should be designed incorporating the certification requirements of respective positions by the Directorate General of Mines and Safety.
Need for designing/ updating training activities (skilling/ up-skilling) based on technological advancements	**Design training programs/ pedagogy in line with technological advancements** *According to the Deloitte Survey, the occupations such as Exploration Drilling, Geological Investigations, Geophysical Exploration and Health, Safety & Environment are anticipated to have low incremental Human Resource requirement in absolute terms over the period 2014-22.*

<table>
<tr><th>Key Issues/ Challenges</th><th>Key Recommendations</th></tr>
<tr><td></td><td>
However, according to the primary interactions, these occupations are anticipated to undergo major technological advancements over next few years. The share of workers across these occupations in overall employment are also anticipated to increase over the next 8 year period.
This entails suitable up-skilling and induction in respect to these technological advancements for the existing mining workers and new entrants respectively. The following table provides the indicative training requirements across these occupations in future:
<table>
<tr><th>S#</th><th>Occupation</th><th>Indicative Training Requirement</th></tr>
<tr><td>1</td><td>Exploration Drilling</td><td>• Differential global positioning system (DGPS) survey
• Exploration of base metals at depth.</td></tr>
<tr><td>2</td><td>Geological Investigation</td><td>• Systematic Geological mapping and exploration technologies
• 2D/3D Seismic Survey Technology, Mineral Resource Estimation
• Planning, designing, development and supervision of geological data acquisition
• Analysis and preparation of geological reports</td></tr>
<tr><td>3</td><td>Geophysical Exploration</td><td>• Use of geophysical loggers
• Grade Engineering</td></tr>
<tr><td>4</td><td>Health, Safety & Environment</td><td>• Occupational health & safety standards
• Environment monitoring & knowledge of ecological/ carbon footprint and emissions
• Knowledge of sustainable mining practices such as mine site closure & rehabilitation, waste management
• Restoration of eco-systems - Vegetation, terrain, soil conservation, Groundwater, flora and fauna research, effluent/ water treatment, rain water harvesting, treatment of mine water, closed water circulation system etc.</td></tr>
</table>
</td></tr>
</table>

Source: Primary interactions with stakeholders and Deloitte Analysis

8. Annexure

Annexure 01 – List of stakeholders covered

List of Employers/ Contractors

#	Mineral Category	State	Name of Entity/ Organization	Key Contact Person	Designation
1	Fuel	Chhattisgarh	Clean Coal Enterprises Pvt. Ltd.	Ashish Agrawal	Company Secretary
2	Fuel	Chhattisgarh	South Eastern Coalfields Limited (SECL)	-	-
3	Fuel	Chhattisgarh	Singhal Marketing Pvt. Ltd.	R. N. Shahi	Mining Manager
4	Fuel	Delhi / NCR	Jindal Steel & Power Ltd.	Kapil Dhagat	Executive Vice President
5	Fuel	Gujarat	Gujrat Minerals Development Corporation	A.N. Thakur	General Manager
6	Fuel	Jharkhand	Jharkhand State Mineral Development Corporation Ltd.	Mr. Devendra Kumar	Geologist
7	Fuel	Jharkhand	Jharkhand State Mineral Development Corporation Ltd.	Chandarma Mishra	General Manager - Geology
8	Fuel	Jharkhand	Central Coalfields Limited	S.C. Jha	General Manager (HRD)
9	Fuel	Jharkhand	Central Coalfields Limited	K.N. Bhattacharya	Senior Officer
10	Fuel	Jharkhand	Central Coalfields Limited	N.P. Singh	General Manager/ TS to CMD
11	Fuel	Jharkhand	Central Coalfields Limited	R.S. Mahopatra	Director (Personal)
12	Fuel	Jharkhand	Tata Steel Ltd.	Sanjay Kumar Singh	General Manager
13	Fuel	Maharashtra	WCl Sasti Opencast Mines	C.R. Trivedi	Chief Executive, Mining
14	Fuel	Maharashtra	Durgapur Opencast Mines	J. Mazumdar	Sr. Mining Officer
15	Fuel	Odisha	Geomine Consultant (S.G.AP)	S.K. Sarangi	President
16	Fuel	Odisha	Tata Sponge	Kundan Kumar	Chief Raw Material Security Task Force

#	Mineral Category	State	Name of Entity/ Organization	Key Contact Person	Designation
17	Fuel	Rajasthan	Rajasthan State Mines & Minerals Ltd.	O.P. Soni	General Manager
18	Fuel	Rajasthan	Rajasthan State Mines & Minerals Ltd.	J.C. Porwal	Dy. General Manager
19	Fuel	Tamil Nadu	Neyvelli Lignite Corporation	Mr. Satish Jain	Dy. General Manager
20	Fuel	Tamil Nadu	Neyvelli Lignite Corporation	Mrs. Veena	Manager-HR
21	Fuel	West Bengal	Coal India Ltd.	Vijay Sagar	Sr. Mining Manager
22	Metallic	Chhattisgarh	Chhattisgarh Mineral Development Corporation Ltd.	B. K. Mishra	OSD-Mining
23	Metallic	Chhattisgarh	National Mineral Development Corporation Ltd.	Rajeev Sharma	Head-NMDC
24	Metallic	Delhi / NCR	Mideast Integrated Steels Ltd.	Rajeev Moudgil	Assistant Vice President
25	Metallic	Goa	Fomento Resources	P. S. Banerjee	Director
26	Metallic	Goa	Sesa Goa Ltd.(Vedanta)	Sauvik Mazumdar	Mining Head
27	Metallic	Goa	V.M. Salgaocar & Bro. Pvt. Ltd.	Mr. Shirish Malge	Addl. General Manager - Mines
28	Metallic	Goa	EMCO Goa Pvt. Ltd.	Madhukar	Managing Director
29	Metallic	Goa	H. L. Nathurmal	Haresh L. Melwani	Managing Director
30	Metallic	Karnataka	Mysore Minerals Ltd.	Mr. Raju	General Manager - HRD
31	Metallic	Karnataka	Geomysore Services India Pvt. Ltd.	Charles Devenish	Chairman
32	Metallic	Karnataka	Deccan Gold Mines	Mr. Karunakaran	Director
33	Metallic	Karnataka	Hathur Traders	Mr. Sayed Faruq	General Manager
34	Metallic	Karnataka	Gadigi Mineral Mining Company	Allum Pramod	Managing Director
35	Metallic	Karnataka	Bellary Iron Ores	Yuvraj Kathari	General Manager
36	Metallic	Karnataka	MSPL Ltd.	Navaghana Pani	Vice President
37	Metallic	Karnataka	Ramgad Mineral & Mining Ltd.	Satya Prakash	Mining Manager
38	Metallic	Karnataka	H. R. G. Alloys & Steel Pvt. Ltd.	H.R. Gariappa	Mining Director
39	Metallic	Karnataka	Laxmi Minerals	Shankar B	General Manager - Mines
40	Metallic	Karnataka	G.G.& Brothers	K.V. Baktha Basthala Naidu	Sr. General Manager - Mines
41	Metallic	Karnataka	R. B. Seth Sriram Narsigh Das	Gopal Joshi	Asst. General Manager
42	Metallic	Karnataka	BMM Ispat	N. Laxman Rao	Manager
43	Metallic	Karnataka	P. Balasuba Sethy & Sons	Krishna Reddy	Mines Manager

#	Mineral Category	State	Name of Entity/ Organization	Key Contact Person	Designation
44	Metallic	Karnataka	B.Kumar Goda Mines	P. Srinivas Rao	General Manager
45	Metallic	Karnataka	Nadim Minerals	C. V. Narayan Reddy	Ass. Mines Manager
46	Metallic	Karnataka	Vesco	Nand Kumar	Mines Manager
47	Metallic	Karnataka	Sandur Manganese & Iron Ores Ltd.	V. Jaiprakash	Dy. General Manager
48	Metallic	Karnataka	V.S. Lad & Sons	Ramesh N.	Manager-HR & Admin
49	Metallic	Karnataka	Sri S.R. Gavisidheshwar Minerals	Srikant Reddy	Mines Manager
50	Metallic	Karnataka	Zeenath Transport Company	J. Srikanth	Mines Manager
51	Metallic	Karnataka	National Mineral Development Corporation Ltd.	P. Vinay Kumar	Dy. Manager
52	Metallic	Karnataka	Mysore Minerals Ltd.	Mr. Ninagappa	Dy. General Manager
53	Metallic	Madhya Pradesh	Bansal Khanij Udyog	R. C. Bansal	Managing Director
54	Metallic	Maharashtra	MOIL Limited	D. Venkatapathi Raju	General Manager (Personnel)
55	Metallic	Maharashtra	MOIL Limited	R.S. Verma	General Manager (Mines)
56	Metallic	Maharashtra	Tirupati Pvt. Ltd.	S.R. Nair	Mining Manager
57	Metallic	Maharashtra	Trimurti Pvt. Ltd.	Mr. Chaturvedi	General Manager
58	Metallic	Maharashtra	Lloyds Metals & Energy Pvt. Ltd.	Manoj Kr. Sahu	Dy. General Manager
59	Metallic	Maharashtra	Gopani Iron & Power India Pvt. Ltd.	Anurag Tripathi	Chief Executive, Mining
60	Metallic	Odisha	EMIL (Aditya Birla)	P.K. Panda	President and Unit Head
61	Metallic	Odisha	Kalinga Corporation Ltd.	R.C. Mohanty	Director
62	Metallic	Odisha	Odisha Mining Corporation Ltd.	P.C. Mahapatra	Manager
63	Metallic	Odisha	Balasore Alloys Ltd.	A.K. Patnaik	Director
64	Metallic	Odisha	Kamaljeet Singh Ahluwalia Pvt. Ltd.	S. K. Patro	Admin Manager
65	Metallic	Odisha	Rungta Mines Ltd.	B.R.Das	Dy. General Manager
66	Metallic	Odisha	Khatau Narbheram & Corp.	J.R. Patro	HR Head
67	Metallic	Odisha	Penguin Trading & Agencies Ltd.	R. R. Nayak	General Manager
68	Metallic	Odisha	Kandhar Mining & Minerals Pvt. Ltd.	A. K. Sharma	Mines Manager
69	Metallic	Odisha	Indrani Patnayak	Tanmay Mishra	Asst. Mines Manager
70	Metallic	Odisha	S. N. Mohanthy	T. Cei	General Manager
71	Metallic	Rajasthan	Hindustan Zinc Ltd.	Manjunath	Mining Engineer
72	Metallic	Rajasthan	Hindustan Zinc Ltd.	Abhay Malviya	Associate Vice President

#	Mineral Category	State	Name of Entity/ Organization	Key Contact Person	Designation
73	Metallic	Tamil Nadu	Core Minerals	A. R. Balaji	Chief Finance Officer
74	Metallic	West Bengal	Hindustan Copper Ltd.	Vivek Gupta	Technical Assistant, Chairman
75	Metallic	West Bengal	Misrilal Jain & Sons	Shivkumar Jain	Managing Director
76	Non-Metallic	Chhattisgarh	Century Cement	B.P. Mishra	Vice - President
77	Non-Metallic	Chhattisgarh	Vjay Kr. Pritwani	Vjay Kr. Pritwani	Managing Director
78	Non-Metallic	Gujarat	Sanghi Industries Ltd.	Gaurang Bhatt	Sr. Vice President
79	Non-Metallic	Jharkhand	Banwarilal Newatia	Manas Ghosh	Geologist
80	Non-Metallic	Jharkhand	Banwarilal Newatia	Mr. Kundan Sharma	Sr. Mining Engineer
81	Non-Metallic	Madhya Pradesh	Rameshwar Pd. Ramchandran Pvt. Ltd.	Rameshwar Prasad	Managing Director
82	Non-Metallic	Madhya Pradesh	Harris Minerals	Arun Bansal	Director
83	Non-Metallic	Madhya Pradesh	Birla Cement	P. C. Mathur	Director
84	Non-Metallic	Madhya Pradesh	Harsh Minerals	Sharda Prasad Bansal	Managing Director
85	Non-Metallic	Maharashtra	CRU Analysis & Consulting India Pvt. Ltd.	Gunjan Agarwal	Team Leader
86	Non-Metallic	Maharashtra	Indian Rare Earths Ltd.	A. K. Pal	General Manager
87	Non-Metallic	Maharashtra	Minikgarh Cement Ltd.	S.K. Tiwari	Dy. General Manager- Mining
88	Non-Metallic	Rajasthan	Udaipur Mineral Development Syndicate Ltd.	Abhimanyu Golcha	Managing Director
89	Non-Metallic	Rajasthan	Khetan Business Corp. Pvt. Ltd.	Umesh Gupta	Chief Mining In-Charge
90	Non-Metallic	Rajasthan	Wolkem India Ltd.	Niranjan Sharma	
91	Non-Metallic	Tamil Nadu	Trimex Ltd.	Deepak Rathore	Geology Manager
92	Non-Metallic	Tamil Nadu	Trimex Ltd.	Aman Kr.	HR Manager
93	Non-Metallic	West Bengal	Steel Authority of India Ltd.	Alok Srivastav	Managing Director
94	Non-Metallic	West Bengal	Lafarge India Pvt. Ltd.	Rajesh Singh	Sr. Manager
95	Minor	Andhra Pradesh	A. P. Mineral Development Corporation Ltd.	M.V. Prasad	Director
96	Minor	Chhattisgarh	Premium Metals Ltd.	Ajay Jhanjhri	Managing Director
97	Minor	Chhattisgarh	Rakesh Dubey	Rakesh Dubey	Managing Director
98	Minor	Chhattisgarh	Laxmi Stone Pvt. Ltd.	Vijay Jadwani	Managing Director

#	Mineral Category	State	Name of Entity/ Organization	Key Contact Person	Designation
99	Minor	Chhattisgarh	Ashapuri Stone	Raju Patil	Owner
100	Minor	Maharashtra	D.P. Rai	Abhishek Rai	Owner (Partner)
101	Minor	Maharashtra	Hasan Construction & Traders (Sand)	Bodan Badig	Side -In charge
102	Minor	Maharashtra	Irai River Desitting (Sand)	Anand Kalkumbe	CEM
103	Minor	Rajasthan	Starline Buildcon Pvt. Ltd.	Dhananjay Meena	Managing Director
104	Minor	Rajasthan	Gangwal KDS Pvt. Ltd.	J. P. Khetan	Managing Director
105	Minor	Rajasthan	Sand Stone Mines	Kishan Ghatiwala	Manager
106	Minor	Rajasthan	R.S. Die Stone	R.S. Gupta	Director
107	Minor	Rajasthan	Rishabh Marble Pvt. Ltd.	Gopal Pandiya	Mines Manager
108	Minor	Rajasthan	Sidharth Marble & Granite	Nilesh Shukla	CA-Mines In-Charge
109	Minor	Rajasthan	Deejay Neelum Marble Industries Pvt. Ltd.	S.K. Sharma	Sr. Mining Engineer
110	Minor	Rajasthan	Narayan Marbles	Ghanshyam Jain	Mines Manager
111	Minor	Rajasthan	Haveli Marbles & Stone Granite	Ashok Singh	Managing Director
112	Minor	Rajasthan	Jaspura Mines	Chandra Shekhar	Managing Director
113	Minor	Rajasthan	SMT Mines	Gunbhadra	Mines Manager
114	Minor	Rajasthan	Rajasthan Barytes	Pramod Trivedi	CEO-Mines
115	Minor	Rajasthan	Nakoda Marbles & Granite Industry	Mahavir Sharma	Mines Manager
116	Minor	Rajasthan	Shubh Marbles & Granite	Om Prakash	Managing Director
117	Minor	Rajasthan	Laxmi Marbles	Virendra Singhwi	Managing Director
118	Minor	Rajasthan	Arihant Marbles & Granite	Mukesh H. Modi	Managing Director
119	Minor	Rajasthan	Mahadev Marbles & Granite	Vijay Singh	Mines Manager
120	Minor	Rajasthan	Birani Marbles & Granite	Bansal Birani	Managing Director
121	Minor	Rajasthan	Mount Stone Marbles	Rajendra Kr. Chandalika	Managing Director
122	Minor	Rajasthan	Gauri Mahesh Natural Resources Pvt. Ltd.	Mahendra	Managing Director
123	Minor	Rajasthan	Vijay Marbles	Subhashchandra Mourya	Managing Director
124	Minor	Rajasthan	Ranabai Marbles	Ramdev Choudhary	Mining Manager
125	Minor	Rajasthan	Rudraksh Singh Stone Pvt. Ltd.	Rameshwar Meena	Managing Director
126	Minor	Tamil Nadu	IBC Ltd.	Rajamohan Reddy	Managing Director
127	Minor	Tamil Nadu	Oren Hydro Carbons Pvt. Ltd.	N. R. Gajalaxmi	Chief Operating Officer
128	Minor	Telangana	Nishita Mines & Minerals	G. Srinivas	Proprietor

#	Mineral Category	State	Name of Entity/ Organization	Key Contact Person	Designation
129	Minor	Telangana	Shri Jayalaxmi Minerals	R. Manikanta Reddy	Managing Director
130	Minor	Telangana	Jai Bhavani Mines & Minerals	Mupah Jai Sinha	Proprietor
131	Minor	Telangana	Harindra Minerals	G. Visheshwar Reddy	Director
132	Exploration	Maharashtra	Mineral Exploration Corporation Limited (MECL)	C.K. Thoolkar	Dy. General Manager (Instrumentation)
133	Exploration	Maharashtra	Mineral Exploration Corporation Limited (MECL)	S.M. Joshi	Dy. General Manager (Drilling)/ HOD
134	Exploration	Maharashtra	Mineral Exploration Corporation Limited (MECL)	Dr. C. Sreerama Murthy	Dy. General Manager/ HOD (H.R.)

