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National Council of Applied Economic Research

The Indian Steel Industry: Key Reforms for a Brighter Future

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11 Indraprastha Estate, New Delhi 110 002

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Published by
Anil K Sharma
Secretary and Head of Operations and Senior Fellow
The National Council of Applied Economic Research
Parisila Bhawan, 11 Indraprastha Estate
New Delhi 110 002
Tel: +91-11-2337-9861 to 3
Fax: +91-11-2337-0164
infor@ncaer.org
www.ncaer.org

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NATIONAL COUNCIL OF APPLIED ECONOMIC RESEARCH
Parisila Bhawan, 11 Indraprastha Estate, New Delhi 110 002
Tel.: + 91 11 2337 0466, 2337 9861 Fax + 91 11 2337 0164
sshah@ncaer.org, www.ncaer.org

Shekhar Shah
Director-General

Foreword

There is much excitement in India about the 'Make in India' program launched by the new Modi government. It is expected that with improved ease of doing business in India, including the reform of labor laws, rationalization of land acquisition, and faster provision of transport and connectivity infrastructure, both foreign and domestic investment will pick up in manufacturing.

The hope is that the rate of growth of manufacturing will accelerate and the share of manufacturing in GDP, which has been stagnant at about 15 per cent for the last three decades, will increase to 25 per cent. Unfortunately, the performance of the manufacturing sector during 2014-15 has been below expectation. The rate of growth of industrial production during the year has been only 2.3 per cent, much below the growth rate of GDP. There is considerable excess capacity in the manufacturing sector, and private corporate investment is not yet showing signs of a strong resurgence. There is clearly a need for deeper understanding of what ails our manufacturing sector and what needs to be done to change the situation.

It is against this background that NCAER launched its study of the steel sector in India. Steel forms about 2 per cent of GDP and about 16 per cent of the industrial sector. A healthy steel sector is vital for the economy, particularly for manufacturing.

The findings of the study suggest that the steel sector in India has a very high potential. While the steel industry in other major economies is aging, with little prospect of high growth, India's steel industry is young. While many old steel producers are struggling with the difficult task of retrofitting, India as a late-comer has the advantage of leapfrogging to the latest technology that is efficient and eco-friendly. If India's economic growth accelerates, the production of steel should increase by several hundred million tons over the next few decades. But the study also finds that the current conditions of the steel industry in India are dismal, with very low profits, low capacity utilization and dim prospects of new private investment, either foreign or domestic. The August devaluation of the Chinese Yuan is further fueling fears about dumping of steel into the Indian market. The enthusiasm about 'Make in India' appears, at least to industry insiders, to be bypassing the steel industry.

The NCAER study finds that the steel industry is constrained not just by the usual supply- side factors, such as availability of land or minerals or environmental clearances, but also by inadequate demand and several other macroeconomic factors. The study identifies 11 road blocks hindering the resurgence of the Indian steel industry. These are: demand deficiency, decline of trade competiveness and surge in imports, financial fragility, excessive taxation, stalemate in land acquisition, delays in project implementation,

suboptimal system of mineral allocation, inadequate exploration of mineral wealth, inadequate availability of skill manpower, high cost and low quality logistic facilities and inadequate progress in meeting the environmental standards expected of a modern steel industry. If the high potential of the steel industry in India is to be realized, the government must introduce a transformational program for the industry. Mere tinkering with the present policies and exhorting greater effort will not achieve much. The study suggests elements of a new policy framework that could be the basis for making a rejuvenated Indian steel industry really shine.

I am grateful to Tata Steel for sponsoring the study and Dr Ramgopal Agarwala (Honorary Senior Fellow, NCAER) for leading it. I am also thankful to Dr Rajesh Chadha (Senior Research Counselor, NCAER), S. Vijay Kumar (Distinguished Fellow, TERI and Senior Consultant for this study) and other team members for their substantive contributions to this study.

We hope that the study will provide an occasion for intense discussion of the future of the Indian steel industry among policymakers, the industry, consumers, and researchers. It would be timely for the government to consider formulating a new Steel Policy White Paper that would allow the industry to realize the full high potential of the sector. We also hope that the authorities will realize that there are deep-seated structural problems in most manufacturing sub-sectors in India that go beyond the need to improve the 'ease of doing business'. NCAER stands ready to work with the government and the private sector to study in depth the various sub-sectors of India's manufacturing sector and to help design and evaluate policies for making India a vibrant manufacturing hub in the world economy. There is much to be done, and as India's demographic transition progresses and finding productive jobs will become India's top political and economic priority, there is no time to be lost.

New Delhi
September 24, 2015

Shekhar Shah
Director-General
NCAER

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Study Team

The report was prepared by a study team led by Dr. Ramgopal Agarwala at NCAER comprising Charu Jain, Jahnavi Prabhakar and Rohitash Chaudhary, with contributions from Senior Consultant S. Vijay Kumar Distinguished Fellow at The Energy and Resources Institute (TERI). Dr. Rajesh Chadha (Senior Research Counselor at NCAER) has made immense contributions in all stages of the work as the key advisor to the project. The other members of the team who have contributed in different stages of the study are Akansha Dubey, Abhishek Goswami, Asrar Alam and Praveen Sachdeva.

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List of Abbreviations

AAQ	Ambient Air Quality
ABC	After Burning Chamber
AIM	Atal Innovation Mission
ASSOCHAM	The Associated Chambers of Commerce and Industry of India
BAU	Business as Usual
BF-BOF	Blast Furnace - Basic Oxygen Furnace
BHJ/BHQ	Banded Hematite Jasper / Banded Hematite Quartz
BIF	Banded Iron Formation
CA	Compensatory Afforestation
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CDQ	Coke Dry Quenching
CDR	Corporate Debt Restructuring
CEPA	Comprehensive Economic Partnership Agreement
CII	Confederation of Indian Industry
CIT	Corporate Income Tax
CMC	Coal Moisture Control
CMIE	Centre for Monitoring Indian Economy
CO	Carbon monoxide
CO_2	Carbon dioxide
CRGO	Cold Rolled Grain Oriented Steel
CSE	Centre for Science and Environment
CSO	Central Statistics Office
CSR	Corporate Social Responsibility
CSTI	Construction Skills Training Institute
DFC	Dedicated Freight Corridor
DIPP	Department of Industrial Policy and Promotion
DMIC	Delhi-Mumbai Industrial Corridor
DFI	Development Finance Institutions
DRI	Direct Reduced Iron
DSC	Dust Settling Chamber
DSP	Draft Steel Policy
EAF	Electric Arc Furnace

EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
ECB	External Commercial Borrowing
EDFC	Eastern Dedicated Freight Corridor
EMP	Environment Management Plan
EPA	Environment Protection Act
ESOPs	Employee Stock Option Plans
ESP	Electrostatic Precipitator
ESZ	Ecologically Sensitive Zone
FCA	Forest Conservation Act
FCFS	First Come, First Served
FDI	Foreign Direct Investment
FIMI	Federation of Indian Mineral Industries
FiT	First-in-Time
FTAs	Free Trade Agreements
FRA	Forest Rights Act
GCal	Giga Calories
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GP/GC	Galvanised Plain and Corrugated sheets/coils
GSI	Geological Survey of India
Ha	Hectare
HLC	High Level Committee
HTREL	High-Technology Reconnaissance-cum-Exploration Licence
ICR	Interest Coverage Ratio
IBM	Indian Bureau of Mines
IIT	Indian Institute of Technology
IMMT	Institute of Minerals and Materials Technology
JNPT	Jawaharlal Nehru Port Trust
JORC	Joint Ore Reserves Committee
JPC	Joint Plant Committee
JSPL	Jindal Steel and Power Limited
Kg	Kilogram
Kg/thm	Kilograms per Tonne of Hot Metal
Km	Kilometre

LARR	Land Acquisition, Rehabilitation and Resettlement Act
LCA	Life Cycle Assessment
LD	Linz Donawitz
LTIFR	Lost-Time Injury Frequency Rates
m^3	Cubic metre
M&A	Mergers and Acquisitions
MCDR	Mineral Conservation & Development Rules
MCR	Mineral Concession Rules
MECL	Mineral Exploration Corporation Ltd
ML	Mining Lease
MMDR	Mining and Minerals Development and Regulations Act
MMT	Million Metric Tonne
MoS	Ministry of Steel
MRRT	Mineral Resource Rent Tax
MT	Million Tonnes
MTPA	Million Tonnes Per Annum
NDA	National Democratic Alliance
NIIF	National Investment and Infrastructure Fund
NIT	National Institute of Technology
NITI Aayog	National Institution for Transforming India
NMIZ	National Investment and Manufacturing Zone
NOx	Nitrogen oxide
NPA	Non-Performing Asset
NPV	Net Present Value
OECD	Organisation for Economic Co-operation and Development
OGP	Obvious Geological Potential
PAH	Polycyclic Aromatic Hydrocarbon
PAT	Profit After Tax
PESA	Panchayat Extension to Schedule Areas Act
PL	Prospecting Licence
PPP	Public-Private Partnership
PSU	Public Sector Undertaking
R&D	Research and Development

RBI	Reserve Bank of India
RP	Reconnaissance Permit
RQP	Recognised Qualified Person
SAIL	Steel Authority of India Limited
SARFAESI	The Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act, 2002
SDF	Steel Development Fund
SEIAA	State Environment Impact Assessment Authority
SETU	Self-Employment and Talent Utilisation
SEZs	Special Economic Zones
SMS	Steel Melting Shop
SO2	Sulphur dioxide
SPCB	State Pollution Control Board
SPM	Suspended Particulate Matter
SSC	Sector Skills Council
TCO_2	Tonnes Carbon Dioxide
TCS	Tonnes of Crude Steel
TFYP	Twelfth Five Year Plan
Thm	Tonnes of hot metal
TRT	Top Pressure Recovery Turbine
TPD	Tonnes per day
TTC	Technical Training Centre
t/t	Tonnes of CO_2 emitted per tonne of liquid steel produced
Ug/m3	Micro gram per cubic metre
ULCOS	Ultra–Low CO_2 Steelmaking
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFC	United Nations Framework Classification
WDFC	Western Dedicated Freight Corridor
WGEEP	Western Ghats Ecology Expert Panel
WSA	World Steel Association
WSD	World Steel Dynamics
WTO	World Trade Organization

Executive Summary

1. High Long-term Potential of the Indian Steel Industry

- Steel is everywhere in life. No major country has become rich without a significant steel industry, even when it is not endowed with key raw materials such as coal and iron ore. If India is to become a high-income country, the steel industry must play its role.
- To assess the role of the steel industry in the Indian growth story, we focus on the 'peaking level' of steel production. Developed India will require steel capacity of at least 700 million tonnes and steel consumption of at least 600 million tonnes by the year 2050. These numbers are, of course, subject to a wide range of variation. But the central theme of the report and the policy recommendations remain valid for a wide band of possible outcomes.
- The expansion potential of 600 million tonnes of steel use even with plus or minus 20 per cent will be unmatched by any other country. India will be the place to be in for producers of steel machinery and suppliers of raw materials at the margin. India is the new China in steel-making.
- For India, it will be a great opportunity to leapfrog to the latest and best global practices in steel. This calls for a basic change from the mentality of a poor developing country to that of a resurgent country. India will have the luxury of prevention, while others are struggling with the cure.
- But nothing is pre-ordained either for the national economy or for the steel industry. We have to work for it. As discussed in the report, it is not clear if we are doing a good job of it at present.

2. Current Distress of the Steel Industry

- During the five golden years of growth in India, 2003–07, the steel industry also had stellar performance and if that performance can be replicated during 2015–50, our aspirational goals will be realised.
- However, for the past three years, the economy as well as the steel sector is in the doldrums. Over the past three years (2010–11 to 2013–14), the profits of steel producers have declined by more than 46 per cent in nominal terms. Medium and small companies in steel have been experiencing huge losses in recent years.
- According to RBI data, many steel companies are experiencing debt service difficulties and are resorting to debt restructuring with a growing incidence of non-performing assets (NPAs).
- Many companies in the secondary sector are experiencing an increasing excess capacity and are on the verge of collapse unless special financial assistance is provided.

- There have been several high-profile exits from CAPEX plans involving companies such as Posco, ArcelorMittal and JSW indicating, among other things, their downbeat assessment of the prospects of their investments in India.
- Under the circumstances, there is no chance of the steel sector meeting the 12th Plan targets or of achieving the target of 300 million tonnes capacity by 2025 as envisaged by the Steel Policy 2012. Stabilisation rather than expansion is the issue in the steel industry today.
- Our diagnosis is that the poor performance of the steel industry is due to a combination of demand-side and supply-side problems. We identify as many as 11 roadblocks to be removed before we can reach our aspirational goals on steel.
- The remedies required are 'transformational' types, not tinkering types and go beyond the mandate of the Steel Ministry. It is NITI Aayog that is the right venue for consensus building on Steel Policy, with support from the Ministry of Steel and other ministries as well as think tanks in the country.

3. Demand-side Issues

Diagnosis

- Slow GDP growth, despite some 'mystifying' accounting.
- Growth led by trade, hotels, finance and government consumption where steel-intensity is low.
- Slow growth in fixed investment, mining and manufacturing.
- Low elasticity of demand for steel with respect to GDP.
- Low steel-intensity in construction.

The Way Forward

- Push physical infrastructure through public investment. Revise PPP as necessary.
- Major push for the construction sector and for increasing steel-intensity in construction.
- Redefine the concept of fiscal prudence. Focus on public savings and not on fiscal deficit.
- Reduce interest rates.
- Dramatically improve ease of doing business, defined not in terms of ranking by the World Bank but in terms of moving towards catching up with the best, such as Singapore.

4. Competitiveness and Trade

Diagnosis

- Slowdown in demand for steel in India is taking place in an unfavourable external environment. As per the OECD Steel Committee, there is a huge excess capacity globally, unsurpassed in a decade.
- India is losing export competitiveness due to high relative unit cost of labour, capital, logistics and now even raw materials, partly due to a decline in international prices of iron ore and partly due to the new auction process in India that will push up costs of coal as well as iron ore.
- Increased vulnerability to imports due to huge excess capacity in export-aggressive China, dramatic devaluation of the Russian rouble and recent devaluation of the Chinese Yuan.
- There has been an import surge in most of the steel products. During 2014–15, steel imports to India surged to 10.0 million tons with 3.6 million coming from China alone. China has the potential to devastate the steel industry in India just it has done to several other sections of manufacturing.
- The government recognises the problem but the government machinery for remedial actions is slow.

The Way Forward

- Need to cut the costs of labour, capital and raw materials for export competitiveness.
- The government should keep an eagle eye on unfair trade practices and listen to noises from affected domestic industries.
- The government should take swift corrective actions, including technical instruments for the safeguard and quality control of imports. It should adopt East Asian strategic import substitution/protection combined with export promotion with exceptions where necessary. Encourage import substitution of steel-making machines to reduce cost over time. Take 'Make in India' seriously for steel, including publicity for the use of steel made in India. Restrict the export of iron ore through fiscal measures when appropriate.
- Continued integration with the world economy and in the region is necessary for sustained growth of the economy. The focus has to be on improving the competitiveness of the steel industry.

5. Financial Viability and Resilience

Diagnosis

- The steel industry requires huge long-term finance with the capacity to withstand cyclical volatility of profits. This should be provided by financial institutions with long-maturity debt and long-term bonds, preferably with pro-cyclical debt-service burden.
- With 1991 reforms, state ownership as well as support through development finance institutions (DFIs) declined and other sources of finance such as banks, External Commercial Borrowing (ECB) and capital markets took over. But these sources were not equipped for the long-term finance that the steel industry requires.

- Expansion was financed without 'due diligence' in granting and monitoring of loans. There was high and volatile debt-equity ratio and interest coverage ratio for many steel companies.
- Slow debt relief and bankruptcy mechanism. Poor record of effective restructuring through these procedures. Risks of disorderly loss of productive capacity and banking capital.

The Way Forward

- Improve procedures for debt restructuring of financially distressed companies.
- Develop long-term finance institutions backed by long-term savings such as pension funds and long-term bonds. Learn from East Asian practices. Consider infrastructure status for the steel industry.
- Strengthen due diligence for steel finance.
- Provide attractive joint venture packages to foreign investors.

6. Mineral Taxation

Diagnosis

- Royalty rates for iron ore increased recently to 15 per cent, whereas global standards are mostly in the range of 3–7 per cent.
- Further increase is proposed under MMDR (Mining and Minerals Development Regulations Act), 2015 with royalty to be paid to the District Mineral Foundation. The additional levy will be up to one-third of royalty for newly auctioned mines but could go up to 100 per cent of royalty for older mines.
- Frequent changes in royalty and taxation lead to uncertainties in mining, an activity that requires a long-term horizon.

The Way Forward

- Focus more on scale than on rate of taxation. Facilitate a quantum jump in mining output with lower tax rates, which will increase revenue yield. With the mining industry in turmoil, now is not the time to raise taxation on mines.
- Reduce frequency of changes in taxation on mining.

7. Land Acquisition

Diagnosis

- There has been a shift from draconian measures for land acquisition under the colonial era law of 1894 to the extreme complexity of LARR (Land Acquisition, Rehabilitation and Resettlement Act), 2013.
- With or without amendment to LARR, large-scale acquisition of land for steel will be difficult due to public resistance.

The Way Forward

- Build consensus on why transfer of some 5-10 per cent of agricultural land to non-agricultural use is essential for improving the lot of farmers that remain on the land and for jobs for their children in non-agricultural activities.
- Make better use of land under public ownership.
- There is a huge amount of underutilised land held by the steel majors, which can permit the addition of 100 million tonnes of capacity. So, there is no need for land acquisition for steel majors for the next 15 years. The expansion programme of SAIL is inadequate to fully utilise the land in its possession. Privatise steel mills and/ or use land under the public sector for expansion by steel majors such as POSCO, Mittal, Kobe, Tata or Jindal through joint ventures with them.
- Utilise the window of 15 years to provide education to the young and resettle the population from the hills with minerals and the villages to the existing mineral townships.

8. Project Implementation

Diagnosis

- The Indian mining sector is facing serious problems because of enormous delays in the processing and grant of mineral concessions.
- While environmental, forestry and related clearances are major contributory factors; the primary problem is the non-transparent and discretionary nature of the mineral grant system.
- Before a Mining Lease can be executed or a steel plant set up, numerous clearances are required at the state and central levels under the Forest (Conservation) Act, 1980 (FCA), Environment (Protection) Act, 1986 (EP Act), Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981.
- While industry has been advocating a 'single window' approach to the grant of approvals, the state and central governments face practical problems in operationalising the system because the rigidity of the statutory framework forces procedures into departmental silos.
- Though the Indian Bureau of Mines seeks and obtains an Environmental Management Plan (EMP) as part of the Mining Plan and detailed procedures are given in the Mineral Conservation and Development Rules (MCDR), the EP Act requires the procedure to be duplicated in elaborate detail by another agency from the environment side.

The Way Forward

- The MMDR Act 1957, even after its amendment in 2015, is not adequate and reforms are needed to ensure quicker decisions on concession applications.