List of Central/ Apex organizations/ Mining Associations

S#	State	Name of Entity/ Organization	Key Contact Person	Designation
1	Andhra Pradesh	Quartz & Feldspar Mine Owners & Manufacturing Association	V. Sudhakar	Secretary
2	Delhi NCR	Ministry of Mines	Sudhakar Shukla	Economic Advisor
3	Delhi NCR	Ministry of Coal	Anil Swarup	Secretary
4	Goa	Goa Mining Association	Glen Kalavampara	Secretary
5	Gujarat	National Institute Of Occupational Health	Dr. H. B. Sadhu	MD Scientist F
6	Jharkhand	Central Institute of Mining and Fuel Research (CIMFR)	Dr. C.N. Ghosh	Dy. Director
7	Jharkhand	Central Institute of Mining and Fuel Research (CIMFR)	Dr. M. S. Alam	Head, CSPD, CPIO
8	Jharkhand	Central Mine Planning & Design Institute Limited (CMPDI)	A. K. Debnath	Chairman-cum-Managing Director
9	Jharkhand	Central Mine Planning & Design Institute Limited (CMPDI)	S.K. Dubey	Asst. of Chairman
10	Jharkhand	Directorate General of Mines Safety (DGMS)	Saurabh Chakrawarti	Director HQ
11	Jharkhand	Directorate General of Mines Safety (DGMS)	Rahul Guha	Director
12	Karnataka	Federation of Indian Granite & Stone Industries (FIGSI)	K. B. Munivenkata Swamy	CEO
13	Maharashtra	National Institute of Miners' Health (NIMH)	Dr. Rajnarayan Tiwari	Director
14	Maharashtra	National Institute of Miners' Health (NIMH)	Shilpa Ingole	Research Officer
15	Maharashtra	National Institute of Miners' Health (NIMH)	Dr. S. Nandi	Sr. Research Officer
16	Maharashtra	Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDD)	P. K. Bhukte	Sr. Scientist
17	Maharashtra	Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDD)	R. S. Mishra	Sr. Scientist
18	Maharashtra	Indian Bureau of Mines (IBM)	M. M. Soman	Mineral Economist (Intelligence)
19	Maharashtra	Indian Bureau of Mines (IBM)	D. S. Walde	Mineral Economist
20	Maharashtra	Indian Bureau of Mines (IBM)	D. W. Beck	Mineral Economist (I)
21	Maharashtra	Indian Bureau of Mines (IBM)	A. B. Panigrahi	Dy. Controller Mines
22	Maharashtra	Indian Bureau of Mines (IBM)	K. Thomas	Dy. Controller - Mineral and Mines Statistics
23	Maharashtra	Indian Bureau of Mines (IBM)	Mr. Sakpal	Director, Training
24	Maharashtra	Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDD)	Dr. Pottewar	Sr. Scientist
25	Maharashtra	Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDD)	Dr. Anupam Agnihotri	Director
26	Maharashtra	Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDD)	M. J. Chaddha	Scientist - V

S#	State	Name of Entity/ Organization	Key Contact Person	Designation
27	Odisha	Eastern Zone Mining Association	R. L. Mohanthy	Vice-President
28	Rajasthan	Federation of Mines Associations of Rajasthan	Akshaydeep Mathur	Secretary General
29	Rajasthan	Jaipur Chamber of Commerce & Industry	Ashok Kr. Dhoot	Vice Chairman
30	Telangana	Mining Engineers Association of India (MEAI)	Mr. Rao	Secretary
31	West Bengal	Bengal Chamber of Commerce & Industry	Sutanu Ghosh	President
32	West Bengal	Geological Survey of India (GSI)	E. Ramalingam	Additional Director
33	West Bengal	Office of Coal Controller	Anjani Kumar	Mining Engineer (Coal Controller)

List of State Government Officials

S#	State	Name of the Department	Key Contact Person	Designation
1	Andhra Pradesh	Department of Mines & Food Processing	Girija Shankar	Director
2	Andhra Pradesh	Department of Mines & Geology	K. C. L. Narsimha Reddy	Joint Director
3	Chhattisgarh	Mineral Resources Department	S. K. Trivedi	Officer On Special Duty
4	Goa	Department of Mines & Geology	Ramnath Shetgonkar	Asst. Geologist
5	Gujarat	Gujarat Mineral Research Development Society	K. S. Prajapati	Joint Secretary
6	Gujarat	Gujarat Mineral Research Development Society	A. K. Mulai	Sr. Geologist
7	Gujarat	Department of Employment & Training	S. K. Bamania	Dy. Secretary
8	Jharkhand	Department of Mines & Geology	Shri S. K. Satapathy	Principal Secretary
9	Jharkhand	Department of Labour and Employment	Umesh Prasad	Joint Secretary
10	Jharkhand	Department of Mines & Geology	S. P. Negi	Director
11	Jharkhand	Department of Mines & Geology	A. K. Singh	Asst. of Director
12	Jharkhand	Department of Employment and Training	Rakesh Kr. Singh	Director
13	Jharkhand	Department of Labour and Employment	Pravin Kr. Toppo	Commissioner
14	Jharkhand	Department of Labour and Employment	G.S. Goraiburu	Director
15	Jharkhand	Department of Labour & Employment (Department of Skill Development)	Vishwaroop Thakur	Asst. Director
16	Jharkhand	Ministry of Labour and Employment	G. S. Doraiburu	Regional Labour Commissioner (Central)
17	Jharkhand	Ministry of Labour and Employment	-	Dy. Labour Commissioner (Central)
18	Karnataka	Directorate General of Mines Safety (DGMS)	P. K. Sarkar	Dy. Director General
19	Karnataka	Directorate General of Mines Safety (DGMS)	S. S. Patansethy	Director
20	Karnataka	Department of Technical Education	A.M. Bodedar	Joint Director
21	Madhya Pradesh	Mineral Resources Department	Sheo Shekhar Shukla	Secretary
22	Madhya Pradesh	Mineral Resources Department	Vinit Kr. Astin	DGM
23	Maharashtra	Directorate of Geology & Mines	Ms. Nagrekar	Additional Secretary
24	Maharashtra	Maharashtra State Mining Corporation Ltd. (MSMC)	P.Y. Tembhare	General Manager (OP)
25	Maharashtra	Maharashtra State Mining Corporation Ltd. (MSMC)	Mr. Aditya Rathore	Mining Engineer

S#	State	Name of the Department	Key Contact Person	Designation
26	Maharashtra	Directorate of Geology & Mines	Suyog Jagtap	Senior Geologist
27	Odisha	Department of Mines & Geology	R. K. Sharma	Principal Secretary
28	Odisha	Department of Mines & Geology	S. L. Seal	Addl. Secretary
29	Odisha	Department of Geology	A. T. Das	Director
30	Odisha	Department of Skill & Technical Education	L. N. Gupta	Principal Secretary
31	Odisha	State Employment Mission	G. Rajesh	Director
32	Odisha	State Employment Mission	H. S. Lenka	Asst. Director
33	Odisha	Directorate of Mines/ Department of Mines & Geology	Dipak Mohanthy	Director
34	Rajasthan	Department of Mines & Geology	Mr. P.S. Lorha	Officer on Special Duty-Mining Sector
35	Tamil Nadu	Department of Mines & Geology	R. Sundaram	Joint Director
36	Tamil Nadu	Department of Mines & Geology	K. Deepa	Asst. Director
37	Telangana	Department of Employment & Training	K. V. Chandrashekhar	Asst. Director
38	Telangana	Department of Mines & Geology	B.V.R. Susheel Kumar	Director
39	Telangana	Directorate General of Mines Safety (DGMS)	Syedbuetiaz	Director
40	West Bengal	Directorate of Mines & Minerals	Durga Das Goswami	Director

List of Educational Institutes

S#	State	District	Name of Institute	Type of Institute
1	Andhra Pradesh	East Godavari	B.V.C. Engineering College	College
2	Andhra Pradesh	East Godavari	Aditya Engineering College	College
3	Chhattisgarh	Raipur	I.T.I. Mana Camp.	ITI
4	Chhattisgarh	Raipur	Shri Rawatpura Sarkar Ashram	ITI
5	Chhattisgarh	Bilaspur	Government Polytechnic	Polytechnic
6	Goa	Panaji	Goa College of Engineering	College
7	Goa	Panaji	Government Polytechnic	Polytechnic
8	Goa	Panaji	Govt. Industrial Training Institute	ITI
9	Gujarat	Bhuj	Government Engineering College	College
10	Gujarat	Bhuj	Government Polytechnic	Polytechnic
11	Gujarat	Ahmedabad	Industrial Training Institute, Saraspur	ITI
12	Jharkhand	Ranchi	Birsa Industrial Training Institute	ITI
13	Jharkhand	Dhanbad	Indian School of Mines	Specialized Institute
14	Karnataka	Bangalore	Govt. Industrial Training Institute	ITI
15	Karnataka	Bangalore	Acharya Polytechnic	Polytechnic
16	Karnataka	Bangalore	Acharya Institute of Technology	College
17	Karnataka	Mangalore	National Institute of Technology	Specialized
18	Karnataka	Kolar	Vijaylaxmi Polytechnic	Polytechnic
19	Karnataka	Kolar	Dr. T. Thimmaiah Institute of Technology	College
20	Madhya Pradesh	Bhopal	Sardar Patel Polytechnic College	Polytechnic
21	Madhya Pradesh	Satna	Aditya College of Technology & Science	College
22	Maharashtra	Nagpur	Govt. Polytechnic. Nagpur.	Polytechnic
23	Maharashtra	Nagpur	ITI, Lower Parel	ITI
24	Maharashtra	Nagpur	Kamptee Polytechnic	Polytechnic
25	Odisha	Bhubaneshwar	I.T.I., Mancheswar Industrial Estate	ITI
26	Odisha	Angul	Narayani Institute of Engineering & Technology	Polytechnic
27	Odisha	Angul	Pabitra Mohan Institute of Technology	Polytechnic
28	Rajasthan	Jaipur	Government ITI	ITI
29	Rajasthan	Udaipur	Pacific Polytechnic College	Polytechnic
30	Rajasthan	Udaipur	College of Technology & Engineering	College
31	Tamilnadu	Chennai	Vivekananda ITI	ITI
32	Telangana	Hyderabad	Adusumilli Vijaya College of Engineering & Research Centre	Polytechnic
33	Telangana	Hyderabad	University College of Engineering	College
34	Telangana	Hyderabad	Advanced Training Institute	ITI
35	West Bengal	Kolkata	Indian Institute of Engineering & Science University	PG College
36	West Bengal	Kolkata	Industrial Training Institute	ITI
37	West Bengal	Kolkata	IIT, Kharagpur	Specialized Institute

List of Labor Unions

S#	State	District	Name of Entity/ Organization	Key Personnel Covered	Designation
1	Andhra Pradesh	Hyderabad	Indian National Trade Union Congress (INTUC)	Dr. D. Sanjiva Reddy	President
2	Chhattisgarh	Raipur	Chhattisgarh State Cooperative Union Ltd.	K. N. Kankane	President
3	Delhi / NCR	Delhi	Lal Jhanda Union	Amar Sigh Yadav	Secretary
4	Goa	Panaji	Bhartiya Mazdoor Sangh	Harudiyanath Shirodkar	President
5	Gujarat	Ahmedabad	Gujarat Kamgar Sewalaya	Kamla Ben Shah	President
6	Jharkhand	Ranchi	Bhartiya Mazdoor Sangh	K.N. Singh	Vice President
7	Karnataka	Bangalore	Bhartiya Mazdoor Sangh	Kumari Mangla	Secretary
8	Madhya Pradesh	Bhopal	Bhartiya Mazdoor Sangh	A. D. Jagdale	Assistant of Secretary
9	Maharashtra	Nagpur	Bhartiya Mazdoor Sangh	Neeta Choubey	Secretary
10	Odisha	Bhubaneshwar	Indian National Trade Union Congress (INTUC)	Satyabrat Nayak	President
11	Rajasthan	Jaipur	Bhartiya Mazdoor Sangh	S. K. Rathore	Secretary
12	Tamil Nadu	Chennai	INTUC	Rek Murugesan	Secretary
13	Tamil Nadu	Chennai	Bhartiya Mazdoor Sangh	S. Durai Raj	Secretary
14	West Bengal	Kolkata	Bhartiya Mazdoor Sangh	Shankar Das	Secretary

Annexure 02 – Study Tools Used

Discussion Agenda – Industry

A. OUTPUTS OF THE STUDY

- *Understand current structure of the Mining sector along with subsequent skilling requirement*
- *Estimation of current and incremental human resource requirement in the Mining sector*
- *Estimation of quantitative and qualitative skill gaps*

B. DETAILS OF THE RESPONDENT

Name of Organization			
Name of Respondent			
Designation			
Contact #		Email ID	
Address of Head Office			

C. ORGANIZATION PROFILE

1. Year of establishment				
2. Key Industry sub-sector as per Mining operation	Fuel Minerals	Metallic Minerals	Non Metallic Minerals	Minor Minerals & Dimension Stones
- **Key Minerals**				
- **Est. share in total value of mineral produced**				
3. Other Sub-sector/s of Operation	Prospecting & Exploration	Mineral Processing & Beneficiation	Associated services	
4. Type of Mining	Surface Mining	Underground Mining	Both	NA
5. Key states of operation in India	North	East	West	South
6. Affiliation (s) with Industry Association				
7. Total estimated strength of employees	Company Pay Rolls	Contractual/ Outsourced		
8. % distribution of employees based on gender	Males	Females		
9. % distribution of employees based on domicile	Local (Within district)	Migrated from other districts of the state	Migrated from other states of India	

10. % distribution of employees across levels by basic educational qualification	Education/ Training level	% distribution in firm	Source of recruitment	Trainings provided (Pls. tick if applicable)	
	Primary (1st to 5th Std.)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Upper Primary (6th to 8th Std.)			Induction	On the Job
				Upskilling	Ext. Certification

				Others:	
	Secondary (9th / 10th Std.)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Higher Secondary (11th / 12th)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Short term skill certification (<6 months)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Medium term skill certification (6 months - 1 yr.)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Diploma – ITI or equivalent			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Advanced Diploma – Polytechnic or equivalent			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Bachelor's Degree			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Post Graduate Diploma			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Master Degree			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Doctorate			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	

D. CURRENT INDUSTRY OVERVIEW

11. Kindly provide a general overview of your top 3 industry	Parameters	Prospecting & Exploration	Fuel Minerals	Metallic Minerals	Non Metallic Minerals	Minor Minerals & Dimension Stones	Mineral Processing & Beneficiation
	Total size (turnover)						

sub-sectors according to your area of operations	Total employment							
	Current growth rate, 2014							
	Expected growth rate, 2014-17							
	Expected growth rate, 2017-22							
	Key mining clusters							

12. What are major investments proposed in the sector?	**Government (Central/ State)**	**Private/ Others**
13. What are enabling policies (existing/ proposed) by govt. in sector?	**Central Government**	**State Government**

14. What are your views on competitiveness of **your industry sub-sectors**? w.r.t. the following aspects

	Parameters	Key Strengths	Key Challenges	Key Opportunities	Key Threats
a.	**Availability of employable workforce**				
b.	**Transportation network**				
c.	**Availability of utilities including power, water etc.**				
d.	**Use of technology**				
e.	**Central/ State Govt. policies/ initiatives**				
f.	**Availability of capital/ funding**				
g.	**Others (pls. specify)**				

15. Details of existing Sub-Sector (2014) – Functional classification within the sub-sector

S	a. Major/ Core Functions within Mining Industry	b. Est. share of core function in total employment of firm (%)	c. Key Designations	d. Est. annual growth of employees in	
				(i) Last 5 yrs. (%)	(ii) Next 5 yrs. (%)
1	Trades and Production Occupations				
2	Professional Occupations				
3	Supervisors, Coordinators & Foremen				
4	Technical Occupations				
5	Peripheral Services (subsidiary activities to mining operations)				
6	Support Services (Accounts, IT, HR etc.)				

16. Key changes expected in the sector/ industry over next 5 years affecting the Industry and impacting skill requirements

a. Key Technological / structural changes expected over next 5 years	
b. New/ additional job roles and skills required as a result of the above	
c. Job roles likely to become redundant over next 5 yrs.	
d. Projected growth in any major functions over next 5 yrs. (est. %)	
e. Key skill development / trainings required for reskilling the workforce as a result of above	

SKILL DEVELOPMENT

17. Are there any other comments/ suggestions/ recommendation that you may like to share to improve the skill development system for following key stakeholders of mining sector in your state?

S#	Key Stakeholders	Comments
1.	State/ Centre Government	
2.	Industry/ Industry Association	
3.	Skill Council for Mining Sector/NSDC	
4.	Technical Training Institutes	
5.	Trainers	
6.	Any Others, Specify:	

Are there any key job roles that have been missed out in the below annexure? Kindly elaborate.

Interview Information (Not to be filled by respondent)		
Date (dd/mm)		
Name of interviewer		
Mode	☐ In Person	☐ Over telephone
Deloitte's Rep. (if any)		
Remarks, if any		

SCMS's Occupation Matrix for Mining Sector

NSQF Level	Natural Resource Management				Mining Operations							Engineering Services			Mineral Beneficiation		
	Exploration												Mechanical Services				
Occupation	Geological Investigations	Geophysical Exploration	Exploration Drilling	Resource Management	Mine Surveying	Drilling & Cutting	Blasting	Loading & Hauling – Opencast	Loading & Hauling – Underground	Specialist Operations – Underground	HSE Functions	Electrical Services	Field Services	Workshop	Ore Processing	Instrumentation & Control Systems	AG. NO. ( )
10 (____)	MD/ Business Head (____)																
9 (____)	Corporate Manager – Mining/ Engineering/ Resources (____)																
8 (____)	Head – Mining Project, Department Heads (____)																
	AGGREGATE NO. (____)				AGGREGATE NO. (____)							AGGREGATE NO. (____)			AGGREGATE NO. (____)		
7 (____)	Project Geologist (____)	Project Geophysicist (____)	-	Senior Resource Geologist (____) Mining Economist (____) Remote Sensing Specialist (____)	Senior Mining Engineer (____) Senior Geotechnical Engineer (____)						Emergency Response & Rescue Specialist (____) Occupation Health Specialist (____) Safety Specialist (____) Environmental Specialist (____)	Senior Electrical Engineer (____)	Senior Mechanical Engineer (____)		Senior Mineral Processing Engineer (____)		AGGREGATE NO. (____)
6 (____)	Mining Geologist (____)	Geophysicist (____)	Drilling Engineer (____)	Resource Geologist (____)	Mining Engineer (____) Geotechnical Engineer (____)						Environmental Engineer (____)	Electrical Engineer (____)	Mechanical Engineer (____)		Mineral Processing Engineer (____)	Chemists (____)	
5 (____)	Mining Geologist (____)	Geophysicist (____)	Driller (____)	GIS Operator (____)	Land Survey Technologists (____)	Mining Engineer (____) Material Engineer (____) Reclamation Supervisor (____) Supervisor - Plant Operations (____) Mining Supervisor (____) Mining Mate (____)				Mine Ventilation Supervisor (____)	Environmental Engineer (____)	Electrical Engineer (____) Electrical Supervisor (____)	Mechanical Engineer (____) Mechanical Supervisor Field Services (____)	Mechanical Engineer (____) Mechanical Supervisor – Workshop (____)	Electronics & Instrumentation Engineer (____) Mineral Processing Engineer (____) Supervisor Plant Operations (____)		
	AGGREGATE NO. (____)				AGGREGATE NO. (____)							AGGREGATE NO. (____)			AGGREGATE NO. (____)		
4 (____)	Sampler (____)	Geophysics Survey Operator (____)	Driller (____)	Data Processing Technician (____)	Assistant Mine Surveyor (____)	Rig mounted Drill operator (____) Wire Saw Operator (____) Jumbo Drill Operator (____) Jack-hammer Operator (____)	Shot Firer/Blaster (____) Explosive Van Operator (____)	Excavator (____) Loader (____) Dumper (____) BullDozer (____) Sprinkler & Vehicles driver (____) Grader (____) Bucket Wheel Excavator (____) Surface Miner (____) Stacker & Reclamation Operator (____) Mobile Conveyor Belt Operator (____)	SDL & LHD Operator (____) Track layer Operator (____) Long wall Operator (____) Haulage Operator (____) Haul Truck Operator (____)	Winding Engine Operator (____) Banksman (____) Roof / Cable Bolters (____) Gas Detector (____) Ventilation Adequacy Checker (____) Strata Monitoring Operator (____) Road Header Operator (____) Scaler Operator (____)	Safety Operator (____) Fireman (____)	Mine Electrician (____)	HEMM Maintenance Operator (____)	Machinist Operator (____) Compressor Operator (____) Dewatering pump Operators (____) Welder (____)	Ore Processing Operator (____) Inspector/ Tester – Mineral Processing (____)	Operator Instrumentation/ Mechatronics In-charge (____) Instrumentation Technician (____)	AGGREGATE NO. (____)
	AGGREGATE NO. (____)				AGGREGATE NO. (____)							AGGREGATE NO. (____)			AGGREGATE NO. (____)		
3 (____)	Sampler (____)	-	-	-	-	-	Explosives Handler (____)	-	-	Timberman (____)	-	Assistant Technicians – Electrical (____)	Mechanic/ Fitter (____)		Assistant Specialized Technicians including Sampler (QA/QC) (____)		AGGREGATE NO. (____)
2 (____)	Skilled Helper (____)			-	Skilled Helper (____)				Skilled Helper (____)		Skilled Helper (____)	Skilled Helper (____)			Skilled Helper (____)		
1 (____)	Mazdoor/ Helper (____)				Mazdoor/ Helper (____)							Mazdoor/Helper (____)			Mazdoor/Helper (____)		

S. no.	Job role	NSQF Level	Issues/ Shortage	Qualitative Skill Gaps
	Trade and Production Occupation			
1.	Mazdoor/ Helper	1		
2.	Explosives Handler	3		
3.	Timberman	3		
4.	Sampler	3		
5.	Sprinkler and Other Vehicle Driver	4		
6.	Banksman	4		
7.	Rig Mounted Drill Operator	4		
8.	Explosive Van operator	4		
9.	Grader Operator	4		
10.	SDL & LHD Operator	4		
11.	Strata Monitoring Operator	4		
12.	Track Layer Operator	4		
13.	Haulage Operator	4		
14.	Longwall Operator	4		
15.	Mining Shot Firer/ Blaster	4		
16.	Roof Bolter	4		
17.	Ventilation Adequacy Checker/ Fan Operator	4		
18.	Winding Engine Operator	4		
19.	Wire saw Operator	4		
20.	Welder	4		
21.	Bulldozer Operator	4		
22.	Dumper/ Tipper Operator	4		
23.	Excavator Operator	4		
24.	Loader Operator	4		
25.	Machinist Operator	4		
26.	Assistant Mine Surveyor	4		
27.	Jumbo Drill Operator	4		
28.	Ore Processing Operator	4		
29.	Mine Electrician	4		
30.	Compressor Operator	4		
31.	Dewatering Pump Operator	4		
32.	Reclamation Operator	4		
33.	Road Header Operator	4		
34.	Haul Truck Operator	4		
35.	Surface Miner	4		
36.	Mobile Conveyor Belt Operator	4		
37.	Reclamation Supervisor	5		

S. no.	Job role	NSQF Level	Issues/ Shortage	Qualitative Skill Gaps
	Technical Occupation			
38.	Fireman	4		
39.	Safety Operator	4		
40.	Gas Detector	4		
41.	Inspectors and testers, mineral processing	4		
42.	Land Survey Technologists	5		
43.	Geophysicist	6		
44.	Emergency Response and Rescue Specialist	7		
	Supervisors, Coordinators, and Foremen			
45.	Mining Mate	5		
46.	Supervisors, mining and quarrying	5		
47.	Supervisor - Plant Operations	5		
48.	Safety Specialist/ Workman Inspector	7		
	Professional Occupation			
49.	Material Engineers	5		
50.	Mining Engineers	5		
51.	Mineral Processing Engineer	5		
52.	Environment Engineer	5		
53.	Mining Geologist	5		
54.	Geotechnical Engineer	6		
55.	Occupation Health Specialist	7		
56.	Mining Economists	7		
57.	Remote Sensing Specialist	7		
	Peripheral Services			
58.	Mechanic/ Fitter	3		
59.	Data Processing Technician	4		
60.	Operator Instrumentation/ Mechatronics	4		
61.	HEMM Maintenance Operators	4		
62.	Instrument Technician	4		
63.	Mechanical Engineers	5		
64.	Electrical and Electronics Engineers	5		
65.	GIS Operator	5		
66.	Chemists	6		

Discussion agenda – Industry Associations

A. OUTPUTS OF THE STUDY

- *Understand current structure of the Mining sector along with subsequent skilling requirement*
- *Estimation of current and incremental human resource requirement in the Mining sector*
- *Estimation of quantitative and qualitative skill gaps*

B. DETAILS OF THE RESPONDENT

Name of Industry Association			
Name of Respondent			
Designation			
Contact #		Email ID	

C. ORGANIZATION PROFILE

1. Year of establishment				
2. Key focus area/ objectives				
3. Total members of the association				
4. Approx. number of members as per Industry sub-sectors	Fuel Minerals	Minor Minerals & Dimension Stones	Metallic Minerals	Non Metallic Minerals
5. Approx. number of members involved in other activities of mining	Prospecting & Exploration	Mineral Processing & Beneficiation	Associated services	

D. CURRENT INDUSTRY OVERVIEW

	Parameters	Prospecting & Exploration	Fuel Minerals	Metallic Minerals	Non Metallic Minerals	Minor Minerals & Dimension Stones	Mineral Processing & Beneficiation
6. Kindly provide a general overview of your top 3 industry sub-sectors as per share of member organizations	Total size (turnover)						
	Total employment						
	Current growth rate, 2014						
	Expected growth rate, 2014-17						
	Expected growth rate, 2017-22						
	Key mining clusters						
	Key members						

7. What are major investments proposed in sector?	**Government (Central/ State)**	**Private/ Others**

8. What are enabling policies (existing/ proposed) by govt. in sector?	Central Government	State Government	
9. What are major schemes for skill dev. in sector?	Central	State	Private/ Others

10. What are your views on **competitiveness of your industry sub-sectors**? w.r.t. the following aspects

Parameters	Key Strengths	Key Challenges	Key Opportunities	Key Threats
a. Availability of employable workforce				
b. Transportation network				
c. Availability of utilities including power, water etc.				
d. Use of technology				
e. Central/ State Govt. policies/ initiatives				
f. Availability of capital/ funding				
g. Others (pls. specify)				

11. Details of existing Sub-Sector (2014) – Functional classification within the sub-sector

S	e. Major/ Core Functions within Mining Industry	f. Est. share of core function in total employment of firm (%)	g. Key Designations	h. Est. annual growth of employees in	
				(i) Last 5 yrs. (%)	(ii) Next 5 yrs. (%)
1	Trades and Production Occupations				
2	Professional Occupations				
3	Supervisors, Coordinators & Foremen				
4	Technical Occupations				
5	Peripheral Services (subsidiary activities to mining operations)				

S	e. Major/ Core Functions within Mining Industry	f. Est. share of core function in total employment of firm (%)	g. Key Designations	h. Est. annual growth of employees in	
				(i) Last 5 yrs. (%)	(ii) Next 5 yrs. (%)
6	**Support Services (Accounts, IT, HR etc.)**				

12. Key changes expected in sector over next 5 yrs. affecting Industry and impacting skill requirements

a. Key Technological / structural changes expected over next 5 years	
b. New/ additional job roles and skills required as a result of the above	
c. Job roles likely to become redundant over next 5 yrs.	
d. Projected growth in any major functions over next 5 yrs. along with estimated %	
e. Key skill development / trainings required for reskilling the workforce as a result of above	

SKILL DEVELOPMENT

13. Are there any other comments/ suggestions/ recommendation that you may like to share to improve the skill development system for following key stakeholders of mining sector in your state?

S#	Key Stakeholders	Comments
1.	State/ Centre Government	
2.	Industry/ Industry Association	
3.	Skill Council for Mining Sector/NSDC	
4.	Technical Training Institutes	
5.	Trainer	
6.	Any Others, Specify:	

Are there any key job roles that have been missed out in the above? Kindly elaborate.