- Ensure quicker decisions on concession applications, by removing discretion and making FiT (with seamless assured transition) in the case of virgin areas, and auction in the case of known deposits, as the case may be, thus adopting two modes for grant of concessions instead of the current "auctions only" approach.
- Create an independent mining tribunal that can pass binding orders relating to grants or delays.
- Regulations must be based on standard principles that recognise the federal structure under the Constitution.
- The appropriate architecture for environmental (and forest) regulation in the mining sector is probably a central sectoral regulatory institution (like the IBM) that covers mining and related air, water and other environmental areas. This institution should work closely with the national environmental regulator to set standards, develop codes of practice, conduct R&D and special studies/ regional assessments/ environmental audits, provide training and capacity building and disseminate best practices and information.
- The regulatory framework must enable regional impact assessments and internalisation of suitable sustainable development sectoral practices to improve environmental sustainability consistent with sectoral objectives.
- For facilitating businesses in cases of multiple numbers of Public Consultations mandated under different statutes, a twin approach should be used to streamline each procedural stream and capacitate the departments and panchayats to deal professionally with these issues under the active support of the District Administration. Where multiple panchayats are involved, the single Block panchayat rather than the Gram Panchayat is the more appropriate level.

9. System of Mine Allocation

Diagnosis

- Reconnaissance and exploration though necessary prerequisites to mining are high-risk ventures and it is difficult to justify the use of scarce public resources in a wild goose chase which exploration often is.
- Unfortunately, exploration in itself is not a paying proposition and it is only the incentive of being allowed to be able to mine a mineral find that can incentivize the private sector to do exploration.
- If reconnaissance and exploration is to be incentivised, the person who does this work with his own funds at high risk must be assured of the mine if he finds minerals that are technically and economically extractable. If the mineral resources are yet to be discovered and future resource security is in question, it is important to incentivise exploration. That means allowing the exploration companies the incentive of being allowed to mine a resource if they find it. This is not compatible with an auction system at the mining stage.

- The best safeguard a country can have to get fair value for minerals is to use the instrument of royalty. Royalty, being predictable and transparent, is a better way of recovering a fair value without disincentivising either exploration or mining.
- If minerals are given out only through auction as the MMDR Act, 2015 provides, it will bring exploration activity in the country to a halt and is likely to be detrimental to a 'Make in India' initiative by preventing the discovery of industrial metals including base metals and technology metals. In the long run, it is likely to be detrimental to our national security.

The Way Forward

- Exploration needs to be incentivised. The new provision for 'auctions only' needs to be replaced with a system that encourages exploration with the promise of mining rights in case of success.
- Only fully prospected mineral deposits should be auctioned. Auctions should be based on sealed bids rather than online e-auctions, and the reserve price should be based on independent, credible third-party evaluations using the VALMIN Code or equivalent.
- Supplement the auction system with the 'first come, first served' (FCFS) system, which is used worldwide. The FCFS system yields less spectacular revenues, but the government needs to take a policy decision whether the goal is revenue maximisation or scientific development of the sector.
- There should be no restriction on the sale of unusable grades, and value addition for sale should be encouraged with royalty concessions if required.
- Transferability of concessions should be facilitated, not only for auctioned concessions but for all concessions, so as to promote consolidation, viability, backward integration by metal-making companies and efficiency, including new technology.
- Reservation for the public sector and exclusive preference for metal-makers in allocation/ auction should be replaced by a system that promotes a level playing field and a market for ore and ore products.

10. Exploration for Resource Security

Diagnosis

- The Geological Survey of India (GSI) is in need of reform and is undergoing restructuring, which is behind schedule.
- The GSI needs to complete its geophysical and geochemical mapping expeditiously, so as to develop potential areas for prospecting for mineral wealth. It also needs to start a Mission for close-spaced, low-height national aeromagnetic surveys in a comprehensive and systematic manner for the country.

- To serve stakeholders who want detailed reconnaissance and regional survey information, the GSI portal should enable 1:50,000 scale geological, geophysical and geochemical maps to be served on the Internet on the GIS platform in line with best international practice. The system should be capable of integrating third-party exploration data, as is the practice in Western Australia and the Canadian provinces.
- Large areas under lease are still awaiting detailed exploration and an even larger area covering the known mineralised areas having favourable geological conditions for the localisation of mineral prospects is yet to be regionally explored. A High-Technology Reconnaissance-cum-Exploration Licence concession (HTREL in the MMDR Bill 2011) needs to be to be operationalised by the government on an FCFS basis as advocated by the Hoda Committee in 2006.
- To ensure a steady stream of new discoveries and to be able to steadily augment the resource base, as is done in other mineral rich countries, the government needs to create a conducive base for reconnaissance and exploration, which can lead to the discovery of mineable mineral deposits.

The Way Forward

- Most of the resource estimates of iron ore deposits were made at least three decades ago. The resources need to be reassessed.
- *Exploration by deeper proving:* The assessments of potential reserves of iron ore are based on mining depth of 50 metres with a grid interval of more than 500 metres or so. But iron ore can be available at far greater depths. Steps should be taken to examine the availability of iron ore resources beyond the Banded Hematite Jasper/ Banded Hematite Quartz (BHJ/BHQ) formations.
- *Systematic exploration in leasehold areas:* In all leasehold areas of both the private and public sectors, most of the evaluated resources are in the "indicated" or "inferred" categories. Close-spaced deep drilling may be undertaken to estimate proved "reserve"/ "resource" of iron ore deposits. The Ministry of Mines issued instructions in 2010 to all lease holders to complete a detailed exploration of their entire lease within five years.
- *Exploration in forest areas:* Many of the iron ore deposits lie in forest areas. The total resource potential of such deposits, as in the Bailadila iron ore deposit in Chatttisgarh and Ghatkuri iron ore deposit in Jharkhand, is not known. All such deposits have to be assessed for the quality of the resource, availability of alternatives, the possibility of less intrusive extraction, etc.
- *Re-assessment due to lowered cut-off:* Previously, resources and reserves were calculated based on 55 per cent Fe as the cut-off to produce a mineable ore, but recently the Indian Bureau of Mines (IBM) has lowered the threshold value of iron ore to +45 per cent Fe. This is likely to add substantially to resources and reserves.
- *Chrome:* Only about 26 per cent of the chrome ore resources are developed into reserves. Exploration of deep-seated ore bodies needs to be carried out on priority.

11. Skilled Manpower and R&D

Diagnosis

- The country needs an additional 43,000 engineers and 15,000 metallurgists in the industry by 2025. These numbers are not available.
- Geology, mining and metallurgy are losing their attraction for students. The migration of the skilled workforce from manufacturing to the service sector has aggravated the problem of a shortage of skilled workers.
- India produces 4.5 lakh engineering graduates every year of which only 50–55 per cent enters the job market because their skill set does not meet industry requirements.
- Inadequate women inclusion and empowerment in the steel sector. Global best practices include Chile, South Africa and Australia where women are now an integral part of the mining workforce.
- Low R&D investment by companies, at 0.3–0.5 per cent of turnover.hvv

The Way Forward

- Introduce metallurgical engineering courses in a larger number of institutes and increase the number of seats. Introduce dedicated customised courses on iron and steel-making in engineering institutes.
- Enhance industry-student interaction, mentorship programmes and industrial online projects.
- Initiate collaborative R&D projects between academics, research institutes/laboratories and industry.
- Set up faculty development centres to impart training to the faculty of steel vocational institutes.
- Industry should upgrade in-house training facilities for employees and potential employees on various technical/ non-technical aspects, e.g., L&T and Maruti.
- Speedy allocation of funds by the government to increase the capacity of vocation education.
- Set up a Steel University in collaboration with industry.
- Introduce attractive salary packages, employee-centric incentives, safety measures, health benefits and insurance to steel mill personnel.
- Provide adequate inclusion of women in the workforce of steel plants.
- Recruit experts who have R&D aptitude and qualifications.
- Increase R&D investments to 1–2 per cent of turnover by companies.

12. Supply of Logistical Facilities

Diagnosis

- The production of one tonne of steel requires the transportation of more than 4 tonnes of materials. This requires an efficient and cost-effective transport system for a healthy steel industry, but transport infrastructure in India is distorted.
- Railway rates are extortionist and even charge more for the same ore over the same distance if it is meant for export, which misclassifies the movement as domestic.
- Roadways share in freight movement is nearly 55–60 per cent. National highways form just 2 per cent of the total road network but carry 40 per cent of the total road traffic. Roadways suffer from congestion and high transit times and emit more pollution. Road traffic is four times more expensive than waterways and is twice that of the railways.
- Railways share in freight movement is down to 36 per cent. Rail route km has increased by 3 per cent and track km by 6.6 per cent, while freight and passenger traffic has increased by 54 per cent. The problems are high transit times, lack of special wagons and oversaturation of trunk rail routes.
- Indian ports lack adequate road and railway connectivity, which leads to the slow movement of cargo. The turnaround time at Indian ports is high, at 2.5 to 6.5 days against international performance of 1 to 1.5 days.
- The share of water transport in domestic freight traffic is about 6 per cent compared to China (47 per cent), the US (12.4 per cent) and Japan (34 per cent).

The Way Forward

Tripling steel production by 2025 will require at least a tripling of transport facilities. This requires:

- Creating the necessary additional infrastructure (including railway electrification) and removing system bottlenecks in the existing rail, road and port sectors to reduce the turnaround time of railway wagons, trucks and ships.
- Investing in the construction of rail dedicated freight corridors and coastal freight corridors.
- Increasing water transport, both inland and marine.
- Increasing the depth at major ports to enable handling larger vessels.
- Improving rail and road links to ports, mines and industrial centres.
- Developing the skills of personnel in the logistics sector.

13. Managing Environment

Diagnosis

- Centre for Science and Environment (2012) gives a damning account of the performance of the steel industry in terms of its environmental performance. "Our final assessment: all is bad with the steel sector".
- The CSE study, while valuable, is outdated and its assessment seems unbalanced. More recent studies suggest that significant improvement in environmental management is taking place in the steel industry, though much more remains to be done.
- Steel in potentially 100 per cent recyclable. The Life Cycle Approach (LCA) described by the World Steel Association shows the benign environmental potential of the steel industry.
- With upcoming constraints on greenhouse gas (GHG) emissions, the required expansion in the steel industry will not be possible unless the GHG intensity of steel production in India is reduced substantially below its present levels.
- A large amount of metallurgical waste is generated through blast furnace and steel melting shops; coke oven is one of the main sources of toxic water, though globally the best practice is zero untreated wastewater discharge.
- The monitoring and enforcement mechanism for environmental compliance is weak.

The Way Forward

- CO_2 emission levels must be brought down from the present 2.7 tonnes per tonne of steel to the global average of 1.8, particularly for new plants.
- Global standards for air and water pollution must be achieved, particularly for new plants.
- The monitoring and enforcement mechanism must be strengthened.
- The Indian steel industry should look into the Life Cycle Approach (LCA) because steel is 100 per cent recyclable.

CHAPTER I

High Long-term Potential of the Indian Steel Industry

This report is about the steel industry. But steel, as they say, is everywhere in our lives. And precisely because of that, the steel industry is deeply connected with the rest of the economy, both as a facilitator for the development of other industries and as dependent on the development of other industries and the economy as a whole. Ideally, a perspective plan for the steel industry should be prepared within the framework of a perspective plan for the economy as a whole with full recognition of the interdependence in an input-output framework and a general equilibrium analysis. However, in this study, we look at the role of the steel industry only in relation to the overall growth story of the country.

An Aspirational Goal in the Steel Sector

We begin with an aspirational scenario of India's growth story. The NDA government's vision of development encapsulated in the theme 'Sabka Saath Sabka Vikas' (Together with all, Development of all) has been widely acclaimed as a sound and inspiring vision. This means a departure from the earlier focus on poverty alleviation that left out the rising aspirations of the growing middle class in India and elsewhere[1]. The strategy promises to be business-friendly as well as friendly to the poor. By involving all in the development process, it promises the rise of all and urges that all Indians march in the same direction. It may be as inspiring for India as Deng Xiaoping's slogan "To be rich is glorious" was for China. Articulation of the details of this theme will be the task of development policy in India for many years.

The Government of India has not yet defined the meaning of vikas (development) in quantitative terms. We believe that it is plausible to define that goal as reaching the standard of living of high-income countries today (2014), which will in all probability lead to "very high human development" as defined by the UNDP and the elimination of absolute poverty. This would mean achieving per capita income of about $33,000 in constant 2005 PPP terms, which we believe India can achieve within a generation or so[2].

If India is to achieve these goals, the steel industry must play a crucial role as has been the case with all the major developed countries and East Asian countries such as Japan, South Korea and China. The availability of steel facilitated the development of infrastructure and the machinery industry, which were crucial for the development of all these countries. This was the basic insight behind P.C. Mahalanobis' emphasis on the development of the capital goods sector[3], including steel, though his growth model overstretched the point.

[1]Dr. Kaushik Basu, Chief Economist of the World Bank, recently stated that the World Bank is formally moving away from the focus on poverty alleviation to focus on shared prosperity (see *The Hindu,* December 2014).

[2]For a detailed roadmap on how India can become a high-income country by 2050, see Ramgopal Agarwala (2014), *India 2050: A Roadmap to Sustainable Prosperity.*

[3]See P.C. Mahalanobis (1955), "The approach of operational research to planning in India", Sankhya (*Indian Journal of Statistics*), December.

In order to get a quantitative feel for the place of steel in India's growth story, we review the link between per capita income and per capita use of steel. As noted in Table I.1, per capita use of steel typically rises with per capita income, though it begins to decline after a certain point.

Figure I.1: Per Capita Steel Consumption vs. GDP Per Capita in PPP ($)

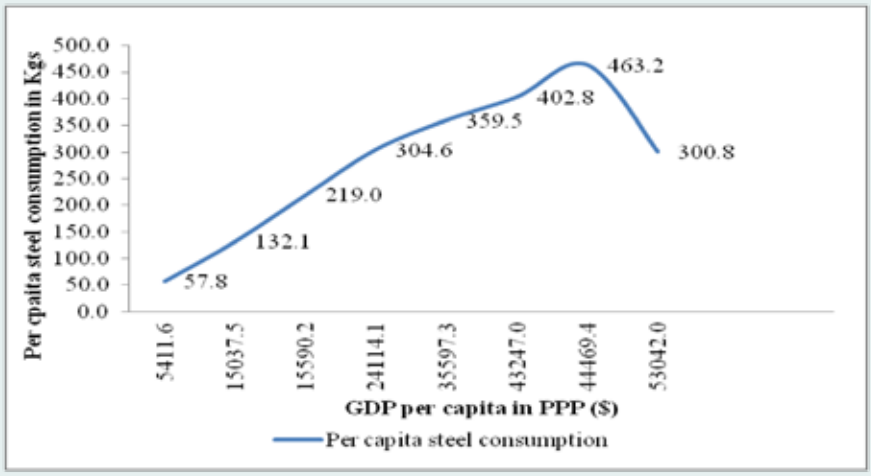


Table I.1: Per Capita Steel Consumption vs. GDP Per Capita in PPP Terms (2013)

Country	Per capita steel consumption (kg.)	GDP per capita (in 2013 PPP US$)
India	57.8	5411.6
China	545.0	11906.5
Brazil	132.1	15037.5
Iran	219.0	15590.2
Russia	304.6	24114.1
Italy	359.5	35597.3
Japan	516.8	36449.1
France	213.5	37871.9
Canada	402.8	43247.0
Germany	463.2	44469.4
United States	300.8	53042.0

Note: China, Japan and France are excluded in Figure I.1 because they are outliers.

Source: World Bank.

In Europe and North America, per capita consumption of steel reached a peak of about 400 kg per year by 2001 and then declined to about 300 kg by 2013. The major infrastructure development programmes of these countries seem to have been completed and per capita consumption of steel is levelling off. In East Asian countries such as Japan, South Korea and China, per capita of steel use was on a higher trajectory than in the US and Europe. The consumption of steel peaked at about 650 kg in Japan, 1,200 kg in South Korea and has reached a high level of 500 kg in China and is still rising. This higher intensity of steel consumption in East Asian countries was due partly to their higher share of manufacturing in GDP and partly to the high demand for steel-intensive infrastructure that was necessitated by their low land-man ratio. In India, the land-man ratio is as low as that in East Asian countries, and this may point to high steel intensity that is required by heavy infrastructure and the vertical growth of residences in cities. On

the other hand, due to growing concerns about carbon emissions, India may have to follow a less carbon-intensive development path and hence the steel intensity of its GDP may be lower than that of East Asian countries. Also, if there is an increased use of plastics as a substitute for steel in construction and consumer durables, steel intensity will decline in the future. In this study, we remain on the conservative side and assume that per capita consumption of steel in India may peak at an average of that obtained in Europe and the US. This gives us a figure of about 400 kg per year per capita of steel consumption in 2050, which is our target year for India to become a high-income country with per capita income in 2013 PPP$ of about US$45,000. Combining this figure with the population projection for India by the UN (1.5 billion in 2050), we get a peak consumption of 600 million tonnes (MT) by 2050.

India becoming a high-income country by 2050 is based upon the assumption that between 2013 and 2050 India's per capita income can grow by 6 per cent per year. If that growth rate is lowered to only 4 per cent, convergence will occur in 55 years, i.e., by 2068. If, on the other hand, the per capita income growth rate is faster at 7 per cent per year, the convergence will occur in 32 years, i.e., by 2045. Thus, if India can maintain the growth trajectory it has been on during the past 30 years, it can expect to achieve high-income status around the middle of this century along with steel consumption of about 600 MT per year.

Steel used in India does not have to be produced in India. With improved communication and declining international freight costs, international trade is becoming an important feature of the global economy and a developed India may, in principle, meet a substantial share of its needs from imports. However, India has a relatively favourable endowment of iron ore and coal and it may have a comparative advantage in the sector. There is also the argument from the point of view of security of supply of this vital commodity just as there is one for food and energy. For a large country with demand in the region of 600 MT per year, it may not be advisable to depend on foreign supplies except at the margin. So, for our baseline, we assume zero net balance on trade in steel, with allowance for some 10 per cent of net trade in either direction. Further assuming a capacity-production ratio of about 1.2, we get a production capacity of about 720 MT per year required by 2050.

There is obviously a great deal of uncertainty about the growth trajectory as well as about steel use per capita, net balance of trade and even the capacity-production ratio. However, the point of our exercise is that *within a wide range of variation, the capacity expansion required is substantial (in several hundred million tonnes) which is quite different from the outlook for any other major economy and most of the policy recommendations made in the report remain valid within this wide range.*

The implications of the rise of India and its steel production need to be highlighted. With the current steel production capacity of about 100 MT per year, this goal will imply *increasing capacity by more than 600 MT per annum. Even with a variation of 150 MT in either direction, Indian steel has a growth prospect unmatched by any other country in the world.* In the US, Europe, Japan and China, growth prospects of the steel industry are at best modest. India would thus be the most attractive market for producers of steel machinery as well as for suppliers of raw material for steel. What China has been for the steel industry in the past 20 years, India could be for that industry in the next few decades. For producers of steel machineries as well as producers of raw materials for steel, in particular coal and iron ore, India should be the place to be in.

The fact that most of India's growth in steel production lies in the future also means a big opportunity for India. India can aim not at where the steel industry has been in the past but where the best in the industry is trying to go and thus 'leapfrog' to the latest and the best technology and best practices in steel production.

In particular, it should avoid past practices that led to environmental damage in several countries including China and put sustainability at the core of its development vision. That means overcoming the earlier mentality of a poor developing country and benchmarking with the best in the world.

Draft Steel Policy, 2012

The aspirational goals presented above are broadly in line with the government's Draft Steel Policy 2012 (DSP), the salient features of which are noted below.

- The DSP aims at reaching crude steel capacity of 300 MT and a production level of 250 MT by 2025–26.
- Based on the experience during 2005–12 when steel consumption grew at 10 per cent per annum and production at 7.8 per cent per annum, it assumes that the constraints are on the supply side and not on the demand side.
- It aims at addressing supply-side bottlenecks in:
  - Acquisition of land with minimum possible displacement of local people and loss of their livelihoods and the formation of steel clusters especially for small and medium-size units for optimising land use.
  - Delays in the grant of environmental and forest clearances by introducing a transparent and easy system for submitting and tracking the status of applications for the grant of resources/ clearances from multiple governmental agencies through an online single e-window in consonance with the national e-governance plan.
  - Availability of raw materials through encouraging more intensive explorations and greater resort to underground mining, prioritising the allocation of captive iron ore mines to steel producers and discouraging exports of iron ores.
  - Infrastructure facilities by supporting more diversified location of steel plants away from the current hotspots to shore-based facilities, augmenting railways projects particularly in the eastern and southern states, improving port facilities and encouraging coastal transport and slurry pipelines.
- It aims at achieving efficiency levels at par with the global bests, especially in areas such as energy consumption, material efficiency, quality of steel, water consumption, productivity of major steel-making equipment, pollution levels and CO_2 emissions.
- It provides greater focus on R&D for developing indigenous technologies especially to find solutions for optimal utilisation of indigenous resources including lower quality coal and iron ore fines.
- It plans to develop indigenous capabilities in design, engineering and manufacture of critical capital equipment required for steel production.

The Ministry of Steel is reviewing its long-term perspectives on the steel sector and is in the process of rewriting the Draft Steel Policy 2012. However, the general tone of optimism about the long-term perspectives remains and the proposed reforms are gradualist and incremental.

The aspirational scenario presented above is achievable and with the continuance of the present dynamic political leadership even highly likely. But it is by no means pre-ordained. In fact, in India we have had so many episodes of false high hopes that a certain amount of caution is indeed appropriate. As discussed in what follows, the performance of the economy in general and the steel industry in particular in the past three years (including one year of the new government) have been much below the aspirational scenario. However, we argue that these shortfalls are due to identifiable policy mistakes that can be corrected by a determined government and the public. And we believe that the country is in the mood to launch transformational policy reforms that can help us achieve our aspirational goals.

CHAPTER II

Current Distress of the Steel Industry

Five Golden Years of the Economy and the Steel Sector

The five years from 2003–04 to 2007–08 were golden years for the Indian economy as well as for the steel sector, confirming the synergy between the two. As noted in Table II.1, the GDP growth rate during this period was 8.8 per cent per year. All the growth components connected with steel consumption had healthy growth rates. Gross fixed capital formation grew at 16.2 per cent per year, construction at 12.4 per cent per year, manufacturing at 9.4 per cent per year and mining at 4.6 per cent per year. Finished steel consumption grew at 12 per cent per year, implying an income elasticity of steel consumption of 1.4. The profits of the steel industry, which were in negative territory in 2001–02 at Rs. (–)4397 crore and a modest Rs. 931.5 crore in 2002–03, grew to Rs. 6,554 crore in 2003–04 and to 19,615 crore in 2007–08 (implying a CAGR of 24.5 per cent during the five years).

Table II.1: Golden Years of Growth (2003–07) for the Indian Economy and Steel (GDP numbers in 2004–05 prices)

Indicators	2002–03	2003–04	2007–08	CAGR (per cent), 2003–07
GDP at market price	3.8	7.9	9.8	8.8
Gross Fixed Capital Formation	(–)0.4	10.6	16.2	16.2
GDP in construction	8.3	12.4	10.8	12.4
GDP in manufacturing	6.9	6.3	10.3	9.4
GDP in mining	8.4	2.7	3.7	4.6
Finished steel consumption (million tonnes)	31	33	52	12.0
Industry profits (Rs. crore)	932	6554	19615	24.5

Source: CSO and CMIE.

If the economy can return to the growth trajectory of the golden years and sustain it for 36 years from 2014 to 2050, the aspirational scenario presented in Chapter 1 will be eminently achievable. Even with a GDP growth rate of 6 per cent per year and income elasticity of demand for steel at 1.0, steel production in 2050 will reach a level of about 600 million tonnes.

The big question before us is: How do we get the economy back to the track it was on during the golden years? This requires an analysis of the factors behind the growth spurt during the golden years and an examination of their replicability in the years 2014–50. As discussed at length in Agarwala (2009)[4], the growth during 2003–07 was not associated with any 'big bang' reforms or structural changes. It was mainly due to a spurt in exports and investments, both closely connected with stimulus to the world economy

[4]Agarwala, Ramgopal (2009), On Managing Risks Facing the Indian Economy: Towards Better Balance between Public and Private Sectors. Discussion Paper No.158, Research and Information System (RIS) for Developing Countries, New Delhi.

provided by a sharp increase in imports in the US and easy supply of external finance at low cost. It was largely a Keynesian-type demand boost with supply-side factors accommodating the demand–push factors.

Looking forward, we cannot depend on external stimulus for either exports or investment either in the near term or in the long term. The world economy is still suffering from the adverse effects of the Great Recession of 2008 and a secular stagnation of the developed economies is the most likely prospect for decades. The sources of finance in the developed countries are also risk averse and no big inflow of long-term investment capital of the type that came during the golden years can be expected. We have to look for largely domestic instruments to put the economy on a high growth trajectory. In our assessment, the Indian economy has big Keynesian pockets of underemployment equilibrium, and for several years public investment stimulus can be provided to stimulate growth without creating overall excess demand. Over the longer term, however, we need to adopt structural reforms in the economy as a whole and in the steel sector.

Current Distress in the Steel Sector

There is much euphoria in India today about the high GDP growth rates that the new National Income Accounts show. Reversing the earlier estimates of around 5 per cent annual growth in GDP, the new data show growth rates of 6–7 per cent per year for the period 2012–15. It is a matter of much celebration that Indian GDP growth rates may now surpass those of China, the star performer for several years. These numbers are, however, somewhat suspect. As noted in Table II.2, in terms of final expenditures, it is Government Final Consumption Expenditures that show 8–10 per cent growth, which is surprising in view of the poor revenue growth of the government and efforts to limit fiscal deficits. In terms of sectoral performance, double-digit growth rates are being shown for trade, hotels, transport etc. and for financial, real estate and professional services, which in the past were generally in line with overall GDP growth.

Table II.2: Gross Value Added by Industry GDP by Expenditure (at 2011–12 Price Percentage Change over Previous Year)

Indicators	2013–14 (Est.)	2014–15 (Adv. Est.)
1. Agriculture, forestry & fishing	3.7	1.1
2. Mining and quarrying	5.4	2.3
3. Manufacturing	5.3	6.8
4. Electricity, gas, water supply & other utility services	4.8	9.6
5. Construction	2.5	4.5
6. Trade, hotels, transport, communication and services related to broadcasting	11.1	8.4
7. Financial, real estate & professional services	7.9	13.7
8. Public Administration, defence and other services	7.9	9.0
GVA at Basic Price	6.6	7.5
Private Final Consumption Expenditure	6.2	7.1
Government Final Consumption Expenditure	8.2	10.0

(Contd...)

Table II.2: (Contd...)

Gross Fixed Capital Formation	3.0	4.1
CIS	(–)21.4	3.9
Valuables	(–)48.7	28.2
Exports of goods and services	7.3	0.9
Less Imports of goods and services	(–)8.4	(–)0.5
GDP	**6.9**	**7.4**

Source: Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation.

Be that as it may, the performance of the steel sector shows no cause for celebration, particularly in terms of financial performance. Being largely in the private sector, the steel industry can flourish only if it is adequately profitable. Unfortunately, in recent years the profit margins in the industry have declined sharply and the industry is under serious stress at present.

Declining Profits

As noted in Table II.3, profits after tax (PAT) have declined by about 50 per cent in nominal terms (and with inflation rate of 10 per cent per year, more than 70 per cent in real terms) between 2007–08 and 2013–14 for steel producers. Figures for 2014–15 are not yet available, but company reports until the third quarter of the fiscal year suggest a further worsening of the situation.

Table II.3: Profits after Tax (PAT) of Steel Companies (Rs. crore)

	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14
Industry PAT	19757.11	15183.59	17980.49	16982.26	15287.83	9141.32	10813.64

Source: CMIE.

While the profit margins of the big players in the steel industry are deteriorating, the performance of small and medium units in the sector is assuming alarming proportions. As noted in Table II.4 in the past three-and-a-half years (H1 2013–14 to H1 2014–15) the net profit margin for small producers has become negative to the extent of about 40 per cent and for medium producers it is about 4 per cent. Capacity utilisation in many of these small and medium producers has gone well below 50 per cent.

Table II.4: Performance in Iron and Steel Sector, 2013–15

	H1 2013–14	H2 2013–14	H1 2014–15
Large			
Sales Growth (YOY)	(–)2.3	11.8	11.0
EBITDA Margin (per cent)	16.4	17.9	18.3
Net Profit margin (per cent)	3.2	4.8	5.4
Medium			
Sales Growth (YOY)	(–)9.3	(–)10.3	1.2
EBITDA Margin (per cent)	4.8	0.1	6.0
Net Profit margin (per cent)	(–)3.2	(–)5.2	(–)2.7

(Contd...)

Table II.4: (Contd...)

Small			
Sales Growth (YOY)	(–)43.3	(–)13.1	(–)41.0
EBITDA Margin (per cent)	(–)3.2	2.4	(–)8.1
Net Profit margin (per cent)	(–)47.7	(–)34.7	(–)37.4
All Companies			
Sales Growth (YOY)	(–)4.0	8.6	9.3
EBITDA Margin (per cent)	14.5	15.8	16.8
Net Profit margin (per cent)	1.8	3.5	4.2

Source: Reserve Bank of India Bulletin, February 2015, "Performance of Private Corporate Business Sector during First Half of 2014–15", p.66.

Increased Debt Distress

Table II.5: Growing Debt Burden on Steel Companies: Debt–Equity Ratio (times)

Company	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14
Bhushan Steel	3.46	3.65	3.81	3.61	3.28	3.96	3.90
Tata Steel	1.08	1.32	0.68	0.58	0.48	0.48	0.44
SAIL	0.13	0.27	0.50	0.52	0.41	0.53	0.59
JSPL	1.03	0.92	1.24	1.39	1.45	1.66	1.87
JSW Steel	1.06	1.51	1.26	0.72	0.89	0.93	1.19
Essar Steel	1.37	1.59	2.01	2.13	2.97	4.24	5.92
Industry Average	1	1.04	0.98	0.99	0.97	1.1	1.19

Source: CMIE.

Declining profits have been associated with rapidly rising debt burden in the industry. During the period of boom in the economy and rapidly rising profits, many steel companies (both big and small) embarked on large expansion programmes. Since a large part of these expansions were financed by debt (predominantly bank loans), the debt burden of the companies was high and /or increased rapidly as noted in Table II.5.

Unfortunately, this coincided with a period when the Reserve Bank of India was raising interest rates sharply in order to combat inflation. The combination of rising debt burden and rising interest rate led to a sharp deterioration in the interest coverage ratio of major companies (Table II.6).

Table II.6: Declining Interest Coverage Ratio of Steel Companies (times)

Company	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14
Bhushan Steel	1.78	1.55	1.40	1.58	1.48	1.38	1.03
Tata Steel	8.48	5.82	4.64	6.39	5.49	4.83	5.57

(Contd...)

Table II.6: (Contd...)

SAIL	48.62	29.45	12.77	15.61	7.62	5.10	2.64
JSPL	7.73	9.53	7.69	5.00	3.54	2.44	1.79
JSW Steel	5.30	1.48	3.47	3.28	2.38	2.42	1.70
Essar Steel	2.36	1.72	1.06	0.65	0.62	0.34	(–)0.24
Industry Average	5.83	3.68	3.55	3.25	2.27	1.71	1.55

Source: CMIE.

Debt Restructuring

Under the dual pressure of rising debt-service burden and falling profit rate, many companies are unable to service their debt on time. The Reserve Bank of India has highlighted the growing incidence of debt restructuring by Indian companies in recent months and steel companies account for a large share of these debt-restructuring proposals (Table II.7).

Table II.7: Industry-Wise Classification of Live Cases

Industry	No.	Aggregate Debt (Rs. cr)	Debt in per cent
Infrastructure	30	58554	21.52
Iron & Steel	55	45160	16.60
Power	20	31380	11.53
Textiles	41	21837	8.03
Construction	11	16893	6.21

Source: Corporate Debt Restructuring (CDR) Cell progress report, December 2014.

Unless prompt measures are taken for debt relief and improving the profitability of the industry, there may be several cases of bankruptcies and the closure of several companies, particularly the smaller ones. This will make it difficult to meet the demand for steel as the economy recovers and the long-term goal of steel production capacity.

Stalled Projects

Economic Survey (2015) notes that the stock of stalled projects at the end of December 2014 was as large as 8.8 lakh crore or 7 per cent of GDP. It further notes that the top reasons why private projects are held up are market conditions and non-regulatory factors, whereas government projects are stalled due to lack of the required clearances (Table II.8). This is not to deny that the policy paralysis and sheer inaction on the part of the central and state governments also contributed to delays in clearances, leading to stalled projects and turning many investments into NPAs (see Annexure Table A.18).

Table II.8: Top Reasons for Stalled Projects across Industries

Industry	No. of Projects	Top Reasons
Manufacturing	212	Unfavourable market conditions
Mining	40	Lack of non-environmental clearances
Electricity	80	Fuel/feedstock/raw material supply problem
Services	283	Lack of promoter interest
Construction and Real estate	143	Lack of non-environmental clearances

Source: Economic Survey, 2014–15.

High-profile Exits from Capacity Expansion

Ten years ago, when the steel industry was in a boom, major expansion plans were envisaged by investors, involving investment of over Rs. 600,000 crore, which would have added nearly 100 million tonnes of capacity. Among the major investors were ArcelorMittal, Posco, Tata Steel and JSW Steel. But the prospects of the steel industry have deteriorated since 2007–08 and subsequent years saw the cancellation and postponement of nearly 40 million tonnes of expansion plans. In 2013, POSCO announced that it was pulling out of the 6 million tonne plant in Karnataka; ArcelorMittal announced that it is pulling out of its Odisha venture; and in December 2014, JSW Steel announced that it was pulling out of its steel and power project in West Bengal. Delays in allocation of land and uncertainties about allocation of mines were obvious factors behind these decisions. But subdued market conditions also played their part[5].

Performance of the Steel Industry vis-à-vis the Twelfth Five Year Plan and the Draft Steel Policy 2012

The Twelfth Five Year Plan (TFYP) postulated: "With a GDP growth of ~9 per cent, the sector is expected to grow by ~10.3 per cent in terms of steel consumption. This translates to the need for an installed capacity addition of 142.3 MT of steel in the Twelfth Plan."

With three years of the TFYP gone, steel consumption has grown by only 1.9 per cent per year. Even if consumption picks up in the next two years, overall steel consumption will be significantly below the Plan targets. Our projection will be of consumption by 2016–17 at less than 90 million tonnes.

On capacity creation too, the Plan target is unlikely to be met. Using the analysis done by Boston Consultancy Group, we would put capacity in 2016–17 at best at 120 million tonnes. The capacity utilisation rate for the sector is to go down from the already low level of about 80 per cent in 2013–14. The adverse effects of excess capacity will be particularly visible for secondary steel producers.

The recent performance does not augur well for fulfilment of the steel capacity targets in the Draft Steel Policy 2012. The current atmosphere of excess capacity in steel in India and the world, combined with the

[5]For example, Press Release by Arcelor Mittal, July 17, 2013 reported:

"However, unfortunately the project has faced significant external delays. Arcelor Mittal has not been able to acquire the requisite land for the steel plant, nor has it been able to ensure captive iron ore security, which is a necessary requirement for the project. Therefore, *taking into account the current economic climate*, Arcelor Mittal has concluded it will no longer be pursuing its plans for a steel plant in Keonjhar at this stage." (emphasis added). Similarly, Press Release by POSCO, July 16, 2013 reported:

difficulties of 'doing business' in India and the high cost of capital, means that new starts on steel projects in the next 2–4 years are likely to be modest. Considering that the gestation lag in steel projects in India is 5–8 years, capacity by 2025 may be at best 200 million tonnes.

Factors behind Stress in the Steel Industry: A Framework for Diagnostics

In the Steel Policy Paper of 2012 as in other conventional discussions of the constraints on the steel industry, the focus is on supply-side factors: availability of raw materials, infrastructure facilities, etc. These are undoubtedly important; but in recent years, demand-side issues have been as important as supply-side factors. For a comprehensive analysis of what ails Indian steel, we propose a wider framework of as many as 11 factors covering both the demand and supply sides.

These factors are:

- Demand deficiency
- Decline in international competitiveness and surge in imports
- Financial fragility
- Excessive taxation
- Stalemate on land acquisition
- Excessive delays in project implementation due to environmental and other clearances and approvals
- Sub-optimal system of mines allocation, which incentivises unscientific mining practices and resource use inefficiency
- Inadequate explorations and failure to ensure discovery of new mineral deposits for better resource security
- Emerging shortage of skilled manpower and inadequate investments in R&D
- High cost and inadequate supply of logistical facilities
- Growing problem of pollution

In the chapters that follow we analyse the nature of the constraints on the steel industry created by each of these factors and suggest the way forward for tackling these constraints.

CHAPTER III

Demand-side Issues

As noted in Chapter II, conventional discussions of the steel industry in India focus on supply-side issues. These issues are, of course, important. But at present even more serious is the issue of the demand for steel.

Just as the ink was drying on the Draft National Steel Policy of 2012, the economy began to deteriorate. There were several high-profile scams involving high-level political leaders and officials. And that led to a sort of policy and administrative paralysis where decisions were delayed even more than usual. A Land Acquisition Act was passed by Parliament in 2013, which made land acquisition highly expensive and complex and dealt a blow to all corporate investment and even public investment. At the same time, inflation was accelerating in the economy largely due to cost-push factors such as increase in wages and public sector salaries, minimum support prices for agricultural products and land prices. The Reserve Bank of India mistook this inflation to be demand push inflation and initiated a programme of high interest rate policy, which did little to control inflation but knocked down private corporate investment. In the meantime, India's exchange rate was appreciating in real terms and the irrational fascination with a strong rupee led to deterioration in the external balance. At the same time, the government was working under the rules of the Fiscal Responsibility and Management Act, which had copied both the concept and even the numbers of fiscal deficit as proposed in the Maastricht Treaty without demonstrating their relevance to the Indian context. The government was trying to reduce fiscal deficits while promoting 'freebies' to low-income groups. The result was a cut in public investment that contributed to a further slowdown in the economy, particularly in fixed investment. As a result of this macro mismanagement, the economy suffered badly, and the mining and manufacturing sectors also took a severe beating. The rate of growth in these two sectors over three years, 2012–14, became the worst in any three years since Independence.

Since the steel industry is dependent on the growth of investment and construction, growth in the steel industry slowed down severely. Domestic consumption of steel grew by 3.5 per cent in FY 13, by 0.8 per cent in FY14 and by 3.1 per cent in FY15. In FY15, this was combined with 8 per cent decline in exports and 71 per cent increase in imports (Table III.1).