Interview Information (Not to be filled by respondent)		
Date (dd/mm)		
Name of interviewer		
Mode	☐ In Person	☐ Over telephone
Deloitte's Rep. (if any)		
Remarks, if any		

Annexure - Distribution of Job Roles in the Organization

A. Trade and Production Occupation

S #	Job role	NSQF Level	Key Job Role (Pls. tick as applicable)	Issues/ Shortage	Qualitative Skill Gaps
1	Mazdoor/ Helper	1			
2	Explosives Handler	3			
3	Timberman	3			
4	Sampler	3			
5	Sprinkler and Other Vehicle Driver	4			
6	Banksman	4			
7	Rig Mounted Drill Operator	4			
8	Explosive Van operator	4			
9	Grader Operator	4			
10	SDL & LHD Operator	4			
11	Strata Monitoring Operator	4			
12	Track Layer Operator	4			
13	Haulage Operator	4			
14	Longwall Operator	4			

S #	Job role	NSQF Level	Key Job Role (Pls. tick as applicable)	Issues/ Shortage	Qualitative Skill Gaps
15	Mining Shot Firer/ Blaster	4			
16	Roof Bolter	4			
17	Ventilation Adequacy Checker/ Fan Operator	4			
18	Winding Engine Operator	4			
19	Wire saw Operator	4			
20	Welder	4			
21	Bulldozer Operator	4			
22	Dumper/ Tipper Operator	4			
23	Excavator Operator	4			
24	Loader Operator	4			
25	Machinist Operator	4			
26	Assistant Mine Surveyor	4			
27	Jumbo Drill Operator	4			
28	Ore Processing Operator	4			
29	Mine Electrician	4			

S #	Job role	NSQF Level	Key Job Role (Pls. tick as applicable)	Issues/ Shortage	Qualitative Skill Gaps
30	Compressor Operator	4			
31	Dewatering Pump Operator	4			
32	Reclamation Operator	4			
33	Road Header Operator	4			
34	Haul Truck Operator	4			
35	Surface Miner	4			
36	Mobile Conveyor Belt Operator	4			
37	Reclamation Supervisor	5			

B. Technical Occupation

S #	Job role	NSQF Level	Key Job Role (Pls. tick as applicable)	Issues/ Shortage	Qualitative Skill Gaps
38	Fireman	4			
39	Safety Operator	4			
40	Gas Detector	4			
41	Inspectors and testers, mineral processing	4			
42	Land Survey Technologists	5			
43	Geophysicist	6			
44	Emergency Response and Rescue Specialist	7			

C. Supervisors, Coordinators, and Foremen

S #	Job role	NSQF Level	Key Job Role (Pls. tick as applicable)	Issues/ Shortage	Qualitative Skill Gaps
45	Mining Mate	5			
46	Supervisors, mining and quarrying	5			
47	Supervisor - Plant Operations	6			
48	Safety Specialist/ Workman Inspector	6			

D. Professional Occupation

S #	Job role	NSQF Level	Key Job Role (Pls. tick as applicable)	Issues/ Shortage	Qualitative Skill Gaps
49	Material Engineers	5			
50	Mining Engineers	5			
51	Mineral Processing Engineer	5			
52	Environment Engineer	5			
53	Mining Geologist	5			
54	Occupation Health Specialist	7			
55	Mining Economists	7			
56	Remote Sensing Specialist	7			

E. Peripheral Services

S #	Job role	NSQF Level	Key Job Role (Pls. tick as applicable)	Issues/ Shortage	Qualitative Skill Gaps
57	Mechanic/ Fitter	3			
58	Data Processing Technician	4			

S #	Job role	NSQF Level	Key Job Role (Pls. tick as applicable)	Issues/ Shortage	Qualitative Skill Gaps
59	Operator Instrumentation/ Mechatronics	4			
60	HEMM Maintenance Operators	4			
61	Instrument Technician	4			
62	Mechanical Engineers	5			
63	Electrical and Electronics Engineers	5			
64	GIS Operator	5			
65	Chemists	6			

Data Sheet - Employees in Mining Organizations

A. OUTPUTS OF THE STUDY

- *Ascertain the human resource and skill requirements for the mining sector*
- *Estimation of qualitative and quantitative skill gaps in mining sector*
- *Understand current skills training provision by various govt. & private training organizations in mining sector*

B. EDUCATION/ RESPONDENT INFORMATION

1. Name of Respondent					
2. Age (years)			3. Gender	☐ Male	☐ Female
4. Socio-Religious Category	SC	ST	OBC	Minority	General
5. Current District			6. Current State		
7. Home District			8. Home State		
9. Highest level of Education achieved	☐ Doctorate / PhD ☐ Master's / Post graduate Degree ☐ Post Graduate Diploma ☐ Bachelor's / Graduate Degree ☐ Advanced Diploma – Polytechnic or equivalent ☐ Diploma - ITI or equivalent		☐ Medium term skill certification (6 months – 1 year) ☐ Short term skill certification (< 6 months) ☐ Higher Secondary (11th / 12th) ☐ Secondary (9th / 10th Std) ☐ Upper Primary (6th to 8th Std) ☐ Primary (1st to 5th Std) ☐ Never gone to school ☐ None of the above		
10. Name of Course / Degree, if any					
11. Have you received any training pertain to your current job role before joining?			☐ Yes		☐ No
12. If response to Q. 11 is **Yes**, then mention	Duration (in months)		Place		Nature of Training: ☐ On the Job ☐ Induction ☐ Others

C. EMPLOYMENT DETAILS

13. What was your occupation before entering the Mining Sector?	☐ Student	☐ Working in Mining Sector	☐ Working in other sector	☐ None
14. How did you get this Job?	☐ Contractor	☐ Institute	☐ Friends/ Relatives	☐ Others (specify)

15. Mining Sub-sector (Kindly √ as appropriate)	☐ Exploration & prospecting ☐ Core Mining	☐ Mineral Processing & Beneficiation ☐ Associated services
16. If Core Mining operation, please select one	☐ Metallic ☐ Non-metallic	☐ Fuel minerals ☐ Minor minerals and dimensional stones

17. Current Role/ Designation			18. Role/ Designation at time of Joining		
19. Functional category (Kindly √ as appropriate)	☐ Professional occupation	☐ Technical occupations	☐ Supervisors, coordinators and foremen	☐ Trades & production occupations	☐ Peripheral services (mine rescue, health etc.)
20. Occupation as per current Job role (Kindly √ as appropriate)	☐ Blasting ☐ Drilling & Cutting ☐ Electrical Services ☐ Equipment Maintenance ☐ Exploration Drilling ☐ Geological Investigations ☐ Geophysical exploration ☐ Mechanical Services		☐ Instrumentation maintenance ☐ Loading & Hauling ☐ Mine Surveying ☐ Modelling & Acquisitions ☐ Ore Processing ☐ Research and Development ☐ Health, Safety and Environment Functions ☐ Specialist Operations Services		

21. Please provide the total number of years of work experience and details of your previous job roles, if any (designation, department, name of company, tenure)	Name of Company	Role/Designation	Department	Duration of Engagement

22. a. Total years of work experience in mining sector		b. Total years of overall work experience	
23. Are you associated with any labor union? If yes, please specify the name/ nature of association			

24. Are there any other comments/ suggestions/ recommendation that you may like to share to improve the skill development system for following key stakeholders of mining sector in your state?

S#	Key Stakeholders	Comments
1.	State/ Centre Government	
2.	Industry/ Industry Association	
3.	Skill Council for Mining Sector/NSDC	
4.	Technical Training Institutes	
5.	Any Others, Specify:	

D. INTERVIEWER INFORMATION

Interview Information (Not to be filled by respondent)		
Date (dd/mm)		
Name of interviewer		
Mode	☐ In Person	☐ Over telephone
Deloitte's Rep. (if any)		
Remarks, if any		

Discussion Agenda – Labor Union

A. OUTPUTS OF THE STUDY

- *Understand current structure of the Mining sector along with subsequent skilling requirement*
- *Estimation of current and incremental human resource requirement in the Mining sector*
- *Estimation of quantitative and qualitative skill gaps*

B. DETAILS OF THE RESPONDENT

Name of Labor Union			
Name of Respondent			
Designation			
Contact #		Email ID	
Address			

C. ORGANIZATION PROFILE

1. Year of establishment of union				
2. Type of Mining workers associated with union	Surface Mining	Underground Mining	Both	NA
3. Mining Sub-sector (Kindly √ as appropriate)	☐ Exploration & prospecting ☐ Core Mining		☐ Mineral Processing & Beneficiation ☐ Associated services	
4. If Core Mining operation, please select one	☐ Metallic ☐ Non-metallic		☐ Fuel minerals ☐ Minor minerals & dimensional stones	
5. Type of Mining workers associated with union	Surface Mining	Underground Mining	Both	NA
6. Total years of work experience in mining sector		**7. Total years of overall work experience**		
8. % distribution of members based on gender	Males	Females		
9. % distribution of members based on domicile	Local (Within district)	Migrated from other districts of the state	Migrated from other states of India	

10. % distribution of members across levels by basic educational qualification	Education/ Training level	% distribution in union	Source of recruitment	Trainings provided by employer (Pls. tick if applicable)	
	Primary (1st to 5th Std.)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Upper Primary (6th to 8th Std.)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Secondary (9th / 10th Std.)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	

	Higher Secondary (11th / 12th)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Short term skill certification (<6 months)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Medium term skill certification (6 months - 1 yr.)			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Diploma – ITI or equivalent			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Advanced Diploma – Polytechnic or equivalent			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Bachelor's Degree			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Post Graduate Diploma			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Master Degree			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	
	Doctorate			Induction	On the Job
				Upskilling	Ext. Certification
				Others:	

D. INDUSTRY OVERVIEW

6. Details of existing Sub-Sector (2014) – Functional classification within the sub-sector

S	a. Major/ Core Functions within Mining Industry	b. Est. share of core function in total employment of firm/ industry (%)	c. Key Designations	d. Est. annual growth of employees in	
				(i) Last 5 yrs. (%)	(ii) Next 5 yrs. (%)
1	Trades and Production Occupations				
2	Professional Occupations				
3	Supervisors, Coordinators & Foremen				
4	Technical Occupations				
5	Peripheral Services (subsidiary activities to mining operations)				

S	a. Major/ Core Functions within Mining Industry	b. Est. share of core function in total employment of firm/ industry (%)	c. Key Designations	d. Est. annual growth of employees in	
				(i) Last 5 yrs. (%)	(ii) Next 5 yrs. (%)
6	**Support Services (Accounts, IT, HR etc.)**				

7. Key changes expected in the sector/ industry over next 5 years affecting the Industry and impacting skill requirements

a. Key Technological / structural changes expected over next 5 years	
b. New/ additional job roles and skills required as a result of the above	
c. Job roles likely to become redundant over next 5 yrs.	
d. Projected growth in any major functions over next 5 yrs. (est. %)	
e. Key skill development / trainings required for reskilling the workforce as a result of above	

E. SKILL DEVELOPMENT

8. Kindly provide your views on key issues/ challenges with respect to skilling of your existing members.

S	a. Major/ Core Functions within Mining Industry	b. Key issues/ challenges with respect to skilling
1	**Trades and Production Occupations**	
2	**Professional Occupations**	
3	**Supervisors, Coordinators & Foremen**	
4	**Technical Occupations**	
5	**Peripheral Services (subsidiary activities to mining operations)**	
6	**Support Services (Accounts, IT, HR etc.)**	

9. Are there any comments/ suggestions/ recommendation that you may like to share to improve the skill development system for following key stakeholders of mining sector in your state?

S#	Key Stakeholders	Comments
1.	State/ Centre Government	
2.	Industry/ Industry Association	
3.	Skill Council for Mining Sector/NSDC	

4.	Technical Training Institutes	
5.	Trainers	
6.	Any Others, Specify:	

Interview Information (Not to be filled by respondent)		
Date (dd/mm)		
Name of interviewer		
Mode	☐ In Person	☐ Over telephone
Deloitte's Rep. (if any)		
Remarks, if any		

Discussion Agenda – Government Ministries/ Departments

A. OUTPUTS OF THE STUDY

- *Ascertain the human resource and skill requirements for the mining sector*
- *Estimation of qualitative and quantitative skill gaps in mining sector*
- *Understand current skills training provision by various govt. & private training organizations in mining sector*

B. DETAILS OF THE RESPONDENT

Name		State	
Designation		Department	
Contact No.		Email ID	

C. INDUSTRY OVERVIEW

1. What are the **current policy initiatives** taken by the government to enable growth of mining of sector in the state? *(Details to be collected regarding the applicable schemes/ programs)*

	Current Scheme/ Program Details	Budget	Target Beneficiaries	Challenges/ Hindrances (if any)
Central Government *(if applicable)*				
State Government *(if applicable)*				
Others, Specify (private/ local institutions)				

2. Are there any **future schemes/ policies/ large scale investments** to be implemented that would have an impact on mining sector in the state?

	Future Scheme Details	Targeted Geography	Project Investments (in INR)	Nature of Employment Opportunities
Central Government *(if applicable)*				
State Government *(if applicable)*				
Others, Specify (private/ local institutions)				

3. Please provide information on the initiatives of the respective stakeholders (in the table below) in reference to **Industrial Training or Skill Development for mining sector or mining labour** in the state? (*Details to be collected regarding the applicable schemes/ programs)*

	Name of Departments/Agency	Name of scheme	Nature of Trainings (Sub-sectors, Trades and Implementing Agencies)	Major Achievements
Central Government *(if applicable)*				
State Government *(if applicable)*				
Others, Specify (private/ local institutions)				

D. DEMAND ESTIMATION

4. Please validate key minerals in your state and list key district/ mining cluster corresponding to it.

S#	Key Minerals	Kindly tick (√) relevant boxes	Key Districts/ Mining Clusters	Qualitative Skill Demand/ Shortage/ Issues
1.	Coal			
2.	Lignite			
3.	Iron Ore			
4.	Zinc			
5.	Lead			
6.	Bauxite			
7.	Chromite			
8.	Gold			
9.	Manganese			
10.	Phosphorite			
11.	Barytes			
12.	Dolomite			
13	Limestone			
14.	Minerals like building stones, clay, ordinary gravel, ordinary sand, limestone used for lime burning, boulders			
15.	Others, if any (Please see, reference document)			

5. What are the **top 3 key drivers** for competitive growth of mining sector in country/ state (as applicable) and why?

    1.
    2.
    3.

E. SUPPLY ESTIMATION

6. Please comments on the current supply infrastructure w.r.t. the following aspects in the context of mining sector.

Parameters	Key Strengths	Key Challenges	Opportunities
a. **Availability of employable workforce**			
b. **Availability of Training Institutes** *(Specific to Mining Sector)*			
c. **Transportation network (roads, railways, airways, ports)**			
d. **Availability of utilities including power, water etc.**			
e. **Use of technology**			
f. **Central/ State Govt. policies/ initiatives to promote Industry/ Entrepreneurship**			
g. **Availability of capital/ funding**			
h. **Others (Pls. specify)**			

F. DATA AND SUGGESTIONS

7. Are there any other comments/ suggestions/ recommendation that you may like to share to improve the skill development system for following key stakeholders of mining sector in your state?

S#	Key Stakeholders	Comments
1.	State/ Centre Government	
2.	Industry/ Industry Association	
3.	Skill Council for Mining Sector/NSDC	
4.	Technical Training Institutes	
5.	Any Others, Specify:	

8. Please share district level data related to employment, Mining Cluster and sub-sectors & Mineral Industries.
9. Please share last two annual report and any other related report/ data compilations done by the department.
10. Are you aware of any **reports or studies** (conducted by any party) related to the Skill Development for Mining Sector in the state? Please provide the details/ copy of the same.