Table III.1: Performance on Steel Demand and Capacity (in million tonnes)

FY	Consumption (after adj. for double counting)	Exports	Imports	Net Trade	Total Crude Steel Production	Working Capacity	Capacity Utilisation Ratio (per cent)
2007–08	52.1	5.1	7.0	(–)2.0	53.9	60	89.8
2008–09	52.4	4.4	5.8	(–)1.4	58.4	66	88.5
2009–10	59.3	3.3	7.4	(–)4.1	65.8	75	87.7
2010–11	66.4	3.6	6.7	(–)3.0	69.6	80	87.0
2011–12	71.0	4.6	6.9	(–)2.3	73.6	91	80.9
2012–13	73.5	5.4	7.9	(–)2.6	76.7	97	79.1
2013–14	74.1	6.0	5.5	0.5	81.2	100	81.2
2014–15P	76.4	5.5	9.3	(–)3.8	88.3	-	-

Source: Joint Plant Committee (JPC).

Note: P=Provisional

The income elasticity of demand for steel, which is assumed by planners to be 1.1 or more, has been well below one. For the three years, using the new National Income Accounts, it comes to 0.3. The growth in GDP is now coming predominantly from service sectors where the intensity of demand for steel is low. The much-vaunted $1 trillion of investment in infrastructure during the Twelfth Five Year Plan has not been forthcoming. In particular, fixed investment, which is a major source of demand for steel, has experienced a decline in these years even when overall GDP seemed to be increasing rapidly. If 'Make in India' succeeds in improving the pace of growth in manufacturing and in infrastructure, the situation for the steel industry may also turn around but that has not happened yet.

The slack demand has led to a decline in steel prices while the overall inflation is over 5 per cent per year. Since April 2014, the price of long steel, which is used in construction, has fallen by more than 10 per cent at Mandi Gobindgarh. The prices of other steel products are also under stress.

The outlook for the next two years is not promising. The new government has been broadly following the macro-economic policy of the earlier regime. There are some recent signs of rethinking on the role of public investment as an engine of growth. But the overall strategy has not yet changed and it is likely that in a business-as-usual scenario, the investment growth in the next two years will be modest and so will the growth in demand for steel. With a bulge in capacity in SAIL coming on-stream, capacity between 2014 and 2016 is likely to increase by at least 20 per cent whereas demand for domestic steel will increase by at most 10 per cent, leading to a further decrease in the currently low utilisation ratio with its adverse effects on profitability.

The Way Forward

The fortunes of the steel industry are intimately connected with macro-economic developments in the country. It is worth noting that when the overall investment rate in the economy was booming as it was during the five golden growth years of 2003–2007, the profits of the steel industry were booming and the industry would find ways around many hurdles of infrastructure, clearances, raw material availability, etc. Thus, moving towards a high-growth scenario is a key component of getting the steel industry out of its current doldrums.

In our assessment, the key issue is to recognise that the Indian economy is in a Keynesian situation with underemployment equilibrium of many factors of production including land, labour and capital. The inflation that was observed in recent years was due not to excess aggregate demand but to supply-side bottlenecks in particular sectors such as land, food grains, vegetables, etc. In any case, that phase is now largely over and public policy should now focus on demand stimulation, in particular investment. It should also be recognised that the corporate private sector is debt distressed and risk averse. While every effort should be made to improve ease of doing business in India, the results will not be visible for several years. In the near term, the key instrument is stimulation of public investment, both by the government at the central and state levels and by public sector enterprises at both the central and state levels.

The steel sector in India will get a major boost if the growth trajectory can move towards a double-digit rate. The roadmap to such double-digit growth has been elaborated in the book, *Resurgent India: Ideas and Priorities* by Ramgopal Agarwala, Rajiv Kumar and Rajesh Shah (2015). We note some of the key policy reforms mentioned in the book.

Reduction in interest rates. The RBI policy of pushing up interest rates to correct inflation was basically misconceived. Now that the inflation rate is coming down and real interest rates have become high by global standards, there should be an immediate reduction in interest rates by several hundred basis points. That action alone will relieve the debt pressure on the private and public sector, and facilitate a resumption of investment in both the private and public sectors.

Improving ease of doing business. The difficulties of doing business connected with permits and clearances, land purchase, contract enforcement, labour relations, etc. are universally recognised as major impediments for stimulating investments, which is a crucial precondition for revival in the steel sector. However, the conventional approach of trying to improve India's rank on ease of doing business in the World Bank assessment is flawed. First, the World Bank assessment is based on a very limited sample of two cities in India. Second, progress in the ranking of India is not dependent on what India does; it is also dependent on what other countries are doing. Our rank may not improve with the best of efforts if other countries are also improving their performance. Lastly, this is an indicator that we cannot monitor on our own; it all depends on when the World Bank assessment is carried out. A better approach is to define ease of doing business in absolute terms in comparison with a suitable benchmark such as Singapore and then set targets and measure progress in closing the gap with the benchmark.

Push physical infrastructure through public investment. With the best of efforts, improvement in ease of doing business is going to be a slow process. In the near term, public investment needs to be given a push. There are enormous possibilities of greater investment in railways, roads, power, irrigation and water transport as well as in many public sector enterprises including steel. In this context it should be recognised that the old model of public-private partnership for infrastructure investment is broken. It is the public sector that has to fund infrastructure investments as was done, for example, in China. An adoption of that strategy is at present constrained by an ill-advised fetish with targets on fiscal deficits. There is no demonstrable link between fiscal deficits and any other major macro-indicator such as inflation or private investment or growth. In any case, these targets should not be defined independently of the business cycle that the economy might be in. A more appropriate concept would be that of public savings and the gap between public savings and public investments, which is indicative of the savings from the private sector that the public sector is appropriating. On the basis of that approach, we would call for an increase in public investment by at least 5 percentage points of GDP in the next few years.

Massive privatisation of PSUs and improved ROR from the remainder. The public sector units PSUs) are absorbing a huge amount of national capital, including land. The rate of return of these assets is sub-optimal. There should be a massive programme for privatisation of PSUs, including in steel. For enterprises that remain in the public sector, there should be a significant improvement in rate of return on capital, which could then go to finance public investment.

CHAPTER IV

Competitiveness and Trade

Unfavourable global environment for steel

The slowdown in growth of demand for steel in India has coincided with a slowdown in the world economy and the emergence of huge excess capacity in global steel. The problem has been highlighted by the World Steel Association as well as the OECD Steel Committee. OECD[6] (2015) notes:

The world's nominal steelmaking capacity is estimated to reach 2,241 million metric tonnes (mmt) in 2014, according to the OECD Secretariat, a level that is more than twice as high as the 1,060 mmt capacity level observed in 2000. With investment projects continuing to take place in many parts of the world, nominal global steelmaking capacity is expected to climb by a further 120 mmt in the period to 2017, bringing the total worldwide capacity to 2,361 mmt by 2017. (p.4)

The OECD (2015) also states: "In 2013, crude steel demand stood at 1,648 mmt, or about 516 mmt below nominal capacity, representing one of the highest gaps in the history of the global steel industry." (p.5)

The effect of this excess capacity at the global level is similar to what is happening to the Indian steel industry. In the words of OECD (2015): "Excessive levels of steelmaking capacity have important implications for the steel industry, often associated with over-supply, low prices, weak profitability, bankruptcies and localised job losses. Recent work conducted by the OECD has examined the financial health of the steel industry and established a link between excess capacity and profitability. It has shown that the financial performance of the industry is perhaps worse now than it was during the global steel crisis of the late 1990s, in large part due to the significant excess capacity that exists today."

Decline in Export Competitiveness

Faced with slow growth in domestic demand, Indian industry could have tried exports as its way out. Unfortunately, India's low competitiveness in exports has suffered a further decline in recent years. Its unit cost of production is high not only for capital, but also for labour, logistics and even raw materials.

As noted by World Steel Dynamics (WSD), India's main producers SAIL and Tata had higher unit labour cost and higher unit capital cost than comparators such as China, Korea and Japan. With an abundant labour force and relatively low wages, one would expect India to have a cost advantage in labour. But per capita labour productivity in India is at 90–100 tonnes, which is one of the lowest in the world. Labour productivity in Japan, Korea and some other major steel-producing countries is about 600–700 tonnes per man per year. At Gallatin Steel, a mini-mill in the US, there are fewer than 300 employees to produce 1.2 million tonnes of hot rolled coils; a comparable facility in India employs 5,000 workers.

The cost disadvantage in capital is, of course, well known. India has to import machinery for steel at international prices and the cost of land in India often surpasses that in many developed countries. And at present the interest rate is in double digits, often 4–5 times that in developed countries.

[6]OECD (2015), "Excess Capacity in the Global Steel Industry and the Implications of New Investment Projects", OECD Science, Technology and Industry Policy Papers, No. 18, OECD Publishing, available at http://dx.doi.org/10.1787/5js65x46nxhj-en.

The main cost advantage for Indian producers comes from the low transfer price they put on the product of captive mines of iron ore and coal. But that advantage is not available to new producers who obtain raw materials in the market. Iron ore for immediate delivery to the port of Tianjin in China in April 2015 is below US$50 per tonne (down from about US$185 during 2011), while the price in Odisha for grade 60 is quoted at US$48–57 per tonne.

Table IV.1: Competitiveness in Global Context

Fields	Nippon Steel (Japan)	POSCO (Korea)	Tisco	SAIL	Severstal (Russia)	BAO (China)
Steel sector labour cost per tonne produced (USD)	58.2	43.1	86.5	123.9	119.9	8.6
Steel sector material and other costs per tonne produced (USD)	843.3	762.4	549.3	578.5	659.4	870.5
Operating rate (per cent)	94	99.4	73.5	80	93.3	92.5
Value added per employee (thousand USD)	326.2	419.2	91.3	30	77.4	97.8

Source: World Steel Dynamics (WSD) report.

Threat from Imports

The domestic steel industry is also facing a serious threat from imports. As noted above, the world steel industry is suffering from large excess capacity. In China alone, the excess capacity in steel is estimated to be more than 100 million tonnes. With the dominant role of the state in the steel industry and its power to manipulate export prices including exchange rates, China can underprice Indian steel producers in a big way. China can be as devastating for steel in India as it has been for several other manufacturing segments.

The free trade agreement under CEPA (Comprehensive Economic Partnership Agreement) with South Korea and Japan has brought down customs duties on flat products from 7.5 per cent to 2 per cent. And with the dramatic devaluation (85 per cent) of the Russian rouble in 2014, Russian steel mills that have good connections with Indian markets are posing a big challenge to Indian steel producers.

During April–March 2014–15, steel imports by India surged to 10 million tonnes, with 3.6 million tonnes coming from China alone (Table IV.2).

Table IV.2. Country-wise Imports (million tonnes)

Country	FY 15 P	FY14	Per cent change
China	3.610	1.088	232
Japan	1.601	1.358	18
Korea	1.926	1.321	46
Russia	0.228	0.147	55
Ukraine	0.349	0.323	8
Other countries	2.229	1.470	56
Total	10.016	5.708	75

Note: P=Provisional

Imports have been particularly large in specific products such as stainless steel, CRGO (Cold Rolled Grain Oriented Steel) sheets for the electric transformer industry and coated steel (galvanised/organic).

The steel industry has raised concerns about imports and the government authorities are aware of the issue. However, the authorities are torn between the trade rules under the World Trade Organization (WTO) and Free Trade Agreements (FTAs), on the one hand, and the needs of domestic industry on the other. Unlike in the US, which acts swiftly in response to indications of potential injury to their domestic sector, it takes a long time in India to provide protection. This policy schizophrenia combined with the slow-moving government machinery creates the likelihood of serious damage to the domestic steel industry in the near future.

The Way Forward

Towards a Competitive Exchange Rate

As noted in Economic Survey (2015), the exchange rate in India has been allowed to appreciate by a significant margin. This is hurting exports and encouraging imports in general and has grave consequences for the steel industry. There is an urgent need for devaluation of the rupee by at least 10 per cent.

Cost-cutting

To restore competitiveness, Indian industry must improve its efficiency and cut costs. Surplus labour needs to be redeployed in new expansion of production and overall wage cost per unit must be reduced. As noted earlier, there is a strong case for reduction in interest rates in the economy. On raw materials and taxation also, the temptation of a higher bill to industry may hurt the long-term interests not only of the industry but also of the mineral-producing states. As discussed in other chapters, there is a strong case for reducing the level of taxation on mining and bringing down the costs of raw materials from the high levels they are reaching under the new system of mine auctions.

Free Trade or Fair Trade?

India has espoused a liberal trade approach that is consistent with WTO principles and it is also entering into several FTAs. However, the world trade environment is not always fair with other countries, often adopting a mercantilist approach to promote exports and protect their industries. There are also occasions, such as the drastic devaluation of the rouble in Russia that can cause import surges. The government must keep an eagle eye on dumping and unfair trade practices including undervalued exchange rates by India's trading partners. It should also pay prompt attention to distress caused by excess imports to domestic producers. In particular, the use of technical qualifications for imports can provide a swift and WTO-compatible means of protection when needed. If there are cases of poor quality imports coming in, restrictive measures should be introduced promptly. Nor should the government hesitate to publicise the merits of using domestic steel from a national point of view when other things are constant. More generally, it should recognise that all developed countries practiced selective and strategic industrial policy in their developmental phase and India's Department of Industrial Policy and Promotion (DIPP) should live up to its name. It should encourage and incentivise strategic import substitution in key sectors such as defence, metallurgical machinery, machine tools and earth-moving equipment, which will increase demand for domestic steel. The East Asian strategy of strategic import substitution combined with export promotion rather than a simple 'free trade' model should be the strategy in an environment where global trade is anything but 'free' or 'fair'. And while export promotion is generally desirable, there may be a case for giving priority to domestic value addition rather than exports of particular products such as iron ore.

On the issue of whether FTAs and CEPA are unduly hurting the steel industry and whether steel should be put on the negative list for these trade agreements, the jury is still out. There is a need for further study on the pluses and minuses of these trade agreements and the case for including steel in the negative list. Our preliminary conclusion is that the steel industry in India is a mature (not infant) industry and should aim at achieving international competitiveness. Thus, while it should be provided prompt and effective protection from unfair trade practices (as may be the case with exports from China or Russia), it should not seek unfair protection. For long-run sustainability and fulfilment of its potential, the steel industry must be internationally competitive, and for that purpose the disadvantages the industry suffers on supply-side factors must be corrected. It is to these issues that we turn in what follows.

CHAPTER V

Financial Viability and Resilience

The steel industry requires a huge amount of capital of long-term maturity. If the steel capacity in India is to be augmented by 600 million tonnes by 2050, about $600 billion (at present prices) of investment will be required over the next 35 years. This would mean an average annual investment of about $20 billion or nearly one per cent of current GDP ($2 trillion) for the next 30 years or so. This is a huge amount by any standard. Moreover, steel machinery is typically of long duration and the investment pays off over a long term. Thus, the capital required is of long maturity.

Not only that. Steel demand depends on fixed capital formation and on expenditures on consumer durables in the economy. Growth rates in both these items are cyclical and thus demand and profits of the steel industry are cyclically sensitive. The terms of finance should be such that it allows the industry to withstand these cyclical fluctuations[7].

It is for these reasons that the steel industry even in market-oriented countries developed initially with state support, either with state ownership or state-supported finance. In recent years, there is increasing privatisation of the steel industry in developed countries, partly because in these countries the steel industry is no longer in an expansionary phase and partly because sophisticated financial instruments of long maturity with flexibility have been developed in these countries. In South Korea and China, investment in the steel industry was largely supported by state-backed financial institutions. In independent India, the initial steel expansion was largely in the public sector. After the liberalisation programme of 1991, the private sector played a dominant role in steel capacity expansion but the financial sector was often not in line with the requirements of the industry. Expansion was often financed by short- and medium-term maturity loans from the banking sector. This mismatch between the needs and availability of finance for the steel industry contributed to the debt debacle of the industry in the late nineties from which it took many years to recover.

During 2003–2008, the Indian economy experienced a big boom in income and investment, largely because of a boom in external demand and the inflow of external finance. During this period, the steel industry along with coal and iron ore experienced a boom and was largely financed by short and medium-term borrowing, both internal and external.

Table V.1 provides basic figures on debt-equity ratios and interest coverage ratios for some major steel producers and for the industry as a whole. It is striking how many large steel companies were allowed to violate prudential practices on debt-equity ratio as well as on interest coverage ratios.

[7]China set up a State Development Bank in 1994 to provide long-term development finance to industries such as steel. By that time, there was much opposition in the international development community to state-supported development finance institutions. India fell for this new theme, but China firmly rejected this advice.

Table V.1: Debt–Equity Ratio and Interest Cover for Major Steel Companies and the Industry

Company	Field	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14
Bhushan Steel	Interest cover (times)	1.78	1.55	1.40	1.58	1.48	1.38	1.03
	Debt to equity ratio (times)	3.46	3.65	3.81	3.61	3.28	3.96	3.90
Tata Steel	Interest cover (times)	8.48	5.82	4.64	6.39	5.49	4.83	5.57
	Debt to equity ratio (times)	1.08	1.32	0.68	0.58	0.48	0.48	0.44
SAIL	Interest cover (times)	48.62	29.45	12.77	15.61	7.62	5.10	2.64
	Debt to equity ratio (times)	0.13	0.27	0.50	0.52	0.41	0.53	0.59
JSPL	Interest cover (times)	7.73	9.53	7.69	5.00	3.54	2.44	1.79
	Debt to equity ratio (times)	1.03	0.92	1.24	1.39	1.45	1.66	1.87
JSW Steel	Interest cover (times)	5.30	1.48	3.47	3.28	2.38	2.42	1.70
	Debt to equity ratio (times)	1.06	1.51	1.26	0.72	0.89	0.93	1.19
Essar Steel	Interest cover (times)	2.36	1.72	1.06	0.65	0.62	0.34	(–)0.24
	Debt to equity ratio (times)	1.37	1.59	2.01	2.13	2.97	4.24	5.92
Industry Average	Interest cover (times)	5.83	3.68	3.55	3.25	2.27	1.71	1.55
	Debt to equity ratio (times)	1	1.04	0.98	0.99	0.97	1.1	1.19

Source: CMIE.

As discussed in Chapter 2, the steel industry is going through a difficult time in servicing the debt it has acquired somewhat imprudently. The seriousness of the problem is indicated by the fact that the Ministry of Steel and one industry organisation have written to the Reserve Bank of India to help the debt-distressed companies restructure their debts.

Financial Express 15 March 2015 reports:

> Seeking relief for the sector, the steel ministry has asked the Reserve Bank of India (RBI) to allow a longer re-payment period of 25 years for loans of financially stressed projects. It has also urged the RBI to direct banks to re-finance external commercial borrowings (ECBs) taken by the companies. …Since some enterprises have raised low-cost ECBs, the same should be permitted to be re-financed or re-scheduled by the RBI "under the automatic route without the asset being classified as restructured assets," the secretary said in his letter.

In a similar vein *The Times of India* 28 November 2014 reports:

> "The aggregation of challenged raw material availability owing to increased price trends, declining end products' demand together with falling steel prices have been causing a severe blow to the domestic steel industry resulting in closure of numerous small and medium steel factories thereby putting operations and viability of larger ones in question," said The Associated Chambers of Commerce and Industry of India (Assocham) in a communication addressed to the Reserve Bank governor, Raghuram Rajan.