H. INTERVIEWER'S INFORMATION

Interview Information (Not to be filled by respondent)		
Date (dd/mm)		
Name of interviewer		
Mode	□ In Person	□ Over telephone
Deloitte's Rep. (if any)		
Remarks, if any		

Discussion Agenda - Students

A. OUTPUTS OF THE STUDY

- *Ascertain the human resource and skill requirements for the mining sector*
- *Estimation of qualitative and quantitative skill gaps in mining sector*
- *Understand current skills training provision by various govt. & private training organizations in mining sector*

B. RESPONDENT INFORMATION

Name (optional)				
Age (yrs.)		Gender	☐ Male	☐ Female
Name of Institute				
State				
Mining Course Name		Duration of course		
Sector / Sub-sector				
Mobile/ Email-Id (optional)				

C. STUDENT/ TRAINEE FEEDBACK SECTION

1. Prior to attending the training programme at this institute, you were (Please tick one and enter details)

☐ Student	☐ Working in mining sector	☐ Working in other sectors	☐ None

2. What was your level of education before attending this mining course? (please tick one)

☐ Doctorate / PhD ☐ Master's / Post graduate Degree ☐ Post Graduate Diploma ☐ Bachelor's / Graduate Degree ☐ Advanced Diploma – Polytechnic or equivalent	☐ Diploma - ITI or equivalent ☐ Medium term skill certification (6 months – 1 year) ☐ Short term skill certification (< 6 months)	☐ Higher Secondary (11th / 12th) ☐ Secondary (9th / 10th Std) ☐ Upper Primary (6th to 8th Std) ☐ Primary (1st to 5th Std) ☐ Never gone to school ☐ None of the above

3. Kindly provide your responses and remarks on Training aspects, Infrastructure and Resources at your centre (Quality Rating is as follows 1 - poor, 2 – Fair, 3 - Good)

Dimension	Response (Yes / No)		If Yes, kindly rate its quality (1-good, 2-satisfactory, 3-poor)			Suggestion/ Remarks (If Any)
a) **Does the training course have an in house practical training component?**	Y	N	1	2	3	
b) **Does the training course have adequate laboratory / equipment available, as required by you?**	Y	N	1	2	3	
c) **Does the institute have the latest technology & equipment required for training?**	Y	N	1	2	3	
d) **Does the training programme have on-the-job training / internship component with industry as part of the course?**	Y	N	1	2	3	

e) **Are you aware if your course has been certified by any regulatory body (AICTE, skill council etc.)?**	Y	N		

5. Readiness/ Willingness to migrate (tick one)

☐ High	☐ Medium	☐ Low

6. Sector(s) of choice (Pls. tick relevant choices)

☐ Exploration & prospecting	☐ Core mining	☐ Processing & beneficiation	☐ Associated services

7. Segment of choice (Pls. tick appropriate options)

☐ Blasting ☐ Drilling & Cutting ☐ Electrical Services ☐ Equipment Maintenance ☐ Exploration Drilling ☐ Geological Investigations ☐ Geophysical exploration ☐ Mechanical Services	☐ Instrumentation maintenance ☐ Loading & Hauling ☐ Mine Surveying ☐ Modelling & Acquisitions ☐ Ore Processing ☐ Research and Development ☐ Health, Safety and Environment Functions ☐ Specialist Operations Services

8. Please mention any particular skill(s) you wish to learn apart from what is being taught in the course, that you believe will help you get a job of your choice?

☐ Interpersonal Skills ☐ English Language ☐ Basic IT/ Computer skills	☐ Teamwork ☐ Problem Solving / Analytical ☐ Time Management	☐ Self-Management ☐ Core Technical Skills ☐ Others (please specify)

9. Please provide rating and suggestions, if any, for the improvement of the following (Scale of 1-3, where
1 – Poor, 2 – Fair, 3 – Good)

Dimension	Rating (scale of 1-3)			Suggestions, if any
a) Course (Interesting, relevant etc.)	1	2	3	
b) Faculty at Training Institute	1	2	3	
c) Infrastructure at training institute	1	2	3	

10. Kindly provide your views on the key current supply aspects for mining sector in the state. Kindly tick (√) relevant boxes

Parameters	Challenges/ Issues
Training Infrastructure facilities	
Faculty/ Human resources	
Industry participation • **Guest lectures** • **On-The-Job/ Internship** • **Placement in companies**	
Certification – awareness, reach, acceptance and cost	
Placement of students	
Others (please specify)	

11. Are there any other comments/ suggestions/ recommendation that you may like to share to improve the skill development system for following key stakeholders of mining sector in your state?

S#	Key Stakeholders	Comments
1.	State/ Centre Government	
2.	Industry/ Industry Association	
3.	Skill Council for Mining Sector/NSDC	
4.	Technical Training Institutes	
5.	Any Others, Specify:	

D. INTERVIEWER'S INFORMATION

Interview Information (Not to be filled by respondent)		
Date (dd/mm)		
Name of interviewer		
Mode	□ In Person	□ Over telephone
Deloitte's Rep. (if any)		
Remarks, if any		

Discussion Agenda for Faculty/ Staff of Training Institutions

A. OUTPUTS OF THE STUDY

- *Ascertain the human resource and skill requirements for the mining sector*
- *Estimation of qualitative and quantitative skill gaps in mining sector*
- *Understand current skills training provision by various govt. & private training organizations in mining sector*

B. RESPONDENT'S PROFILE

1. Name of respondent		**2. State**	
3. Designation		**4. Name and address of the Institute**	
5. Contact No.		**6. Email ID**	

C. INSTITUTE'S PROFILE

7. Type of Training Institute *(Tick √ as applicable)*	VTP (MES)	ITI	Private Training Agencies/ SSC Partners	Polytechnic	College	Others:
8. Year of establishment		**9. Affiliation with/ to**	AICTE	NCVT	NSDC/ SSC	Others:
10. Training Level(s) offered *(Tick √ more than one if applicable)*	Never gone to school	Primary (1st to 5th Std)	Upper Primary (6th to 8th Std)	None		
	Secondary (9th / 10th Std)	Higher Secondary (11th / 12th)	Short term skill certification (<6 months)	Medium term skill certification (6 months - 1 year)	Diploma – ITI or equivalent	
	Advanced Diploma – Polytechnic or equivalent	Bachelor's Degree	Post Graduate Diploma	Master Degree	Doctorate	

11. Number of students in all Mining courses currently offered by institution

Trades/ Courses relevant to Mining	Course affiliation (if applicable)	Intake Capacity	Course Duration	Fees

12. Placement details

Year	2014-15	2013-14	2012-13
Number of companies			
Number of students placed (%)	<20	20-40	40-60	>60
Average Salary (in INR)			

13. Placement details (top three companies in terms

Company Name	Contact Person	Contact Details
1.		
2.		

	of number of students placed)	3.				
14.	**Placement details – location %**	Within state		Outside state		Not Placed	

F. SUPPLY ESTIMATION

15. With reference to the courses being taught at your institute, what are the **core technical skills and employability (soft) skills** that are critical from the employability viewpoint?

Course/s	Core Technical Skills pertaining to Occupation		Employability Skills
☐ Mining Engineering ☐ Mining & Surveying ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Others (please specify)	☐ Blasting ☐ Drilling & Cutting ☐ Electrical Services ☐ Equipment Maintenance ☐ Exploration Drilling ☐ Geological Investigations ☐ Geophysical exploration ☐ Mechanical Services	☐ Instrumentation maintenance ☐ Loading & Hauling ☐ Mine Surveying ☐ Modelling & Acquisitions ☐ Ore Processing ☐ Research and Development ☐ Health, Safety and Environment Functions ☐ Specialist Operations Services	☐ Interpersonal Skills ☐ English Language ☐ Basic IT/ Computer skills ☐ Teamwork ☐ Problem Solving / Analytical ☐ Time Management ☐ Self-Management ☐ Others (please specify)

16. Kindly provide your views on the **key current supply aspects** for mining sector in the state.

S #	Parameters	Challenges/ Issues/ Any Comments
1.	**Skilling ecosystem – State govt. depts./ State Skill Development Mission**	
2.	**Skilling ecosystem – Skill Council for Mining Sector (SCMS)**	
3.	**Training Infrastructure facilities**	
4.	**Faculty/ Human resources**	
5.	**Industry participation** • **Guest lectures** • **On-The-Job/ Internship** • **Placement**	
6.	**Certification – awareness, reach, acceptance and cost**	
7.	**Placement of students**	
8.	**Access to funds for institutional growth**	
9.	**Others (please specify)**	

17. What are the nature of capacity building/ training requirements for **trainers/ faculty** of your

institute?

S#	Areas of Improvements	Role should be undertaken by (Kindly tick (√) appropriate stakeholder)			Explain key steps expected to be taken by respective stakeholder
1.	Instructional Development	Govt.	Industry/ Industry Association	NSDC /SCM S	
2.	Organizational Development	Govt.	Industry/ Industry Association	NSDC /SCM S	
3.	Change Management	Govt.	Industry/ Industry Association	NSDC /SCM S	
4.	Technology Adoption	Govt.	Industry/ Industry Association	NSDC /SCM S	

G. DATA AND SUGGESTIONS

18. Are there any other comments/ suggestions/ recommendation that you may like to share to improve the skill development system for following key stakeholders of mining sector in your state?

S#	Key Stakeholders	Comments
1.	State/ Centre Government	
2.	Industry/ Industry Association	
3.	Skill Council for Mining Sector/NSDC	
4.	Technical Training Institutes	
5.	Any Others, Specify:	

19. Please share your institute's brochure/ profile consisting intake capacity and course streams.
20. Please fill **Annexure - Course Curriculum mapping to Job Roles**.

H. INTERVIEWER'S INFORMATION

Interview Information (Not to be filled by respondent)		
Date (dd/mm)		
Name of interviewer		
Mode	□ In Person	□ Over telephone
Deloitte's Rep. (if any)		
Remarks, if any		

Annexure – Mining Course Curriculum mapping to Job Roles

Instructions:

1. Write down the **mining course**(s) name offered by Institutions
2. Please refer respective Job Roles based on Type of Institute as given in '2. Type of Training Institute'
3. Encircle the appropriate Course Number in the below table: Job Roles to which trainees get employed/ placed after attending respective courses as mentioned in '1. Name of **Mining Course(s)** offered by Institution.'

1. Name of Mining Course (s) Offered by Institution		a.	b.	c.
		d.	e.	f.
2. Type of Training Institute	**VTP/ ITI**	Refer Job Roles from S# 1-36 & S#60-65	**Polytechnic**	Refer Job Roles from S# 37-52
	College/ University	Refer Job Roles from S# 37-59 & S#66-68	**Private Training Agencies/ SSC Partners**	Refer Job Roles from S# 1-36 & S#60-65

3. S. No.	4. Job role	5. Job Roles to which trainees get employed/ placed from respective Course Number (Encircle as applicable)						6. Function	7. NSQF Level
1	Mazdoor/ Helper	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	1
2	Explosives Handler	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	3
3	Timberman	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	3
4	Sampler	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	3
5	Sprinkler and Other Vehicle Driver	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
6	Banksman	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
7	Rig Mounted Drill Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
8	Explosive Van operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
9	Grader Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
10	SDL & LHD Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
11	Strata Monitoring Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
12	Track Layer Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
13	Haulage Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
14	Longwall Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4

3. S. No.	4. Job role	5. Job Roles to which trainees get employed/ placed from respective Course Number (Encircle as applicable)						6. Function	7. NSQF Level
15	Mining Shot Firer/ Blaster	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
16	Roof Bolter	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
17	Ventilation Adequacy Checker/ Fan Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
18	Winding Engine Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
19	Wire saw Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
20	Welder	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
21	Bulldozer Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
22	Dumper/ Tipper Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
23	Excavator Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
24	Loader Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
25	Machinist Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
26	Assistant Mine Surveyor	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
27	Jumbo Drill Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
28	Ore Processing Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
29	Mine Electrician	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
30	Compressor Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
31	Dewatering Pump Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
32	Reclamation Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
33	Road Header Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
34	Haul Truck Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
35	Surface Miner	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4

3. S. No.	4. Job role	5. Job Roles to which trainees get employed/ placed from respective Course Number (Encircle as applicable)						6. Function	7. NSQF Level
36	Mobile Conveyor Belt Operator	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	4
37	Reclamation Supervisor	a.	b.	c.	d.	e.	f.	Trades & Production Occupations	5
38	Fireman	a.	b.	c.	d.	e.	f.	Technical Occupation	4
39	Safety Operator	a.	b.	c.	d.	e.	f.	Technical Occupation	4
40	Gas Detector	a.	b.	c.	d.	e.	f.	Technical Occupation	4
41	Inspectors and testers, mineral processing	a.	b.	c.	d.	e.	f.	Technical Occupation	4
42	Land Survey Technologists	a.	b.	c.	d.	e.	f.	Technical Occupation	5
43	Geophysicist	a.	b.	c.	d.	e.	f.	Technical Occupation	6
44	Emergency Response and Rescue Specialist	a.	b.	c.	d.	e.	f.	Technical Occupation	7
45	Mining Mate	a.	b.	c.	d.	e.	f.	Supervisors, Coordinators, and Foremen	5
46	Supervisors, mining and quarrying	a.	b.	c.	d.	e.	f.	Supervisors, Coordinators, and Foremen	5
47	Supervisor - Plant Operations	a.	b.	c.	d.	e.	f.	Supervisors, Coordinators, and Foremen	6
48	Safety Specialist/ Workman Inspector	a.	b.	c.	d.	e.	f.	Supervisors, Coordinators, and Foremen	6
49	Material Engineers	a.	b.	c.	d.	e.	f.	Professional Occupation	5
50	Mining Engineers	a.	b.	c.	d.	e.	f.	Professional Occupation	5
51	Mineral Processing Engineer	a.	b.	c.	d.	e.	f.	Professional Occupation	5
52	Environment Engineer	a.	b.	c.	d.	e.	f.	Professional Occupation	5
53	Mining Geologist	a.	b.	c.	d.	e.	f.	Professional Occupation	5
54	Occupation Health Specialist	a.	b.	c.	d.	e.	f.	Professional Occupation	7
55	Mining Economists	a.	b.	c.	d.	e.	f.	Professional Occupation	7
56	Remote Sensing Specialist	a.	b.	c.	d.	e.	f.	Professional Occupation	7

3. S. No.	4. Job role	5. Job Roles to which trainees get employed/ placed from respective Course Number (Encircle as applicable)						6. Function	7. NSQF Level
57	Mechanic/ Fitter	a.	b.	c.	d.	e.	f.	Peripheral Services	3
58	Data Processing Technician	a.	b.	c.	d.	e.	f.	Peripheral Services	4
59	Operator Instrumentation/ Mechatronics	a.	b.	c.	d.	e.	f.	Peripheral Services	4
60	HEMM Maintenance Operators	a.	b.	c.	d.	e.	f.	Peripheral Services	4
61	Instrument Technician	a.	b.	c.	d.	e.	f.	Peripheral Services	4
62	Mechanical Engineers	a.	b.	c.	d.	e.	f.	Peripheral Services	5
63	Electrical and Electronics Engineers	a.	b.	c.	d.	e.	f.	Peripheral Services	5
64	GIS Operator	a.	b.	c.	d.	e.	f.	Peripheral Services	5
65	Chemists	a.	b.	c.	d.	e.	f.	Peripheral Services	6

Annexure 03 - Exploration activities undertaken by organization in 2012-13

Organization	Mineral	Quantity	Location
Geological Survey of India	Coal	3,172 million tonnes	Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Odisha and Maharashtra
	Limestone	389 million tonnes	Meghalaya
	Lignite	484 million tonnes	Rajasthan, Tamil Nadu and West Bengal
	Rock Phosphate	36,500 million tonnes	Madhya Pradesh
Mineral Exploration Corporation of India	Coal	1,132 million tonnes	Chhattisgarh, Jharkhand and Maharashtra
	Lignite	768.5 million tonnes	Rajasthan
	Limestone	274 million tonnes	Meghalaya
	Lead & Zinc	9.4 million tonnes	Rajasthan
	Dolomite	561 million tonnes	Arunachal Pradesh
	Manganese ore	56.5 million tonnes	Odisha
Directorate of Geology & Mining, Chhattisgarh	Coal	12.6 million tonnes	Surguja
	Bauxite	2.2 lakh tonnes	Kabirdham
	Bauxite (Metal grade)	5 lakh tonnes	Surguja
	Iron ore	10 lakh tonnes	Kondagaon, Raipur, Bastar and Sukma
	Limestone	71.2 million tonnes	Raipur, Bastar, Sukma
	Black Granite	32 lakh cubic meters	Bastar, Kanker and Dantewada
	Dolomite	30 million tonnes	Janjgir – Champa
Directorate of Geology & Mining, Rajasthan	Limestone	101.8 million tonnes	Nagaur
Directorate of Geology & Mining, Uttar Pradesh	Platinum	0.01 million tonnes	Lalitpur
	Asbestos	0.3 million tonnes	Jhansi
Directorate of Geology & Mining, Kerala	Sandy Clay	1.2 million tonnes	Kollam
Gujarat Mineral Development Corporation (GMDC)	Lignite	119.9 million tonnes	Bhavnagar, Kutch
Hutti Gold Mines Ltd. (HGML)	Gold ore	17.8 million tonnes	Raichur
Singareni Collieries Company Ltd (SCCL)	Coal	45.4 million tonnes	Godavari valley
National Mineral Development Corporation (NMDC)	Iron Ore	1.2 million tonnes	Bellary
Source: Indian Mineral year Book 2013, Vol-I			

Annexure 04 - Sector and Sub-Sectors – according to NIC 2008 classification

Division 05 : Mining of coal and lignite	
0510 Mining of hard coal	05101 Opencast mining of hard coal 05102 Belowground mining of hard coal 05103 Cleaning, sizing, grading, pulverizing, compressing etc. of coal 05109 Other operations relating to mining and agglomeration of hard coal
0520 Mining of lignite	05201 Opencast mining of lignite (brown coal) 05202 Belowground mining of lignite (brown coal) 05203 Washing, dehydrating, pulverizing, compressing of lignite 05209 Other operations relating to mining and agglomeration of lignite
Division 07: Mining of metal ores	
0710 Mining of Iron ores	071000 Mining of Iron ores
0720 Mining of non-ferrous metal ores	07291 Mining of copper ore 07292 Mining of aluminium ore (bauxite) 07293 Mining of manganese ore 07294 Mining of chromium ore 07295 Mining of precious metal ore (gold, silver) 07296 Mining of lead and zinc ore 07299 Mining of other non-ferrous metal ores, n.e.c. [titanium (ilmenite and rutile) ,niobium, tantalum, vanadium or zirconium ores; tin bearing ores; and, nickel, cobalt, tungsten, molybdenum, antimony and other non-ferrous metal ores]
Division 08: Other Mining and quarrying	
0810 Quarrying of stone, sand and clay	08101 Quarrying of marble 08102 Quarrying of granite 08103 Quarrying of slate and building and monumental stone other than marble and granite 08104 Mining of dolomite 08105 Mining of gypsum including selenite 08106 Operation of sand or gravel pits, basalt / porphyry, clay (ordinary), crushing and breaking of stone for use as a flux or raw material in lime or cement, manufacture or as building material, road metal or ballast and other materials for construction 08107 Mining/quarrying of limestone, lime shell, 'kankar' and other calcareous minerals including calcite, chalk and shale 08108 Mining of clays (kaolin, ball clay, wollastonite, bentonite, fuller's earth, fire clay etc.) 08109 Mining of refractory non-clay minerals (andalusite, Kyanite, Sillimanite, dunite, diaspore magnesite, diaspore, magnesite)
0891 Mining of chemical and fertilizer minerals	08911 Mining of native sulphur or pyrites and pyrrhotites valued chiefly for sulphur 08912 Mining of natural phosphates including apatite minerals 08913 Mining of earth colors (ochre including red oxide). 08914 Mining of fluorspar

	08915 Mining of Barytes 08919 Mining of potash bearing salts/minerals; borate minerals and other fertiliser and chemical minerals n.e.c.
0892 Extraction and agglomeration of peat	This class excludes: - service activities incidental to peat mining - manufacture of articles of peat
0893 Extraction of salt	08931 Salt mining, quarrying, screening etc. 08932 Salt production by evaporation of sea water or other saline waters
0899 Other mining and quarrying n.e.c.	08991 Mining of gemstones (agate, diamond, emerald, garnet (gem), jasper, ruby/ sapphire etc. 08992 Mining and quarrying of abrasive materials (pumice stone, emery, corundum, garnet and other natural abrasives) 08993 Mining of mica 08994 Mining of natural graphite 08995 Mining of asbestos 08996 Mining of vermiculite, perlite and chlorites 08997 Mining of feldspar and silica minerals including quartz, quartzite and fuch, Quartzite 08998 Mining of talc/ steatite 08999 Mining of laterite, diatomite and silicious fossil meals (e.g. diatomite); and other natural fluxes; natural asphalt or bitumen and other mining n.e.c.
099 Support activities for other mining and quarrying	
0990 Support activities for other mining and quarrying	This class includes support services on a fee or contract basis, required for mining activities of divisions 05, 07 and 08 (exploration services, e.g. traditional prospecting methods, such as taking core samples and making geological observations at prospective sites, draining and pumping services, on a fee or contract basis, test drilling and test hole boring)
Source: National Industry Classification 2008, Central Statistical Organisation, Ministry of Statistics and Programme Implementation, GoI	

Annexure 05 - Distribution of ITI's across states & Union Territories of India

#	State	Total ITI's	Govt. ITI's	Pvt. ITI's	Trades Offered	Seats Count	Student Count	Capacity Utilization
1	Andaman & Nicobar Islands	2	2	0	Electrician, Fitter, Information Communication Technology, Surveyor, Welder, Mechanic (Motor Vehicle)	251	215	86%
2	Andhra Pradesh	456	58	398	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Welder, Mechanic (Motor Vehicle)	91,369	76,238	83%
3	Arunachal Pradesh	4	3	1	Electrician, Fitter, Information Communication Technology, Surveyor, Welder, Mechanic (Motor Vehicle)	429	264	62%
4	Assam	27	22	5	Driver Cum Mechanic, Electrician, Fitter, Machinist, Welder, Surveyor, Mechanic (Motor Vehicle), Mechanic (Tractor), Pump Operator	3,589	2,547	71%
5	Bihar	859	21	838	Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Surveyor, Welder	159529	132244	83%
6	Chandigarh	2	2	0	Driver Cum Mechanic, Electrician, Fitter, HR Executive, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Welder	341	319	94%
7	Chhattisgarh	147	66	81	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Safety Operator, Surveyor, Welder	16576	12279	74%
8	Dadra & Nagar Haveli	1	1	0	Electrician, Fitter, Mechanic (Motor Vehicle), Welder	147	135	92%

#	State	Total ITI's	Govt. ITI's	Pvt. ITI's	Trades Offered	Seats Count	Student Count	Capacity Utilization
9	Daman & Diu	2	2	0	Electrician, Fitter, Welder	231	197	85%
10	Delhi	26	12	14	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Surveyor, Welder	5,090	3,560	70%
11	Goa	14	10	4	Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Welder	1942	1101	57%
12	Gujarat	274	143	131	Driver Cum Mechanic, Electrician, Fireman, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Safety Operator, Surveyor, Welder	41,029	34,840	85%
13	Haryana	222	65	157	Driver Cum Mechanic, Electrician, Fitter, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Safety Operator, Surveyor, Welder	35347	22376	63%
14	Himachal Pradesh	178	62	116	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Pump Operator, Surveyor, Welder	20,078	15,091	75%
15	Jammu & Kashmir	32	32	0	Electrician, Fitter, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Welder	1707	1247	73%
16	Jharkhand	212	13	199	Electrician, Fitter, Information Communication Technology, Machinist, Mechanic	60,422	48,411	80%

#	State	Total ITI's	Govt. ITI's	Pvt. ITI's	Trades Offered	Seats Count	Student Count	Capacity Utilization
					(Motor Vehicle), Surveyor, Welder			
17	Karnataka	1345	129	1216	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Surveyor, Welder	124256	99069	80%
18	Kerala	274	42	232	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Surveyor, Welder (DA), Welder	29,310	19,071	65%
19	Madhya Pradesh	744	97	647	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Safety Operator, Surveyor, Welder	111184	76428	69%
20	Maharashtra	842	408	434	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Mechatronics), Mechanic (Motor Vehicle), Mechanic (Tractor), Operator Advanced Machine Tools, Pump Operator, Safety Operator, Surveyor, Welder (GMAW & GTAW), Welder	154,731	98,262	64%
21	Manipur	1	1	0	Electrician, Fitter, Machinist, Mechanic (Motor Vehicle), Surveyor, Welder	126	56	44%

#	State	Total ITI's	Govt. ITI's	Pvt. ITI's	Trades Offered	Seats Count	Student Count	Capacity Utilization
22	Meghalaya	5	4	1	Driver Cum Mechanic, Electrician, Fitter, Machinist, Mechanic (Motor Vehicle), Surveyor, Welder	483	318	66%
23	Mizoram	3	3	0	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Mechanic (Motor Vehicle), Surveyor, Welder	356	172	48%
24	Nagaland	1	1	0	Electrician, Fitter, Machinist, Mechanic (Motor Vehicle), Surveyor, Welder	168	97	58%
25	Odisha	568	31	537	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Mechatronics), Mechanic (Motor Vehicle), Mechanic (Tractor), Pump Operator, Surveyor, Welder	135193	85103	63%
26	Puducherry	11	6	5	Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Welder	1,034	687	66%
27	Punjab	262	59	203	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Pump Operator, Surveyor, Welder	34113	26438	78%
28	Rajasthan	1707	118	1589	Driver Cum Mechanic, Electrician, Fireman, Fitter, HR Executive, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Safety Operator, Surveyor, Welder	248,860	199,911	80%

#	State	Total ITI's	Govt. ITI's	Pvt. ITI's	Trades Offered	Seats Count	Student Count	Capacity Utilization
29	Sikkim	3	3	0	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Mechanic (Motor Vehicle), Surveyor, Welder	262	148	56%
30	Tamil Nadu	552	55	497	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Mechatronics), Mechanic (Motor Vehicle), Mechanic (Tractor), Pump Operator, Surveyor, Welder	74,414	45,941	62%
31	Telangana	259	44	215	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Welder	48255	43552	90%
32	Tripura	13	12	1	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Mechanic (Motor Vehicle), Pump Operator, Surveyor, Welder	964	601	62%
33	Uttar Pradesh	1843	91	1752	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Pump Operator, Safety Operator, Surveyor, Welder	310922	263988	85%
34	Uttarakhand	91	36	55	Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Mechanic (Tractor), Surveyor, Welder	12,656	9,635	76%

#	State	Total ITI's	Govt. ITI's	Pvt. ITI's	Trades Offered	Seats Count	Student Count	Capacity Utilization
35	West Bengal	126	45	81	Driver Cum Mechanic, Electrician, Fitter, Information Communication Technology, Machinist, Mechanic (Motor Vehicle), Surveyor, Welder	23558	16319	69%

Annexure 06 - Distribution of AICTE approved institutes offering Primary & Auxiliary Courses, 2015-16

State	Total no. of Institutes offering Primary courses for Mining Sector	Approved Intake Capacity across Primary courses for Mining Sector, 2015-16	Total no. of Institutes offering Auxiliary courses for Mining Sector	Approved Intake Capacity across Auxiliary courses for Mining Sector, 2015-16
Andaman & Nicobar Islands	-	-	1	330
Andhra Pradesh	22	1,282	495	2,88,288
Arunachal Pradesh	-	-	2	340
Assam	-	-	33	6,960
Bihar	-	-	71	21,805
Chandigarh	1	78	12	2,660
Chhattisgarh	16	991	103	33,278
Dadra & Nagar Haveli	-	-	1	330
Daman and Diu	-	-	2	540
Delhi	2	56	39	13,551
Goa	2	100	13	3,878
Gujarat	12	1,045	269	1,35,581
Haryana	2	90	341	1,41,092
Himachal Pradesh	-	-	62	20,054
Jammu & Kashmir	-	-	44	8,568
Jharkhand	10	698	46	15,019
Karnataka	20	1,240	489	1,96,934
Kerala	13	354	236	86,407
Madhya Pradesh	10	702	339	1,43,743
Maharashtra	21	1,245	884	3,48,394
Manipur	-	-	1	115
Meghalaya	-	-	3	710
Mizoram	-	-	2	140
Nagaland	-	-	2	300
Odisha	29	2,472	216	92,458
Puducherry	-	-	33	12,339
Rajasthan	8	728	349	1,25,959
Sikkim	-	-	4	1,194
Tamil Nadu	4	272	1,089	4,92,447
Telangana	61	7,241	445	2,61,541
Uttar Pradesh	3	96	641	2,78,130
Uttarakhand	-	-	109	30,994
West Bengal	9	566	216	71,734
Total	**245**	**19,256**	**41,186**	**28,35,813**

Annexure 07 - Incremental Human Resource demand by Geography (in '00), 2014–2022

State	Employment 2014-22	%Share
Jharkhand	331	12.70%
Rajasthan	236	9.10%
Chhattisgarh	232	8.90%
Madhya Pradesh	228	8.80%
Odisha	228	8.80%
Andhra Pradesh*	221	8.50%
West Bengal	221	8.50%
Karnataka	137	5.30%
Tamil Nadu	136	5.20%
Gujarat	131	5.10%
Maharashtra	96	3.70%
Goa	36	1.40%
Others	366	14.10%
TOTAL	**2,599**	**100%**

Source: NSSO Report 68th round, NIC-2008, Directorate General of Mines and Safety (DGMS), Indian Bureau of Mines, Expert Interviews and Deloitte Analysis

Annexure 08 - Incremental Human Resource demand by Job Roles (in '00), 2014–2022

Job Role	Employment 2013-14	2014-22	%Share
Prospecting & Exploration			
Driller	48	10-11	15.30%
Sampler	35	7-8	10.90%
Data Processing Technician	19	5-6	7.90%
GIS Operator	5	3-4	5.00%
Geologist	18	3-4	4.90%
Geophysics Survey operator	2	1-2	2.40%
Drilling Engineer	7	1-2	2.20%
Mining Economist	3	1-2	0.80%
Geophysicist	2	1-2	0.60%
Remote Sensing Specialist	2	1-2	0.50%
Skilled Helper - Prospecting & Exploration	44	9-10	14.0%
Mazdoor/ Helper - Prospecting & Exploration	134	24-25	35.6%
Mineral Extraction			
Mining Supervisor	992	173-174	8.55%
Mining Mate	937	127-128	6.31%
Supervisor - Plant operations	313	113-114	5.63%
Dumper	1,210	82-83	4.07%
Explosives Handler	944	73-74	3.64%
Mining Engineer	642	59-60	2.95%
SDL & LHD Operator	808	55-56	2.72%
Shot Firer/ Blaster	529	49-50	2.43%
Excavator	519	48-49	2.39%
Loader	520	48-49	2.39%
Haulage operator	556	41-42	2.06%
Sprinkler & vehicles driver	438	40-41	2.01%
Mine Ventilation Supervisor	623	37-38	1.87%
Track Layer operator	371	34-35	1.71%
Timberman	587	34-35	1.70%
Mobile Conveyor belt operator	347	32-33	1.59%
Roof/ Cable bolters	332	30-31	1.53%
Bulldozer	328	30-31	1.51%
Jack Hammer Operator	282	26-27	1.30%
Haul Truck operator	266	24-25	1.22%
Rig Mounted Drill Operator	257	23-24	1.18%
Explosive Van operator	226	21-22	1.04%
Jumbo Drill Operator	223	20-21	1.02%
Scaler Operator	214	19-20	0.98%
Grader	182	16-17	0.84%
Banksman	170	15-16	0.78%
Mine Surveyor	161	14-15	0.74%
Wire Saw Operator	162	15-16	0.74%
Surface Miner	147	13-14	0.67%
Strata Monitoring Operator	134	12-13	0.61%
Road Header Operator	124	11-12	0.57%
Material Engineer	60	9-10	0.46%
Reclamation Supervisor	100	9-10	0.46%
Land Survey Technologist	98	9-10	0.45%