The near-term issue is clearly debt restructuring. But for a longer run boost to the steel industry, a mechanism has to be devised for raising the high level of finance mentioned above.

The first source to look to is, of course, the capital markets. However, given the volatility in the steel industry, it is not clear if equity investors will be forthcoming on the required scale at this point.

Foreign investors may be interested in Indian steel because CAPEX in other parts of the world has limited opportunity. The experiences of foreign investors have been frustrating in recent years particularly in the context of land acquisition. The government needs to design attractive strategies for foreign investors. As discussed in Chapter VII, we believe that joint ventures between SAIL companies leveraging the excess land owned by SAIL and foreign investors who bring capital and technology could reduce the problems of land acquisition and reduce the project implementation lags.

The Way Forward

The first step in this area is to find ways of helping debt-distressed companies with minimum of damage to the country's productive capacity. What the Economic Survey 2015 says about the general problem of stalled projects applies to the steel sector as well. To quote:

Better bankruptcy procedures for the future are essential. Debt Recovery Tribunals are over burdened and under resourced, leading to tardy turnaround times and delayed justice. The ownership structure of Asset Restructuring Companies in which banks themselves have significant stakes creates misaligned incentives. The SARFAESI act (The Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act, 2002) seems to work more against the smallest borrowers and medium sector enterprises. Distressed assets hang like a Damocles sword over the economy and require creative solution. One possibility is the appointment of an Independent Renegotiation Commission with political authority and reputational integrity to resolve some of the big and difficult cases. When the next boom and bust comes

around, India needs to be better prepared to distribute pain between promoters, creditors, consumers, and taxpayers. Being prepared for the cleanup is as important as the being prudent in the run-up. (Economic Survey, 2015, p.88)

The second issue is the development of long-term development finance institutions to meet the needs of industries such as steel. The East Asian practices in this area are more relevant than the financing procedures developed in the wake of liberalisation in 1991. The sources of funds of these institutions should include long-term savings such as pension funds and long-term bonds. The steel industry should be considered for giving infrastructure status for financing.

Third, going forward, there should be greater exercise of 'due diligence' in the granting of loans and the usage of funds by borrowers.

Fourth, there is the need to attract foreign investors who have deep pockets and the latest technological capacities that the Indian steel industry badly needs. The experience of foreign investors has not been favourable with the old model where these investors wanted to acquire large pieces of land and captive mines for raw materials. In the new model, the focus will be on joint ventures with companies under SAIL, which have plenty of underutilised land and should be willing to participate in auctions for the allotment of mines and for procuring raw materials from merchant miners where appropriate. Such joint ventures would also be appropriate for domestic private sector steel companies willing and able to set up mega steel plants with the latest technologies.

CHAPTER VI

Mineral Taxation

Over the years, the Government of India has appointed a series of study groups to make recommendations on mineral royalty rates that will "work out optimal royalty rates which do not compromise mineral production on one hand, and yet allow sufficient resource generation for the States on the other".

One landmark report was prepared by a High-Level Committee (HLC) set up under the Chairmanship of Anwarul Hoda, Member, Planning Commission, to review the National Mineral Policy and recommend possible amendments to the Mines and Minerals Development and Regulation (MMDR) Act, 1957 *to give a fillip to private investment including FDI in the sector. One of the terms of reference of this Committee was to examine the ways to augment State revenue from the mineral sector.*

The HLC, after consultations with various stakeholders, recommended in respect of royalty that:

> (a) The method of fixation of rates of royalty should move forward decisively on the basis of ad valorem rates. (b) For retaining specific rates (tonnage basis) for any mineral, a very strong rationale should be required. (c) While considering raising the ad valorem rates further, the rates prevailing in Western Australia would act as a point of reference. (d) A lowering of rates to be considered only for such mineral for which there is evidence to show that the royalty rates are inhibiting mining operations and mineral production is registering a downward trend. (e) The royalty rates for base metals, noble metals, and precious stones, in which the country is grossly deficient, needs to be low to encourage exploration for these minerals. (f) Imposition of an escalating scale of dead rent for idle holding of mines.

The Hoda Committee recommendations are in the right direction. However, using Western Australia as the point of reference may be questionable. India, unlike Australia, is a both a major mining and a major manufacturing country and the comparator countries should be Brazil and the United States rather than Australia.

The Study Group Report of 2009 proposed an end to the regime of specific duties and recommended royalty for iron ore at 10 per cent of sale price on an ad valorem basis. It noted that the governments of Odisha, Karnataka, Chhattisgarh and Jharkhand sought a rate of royalty on iron ore at 20 per cent on ad valorem basis. The Federation of Indian Mineral Industries (FIMI) desired that the royalty should not be charged on ad valorem basis and the present system of tonnage basis may continue. The Study Group held that in view of the fact that iron ore is the basic raw material for the steel industry, a royalty rate at 20 per cent of sale price on ad valorem basis is likely to adversely impact the steel industry in the country. The Study Group also observed that the Ministry of Steel has recommended a royalty rate of 10 per cent on sale price on ad valorem basis. The Study Group considered the cost of production, transportation & handling charges, export and domestic sale prices as arrived at by the sub-group on iron ore and held that the suggested royalty rate by the Ministry of Steel is appropriate. In view of the above, the Study Group recommended a royalty rate at 10 per cent of sale price on ad valorem basis.

India's comparative advantage in the steel industry lies, among other things, in relatively cheaper raw materials, in particular in coal and steel. Until recently, the taxes on these minerals were low (by international standards) and specific. In recent years, these taxes have been rightly made ad valorem. But in the process,

the tax rates have become high. And additional taxes are being proposed for so-called district development funds where the mines are located although there is no mechanism to ensure that these taxes go to these districts rather than to the general state tax pool.

Table VI.1: Mining Taxes

	Australia	Brazil	Canada	India	South Africa	United States
Mineral Tax	a. State royalties b. Mineral Resource Rent Tax ('MRRT')	CFEM- Compensation for Exploitation of mineral Resources	c. Quebec d. BC e. Ontario Mining tax	f. Royalty g. Dead Rent	Mining and Petroleum Resources Royalty	h. Federal Land Royalty i. Nevada Net Proceeds Tax j. Other State Severance Taxes
Iron ore	a: 6.5–7.5 per cent b: 22.5 per cent	2 per cent	c: 16 per cent d: 2–13 per cent e: 5–10 per cent	f.10 per cent g. INR 1000/ha	0.5–7 per cent	h: 0 per cent i: 2–5.0 per cent j: 2.0–5.0 per cent
Coal	a: 7–10 per cent b: 22.5 per cent	2 per cent	c: 16 per cent d: 2–13 per cent e:5–10 per cent	f. INR55 + 5 per cent– INR130 +5 per cent g. INR 1000/ha	0.5–7 per cent	h: 8–12.55 per cent i: 2–5.0 per cent j: 2.0–5.0 per cent

Source: PWC.

In August 2015, based on the Study Group Report 2013 of the Ministry of Mines, the government increased the royalty rate on iron ore to 15 per cent on ad valorem basis. This rate compares with 2 per cent in Brazil, 0.5–7 per cent in South Africa, 2–5 per cent in the US and 6–7.5 per cent in Australia (Table VI.1). Moreover, these taxes are imposed on all grades, lumps, fines and concentrates without any incentive for beneficiation, enrichment of ore or utilisation of waste and recycling. To make matters worse, the Odisha government has, ignoring the central government directive to base royalty on Fe content, issued a directive that the royalty will have to be paid at the highest grade. Karnataka has recently implemented a Forest Development Tax at 12 per cent.

The MMDR Act 2015 imposed further tax burdens on mining. A District Mineral Foundation is to be set up that will have earmarked funds for the benefit of persons affected by mining. The additional levy will be up to one-third of royalty for newly auctioned mines but could go up to 100 per cent of royalty for older mines. In addition, a levy not exceeding 2 per cent of the royalty is to be collected from mines to fund a National Mineral Explorations Trust for the purpose of regional and detailed exploration. There are frequent proposals from various sources such as the Tribal Welfare Council and the Forest Development

authorities to increase taxes arbitrarily. Even the courts have intervened to increase the tax burden: the Supreme Court in the recent judgement on Goa mining has mandated 10 per cent of sale proceeds to be contributed towards intergeneration equity and sustainable mining in the Goa Permanent Fund. A similar impost has been made in Karnataka based on a Supreme Court judgment. State governments have frequently proposed increases in stamp duty and arbitrary charges such as mine closure charges, forest produce taxes, forest protection charges, water/air pollution fees, etc. Altogether it seems that India not only has the highest rate of taxation of mines among comparator countries but also has a most confusing mix of taxes subject to arbitrary and frequent changes.

The recent tax increases on minerals combined with other taxes on the incomes of mining companies makes the general level of taxation on mining companies inordinately high. In its comments in 2012 on the MMDR Bill, the industry organisation FICCI concluded:

> .. at current rates of royalties the proposed changes in the Bill would make India the highest taxed country in the mineral sector. The tax incidence would rise from the current 47.7 per cent in case of Coal to over 61 per cent; in case of iron ore it would rise from current 43 per cent to 55 per cent; and in the case of Bauxite it would be an exorbitant 110 per cent (Note tax incidence is calculated on profit before taxes). Mining in India is already one of the most highly taxed sector globally, with an estimated effective tax rate of around 43 per cent (for iron ore), as compared to 35–40 per cent for most of the major mining countries like Brazil, South Africa, Australia, Canada etc. The tax incidence on mining in various countries is as follows: Australia– 39 per cent, Brazil– 35 per cent, Chile– 28 per cent, Congo– 36 per cent, Russia– 35 per cent and China– 32 per cent, in India it will be more than 60 per cent in case of coal and 55 per cent in case of iron ore after these new provisions are implemented.

The recent flurry of increases in mining taxation may have been prompted by the situation in the boom years of 2003–07 when the profits of mining companies were high and taxation levels were unusually low. But now the pendulum seems to be swinging too far in the opposite direction. Tax increases are particularly ill advised at present when the mining/steel industry is going through a difficult time because of the turmoil in mining leases, a slowdown in the demand for steel and extremely low profit margins.

MMDR 2015 and recent legislations have also shown a strong tendency towards earmarked funds. These are generally regarded as sub-optimal in the theory of public finance, because the collection of funds for earmarked activity and the development needs of the activity may not always coincide. It is better to have a consolidated fund that raises funds according to the payment capacity of the sector concerned and allocates funds according to the development needs of the sector.

The Way Forward

In order to facilitate the development of mining to meet the long-term needs of the development of the country, certain fundamental changes are needed in the approach to taxation of mining.

First, the focus should be more on the scale of the mining tax base than on the rate of mining tax. If, with proper incentives, mining activities can be developed by 5–6 times as necessary to meet the needs of the steel industry in India, the tax revenue would be larger than in the situation where high taxes will lead to stagnation or even a decline in mining activities. The well-known Laffer curve in economics, which posits an inverse relationship between tax rates and tax collection, may well apply to mining taxation in India

at this stage. The issue is particularly serious at present when the mineral sector in India is going through turmoil because of a new system of allocation of mines and the global slowdown in mining and the steel industry. Increases in taxes on mining should be stayed until the industry gets out of its stress.

Second, there should be a greater degree of stability in taxation and a greater degree of uniformity across states in this area. Instead of a system of revising taxes every three years, a longer period of at least five years should be introduced. The states should also be persuaded to adhere to the constitutional provision about the authority of the centre to determine tax rates and not nullify it by various arbitrary taxes and duties.

Thirdly, the proliferation of earmarked funds should be checked. There should be a consolidated fund and umbrella taxation should be decided in light of the bearing capacity of the mining sector in a fiercely competitive global environment. Allocation to the development needs of the people, territory and forest affected by mining should be met from the consolidated funds of the country as the need arises, rather than made dependent on whether taxes on mining are available for the purpose at any particular time.

CHAPTER VII

Land Acquisition

India is only moderately endowed with land resources. Its land-man ratio is much lower than that of large countries such as the US, Canada, Australia and even China though it is higher than that of Japan. Over centuries, a predominant share of its population (more than 50 per cent even now) has eked out a modest living from land and has developed a deep attachment to the land. Thus, any forcible eviction from land has been a traumatic experience for those who were affected. Yet this is what has been inflicted upon farmers and workers on land for decades since independence. Using the colonial era Act of 1894 on Land Acquisition, vast areas of land were acquired for the development of infrastructure and industries including steel with very little compensation paid to those affected. In those years, the case for 'public purpose' was largely valid and widely acceptable. However, in the past 15 years, with increasing reliance on the private sector for development including in Special Economic Zones (SEZs), land acquisition took an ominous turn. Often land acquired on the grounds of public purpose was given to the private sector at low prices with a substantial amount of illicit exchange taking place between government functionaries and the private sector.

The injustices in land acquisition led over time to an adverse public reaction, and championing the cause of farmers against land acquisition by the government proved politically rewarding. In the wake of the victory of the Trinamool Congress in West Bengal, which fought against the ruling party in the state on such acquisitions, the Government of India swung into action to design a new Act on land acquisition, which went to the opposite extreme of making land acquisition so extremely expensive and complex that it became virtually impossible for many industries to get adequate land on a reasonable time-scale to make their industrial projects viable. Among the onerous provisions of the LARR Act (Land Acquisition, Rehabilitation and Resettlement Act) 2013 were the following:

- Consent of at least 70 per cent of the project-affected families is to be obtained through a prior informed process.
- Multi-crop irrigated land shall be acquired only as a last resort measure. An equivalent area of cultural wasteland shall be developed, if multi-crop land is acquired. In districts where net sown area is less than 50 per cent of the total geographical area, no more than 10 per cent of the net sown area of the district will be acquired.
- Where land is acquired for urbanisation, 20 per cent of the developed land will be offered to the affected landowners.
- A comprehensive rehabilitation and resettlement package shall be provided for landowners and livelihood losers including subsistence allowance, jobs, housing, transportation allowance and resettlement allowance.

Recognising the adverse effects that the LARR Act 2013 is having on the development of the country, the new government introduced an ordinance to modify some onerous features of the Act. The principal objective of the ordinance was to do away with the complicated process of getting the consent of 70 per cent of landowners, preparing an elaborate Impact Assessment Analysis and the consultation process, which was likely to prolong the acquisition process.

The Ordinance was introduced without adequate discussion and consensus building and faced opposition in Parliament and outside. The Government has now allowed the Ordinance to lapse, leaving it to the states to design land legislation congruent with their local conditions.

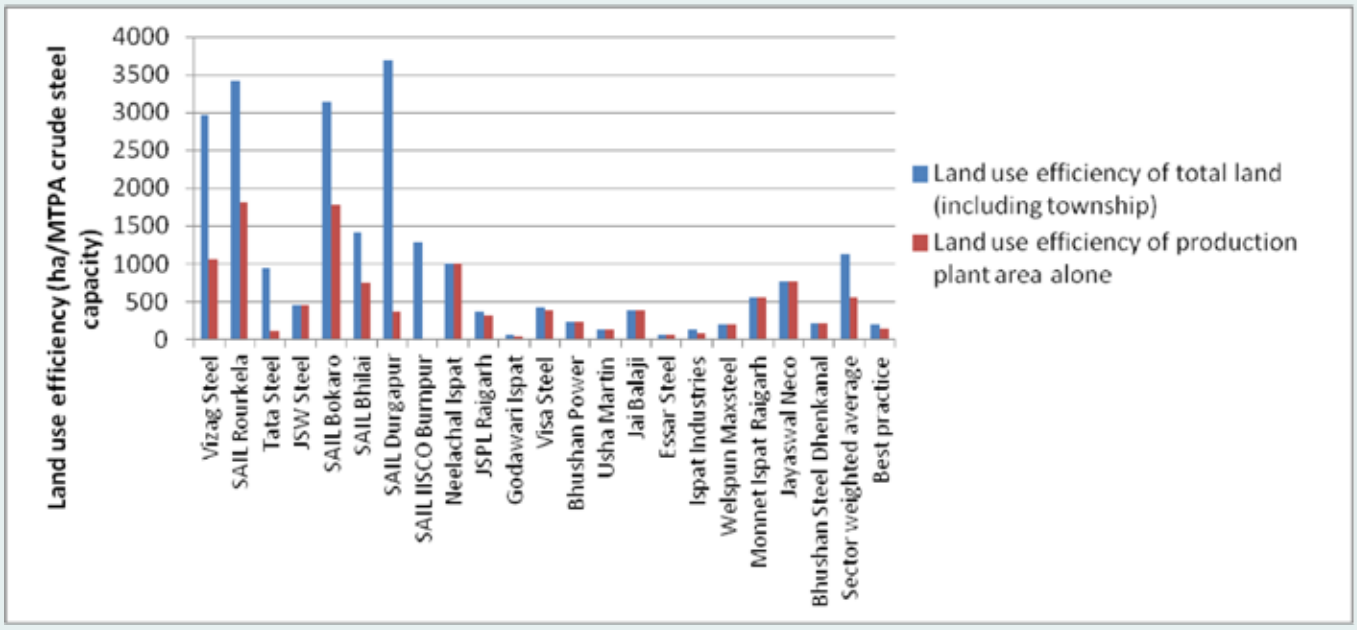
The story of POSCO in India shows both the failure of the old model of land acquisition for steel and the new way forward. In June 2005, the Korean steel company POSCO signed an MOU with the government of Odisha to build a 12 mtpa integrated steel plant at an investment of $12 billion. The company was expecting captive iron ore mines and even a captive port for its trade. However, there have been numerous hurdles in the acquisition of land and other clearances despite the involvement of the highest level of political authorities in both India and Korea. Ten years later, there are signs that POSCO may have to give up on the project. On the other hand, a success story seems to be emerging, with POSCO in a joint venture with the SAIL Bokaro plant where POSCO will bring in its new technology, FINEX, which is eminently suitable for use with India's low-quality iron ore. Initially, POSCO insisted on 51 per cent ownership of the project, which was not acceptable to SAIL. Now it seems there is agreement that SAIL and POSCO will both have 49 per cent ownership, with 2 per cent vested with financial institutions supporting the project. Since additional steel capacity can be built on land under SAIL, the difficult issue of land acquisition will be avoided and access to raw materials would be along the lines available to other steel producers.

The Way Forward

A more appropriate process for handling the land acquisition process would be first to build consensus that converting a certain small amount (5-10 per cent) of agricultural land for the development of industries is essential to absorb the labour waiting to migrate from agriculture. It should be emphasised that it is an iron law in economics that as a country becomes more developed, the share of land under agriculture and in rural area declines. Small farmers' income cannot be improved in line with overall per capita income (which should grow by 10 times over the next 30–40 years) while keeping them on small holdings. Getting the younger generation educated and finding them jobs in industries and modern services is the only way for villagers to improve their livelihood and the migration of some 500 million of the rural population during 2015–2050 will require some land in urban areas. Thus, this conversion of land usage is essential for the improved livelihood of erstwhile rural residents. The villagers should work jointly with the government and the business world to make this transition effective. The landowners and workers should expect compensation as some multiple of the present value of current income streams, and this compensation, along with resettlement programmes, should be delivered before the land is taken away and not just be a promise to be delivered after the land is acquired. However, the inevitability of the conversion of some land should be recognised.