Job Role	Employment 2013-14	2014-22	%Share
Gas Detector	92	8-9	0.42%
Winding Engine Operator	59	5-6	0.27%
Ventilation Adequacy Checker	53	4-5	0.24%
Geotechnical Engineer	40	3-4	0.18%
Stacker & Reclamation Operator	25	2-3	0.11%
Long Wall operator	17	2-3	0.08%
Bucket Wheel Excavator	14	2-3	0.06%
Skilled Helper - Mineral Extraction	1,230	114-115	5.66%
Mazdoor/ Helper - Mineral Extraction	5,944	502-503	24.86%
Associated Services			
Technicians – Electrical	323	47-48	10.09%
Dewatering pump Operators	166	46-47	9.96%
Mechanical Engineer	213	46-47	9.93%
Mine Electrician	203	44-45	9.45%
Mechanic/ Fitter	173	38-39	8.07%
Electrical Engineer	171	37-38	7.98%
HEMM Maintenance Operator	113	24-25	5.24%
Firemen	34	14-15	2.98%
Machinist Operator	54	11-12	2.51%
Safety Operator	48	10-11	2.20%
Welder	81	9-10	1.95%
Compressor Operator	51	6-7	1.47%
Emergency Response & Rescue Specialist	31	6-7	1.43%
Safety Specialist	31	4-5	1.04%
Occupation Health Specialist	22	4-5	1.02%
Environmental Engineer	25	4-5	0.96%
Skilled Helper - Associated Services	98	35-36	7.55%
Mazdoor/ Helper - Associated Services	310	76-77	16.16%
Mineral Processing and Beneficiation			
Ore Processing Operator	26	6-7	19.70%
Instrumentation Technician	13	2-3	7.76%
Mineral Processing Engineer	12	2-3	7.30%
Supervisor Plant Operations	9	1-2	5.58%
Operator Instrumentation/ Mechatronics In-charge	8	1-2	4.99%
Chemists	10	1-2	1.93%
Inspector/ Tester – Mineral Processing	7	1-2	1.75%
Electronics & Instrumentation Engineer	3	1-2	1.37%
Skilled Helper - Mineral Processing & Beneficiation	15	4-5	12.08%
Mazdoor/Helper - Mineral Processing & Beneficiation	59	12-13	37.54%

Source: NSSO Report 68th round, NIC-2008, CSO, Directorate General of Mines and Safety (DGMS), Indian Bureau of Mines, Expert Interviews and Deloitte Analysis

Annexure 09 – Definitions of Functional Classifications

S. No.	Functions	Definitions	Example of Few Job Roles
1	Professional Occupation	Occupations that typically involve the performance of tasks that require complex problem-solving, decision-making and creativity based on an extensive body of theoretical and factual knowledge in a specialized field. The tasks performed typically include analysis and research to extend the body of human knowledge in a particular field, diagnosis and treatment of disease, imparting knowledge to others, and design of structures or machinery and of processes for construction and production. Occupations at this skill level generally require extended levels of literacy and numeracy, sometimes at a very high level, and excellent interpersonal communication skills. These skills usually include the ability to understand complex written material and communicate complex ideas in media such as books, images, performances, reports and oral presentations. The knowledge and skills required for competent performance in occupations at this level are usually obtained as the result of study at a higher educational institution (Engineering and above) for a period of 3-6 years leading to the award of a first degree or higher qualification. In some cases extensive experience and on-the-job training may substitute for the formal education, or may be required in addition to formal education. In many cases appropriate formal qualifications are an essential requirement for entry to the occupation.	- Metallurgical and Materials Engineers - Mining Engineers - General Manager/ CEO/ Managerial Positions - Environment Engineer - Geological Engineers
2	Technical Occupation	Occupations that typically involve the performance of complex technical and practical tasks that require an extensive body of factual, technical and procedural knowledge in a specialized field. Examples of specific tasks performed include: ensuring compliance with health, safety and related regulations; preparing detailed estimates of quantities and costs of materials and labour required for specific projects; coordinating, supervising, controlling and scheduling the activities of other workers; and performing technical functions in support of professionals. Occupations at this skill level generally require a high level of literacy and numeracy and well-developed interpersonal communication skills. These skills may include the ability to understand complex written material, prepare factual reports and communicate verbally in difficult circumstances. The knowledge and skills required for competent performance in occupations this level are usually obtained as the result of study at a higher educational institution (like Polytechnic) for a period of 1-3 years following completion of secondary education. In some cases extensive relevant work experience and	- Gas Detector - Inspectors and testers, mineral and metal processing - Emergency Response and Rescue Officer - Technical occupations in geomatics and meteorology - Drafting technologists and technicians

S. No.	Functions	Definitions	Example of Few Job Roles
		prolonged on-the-job training may substitute for the formal education.	
3	Supervisors, Coordinators, and Foremen	Occupations that typically involve the supervision of unit groups performing same/similar task to support, guide and assist the workers to perform their duties in right manner. Occupations at the ability to ensure information such as safety instructions have been followed, to make written records of work completed, and to accurately perform simple arithmetical calculations is essential. It also require relatively advanced literacy, numeracy and good interpersonal communication skills. In some occupations these skills are required for a major part of the work. The knowledge and skills required for competent performance in these occupations are generally obtained through completion of the first stage of secondary education/higher secondary education. It may include a significant component of specialized vocational education and on-the-job training. Some occupations require completion of vocation-specific education (like ITI) undertaken after completion of secondary education. In some cases experience and on-the-job training may substitute for the formal education.	- Mining Mate - Reclamation Supervisor - Supervisors, mining and quarrying - Supervisors, mineral and metal processing - Work Health & Safety Supervisor
4	Trades and Production Occupations	Occupations that typically involve the performance of simple and routine physical/ manual tasks, or operating machinery and electronic equipment; driving vehicles; maintenance and repair of electrical and mechanical equipment; and manipulation, ordering and storage of information. They may require the use of hand-held tools, such as shovels, or of simple mechanical equipment. They involve tasks such as cleaning; digging; lifting and carrying materials by hand; sorting, storing or assembling goods by hand (sometimes in the context of mechanized operations) and operating non-motorized vehicles. These occupations may require physical strength and/or endurance. For some jobs basic skills in literacy and numeracy may be required. If required these skills would not be a major part of the work. For competent performance in some occupations completion of primary education or the first stage of basic education may be required. A short period of on-the-job training would be sufficient for some jobs.	- Person handling explosives - Timberman - Sampler - Sprinkler and Other Vehicle Driver - Banksman - Rig Mounted Drill Operator

S. No.	Functions	Definitions	Example of Few Job Roles
5	Peripheral Services	Similar to above mentioned description under various functions but are subsidiary activities to Mining Operations. These are not the core mining functions.	- Data Entry Operator - HEMM Mechanic - General office support workers - Industrial instrument technicians and mechanics - Mechanical Engineers - Electrical and Electronics Engineers

Annexure 10 - Definitions of Job Roles

S #	Function	Occupation	Job role	NSQF Level	Definition
1	Trades and Production Occupations	Mining Operations	Mazdoor/ Helper	1	Mazdoor or Helpers in mines perform a variety of duties. A mining helper could be doing any of the following on a regular work day - transporting material and equipment within mine, cleaning the area to build temporary roads, loading and unloading, reject handling, spotting, erecting or dismantling scaffolding at a construction site on the mine, bricklaying, clean and maintain the mining premises, assist trained operators in installing, dismantling or dispatch of any machinery. In addition to this a mazdoor must be safety conscious ensuring safety of himself and others around him in all tasks he is asked to perform.
2	Trades and Production Occupations	Blasting	Explosives Handler	3	Persons handling explosives, in open cast mines, is a part of the blasters sub-category. The individual performing this role facilitates mining operations by cautiously storing, transporting and handling explosives used for blasting in mines. Controlled blasting techniques are used to remove debris and over-burden in order to make way for coal or other metals. The nature of this job requires employees to follow extensive safety precautions therefore the individual has to be experienced and trained in safety procedures and guidelines for mining operations prescribed by DGMS.
3	Trades and Production Occupations	Mining Operations	Timberman	3	Timber man examines the roof and side walls of haulage ways, air passages, shafts, galleries etc. inside the mines and erects timber or steel props, frames etc. He also removes or repairs the defective props fixed earlier.
4	Trades and Production Occupations	Ore Processing	Sampler	3	Sampler takes onsite samples, either in open-cast or underground workings of the mine. He visits the different sections of the mine on a daily basis to take ore samples. This is a specialized task, since the information obtained from the ore is vital for planning.

S #	Function	Occupation	Job role	NSQF Level	Definition
5	Trades and Production Occupations	Loading & Hauling - Opencast	Sprinkler and Other Vehicle Driver	4	Sprinkler and Other Vehicle Driver in mining industry is an ancillary job role. The individual assigned this role could be driving a sprinkler truck to control dust on a haul-road or could be driving mining personnel in an SUV or any other small truck used to haul material. Besides knowledge of driving fundamentals, the role requires the individual to know and understand the basic of mining operations, traffic rules to be followed in the mining area and safety guidelines for mining operations prescribed by DGMS. Vehicle drivers are also responsible for performing basic maintenance on the vehicle and to ensure that the safety systems in the vehicle are functional.
6	Trades and Production Occupations	Specialist Operations - Underground	Banksman	4	The primary role of Banksman entails superintending the lowering and raising of persons, tools and materials and transmitting the signals at the top of a shaft or incline.
7	Trades and Production Occupations	Drilling & Cutting	Rig Mounted Drill Operator	4	A rig mounted drill operator drives and operates a drill machine which is a self-propelled machine used to drill shallow as well as holes in the soil and rock for blasting or for quarry operations. The holes are caused by crushing under percussion and/or by drill bit rotation causing abrasion. The drill operates on pneumatic hydraulic system and uses compressed air as power source. Operating a drill is a specialized task that can be safely performed only with adequate training and experience. Drill operators are also responsible for performing basic maintenance on the machine.
8	Trades and Production Occupations	Blasting	Explosive Van operator	4	Explosive Van operator carries out the blasting explosive/ drive bulk explosives vehicle to mining area safely. Besides knowledge of driving fundamentals, the role requires the individual to know and understand the basic of mining operations, traffic rules to be followed in the mining area and safety guidelines for mining operations prescribed by DGMS. Vehicle drivers are also responsible for performing basic maintenance on the vehicle and to ensure that the safety systems in the vehicle are functional.
9	Trades and Production Occupations	Loading & Hauling - Opencast	Grader Operator	4	The Grader Operator operates the grader and other heavy equipment in a safe and effective manner in order to ensure the roadways are accessible, safe and in good operating condition.

S #	Function	Occupation	Job role	NSQF Level	Definition
10	Trades and Production Occupations	Loading & Hauling - Underground	SDL & LHD Operator	4	The SDL/ LHD operator operates the SDL/LHD/vehicle (Underground Loading Machines) safely, efficiently and effectively and carry out is upkeep and maintenance. Note: Use of side-discharge loaders in underground mines require compliance with specific provisions of Rules, Regulations, bylaws, and orders made under the Mines Act 1952. No SDL/LHD/vehicle shall be used unless it is of a type approved by the Competent Authority and is maintained in its designed condition; and The gate end box controlling power supply to these UG machine shall be suitably interlocked with the auxiliary fan(s)/ ventilation systems in the blind headings so as to ensure that unless the auxiliary fan(s) is working the UG machine should not receive power. Operating a UG loading machinery is a specialized task that can be safely performed only with adequate training and experience.
11	Trades and Production Occupations	Specialist Operations - Underground	Strata Monitoring Operator	4	This role is responsible for conducting end to end activities of monitoring the strata and report any movements/ other observations pertinent to strata in order to take required actions.
12	Trades and Production Occupations	Loading & Hauling - Underground	Track Layer Operator	4	The role of the person involved in track laying is to lay, maintain, divert and repair the rail tracks in an underground mine used for hauling the extracted mineral or the raw material used for the extraction of the mineral, depending upon the size of tubs used for hauling.
13	Trades and Production Occupations	Loading & Hauling - Underground	Haulage Operator	4	A haulage operator removes the cut/ blasted material from the working face or any other raw material required in the operation of the mine, with the help of haulage equipment like tugger, endless haulage, main and tail haulage and remotely controlled haulages in such a manner as to enhance the performance of the loading/cutting machines and maximize the productivity of the overall section.
14	Trades and Production Occupations	Loading & Hauling - Underground	Longwall Operator	4	This role is responsible for end to end activities associated with mining the long wall of coal in a single slice. These activities including cutting of the coal, carrying the coal by conveyors and shifting of the conveyors, support advancement and operation of electric panels for entire long wall apparatus.

S #	Function	Occupation	Job role	NSQF Level	Definition
15	Trades and Production Occupations	Blasting	Mining Shot Firer/ Blaster	4	Shot firer assembles, positions and detonates explosives to break or dislodge rock and soil or to demolish structures. (refer to MMR 1960/ MVTR) In open cast mining operation, shot firer uses larger amounts of explosives to clear masses of earth in open areas. Numerous smaller blasts are often detonated together to create a larger force. In tunneling and underground mining operation, shot firer uses small amounts of explosives to blast through rock underground. Generally, small blasts are detonated in a sequence to minimize the force and decrease the possibility of unwanted damage.
16	Trades and Production Occupations	Specialist Operations - Underground	Roof Bolter	4	Roof bolter bolts the roof for underground mines, conducts quality checks on output and maintains a safe & healthy working environment.
17	Trades and Production Occupations	Specialist Operations - Underground	Ventilation Adequacy Checker/ Fan Operator	4	Fan operator/ Main Mechanical Ventilator operates the main ventilating fan of the mine kept for the supply of adequate quantity of needed to ventilate the entire mine. He will attend, maintain and operate the fan assigned for operation and to report any defect/malfunctioning to competent person/supervisor/engineer/Ventilation Officer (VO).
18	Trades and Production Occupations	Specialist Operations - Underground	Winding Engine Operator	4	Winding Engine Operator controls a cable, for example to power a mining hoist at a pit head. Electric hoist controllers have replaced proper winding engines in modern mining, but use electric motors that are also traditionally referred to as winding engines.
19	Trades and Production Occupations	Drilling & Cutting	Wire saw Operator	4	A Wire saw operator operates a Wire saw machine which is used to cut large blocks of stone out from the marble quarry. Wire saws are large machines that use diamond-impregnated beads on a cable to cut through marble, granite and other similar rocks. Wire saw is also used for squaring of the cut slab into square shaped blocks before transporting to the production plant. Operating a Wire saw is a specialized task that can be safely performed only with adequate training and experience. Wire saw operators are also responsible to ensure basic upkeep of the machine and safety in operations.