The other step is to build on the Prime Minister's assurance that the objective is to use government land more effectively before acquiring cultivable land. This issue is of particular significance for the steel industry. As elaborated in the CSE report (2012)[8], the major steel companies in India with some exceptions are highly inefficient users of land. As shown in Figure VII.1, several public sector units are using land per mil lion tonnes of steel production that is 2–12 times what is best practice (about 150 ha per million tonnes).

Figure VII.1: Land Use Efficiency



Source: CSE (2012). Into the Furnace: The lifecycle of the Indian Iron and Steel Industry.

The average land currently occupied by 21 companies rated by the Report was about 60,000 hectares to produce 51 million tonnes of steel in 2009–10; this is an average of 1,100 ha per tonne of steel. The best practice in land use is 200 ha/million tonnes of installed capacity, which includes land for the production plant, power generation, water disposal and the requirement for staff colonies. Some Indian plants are doing better. The gas-based plant of Essar Steel in Hazira used 100 ha to produce 4.5 million tonnes of steel, i.e., 65 ha per million tonnes. Ispat Dolvi produces 3 million tonnes on 490 ha, which is 160 ha per million tonnes. The worst are the public sector plants, though some capacity expansion is being planned. SAIL Bokaro occupies a massive 14,000 ha for its production of 4.5 million tonnes of steel. Vizag Steel follows, with an equally huge 9,000 ha for 3 million tonnes to be expanded to 6 million tonnes. The newly installed Neelachal Steel in Kalinganagar covers 1,000 ha with an installed capacity of just one million tonnes of steel.

Land under the public sector must be more efficiently used in plants as well as townships with vertical growth. If public sector units alone can improve land utilisation efficiency to 'best practice', 125 million tonnes per year of steel can be produced in this land alone (Table VII.1).

[8]CSE (2012). Into the Furnace: The lifecycle of the Indian Iron and Steel Industry.

Table VII.1: Land Usage Pattern by Select Indian Steel Plants and Potential for Steel Production with Existing Land

Company/Plant	Land Use (in hectares per million tonne) For Factory	Steel making capacity in 2009–10 (mtpa)	Theoretical capacity with available land (at 150 ha/mtpa)
RINL/Visakhapatnam	1061	3.0	21
SAIL/Rourkela	1821	1.9	23
SAIL/Bokaro	1781	4.36	52
SAIL/Bhilai	745	4.30	21
SAIL/Durgapur	361	1.80	4
SAIL/Burnpur	1286	0.50	4
Total public sector		15.9	125
Tata Steel/Jamshedpur	105	6.8	

Source: Author calculations based on CSE (2012).

Thus instead of wasting time, energy and resources on acquiring new land for major steel plants, efforts should be made to utilise the existing land under the major steel producers (particularly in the public sector) to expand for the next 15 years. SAIL is in the process of expanding its capacity. However, it is not clear if it is being done in the most cost-effective manner. In any case, the expansion programmes fall far short of utilisation of all the land in its possession. A better route would be through involving public sector units in joint ventures with big steel producers (domestic or foreign) or, if necessary, by privatisating some public sector steel units for setting up new steel plants on the existing land resources of the PSU. As noted above, the POSCO story illustrates both the difficulties of the old land acquisition approach and the potential success of the joint venture approach.

The expansion of integrated steel plants on land under the public sector can take care of the expansion needs of integrated steel plants for the next 15 years. The time window of these years should be used to educate and find jobs for rural and tribal youth in urban areas so that the population in rural/tribal areas is diminished enough to facilitate their rehabilitation and resettlement before fresh acquisition.

CHAPTER VIII

Project Implementation

There are multiple delays in setting up and operationalising metal-making projects including steel, and many of them are common to setting up a value addition unit such as a steel plant/blast furnace and mining-related operations.

The Indian mining sector is facing serious problems because of enormous delays in the processing and grant of mineral concessions, and the Hoda Committee, set up by the Planning Commission in 2005, identified this as the major reason for FDI not coming into exploration despite the high potential. While environmental, forestry and related clearances are a contributory factor, the non-transparent and discretionary nature of the mineral grant system is itself the primary problem and this is manifested in a number of ways including the following:

- State governments do not strictly follow the FiT (First-in-Time) principle in non-notified areas, though this is a widely accepted principle for incentivising exploration. Instead, the states either negotiate with applicants or wait for others to apply. Such a system at the reconnaissance level creates disincentives to the flow of investment, and is unproductive since there is in fact no knowledge of mineralisation. At the prospecting/exploration level, the invocation of 'special reasons' to the detriment of FiT, though allowed under the provisions of the Mines and Minerals (Development and Regulation) Act 1957 (MMDR Act), leads to allegations of corruption, and the encouragement of non-scientific practices.
- In areas notified for prospecting or mining on the basis of exploration work done earlier by public agencies, the problems may be worse, since the belief that the potential for mineralisation is high sometimes leads to unhealthy competition, and the state government finds it difficult to make a choice.
- In relinquished areas (both reconnaissance and prospecting), the state government is required to notify the area as being open for 're-grant' of concessions. Failure and delays in doing so caused by procedural inefficiencies are reasons for dis-incentivising entrepreneurs.
- Most state governments do not have a transparent system of receiving applications or showing relinquished areas available for re-grant. The pendency of applications is not monitored, even though the mineral concession rules specify that applications should be disposed of within a time limit, namely
  - ➢ 6 months for Reconnaissance Permit (RP)
  - ➢ 9 months for Prospecting Licence (PL)
  - ➢ 12 months for mining Lease (ML)
- The grievance redressal system envisaged in the MMDR Act caters to a situation where a party is aggrieved by a decision, but it does not cater to a situation of delay, where there is no decision, which is often the case. Thousands of applications are pending with state governments, and the applicants have

no recourse but to wait. This adds to the general perception of non-transparency and arbitrariness, and dis-incentivises globally reputed companies that may want to invest high-risk capital raised in venture capital exchanges.

- There is also the possibility that areas applied for may get 'reserved' for use by the public sector.
- There are further uncertainties in the case of operating concessions with respect to renewal, particularly in the case of large mines, which may need to continue beyond the initial lease period of 30 years.

Even after it is decided to grant a mineral concession, such as a mining lease, obtaining approvals for the actual execution of the lease is a long procedure due to the large number of clearances and 'no objections' at the state and central levels, often complicated by the non-standard procedures at the state level. On the mining side, the main clearances are for the Mining Plan, including a Progressive Mine Closure Plan, a Scheme of Mining and annual programme for each of the next five years, etc. under the MMDR Act, 1957, Mineral Concession Rules (MCR), 1960, and Mineral Conservation and Development Rules (MCDR), 1988. The Mining Plan must be prepared by a Recognised Qualified Person (RQP) approved by the central government/IBM under the Rules. The lack of a sufficient number of well-qualified RQPs is a major reason for delay in approvals, as is the issue of adequate capacity in the IBM. The MMDR Bill 2011 endeavoured to address the issue of RQPs by mandating a procedure for empanelling firms as well as individuals, but the matter lapsed along with the Bill.

Clearances are also required at the state and central levels under the Forest (Conservation) Act, 1980 (FC Act), Environment (Protection) Act, 1986 (EP Act), Water (Prevention and Control of Pollution) Act, (The Water Act) 1974, and the Air (Prevention and Control of Pollution) Act, (The Air Act) 1981 before a Mining Lease (ML) can be executed. While industry has been advocating a 'single window' approach to the grant of approvals, the practical problems faced by state and central departments in operationalising the system often stem from the rigidity of the statutory framework, which forces procedures into departmental silos. For instance, though the Indian Bureau of Mines seeks and obtains an Environmental Management Plan (EMP) as part of the Mining Plan, as is standard practice, and detailed procedures are given in this regard in the MCDR, the EP Act requires the procedure to be duplicated in elaborate detail by another agency from the environmental side.

The difficulty of attempting a 'single window' approach is perhaps best exemplified with respect to the environmental, forest (diversion for non-forest purpose) and land (acquisition) issues. Public hearings in respect of environmental clearance are held in terms of MoEF notification under sub-rule (3) of Rule 5 of the Environment (Protection) Rules, 1986. These hearings are to be conducted by the State Pollution Control Board (SPCB). The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (popularly known as the Forest Rights Act or FRA) has a full mechanism laid down in Section 6 for the vesting of rights in forest dwellers under Rule 3 of the Rules of 2007, a Forest Rights committee, Gram Sabha, etc. The MoEF has laid down the procedure for diversion of forest land under the Forest (Conservation) Act in a manner that purports to comply with the provisions of the Forest Rights Act and, as part of the process, the diversion proposal also has to be laid before the Gram Sabha wherever the Forest Rights Act is applicable. On the other hand, the Tribal Affairs Ministry, which is the

administrative Ministry for the Forest Rights Act, has clarified that as regards a combined public hearing under FRA and Forest Clearance, the Gram Sabha meeting under FRA is a statutory requirement while public hearing for Forest Clearance is through an executive instruction. The Gram Sabha meeting under the FRA can also consider the issue of forest clearance, which is consistent with Panchayat (Extention to Scheduled Areas) Act (PESA) provisions. The necessary quorum required under FRA Rules for Gram Sabha meeting shall be met in every case.

As regards the Land Acquisition, Rehabilitation and Resettlement Act (LARR Act), Section 4 provides for a Social Impact Assessment (SIA) and states that the Environmental Impact Assessment (EIA) shall be conducted simultaneously and shall not be contingent on the completion of the SIA. Under section 6(1) of the Act, the SIA report is made available for the EIA. The panchayat/Gram Sabha is to be consulted during the SIA process. The views of affected families are recorded in a public hearing under Section 5 as part of the SIA. The SIA report along with the expert group's recommendation is then considered by the authorities and a decision is made on the acquisition. The Gram Sabha or panchayat does not play a recommending role, but members of the panchayat are included in the expert group.

Once a notification is issued for acquisition, the administrator under the LARR Act prepares an rehabilitation and resettlement package under Section 16, and a public hearing is held in the Gram Sabha, but even this cannot be combined with the earlier public hearing under the same Act because that is prior to the preparation of the SIA report and part of that process.

As can be seen, the process of public hearings and Gram Sabha/panchayat consultation is specific to each process, and is conducted by different authorities in different cases. It is not feasible to have a single consultation process since a sequential process is involved. Clearly, a twin approach is needed that streamlines each procedural stream and capacitates the departments and panchayats to deal professionally with these issues; where multiple Gram Panchayats are involved, the Block Panchayat rather than the Gram Panchayat would seem to be the more appropriate level for many of the purposes.

As per the FC Act guidelines, all mining, including underground mining, in forest land, requires prior approval from the central government. The renewal of an existing ML in a forest area also requires approval. The guidelines provide that prospecting of any mineral done under a PL granted under the MMDR Act, 1957 that requires collection/removal of samples (from pitting, trenching, stream sediment sampling, etc.) from forest land would be treated as a stage between survey and investigation (reconnaissance) and the grant of a mining licence and, therefore, permission under the FC Act is required. Test drilling up to 10 boreholes of a maximum of 4 inches diameter per 100 sq. km for prospecting, without felling of trees, does not attract the provisions of the FC Act. In all other cases involving the drilling of boreholes, prior permission of the central government under the FC Act is required. However, the drilling density needs to be at least 5–8 boreholes per sq km for stratiform, stratabound and tabular deposits such as iron ore, manganese and limestone, a little more for chromite (as regional lode) and more in the case of base metals. It has also been clarified that the permission to survey, explore, or prospect would not ipso facto imply any commitment on the part of the central government to grant a mining licence in forest land. However, such a stipulation militates against the seamless transfer dispensation that needs to be promoted to attract investment into mining.

Currently, forest clearances are accorded in two stages. In the first stage, 'in principle' approval is accorded, which usually covers conditions relating to transfer, mutation, declaration as Reserved/ Protected Forest (RF/PF), and the provision of equivalent non-forest land for compensatory afforestation. After the compliance report is received from the state government, the second stage (formal) clearance is granted by MoEF. If an existing lease has to be renewed, the net present value (NPV) and any Compensatory Afforestation (CA) charges for the renewal have to be calculated. The better course is to ensure a higher exploration standard and to set a likely period for completing the mining in the lease area. The charges can be calculated for the entire period in one go, and recovered in instalments before the initial lease period expires.

As regards environmental clearances, the Notification of 14 September 2006 divides mining projects into two categories: Category A and Category B. Category A covers all mining projects (major minerals as well as minor minerals) with areas of more than 50 hectares, while Category B covers mining projects on lease areas of more than 5 hectares but less than 50 hectares. Mineral beneficiation activity of more than 0.1 million tonnes per annum has been included in Category A, while Category B covers activity of less than 0.1 million tonnes per annum. All projects or activities, including expansion and modernisation of existing projects or activities and changes in product mix, require prior environmental clearance from the MoEF for Category A and from the State Environment Impact Assessment Authority (SEIAA) for Category B.

In sum, the EIA/EMP process under the Environment (Protection) Act is a separate, external process that takes place after the Mining Plan and Progressive Closure Plan is approved. However:

- The Final Mine Closure Plan is approved by the IBM/State Directorates, etc. just a year before the closure and is subsequent to the EIA /EMP process
- After the EIA/EMP, there is no statutorily mandated process to ensure that the Mining Plans and Closure Plans are revised and brought in sync with the environmental clearance and approved by IBM/ State Directorate. So, the IBM and State Directorate during their inspections do not always enforce the EMP. On the other hand, the EP Act institutions at the central and state levels lack the knowledge and resources to inspect mines for compliance. As a result, the EMP and the clearance remain on paper, and are more often observed in the breach.
- Though the EIA Notification dated 14 September 2006 mentions that post-environmental clearance monitoring reports should be submitted by the mine, it is the regulatory authority under the EPA that helps interested parties to obtain a copy. Similarly, Rule 14 requires the mine to submit an annual environmental audit report to the SPCB. The IBM and State Directorate are not facilitated in using these reports during their inspections.
- From the iron ore mining case in Bellary (and later in Goa), consequent to the Supreme Court order in the Bellary iron ore case in which the Ministry of Environment and Forests (rather than the Ministry of Mines) represented the central government, it is clear that:
  - The concept of 'carrying capacity' for mining needs to be developed on a regional basis.
  - Leases should be granted on this basis, and mining plans (specifically, the production plans) have to be seen from this point of view.

It is thus neither practicable nor efficient to keep the mining and environmental processes in different silos, and the mining sectoral institutions have to share the responsibility so as to ensure effectiveness. The overall framework on a regional basis could be laid out by the environmental regulator, enabling project-level regulation by the sectoral regulator and/or the state government. Proper management of the environment, especially in the context of mining, requires the following:

- Mining Plans and Mine Closure Plans need to be fully synchronised with safe environmental standards as part of the same process rather than in separate silos.
- Issues of beneficiation, management of low grades, recovery of minor metals, stacking of sub-grades, management of wastes etc., which have environmental implications but need domain expertise, should be viewed holistically from the environmental and mining angles.
- The inspection process to ensure compliance, detect infringement and deal with problems needs to be multi-disciplinary, seamless and predictable.
- The association of mining experts at the appraisal stage is absolutely crucial.
- The sectoral technical regulator should be accorded appropriate recognition in this process and made a partner, since s/he has the appropriate domain knowledge, the relevant capacity and the best ability to enforce.

In relation to setting up steel plants etc., issues related to the environment and forests are very similar. In addition, there are delays due to land acquisition and the rehabilitation and resettlement of people who are adversely impacted.

The Way Forward

The regulatory regime for the grant of mineral concessions needs to be properly oriented. The MMDR Act 1957, even after its amendment in 2015, is not adequate and reforms need to:

- Ensure quicker decisions on concession applications, by removing discretion and making FiT (with seamless assured transition) or auction, as the case may be, the only two modes.
- Create an independent mining tribunal that can pass binding orders relating to grants or delays.

The process of Land Acquisition was revised in 2013 to include a Social Impact Assessment and a Rehabilitation and Resettlement Plan. The approach cannot be faulted, but the processes need to be made simple and implementable. On the environment side, deeper reforms are needed. The appropriate architecture for environmental (and forest) regulation in the mining sector is probably:

- A central sectoral regulatory institution (like the IBM) that covers mining and related air, water and all other environmental issues to set standards, develop codes of practice, do R&D and special studies/ regional assessments/environmental audits, disseminate best practices, provide training and capacity building and disseminate information, while working closely with the national environment regulator.

- A state-level sectoral regulatory institution for state-level issues similar to the central institution that manages EIA/EMP-related regulations and works closely with the state-level environmental regulator.
- Regulatory processes under sectoral legislation and environmental legislation should be synchronised, enabling sectoral regulators to integrate the EIA/EMP with the sectoral workflow and monitor compliance, in close collaboration with the national and state-level environment regulators and to their satisfaction.
- A regulatory framework that enables regional impact assessments, and internalisation of suitable sustainable development sectoral practices in these sectors to improve environmental sustainability consistent with sectoral objectives. As a transition towards regional assessments, the concept of mining clusters could be used.
- Recognising the federal structure and the concurrent nature of the subject of forests, and that some districts require full-time forest officials for forest conservation.
- A mechanism to prioritise decisions for forest diversion, for example, general exploration and baseline data collection.
- The creation of land banks at the state and central levels to accommodate Compensatory Afforestation will reduce delays and uncertainties and enable better planning of CA (subject to legislative provisions) and management of outcomes.
- Mandating a jointly managed database (between the state and the centre) and workflow to receive and process applications for clearance will increase public and industry confidence.
- 'Environment' like 'forest' needs to be made a concurrent subject. The entire architecture for environmental protection needs to be replaced by an appropriate dispensation that ensures that federal principles and principle of subsidiarity are the basis for the law.
- Environmental, air and water issues need to be integrated in a single legislation in order to deal with inter-disciplinary issues. The various disciplines/ specialisations would be reflected in the composition of the Environmental Regulator.
- The sectoral regulator (where there is one) should be treated as part of the process for policy, planning, approvals, regulation, enforcement and standard setting. His capacity to handle matters of sectoral environmental protection should be built up. For instance, the Mining Plan and Closure Plans would be jointly approved by the sectoral and environmental regulators rather than sequentially as at present.
- Regulation must, as far as possible, be based on standard principles, viz.:
  - Clear relationship between central and state authorities based on complementary functions, with a specific mandate for the central level to build state-level capacity and knowledge.
  - Independence and arm's length from the government, distinct legal status and secure funding.

- Accountability of the central authority to Parliament and of the state authority to the State Legislature.
- Time-bound functioning and quasi-legal procedures with provision for an appellate body at the state and central levels.

- The process of public hearings and Gram Sabha/panchayat consultation for grant of clearances and 'no objections' is specific to each process, and is conducted by different authorities in different cases. A twin approach of streamlining each procedural stream and capacitating the departments and the panchayats to deal professionally with these issues is required, and where multiple panchayats are involved, the Block Panchayat rather than the Gram Panchayat would seem to be the more appropriate level for many of the purposes.

CHAPTER IX

System of Mine Allocation

The mineral resources of a country are important assets to be used for the long-term development of the nation and its people. The industrial revolution gave a particular urgency in this regard and the colonial age that followed was as much a race to secure the raw materials including minerals and energy resources, as it was to find captive markets for mass-produced goods. A 'first come, first served' ((FCFS) basis in some form or another was the obvious way to make mineral discoveries since the ability of the state to actively locate mineral resources was at that time practically non-existent. Royalty, which was the share of the sovereign in the minerals extracted, was seen as the compensation for the extraction. In the 19th century, geological surveys were established in many of the industrialising countries (including in British India in 1856 to locate mineral resources such as coal for steamers and railways and iron ore for making steel).

With the emergence of public agencies to conduct surveys and inventorise resources, it became possible to develop better systems to manage the mineral resources, including resource estimations based on scientific standards. The concept of 'auction' is in a sense a logical development along this path, best applicable in low-risk situations where the nature of the mineral and its occurrence makes estimations reliable and the exploration data enables accurate resource estimation and a robust resource valuation over the life of the mine.

The issue of 'auction' versus 'allocation' on an FCFS basis or some other system (including allocation based on competence and ad valorem royalty and/or profit-sharing) needs to be seen from the perspective that there are two different situations:

- One, where there is a known mineral deposit. That knowledge may have come from the fact that the mineralisation is self-evident and perhaps on the surface. Or it may come from previous exploration or prospecting work by the public or even private agencies (the latter case may be an earlier concessionaire). Generally minerals such as iron ore, bauxite, limestone or so-called bulk minerals fit into this category. Here even if the data is not complete, the risk of exploration to collect the data is not very high because such minerals occur in relatively large spread.

- The other, where there is no knowledge that there are minerals but the general geological conditions of an area are conducive, or some earlier exploration there indicates a possibility. The nature, extent, value and mine ability are not known and there is a good chance that substantial expenditure on drilling and other exploratory work will be involved, with a high possibility of not finding adequate mineralisation. The minerals may occur in thin veins or lodes and may be deep below the surface and may not get detected. Gold, copper, etc. occur in this form.

In the first case, there is a tangible asset that can be valued (though with a degree of uncertainty given the lack of accuracy of mineral estimations and the volatility of mineral prices). In the second case, there is no

asset, only the prospect of expenditure with uncertain returns. This is the broad framework within which the mineral concession system has to be viewed.

At the outset, it must be clear that the state is giving out 'mineral concessions' to private parties only partly because it is unable to devote resources for this purpose, particularly in the second type of case. Mineral concessions are generally of three types, namely, reconnaissance, prospecting/exploration and mining, with different characteristics that need to be understood before one can formulate an efficient system for exploitation of minerals. Reconnaissance and exploration are high-risk ventures and it is difficult to justify the use of scarce public resources on a wild goose chase which exploration often is. That is another reason why governments give mineral concessions to the private sector, which can raise the resources and are better at technological innovations to economise on exploration costs. Unfortunately, exploration in itself is not a paying proposition and it is only the incentive of being allowed to be able to mine a mineral find that can incentivise the private sector to do exploration.

There is no doubt that technically a mine can be valued (with varying degrees of precision, based on the nature of the data, valuation process and expertise of the valuer) and put to bid. But if reconnaissance and exploration is to be incentivised, the person who does this work with his own funds at high risk must be assured of the mine if he finds the minerals, and that is not compatible with an auction system at the mining stage. In a country where the mineral resources have been adequately inventoried for resource security, auction of the known mineral resources will clearly maximise revenues. But if the mineral resources are yet to be discovered and future resource security is in question, it is very important to incentivise exploration. That means allowing the exploration companies the incentive of being allowed to mine a resource if they find it. The best safeguard a country can have to get fair value in such cases is to use the instrument of royalty. Royalty being predictable and transparent is a better way of recovering a fair value without dis-incentivising either exploration or mining.

Auctioning everything just to have a 'non-discretionary' way of allocating resources is a sub-optimal methodology that will lead to far more waste and loss than any other system. In fact, even 'first in time' is non-discretionary, but it was observed more in the breach. At least for exploration of virgin areas, it must be restored for the reasons given above. For partly explored mineral occurrences or deposits, a nuanced system should be followed; if the occurrence/deposit has been partly prospected and is potentially a large and valuable deposit, it would be natural for the government to expend resources on getting it properly prospected. Where the deposit is not very large or the government is unable to expend its own resources for any reason, it would make more sense to call for competing non-financial bids based on technical competence, and commitments of end use, ore linkage provision, etc., all of which can be done on the basis of partial information; royalty systems can be suitably improved (including the concept of a sliding scale ad valorem royalty that captures both buoyancy in prices and economy of scale), so that royalty rather than auction proceeds is the main revenue source. In fact, the MMDR (Amendment) Act 2015 provides for the bid to be a percentage of the value of the minerals dispatched. In the context of the current ad valorem royalty regime, this is nothing but an addition to the royalty, and there is no reason why such a percentage cannot be subsumed into the royalty itself, including legacy mines and captive mines in its ambit, thus avoiding the non-level playing field that the auction system is now going to create.

That is not to say that auction is necessarily a good method in the case of even well-prospected deposits. There are many pitfalls, many of them dependent on the system of auction. An online e-auction with limited parties that allows parties to keep bidding is clearly one of the pitfalls to be avoided, since it can lead to a 'winner's curse' situation. Sealed bids from all eligible parties based on a reserve price arrived at through independent credible valuation is much more fair and stable in the long run. Credible independent third-party evaluations, such as those given in the VALMIN Code, will at least take into account the technical, financial, commodity-cycle and even geopolitical risks, and give some comfort to financial institutions in making investment decisions.

If minerals are given out only through auction as the MMDR (Amendment) Act, 2015 now provides, it will bring exploration activity in the country to a halt. In the Indian context, where the mineral sector has been prone to cronyism, characterised by the plucking of low-hanging fruit of known mineral resources, it is particularly important to incentivise exploration because it will bring in new technologies for discovering and exploiting mineral deposits, in particular of base metals, technology metals, etc. in which the country is currently deficient. Auctioning of minerals by dis-incentivising exploration is likely to be detrimental to our energy security by preventing access to new age metals needed for renewable energy applications. It is likely to be detrimental to a 'Make in India' initiative by preventing the discovery of industrial metals including base metals and technology metals. And in the long run it is likely to be detrimental to our national security.

A separate but related issue is captive mining, and it is important to understand the combined effect of a concession regime that favours both auctions and captive mining. It is necessary to specify the context in which 'captive mining' is being used, since captive mining in the form of backward integration is clearly aligned with efficiency and resource security, and therefore not alien to industry practice. A major change is now underway through the MMDR Amendment Act 2015, which amends the MMDR Act and provides for auction of prospects and mines as the only mode of grant of minerals such as iron ore, and the new Section 10B (6) provides that the state may, while auctioning a mine, reserve a mine for a particular end use and allow only eligible end-users to bid. Currently in India, iron ore mining is a mix of public and private sector, small and large mines and captive and merchant mines. Those with end-use units apply and are given preference, but the state does not determine the purpose of the mine in terms of captive or non-captive. The new provision will clearly interfere with the development of a free market for iron ore by restricting competition and, as explained below, resource use efficiency.

In general, while a system that allows and permits end-users to acquire mines through the normal concession grant system is generally welcome, preference or exclusive reservation for captive use has the following implications in the context of iron ore:

- Sponge iron plants only use iron ore lumps. Lumps constitute 30–40 per cent of the ore and the fines have to be disposed of. If this is not properly managed, there will be tremendous waste of resources.
- Steel plants mostly use lumps and sinters (aggregation of fines). There is a limitation of distance for the carriage of fines/sinters. As such, if the mine is at a distance, the fines may not be used. FINEX, a new technology with POSCO, uses fines directly, but is facing problems in establishing production in India.

- While there is no shortage of iron ore, the composition and quality is variable, with the percentage of fines increasing with depth of extraction. Fines can be used by steel plants after 'pelletisation' which requires substantial investment and lumps are preferred for economic reasons, being available at low cost.

Captive mining is therefore often wasteful of grades that cannot be used by the plant itself. Merchant mining, on the other hand, has the advantage that:

- It can add value at the ore stage and improve grades through blending, thus using resources more efficiently.
- It can enable production of value-added products for sale, such as pellets.
- It is likely to utilise the entire run-of-the-mine efficiently and recover minor metals etc., which may be often ignored by metal-making plants for whom it is not a core business.
- It can mine more efficiently since it will be producing for the market in competitive conditions.

In the case of coal, the MMDR Act 1957 is to be read along with the Coal Mines (Nationalisation) Act 1973, which terminated all private leases and vested the leases with the central government, who then became the lessee of the state government for the purposes of the MMDR Act. The Coal Mines (Nationalisation) Act also placed restrictions on parties eligible to hold leases for coal minerals, namely (in addition to central government entities including public sector undertakings), steel plants, thermal power plants and coal washeries. The MMDR Act was amended in 2010 to allow the grant of reconnaissance permits, prospecting licences and mining leases by bidding, but the provisions were never in fact invoked. The Coal Mines (Special Provisions) Act 2015 passed by Parliament recently, which provided in more detail for the same purposes, actually allows the successful bidder to carry on coal mining operations in India in any form, either for own consumption, sale or for any other purpose in accordance with the permit, prospecting licence or mining lease, as the case may be, and to use the coal for any of its other plants (with the same end use). The Coal Mines (Nationalisation) Act has been amended accordingly. The provisions would appear to be adequate to permit merchant mining by the private sector if the government desires, but the provisions stop well short of the requirements of a free market for coal. Most of the arguments relating to resource use efficiency in the case of iron ore also apply to coal, perhaps more so since the issue of blending imported coal and pricing related to imports could be solved more easily in the context of a free market.

The Way Forward

- India is underexplored for minerals including ferrous minerals, and exploration needs to be incentivised. As such, the new provision for 'auctions only' needs to be replaced with a system that encourages exploration with the promise of mining rights in case of success. If getting 'fair value' is an issue, royalty rates can be more aggressive, including 'sliding scale' royalty to capture profits from economy of scale.
- Only fully prospected mineral deposits should be auctioned. This will ensure better confidence in the auction system. Auctions should be based on sealed bids rather than online e-auctions, and the reserve

price should be based on independent, credible third-party evaluations using the VALMIN Code or equivalent.

- A 'first come, first served' (FCFS) system is not more discretionary than an auction system, provided it does not relax to accommodate 'special purposes'; it may seem to yield less spectacular revenues (which may actually need to be verified over a longer commodity cycle), but the government needs to take a policy decision whether the goal is revenue maximisation or scientific development of the sector, which may need the private sector to hold and reinvest resources for exploration and R&D. As is clear from Table A 14, FCFS is in fact the main system worldwide, and rightly so in the interest of promoting exploration, leaving the revenue maximisation goal to be achieved transparently through the royalty route.
- There should be no restriction on the sale of unusable grades, and value addition for sale should be encouraged with royalty concessions if required.
- Transferability of concessions should be facilitated, not only for auctioned concessions as provided in MMDR (Amendment) Act 2015, but for all concessions, so as to promote consolidation, viability, backward integration by metal-making companies and efficiency, including new technology.
- Reservation for the public sector and exclusive preference for metal-makers in allocation/ auction should be replaced by a system that promotes a level playing field and a market for ore and ore products.

CHAPTER X

Exploration for Resource Security

India has a total land area of 3.28 million sq. km. of which 2.42 million sq km. comprises hard-rock terrain, while the rest has a thick alluvial cover. Only 20-25% of this constitutes obvious geological potential (OGP) areas, (approximately 571,000 sq km) holding potential for metallic and fossil mineral resources. At present, an area of 504,598.43 hectares is under mineral lease, which forms a considerable part of the total area of the known mineral prospects and deposits. However, out of the leased area only a small part is under active exploitation. Large areas under lease are still awaiting detailed exploration and an even larger area covering the known mineralised areas having favourable geological conditions for the localisation of mineral prospects is yet to be regionally explored.

To ensure a steady stream of new discoveries and to be able to steadily augment the resource base, as is done in other mineral-rich countries, the government needs to ensure that proactive steps are taken to create a conducive base for reconnaissance and exploration, which can lead to the discovery of mineable mineral deposits. These steps need to include the following:

- Ensue that the Geological Survey of India (GSI) completes its geophysical and geochemical mapping expeditiously, so as to develop potential areas for prospecting for mineral wealth.
- Start a Mission for close-spaced, low-height national aeromagnetic surveys by the GSI in a comprehensive and systematic manner for the country.
- Redesign the GSI portal to serve stakeholders who want detailed reconnaissance and regional survey information. The portal should enable 1:50,000 scale geological, geophysical and geochemical maps to be served on a GIS platform in line with best international practice.
- Develop a country-wide mining tenement registry and link-up with the state land records database to be integrated with digitised cadastral maps.
- Create a national geophysical data repository and a national drill core repository to assist entrepreneurs to take up exploration.
- Reposition the government's Mineral Exploration Corporation Limited (MECL) and promote its role in exploration.
- Adopt globally acceptable reporting systems such as the United Nations Framework Classification (UNFC), Joint Ore Reserves Committee (JORC) and the VALMIN Code for assessing mineral reserves/ resources, and creating independent technical capacity in the sector to support this framework.

- Incentivise the private sector to create R&D institutions in support of mineralogical research
- Create and enhance the capacity of the GSI and states for offshore / coastal exploration for beach sand / tidal deposit resources and deep sea mineral nodules such as manganese.
- Operationalise a system of high-technology reconnaissance-cum-exploration licence concessions (called HTREL in the MMDR Bill 2011) on an FCFS basis as advocated by the Hoda Committee in 2006.

The following paragraphs discuss these issues in relation to iron ore, manganese and chromite, which are the three main minerals relevant to the steel industry.

Iron Ore

The GSI has done extensive regional and detailed explorations for iron ore in the past, and the earlier work done by the GSI will need to form the starting point for private sector exploration. Based on estimates by the GSI and the Indian Bureau of Mines (IBM), India is endowed with a huge resource base of 25.24 billion tonnes of iron ore. Haematite and magnetite combined together; Reserves (111, 121, 122 as per UNFC) being at 7.06 billion tonnes and Remaining resources (211,221,222, 331, 332, 333 & 334 as per UNFC) at 18.18 billion tonnes. Of the total reserve base of 7.06 billion tonnes, haematite accounts for 7.0 billion tonnes and magnetite is 0.60 billion tonnes.

The major haematite resources are located mainly in Jharkhand (4,036 million tonnes or 28 per cent), Odisha (4,761 million tonnes or 33 per cent), Chhattisgarh (2,731 million tonnes or 19 per cent), Karnataka (1,676 million tonnes or 11 per cent) and Goa (713 million tonnes or 5 per cent). The balance resources, which contain around 4 per cent of haematite, are spread over the states of Maharashtra, Madhya Pradesh, Andhra Pradesh, Rajasthan, Uttar Pradesh and Assam.

Magnetite is the other principal iron ore occurring in the form of oxide. The magnetite resources are placed at 10,619 million tonnes of which only 58 million tonnes constitute reserves, located mainly in Goa. A major share of magnetite resources is located in Karnataka (7,812 million tonnes or 74 per cent), Andhra Pradesh (1,464 million tonnes or 14 per cent), Rajasthan (527 million tonnes or 5 per cent), Tamil Nadu (482 million tonnes or 5 per cent) and Goa (214 million tonnes or 2 per cent). Assam, Jharkhand, Nagaland, Bihar, Madhya Pradesh and Maharashtra together account for a meagre share of magnetite resources. The most important magnetite deposits are located in Bababudan, Kudremukh, Bellary, Anadurga and Bangarkal areas of Karnataka, Goa region, Ongole and Guntur districts of Andhra Pradesh. Other deposits are also located in Jharkhand, Bihar, Tamil Nadu, Kerala and Assam. About 60 per cent of haematite ore deposits are found in the eastern sector and about 80 per cent of magnetite ore deposits occur in the southern sector, especially in Karnataka. Extensive deposits of high-grade haematite ores are available in the following states:

- Jharkhand — Singhbhum district
- Odisha — Sundargarh, Kendujhar, Mayurbhanj and Cuttack districts
- Chhattisgarh — Bastar and Durg districts
- Karnataka — Bellary, Hospet and Chickmagalur districts
- Goa — North and South Goa
- Maharashtra — Chandrapur and Ratnagiri districts

Odisha has the highest amount of resources followed by Jharkhand, Chhattisgarh, Karnataka, Goa and Maharashtra in order of abundance. Large resources of low-grade magnetite ores occur in Karnataka, Goa, Tamil Nadu, Rajasthan and Andhra Pradesh. Karnataka has the highest resources of magnetite ore. Major iron ore deposits in India, distributed in several geographical locales have been grouped by the GSI under five zones as below:

Zone I: The Bonai iron ore ranges of Jharkhand, Odisha and adjoining areas of eastern India. This includes Gorumahisani–Badampahar, Tomka–Daiteri belts.

Zone II: The iron ore deposits in the long (225 km.) north-south trend in the linear belt in central India in the states of Chhattisgarh, Madhya Pradesh and Maharashtra (East)

Zone III: In the Bellary –Hospet region of Karnataka.

Zone IV: The rich magnetite deposits of Bababudan –Kudremukh areas of Karnataka

Zone V: The rich iron ore of Goa and coastal Maharashtra.

The current estimates do not give a complete picture of India's iron ore resources. Most of the resource estimates of iron ore deposits were made at least three decades ago, which were later modified marginally. As is done in other mineral jurisdictions, resources need to be continuously reassessed, based on new technologies and advancement in the state of knowledge of the nature of mineral occurrences. The technical and economic feasibility of extraction also needs to be periodically reassessed. The resource reassessment is most urgently needed in the following areas:

(i) Exploration By Deeper proving

Earlier exploration schemes and the final estimates were dictated by the purpose of exploration, stage of exploration, the desired category of reserve/resource to be established at the stipulated level of depth and accuracy, size and type of deposits, etc. There is the possibility of substantial augmentation of ore resources if all the deposits are explored to the desired depth. Depth of exploration is a key dimension of resource estimation. Currently, the assessments made on the potential reserves of iron ore seem to be based on a

mining depth of 50 metres with a grid interval of more than 500 metres or so. But iron ore can be available to far greater depths as has been experienced by several mines in India. For example, in Karnataka, it has been contended that the reserves are based on a 40-metre depth only, whereas mining has been carried out to a depth of up to 200 metres. In other countries the mining depth has reached more than 200 metres. Mining depth depends on the conditions and there are no uniform geophysical conditions prevailing across the world. But from the experience so far, there seems to be good potential for Indian miners to find more resources by digging deeper. The question of whether to do surface mining or underground mining will depend on the disposition of the ore body and the relative costs of the alternative mining methods.

(ii) Systematic exploration in leasehold areas

In all the leasehold areas of both the private and public sectors where the maximum quantity of known iron ore resources are locked in, proper data evaluation is needed to assess the reserve and resources balances and examine whether the exploration was done in totality or there is still scope to augment reserves/ resources through further exploration. Most of the evaluated resources are in the indicated (332) or inferred (333) categories. In this context, close-spaced deep drilling may be undertaken to estimate proved reserves (111,121)/ resources (331, 321) of iron ore deposits. Efforts should be made for proper planning of exploration in virgin areas and for gaps in the mining leases to find new resources. The Ministry of Mines issued instructions in 2010 to all lease holders to complete a detailed exploration of their entire lease within five years.

(iii) Exploration in Forest areas

Many of the iron ore deposits lie in forest areas. The total resource potentialities of such deposits are not known. An example is Bailadila deposit No.2 (Part 3, 6, 7, 8, 9 and 12) in Chhattisgarh. These come under forest areas that require the necessary clearance. The Ghatkuri iron ore deposit in Jharkhand could not be explored due to forest problems. This deposit lies in a belt that hosts a number of large iron ore deposits. There are many deposits in forest areas, and such deposits have to be assessed in totality, keeping in view the quality of the resource, the availability of alternatives, the possibility of less intrusive extraction, etc.