S #	Function	Occupation	Job role	NSQF Level	Definition
20	Trades and Production Occupations	Mechanical Services	Welder	4	A mine welder is responsible for joining various types of metallic frames, structures, jigs, plates, sheets etc. using heating and melting process created through electrical power and gaseous discharge, maintaining process parameters, conducting quality checks on output product and maintaining a safe & healthy working environment.
21	Trades and Production Occupations	Loading & Hauling - Opencast	Bulldozer Operator	4	The bulldozer operator uses the tractor and blade to scoop out soil, move rock and ore to other locations on the site, and to level the soil. Bulldozers are capable of pushing ore and rock. Bulldozer operators are also responsible for confirming that their safety systems are working properly and for performing basic maintenance on the Bulldozer.
22	Trades and Production Occupations	Loading & Hauling - Opencast	Dumper/ Tipper Operator	4	The Dumper/Tipper operator drives a heavy specialized truck used to haul large volumes of over burden, rock or ore over short distances. The dumper operator then uses the body hoist control lever to tip the rear part of the truck in order to discharge its load to rear, bottom or one side of the truck. Dumper operators are responsible to check that their safety systems are working properly and for performing basic maintenance on the Dumper.
23	Trades and Production Occupations	Loading & Hauling - Opencast	Excavator Operator	4	An Excavator operator drives and controls an excavator which is a self-propelled machine used to dig and dump above the base level of the machine. It is often used to excavate coal, rock, ore, over-burden in mines. In addition to an operator cabin that has all control-systems, it has a fixed boom, a movable dipper stick and a forward opening bucket. Using an excavator is a specialized task that can be safely performed only with adequate training and experience. Safety is extremely critical to avoid property damage and personal injury. Excavator operators are also responsible for performing basic maintenance on the excavator.
24	Trades and Production Occupations	Loading & Hauling - Opencast	Loader Operator	4	A Loader operator drives and operates a Loader which is a heavy vehicle that is used in mines to move aside or load ROM, product etc. into or onto another type of machinery (such as a dump truck, conveyor belt, feed hopper etc. Using a loader is a specialized task that can be safely performed with some training and experience. Safety is extremely critical to avoid property damage and personal injury. Operators

S #	Function	Occupation	Job role	NSQF Level	Definition
					are also responsible for performing basic maintenance on the Loader.
25	Trades and Production Occupations	Mechanical Services	Machinist Operator	4	Mine Machinist reads and interprets the work process documentation to perform cutting, shaping, and finishing metal to make machine precision machining parts and components, also sets up and operates conventional and numerically controlled metal-cutting machines and equipment including saws, drills, grinders, lathes, and mills and performs work-in-process measuring or checking using specialized and precision tools and equipment.
26	Trades and Production Occupations	Mine Surveying	Assistant Mine Surveyor	4	Assistant Mine Surveyor supports the mine surveyor with making measurements and determining property boundaries. This role will further support in making accurate Surveys, Levelling, Contouring, (Traversing, Triangulation, Co-relation, Setting out Curves etc.) and for preparing such Plans, sections and tracing etc. as required under Provision/Statute.
27	Trades and Production Occupations	Drilling & Cutting	Jumbo Drill Operator	4	A Jumbo operator is responsible for the operation of a single and/ or double boom jumbo drilling rig for underground development mining with installation of ground support.
28	Trades and Production Occupations	Ore Processing	Ore Processing Operator	4	This role is responsible for conducting end to end activities of extracting minerals from their ores including crushing and grinding of ore and recovering the minerals from them.
29	Trades and Production Occupations	Electrical Services	Mine Electrician	4	Mine Electrician ensures installation, use, operations and maintenance of the electrical substations and electrical equipment and electrical supply. The role holder also ensures that all the electrical systems and machinery work is in accordance with relevant specifications.
30	Trades and Production Occupations	Mechanical Services	Compressor Operator	4	Compressor operator operates and services power driven air compressor which generates and supplies compressed air to drive pneumatic tools, hoists and other mechanical equipment.
31	Trades and Production Occupations	Mechanical Services	Dewatering Pump Operator	4	A dewatering pump operator operates power driven pumps for pumping, storing and supplying liquids. The operator may also repair and clean, oil and grease the pump.

S #	Function	Occupation	Job role	NSQF Level	Definition
32	Trades and Production Occupations	Loading & Hauling - Opencast	Reclamation Operator	4	Reclamation Operator understands, supports in execution of Environment Management (Protection) Plan prepared along with the Mining plan. Reclamation Operator needs to understand Environmental Safety Area/Zone requirement in which the mine is planned and operates and ensures strict compliance to environmental acts, regulations and norms. Reclamation Operator executes reclamation plan with the help of Dumper Operator, Leveller Operator, Shovel Operator, Dozer Operator and botanical experts. Reclamation operator's role can also start with Rehabilitation of existing population, structures or any other entity existing on the mine site.
33	Trades and Production Occupations	Specialist Operations - Underground	Road Header Operator	4	Underground production and development miners drill, blast, operate mining machinery, and perform related duties to extract coal and ore in underground mines and to construct tunnels, passageways and shafts to facilitate mining operations. They are employed by coal, metal and non-metallic mineral underground mines and by specialized contractors in mine construction, shaft sinking and tunneling.
34	Trades and Production Occupations	Loading & Hauling - Underground	Haul Truck Operator	4	Transport truck drivers operate heavy trucks to transport goods and materials over urban, interurban, provincial and international routes. They are employed by transportation, manufacturing, distribution and moving companies, and trucking employment service agencies, or they may be self-employed. This unit group also includes drivers of special purpose trucks and shunters who move trailers to and from loading docks within trucking yards or lots.
35	Trades and Production Occupations	Loading & Hauling - Opencast	Surface Miner	4	The surface miner is part of a mining team that begins The process of extracting rock and mineral from the ground. - The miner uses sophisticated machines and equipment to blast and move rock containing The sought-after minerals

S #	Function	Occupation	Job role	NSQF Level	Definition
36	Trades and Production Occupations	Loading & Hauling - Opencast	Mobile Conveyor Belt Operator	4	ISC/Q0904: The job holder is responsible for maintenance for the conveyor system including belts, idlers, motors, interlocking of belts, bunkers and control systems. ISC/Q0902: Inspection of the total belt driving system including the controls of conveyor belt as per the required sequence for feeding different raw materials (coal, lime stone, Iron ore etc.) in the service bunker through crushers/screener etc. This also involves basic maintenance and troubleshooting on Conveyor Belt system
37	Trades and Production Occupations	Health Safety and Environment (HSE) Functions	Reclamation Supervisor	5	Reclamation Operator understands, supports in execution of Environment Management (Protection) Plan prepared along with the Mining plan. Reclamation Operator needs to understand Environmental Safety Area/Zone requirement in which the mine is planned and operates and ensures strict compliance to environmental acts, regulations and norms. Reclamation Operator executes reclamation plan with the help of Dumper Operator, Leveller Operator, Shovel Operator, Dozer Operator and botanical experts. Reclamation operator's role can also start with Rehabilitation of existing population, structures or any other entity existing on the mine site.
38	Technical Occupation	Health Safety and Environment (HSE) Functions	Fireman	4	This role is responsible for prevention as well as rescue of the mine areas and mine workers from the hazardous fires that can be a potential threat to life and property.
39	Technical Occupation	Health Safety and Environment (HSE) Functions	Safety Operator	4	Safety Operator is responsible for monitoring and assessing hazardous and unsafe situations and developing measures to assure personnel safety. Safety Operator needs to be aware of applicable safety rules and situations arising in mines. Safety Operator needs to organize safety training sessions for new employees and refreshers & advanced training for existing workers on Safety Equipment and practices. Safety Officer is required to organize periodic meetings of Safety Council and involve in Safety Week initiatives. Safety Officer needs to act as Rescue/Emergency operator and also conduct mock rehearsal.

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40	Technical Occupation	Specialist Operations - Underground	Gas Detector	4	Gas Detector identifies the rate of emission of the adsorbed gas like CH4 from the rock being extracted and identifies the percentage/ concentration of different gases like CO, CO2, etc. which might be present in the general body of air or the sealed off area in an underground mine.
41	Technical Occupation	Ore Processing	Inspectors and testers, mineral processing	4	Inspectors and testers in this unit group inspect, grade, sample or test raw materials and products from mineral ore processing operations. They are employed in mineral ore processing plants such as copper, lead and zinc, steel mills, aluminum plants, precious metal refineries, cement processing plants, clay, glass and stone processing plants and foundries.
42	Technical Occupation	Mine Surveying	Land Survey Technologists	5	Land survey technologists and technicians conduct or participate in surveys to determine the exact locations and relative positions of natural features and other structures on the earth's surface, underground and underwater. They are employed by all levels of government, architectural and engineering firms, and by private sector surveying establishments.
43	Technical Occupation	Geophysical exploration	Geophysicist	6	Technical occupations in geomatics include aerial survey, remote sensing, geographic information systems, cartographic and photogrammetric technologists and technicians, who gather, analyze, interpret and use geospatial information for applications in natural resources, geology, environmental research and land use planning. Meteorological technologists and technicians observe weather and atmospheric conditions, record, interpret, transmit and report on meteorological data, and provide weather information to the agricultural, natural resources and transportation industries and the public. Geomatics technologists and technicians are employed by all levels of government, utilities, mapping, computer software, forestry, architectural, engineering and consulting firms and other related establishments. Meteorological technologists and technicians are employed by all levels of government, the media, natural resources, utilities and transportation companies and consulting firms.

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44	Technical Occupation	Health Safety and Environment (HSE) Functions	Emergency Response and Rescue Specialist	7	Conduct fire team operations contribute to the control of emergencies and critical situations escape from hazardous situation unaided provide aided rescue to endangered personnel apply initial response First Aid Respond to mine incident respond to local emergencies and incidents operate in self-contained regenerative oxygen breathing apparatus control emergencies and critical situations control underground fires conduct underground search extricate casualties from underground incident extricate and transport people involved in incidents establish and operate from fresh air base provide support for rescue operations assess and implement life support systems and stabilize casualties apply and monitor surface operations emergency preparedness and response systems apply and monitor underground coal mine emergency preparedness and response systems lead rescue team apply and monitor underground metalliferous mine emergency preparedness and response systems implement underground coal mine emergency preparedness and response systems implement emergency preparedness and response systems manage major incidents and emergencies establish and maintain emergency preparedness and response systems establish and maintain underground coal mine emergency preparedness and response systems.
45	Supervisors, Coordinators, and Foremen	Mining Operations	Mining Mate	5	Mining mate directly supervises and coordinates the various mine activities and ensures supervising staff, organizing and monitoring work flow for various processes including is playing process understanding, ensuring compliance and team management.
46	Supervisors, Coordinators, and Foremen	Mining Operations	Supervisors, mining and quarrying	5	Supervisors in this unit group supervise and co-ordinate activities of workers engaged in underground and surface mining operations and quarries. They are employed by coal, metal and non-metallic mineral mines and quarries.

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47	Supervisors, Coordinators, and Foremen	Ore Processing	Supervisor - Plant Operations	6	Supervisors, mineral processing, supervise and co-ordinate the activities of workers in the following groups: Central Control and Process Operators, Mineral Processing , Machine Operators and Related Workers in Mineral Products Processing and Manufacturing and Laborers in Mineral Processing. They are employed in mineral ore processing plants such as copper, lead and zinc refineries, steel mills, aluminum plants, precious metal refineries, cement processing plants, clay, glass and stone processing plants and foundries.
48	Supervisors, Coordinators, and Foremen	Health Safety and Environment (HSE) Functions	Safety Specialist/ Workman Inspector	6	To maintain standard procedures and safe working practices establish and maintain the safe mine management system.
49	Professional Occupation	Mining Operations	Material Engineers	5	Metallurgical and materials engineers conduct studies of the properties and characteristics of metals and other non-metallic materials and plan, design and develop machinery and processes to concentrate, extract, refine and process metals, alloys and other materials such as ceramics, semiconductors and composite materials. Metallurgical and materials engineers are employed in consulting engineering firms, mining, metal processing and manufacturing companies, and in government, research and educational institutions.
50	Professional Occupation	Mining Operations	Mining Engineers	5	Mining engineers plan, design, organize and supervise the development of mines, mine facilities, systems and equipment; and prepare and supervise the extraction of metallic or non-metallic minerals and ores from underground or surface mines. Mining engineers are employed by mining companies, consulting engineering companies, manufacturers, government and in educational and research institutions.
51	Professional Occupation	Ore Processing	Mineral Processing Engineer	5	Industrial and manufacturing engineers conduct studies, and develop and supervise programs to achieve the best use of equipment, human resources, technology, materials and procedures to enhance efficiency and productivity. Industrial and manufacturing engineers are employed in consulting firms, manufacturing and processing companies, in government, financial, health care and other institutions, or they may be self-employed.

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52	Professional Occupation	Health Safety and Environment (HSE) Functions	Environment Engineer	5	Identify and assess environmental and heritage concerns. Conduct atmospheric monitoring. Apply environmentally sustainable work practices. Supervise dust and noise control.
53	Professional Occupation	Geological Investigations	Mining Geologist	5	Geological engineers conduct geological and geotechnical studies to assess suitability of locations for civil engineering, mining and oil and gas projects; and plan, design, develop and supervise programs of geological data acquisition and analysis and the preparation of geological engineering reports and recommendations. Geological engineers are employed in consulting engineering companies, electrical utilities, mining and petroleum companies and in government and research and educational institutions.
54	Professional Occupation	Health Safety and Environment (HSE) Functions	Occupation Health Specialist	7	Work safely and follow WHS policies and procedures enter and work in confined spaces maintain amenities work safely at heights control traffic with stop-slow bat conduct fety and health investigations implement traffic management plan supervise work in confined spaces examine and maintain mine safety apply the mine work health and safety management plan implement and monitor health and hygiene management systems maintain standard procedures and safe working practices establish and maintain the WHS management system incorporate health and hygiene factors into mine management.
55	Professional Occupation	Research and Development	Mining Economists	7	To prepare future, mining and metals firms need. Access reliable data and forecast any key economic drivers, as well as analysis of trends in global industrial production, energy and commodity prices, government and consumer spending, and the performance of key end-use-sectors such as construction and automobile manufacturing.
56	Professional Occupation	Research and Development	Remote Sensing Specialist	7	Remote sensing specialists support scientists by designing and conducting remote sensing data gathering efforts. For example, they determine the best techniques, equipment, spectral band, and time of day for a particular mission. They may prepare flight plans, configure sensors, apply the techniques to collect data in the field, and process the resulting data.

S #	Function	Occupation	Job role	NSQF Level	Definition
57	Peripheral Services	Mechanical Services	Mechanic/ Fitter	3	A Fitter is responsible for repair, maintenance and overhaul of crushers, heavy earth moving machinery, medium and light vehicles, pumps and compressors and other mechanical equipment and assemblies used in a mine. A fitter most often works with / assists technicians who are more qualified and experienced. The individual must be trained to work safely and assure that he/she can protect himself and others working around him from getting injured.
58	Peripheral Services	Electronic Data Processing	Data Processing Technician	4	This role is responsible for input and processing of the text and data; preparing, editing and generating the documents for storage, processing, publication and transmission; maintaining process parameters, and maintaining a safe & healthy working environment.
59	Peripheral Services	Instrumentation & Control Systems	Operator Instrumentation/ Mechatronics	4	This role is responsible for design activities and instruction in operation, set-up, maintenance, troubleshooting, and repair of machines and systems where high tech equipment is used.
60	Peripheral Services	Mechanical Services	HEMM Maintenance Operators	4	This job diagnoses, repairs, overhauls and services Heavy Earth Moving Machinery (HEMM) to keep them in good running order. Also carries out repairs of internal combustion engines.
61	Peripheral Services	Instrumentation & Control Systems	Instrument Technician	4	Industrial instrument technicians and mechanics repair, maintain, calibrate, adjust, and install industrial measuring and controlling instrumentation. They are employed by pulp and paper processing companies, nuclear and hydro power generating companies, mining, petrochemical and natural gas companies, industrial instrument and other manufacturing companies, and by industrial instrument servicing establishments.
62	Peripheral Services	Mechanical Services	Mechanical Engineers	5	Mechanical engineers research, design and develop machinery and systems for heating, ventilating and air conditioning, power generation, transportation, processing and manufacturing. They also perform duties related to the evaluation, installation, operation and maintenance of mechanical systems. Mechanical engineers are employed by consulting firms, by power-generating utilities and in a wide range of manufacturing, processing and transportation industries, or they may be self-employed.

S #	Function	Occupation	Job role	NSQF Level	Definition
63	Peripheral Services	Electrical Services	Electrical and Electronics Engineers	5	Electrical and electronics engineers design, plan, research, evaluate and test electrical and electronic equipment and systems. They are employed by electrical utilities, communications companies, manufacturers of electrical and electronic equipment, consulting firms, and by a wide range of manufacturing, processing and transportation industries and government.
64	Peripheral Services	Resource Management	GIS Operator	5	GIS Operator make maps and customized geographic information systems (GIS) applications and manipulate data to serve a variety of purposes. They read and interpret maps, manipulate and understand digital land data, and manage data entered into a GIS database.
65	Peripheral Services	Quality Control	Chemists	6	Chemists conduct research and analysis in support of industrial operations, product and process development, quality control, environmental control, medical diagnosis and treatment, biotechnology, nanotechnology and other applications. They also conduct theoretical, experimental and applied research into basic chemical and biochemical processes to create or synthesize new products and processes. Chemists are employed in research, development and quality control laboratories; chemical, petrochemical and pharmaceutical industries; mineral, metal and pulp and paper industries; and a wide variety of manufacturing, utility, health, educational and government establishments.