(iv) Exploration of iron ore beyond BHJ/BHQ

Steps should be taken to examine for availability of iron ore resources beyond the BHJ/BHQ formations.

(v) Re-assessment due to lowered cut-offs

The lowest grade that can be economically exploited at a particular time is the cut-off grade. The cut-off level varies and is determined by market conditions keeping conservation in view, as these are non-renewable resources. Previously, resources and reserves were calculated based on an arbitrary 55 per cent Fe as the cut-off to produce a mineable ore, but recently the IBM lowered the threshold value of iron ore to +45 per cent Fe. Earlier, enriched banded iron formation (BIF) containing 45–55 per cent Fe was not

considered as ore. New ore enrichment techniques have made it possible to use lower grade ore; however, although such ore is available, their quantity is unknown because low-grade material was not estimated earlier. It has been geologically found that in many iron ore deposits iron ore (+55 per cent Fe) on the top passes through enriched BIF (50–55 per cent Fe) to BIF (<50 per cent Fe) due to supergene enrichment. Earlier enriched BIF with 50–55 per cent Fe was not considered as ore and was not included in the resource table. Since the cut-off grade has been lowered from 55 per cent to 45 per cent Fe, material with 50 per cent Fe to 45 per cent Fe will form part of iron ore.

Manganese

Indian manganese ore deposits occur mainly as metamorphosed bedded sedimentary deposits associated with the Gondite Series (Archaeans) of Madhya Pradesh (Balaghat, Chhindwara and Jhabua districts), Maharashtra (Bhandara and Nagpur districts), Gujarat (Panchmahal district) and Odisha (Sundergarh district) and with the Kodurite Series (Archaeans) of Odisha (Ganjam and Koraput districts) and Andhra Pradesh (Srikakulam and Visakhapatnam districts).

Odisha tops the total resources with 40 per cent share, followed by Karnataka (22 per cent), Madhya Pradesh (16 per cent), Maharashtra (8 per cent), Goa 5 (per cent) and Andhra Pradesh (4 per cent). Rajasthan, Gujarat, Jharkhand and West Bengal together share about 5 per cent of the total resources.

The total resources of manganese ore in the country as per the UNFC system as on 1 April 2005 are placed at 378.57 million tonnes. Of this, 138.15 million tonnes are categorised as reserves and the balance 240.42 million tonnes are in the remaining resources category. In terms of grade, ferro-manganese grade accounts for only 7 per cent, medium grade for 8 per cent, BF grade for 34 per cent and the remaining 51 per cent are of mixed, low, other, unclassified, and not known grades including 0.5 million tonnes of battery/chemical grade.

The following steps are urgently needed to ensure that manganese ore production is well aligned with the needs of the steel industry:

(i) The manganese ore resources are distributed over many states, of which the important ones are Odisha, Madhya Pradesh, Maharashtra and Karnataka. As per the UNFC, these states have potential reserves of manganese ore. At present, only 36 per cent of the resources are in the mineable range in the reserves category and the remaining 64 per cent are in the resources category, which needs techno-economic measures or additional exploration to convert them into reserves. Priority needs be given to convert resources into reserves before the current reserves are depleted. The quality of the pockets of scattered deposits is uncertain, and often mining strategies fail if they are not scientifically investigated.

(ii) The quality and recovery of manganese ore by beneficiation and sintering processes should be improved. The import of low phosphorous manganese could be considered for blending, as the manganese ore in India has high phosphorous content.

(iii) Exploration efforts are needed to find new reserves or to upgrade reserves of high-grade low phosphorus manganese ore, with a thrust on increasing proven reserves. Systematic exploration is required in the states of Odisha and Karnataka to explore the possibility of enhancing the reserves, as these states contribute around 60 per cent of the total resources.

(iv) The existing reserves of 138 million tonnes is likely to result in only about 58 million tonnes of saleable ore after considering the statutory mining regulations and the recovery percentage of saleable ore. This 58 million tonnes can last up to 20 years if the production rate of 3 million tonnes per year is achieved. South Africa has 4,000 million tonnes as a resource base of manganese ore, which constitutes about 80 per cent of the world reserves but accounts for only 20 per cent of world's production; hence, efforts should be made to acquire manganese ore deposits in South Africa or elsewhere to supplement the demand gap.

Chromite

Chromite deposits in the Sukinda and Nausahi ultramafic belt of Odisha constitute 95 per cent of the country's chromite resources. Here, chromite occurs as concentrations and disseminations in the ultramafic rocks in the form of lenses, pockets, thin seams and stringers. Other states contributing to the country's resources of chromite are Karnataka, Maharashtra, Andhra Pradesh, Tamil Nadu, Manipur and Jharkhand. In Karnataka, the ultramafic rocks bearing chromite occur in two belts, viz., Nuggehalli, Arsikhera and Nanjangud in Mysore district. In Maharashtra, it occurs in altered ultramafic rocks. In Andhra Pradesh, it occurs in the Eastern Ghat group of rocks in Khammam and Krishna district. In Tamil Nadu, chromite associated with amphibolites bands is found in the Sitampundi complex of anorthosites. In Nagaland, nickeliferous chromite has been located in the ultramafic belt. Small resources have been established in Karnataka, Maharashtra and Jharkhand. Nearly 2,500 sq. km. area is the potential geological domain of which 85 sq km is leased out.

The total potential area for chromite is approximately 2,720 sq. km., which includes 2,690 sq km in peninsular India and 306 sq km in extra-peninsular India. The total explored area is 604 sq km, which includes 88.7 sq km leasehold areas. The freehold unexplored area is around 2,116 sq km. and the freehold explored area for reassessment is around 515.3 sq km. Chrome ore is being mined by the open-cast method in the Sukinda area (Odisha), which is the most important area for chromite. To mine one tonne of chrome ore, 15 tonnes of overburden is mined. The problem in Sukinda is the occurrence of friable ore at deeper levels. Only 24 per cent of the chrome ore resources are developed into reserves and a lot of deep-seated drilling is required to convert the balance resources into reserves.

The following steps are urgently needed to ensure that chromite ore production is well aligned with the needs of the steel industry:

(i) Chrome is a scarce mineral in India. India has only about 1 per cent of the total chromite ore reserves of the world, whereas exports are 30 to 35 per cent of the world share. Although India has about 213 MT of chrome ore resource, it has only 66 MT of reserves, of which 90 per cent is in Sukinda and the ore is friable at depths of 100–300 metres. The resources will last for only 20 years given the rate of consumption. There is a need to develop our resources and use them more efficiently. Only about 26 per cent of the chrome ore resources are developed into reserves; the remaining 74 per cent is still to be explored and developed fully to be converted into reserves, since most of these are deep-seated and friable. The exploration of deep-seated ore bodies needs to be carried out on priority.

(ii) R&D needs to be carried out on the use of low-grade ore, with or without blending, in the ferro alloys industry for an overall increase in the resource. The development of suitable beneficiation methodology to make effective use of low-grade, friable chromite ore (less than 30 per cent Cr_2O_3) fines, which is available in sizeable quantities in India.

CHAPTER XI

Skilled Manpower and R&D

It is widely recognised that industrial processes including steel-making are becoming increasingly knowledge-intensive and in the resource-constrained environment, the steel industry can achieve its goal of tripling its production by 2025 only if it mobilises the required manpower along with R&D efforts. This chapter will describe the present situation in the steel industry in terms of manpower requirements, the availability of skilled labour and R&D efforts.

Current Situation and Challenges

1. Shortage of Skilled Labour

India currently has a steel manufacturing capacity of about 100 million tonnes per annum (mtpa) in 2013–14. If the target of increasing the capacity to 300 mtpa by 2025 is to be met, the manpower requirement is likely to go up from the present 2 lakh to nearly 5 lakh by 2025 (see Annexure Table). This demand is likely to come for all types of labour—unskilled, semi-skilled and highly skilled. Given the rapidly increasing labour force in India and huge migration of unskilled and low-skilled workers from agriculture, the availability of unskilled workers for the steel industry should not be a problem. However, the availability of skilled manpower such as engineers and metallurgists is an issue.

a) Shortage of Medium-Skill Labour Force

Despite sustained emphasis on the need for skill formation, progress in this category has been poor. The vocational training institutes are often poorly connected with practical training, and young people are often not interested in getting into these training institutes. The steel industry, which is heavily concentrated in Odisha, Jharkhand and Chhattisgarh, can make a breakthrough in this area. There is an urgent need to provide education and training facilities for the tribal youth who could then become part of the industrial development including the steel industry in this region. The Kalinga Institute of Social Science in Bhubaneswar (Odisha) is a good example, which is working towards giving education, medicines and vocational training to around 62 communities of tribals, thereby making them fit for semi-skilled jobs in the steel industry. Such training programmes can go a long way in providing a sufficient labour force of medium-skill workers for the steel industry. For this, the industry needs to come forward and collaborate with NGOs or training institutes so that the course structures can be amended as per industry requirements and, of course, skill development centres also have to be set up.

b) Shortage of High-Skill Manpower

The Indian steel industry is facing a massive manpower shortage, particularly in metallurgy and mining. Given that 15 per cent of the total manpower in a steel plant are engineers, the state-run steel firm estimates that there would be an additional requirement of 43,000 engineers in the industry by 2024–25. In other words, the number of engineers required will increase from 30,000 in 2013–14 to 73,000 in 2025–26 (see Annexure Table). Metallurgy might be a viable option for students, as the steel industry would fill up to 30 per cent of its projected need for engineers from among metallurgists. It is projected that there would

be an additional requirement of around 15,000 metallurgists for the steel industry in the next decade, but such numbers are simply not available. At present, India has 30 institutes that teach metallurgy, with around 1,800 students graduating every year[9]. Outside the IITs and NITs, very few engineering colleges offer metallurgy courses. The report on 'Mapping of Human Resources and Skills for Mining Industry in India' by the Confederation of Indian Industry (CII) projects that at present there are 23 institutes offering BE/ME courses and mining, of which nearly 70–80 per cent join the mining sector. This supply should be increased by three times by 2025 to meet the target. In the case of geology, there are 42 institutes that employ around 70 per cent of the students in the mining sector, which should be increased by 10 per cent. Hence, while increasing the supply of mining engineers and metallurgist is a big challenge, the supply of geologists will closely meet the demand.

c) Inadequate Gender Inclusion and Empowerment

Indian law bans women from entering underground mines, working night shifts, and operating factory machinery. Ironically, these laws, which were passed to protect poor women, are holding back educated women from moving into core leadership positions in the mining and heavy engineering industries. Due to this law, mining training institutes prefer not to admit women into core mining/ mining engineering courses. Although IIT-Kharagpur and IIT- BHU have relaxed this rule, they found that no mining firm would hire its mining/ mining engineering women graduates, being wary of inspectors out to enforce the law. Thus, these women were forced to find IT jobs instead. For the same reason, women are not permitted to apply/ certify for a First Class Unrestricted Mining Certificate, which permits entry into any type of mine. They can only certify for a Restricted Certificate, which permits entry into over-ground mines. So, the law seems to have relegated women to 'second class status' professionally at a time when we are trying to radically boost manufacturing/mining sector development and bring more skilled women into the workforce. Other countries have done so in the past two decades, as a result of which women are now an integral part of the mining workforce and leadership in Chile, South Africa, Australia, etc. However, this is also because their mining industries are significantly more mechanised than ours. In fact, this is one area where semi-literate rural women could be extensively employed with focused training.

d) Mismatch between Available Skills and Industry Requirements

There are sufficient engineering colleges in India, with more than 4.5 lakh[10] students graduating every year. However, a large proportion of these graduates are found to be unemployable in skill-intensive industries. Of the total number of engineering graduates, only 50–55 per cent are able to enter the job market due to the lack of skills required by industry. This could be a constraint on achieving the output targets of the industry by 2025. Companies often have to develop their own training and re-training programmes to convert these engineers in general and metallurgists in particular into employable categories. Given the time it takes to train skilled workers in general and metallurgists in particular, remedial measures have to be introduced in the near term. We should first look at best practices in this area for the steel industry and then go on to implement the recommendations (see Annexures for Best Practices).

[9]See report on 'Adequate supply of manpower a challenge for steel industry' published in PTI, dated 11 June 2014.
[10]Article by Pratibha Patil, published in Economic Times, dated 25 March 2012 on 'India needs to expand education infrastructure'.

e) Metallurgy/Mining losing Attraction in Higher Studies

In the past few years, geology, mining and metallurgy have become less popular subjects for students in higher education[11]. The migration of the skilled workforce from manufacturing to the service sector has further aggravated the unavailability of a skilled workforce. The majority of engineering graduates are now moving to other sectors such as IT and automobiles, for various reasons. Salary is not the only issue. The work environment and a chance to work abroad are major incentives in some white-collar jobs, but the steel industry is not competitive in these two areas. The steel companies will have to design innovative mechanisms such as employee stock option plans (ESOPs), long-term deferred cash plans and safety plans to attract and retain talent.

2) Lack of Research, Development and Innovation Skills

In this area, the performance of the steel industry is relatively poor, as is the case for the country as a whole. Although a few steel companies like SAIL, Tata Steel, JSW Steel and Essar Steel have accomplished some significant work in the area of raw material beneficiation, agglomeration and product development, their main focus is the development of incremental technology to address the present and short-term needs of various production units. As a matter of fact, barring some commendable product development efforts, their contributions towards disruptive technology development have not been noteworthy. India spends a low proportion of the revenues of the steel industry on R&D. The actual investment in R&D by Indian steel companies varies in the range of 0.2–0.3 per cent of their total turnover as against international spending of 1–1.5 per cent (see Annexure Table). Hence, India requires a five-fold increase in this ratio. Expenditure in India is mostly on raw material beneficiation, increasing process efficiency, development of new products and improving the performance of small and medium enterprises, whereas the international thrust is on energy efficiency and climate change issues.

India has several institutes such as the National Metallurgical Laboratory, IMMT (formerly RRL), IITs and NITs engaged in research activities on iron & steel, but there is a need to synergise the activities of these institutions. The main reasons for low expenditure on R&D are lack of available finance, insufficient R&D infrastructure and lack of interest by Indian companies. Although the Government of India releases funds from the Steel Development Fund (SDF), not much is available in this fund. The Government of India has now fixed the target for R&D expenditure by industries at 1 per cent of turnover by 2016–17 and 2 per cent of turnover by 2020, but these appear to be unrealistic targets. The R&D scenario in steel companies abroad, particularly in China, Japan and South Korea, is quite different. They have a large outlay of funds earmarked for R&D and also have visible tie-ups with external laboratories and academic institutions. Annual R&D investment at international standards is very high and is in the range of 1–2 per cent of their turnover (see Annexure Table).

[11]Presentation by P. Rama Rao on 14 Feb 2013 on 'Higher technical education in India: prospects, challenges and the way forward' at INSA, New Delhi.

Appropriate Technology for Future Steel Plants

The competitiveness of the Indian steel industry cannot be sustained in the long run purely on the basis of low labour costs and cheaper raw materials. Technological excellence, innovation and the adoption of environment-friendly techniques at all stages of production, from the extraction of minerals to the treatment of wastes, are the key to sustained growth in this sector. For the installation of a new steel plant, for new production facilities in existing plants or to replace obsolete, old or small facilities, technology selection is normally done by entrepreneurs or the company based on the availability and proven performance of the technology, raw materials, availability of power, fuel, water, land, etc. However, it would be prudent to form a task force that can go into the details of appropriate technology options and technology routes for future steel plants in India. During the past two decades, the Indian steel industry has adopted several new technologies, and productivity and quality have shown marked improvement.

Most of the big companies are now using mixed technology, including 40 per cent hot metal, 40 per cent Direct Reduced Iron (DRI) and 20 per cent scrap. This saves heating time. Even in Blast furnace (BF), some percentage of scrap is required for cooling. Using DRI without BF can increase energy consumption, while using BF without DRI can increase the imports of coking coal. In the next 10 years the demand for the Electric Induction Furnace (EIF) route is expected to decline. At present, in India, scrap generation is low, and in the coming years the Blast Oxygen Furnace/ Electric Arc Furnace (BOF/EAF) route might make use of scrap.

Induction furnace technology is suitable only for scarp melting. In a developed economy, where scrap is available in plenty, this could be an appropriate technology because it is cost effective. However, it does not have the ability to refine the steel to achieve lower contents of sulphur, phosphorus, etc. At present, Indian induction melters primarily use sponge iron and pig iron instead of scarp as the iron inputs, and hence the phosphorus in the steel needs to be reduced. To avoid technological obsolescence and attain sustainability, the industry has to focus on developing a process to remove phosphorus by a suitable refining process. In India, EAF is constrained due to the non-availability of power and its high cost. Steel production by the BOF route will reach a level of 70 per cent by 2025. There is no doubt that its share in overall production will increase, but growth will be limited by the following factors:

- Lack of available land
- High capital costs
- Long gestation period
- Need for several government clearances
- Lack of infrastructure
- Raw material security and allotment of mining leases

New processes are being developed as alternatives to blast furnaces and some of them will mature by 2025. These processes aim at

- Using lean ore and non-coking coals
- Avoiding expensive agglomeration processes
- Reducing CO_2 emissions
- Reducing energy consumption

Currently, the major criterion for the selection of technology appears to be capital cost. As the industry grows, regulatory norms and environment concerns are likely to become more stringent. Green technology and safety may become the key driving factors for the selection of machinery and technology. With increasing steel production, there will be a need to reduce the consumption of resources (iron ore, coal, water, etc.) and to develop processes for recycling all the wastes generated in the production process.

Recent Initiatives

There is no doubt that the government is equally concerned about the manpower shortage and low R& D expenditures in the steel industry. It has been highlighted in the Steel Policy 2012 that Indian steel plants are less efficient in terms of the consumption of raw materials/ consumables, energy/ power consumption and environmental and pollution norms than those in advanced countries. It is essential to build up indigenous capacity to develop technologies that suit indigenous raw materials, improve energy input norms and comply with national and global standards on emissions and carbon footprint. Several small units engaged in manufacturing iron and steel products need to focus on domestic R&D to improve their technology and performance standards. It also indicates that there is need to review and upgrade the existing training facilities to meet the requirements of the mining industry.

Less than 5 per cent of our potential work force gets formal skill training to be employable. In the latest budget 2015–16, a few measures have been taken to improve skills in India. These measures include: National Skill Mission to consolidate skill initiatives spread across several ministries; Deen Dayal Upadhyay Gramin Kaushal Yojana to enhance the employability of rural youth; setting up an IIT in Karnataka; the Indian School of Mines, Dhanbad to be upgraded into a full-fledged IIT. The government also proposes that the Atal Innovation Mission (AIM) should be established in NITI Aayog to provide an innovation promotion platform that involves academics and draws on national and international experiences to foster a culture of innovation, research and development. A sum of Rs 150 crore will be earmarked for this Mission.

The Way Forward

Most of the technological challenges we face in India are 'country-specific' such as the high alumina content in iron ore, high ash content in coal, low interest of academic institutions in metallurgical education and research and low priority to research and technology in the steel industry. The steel industry must resolve to change this scenario by finding innovative solutions to these problems. The following steps may be taken as the way forward:

- There is considerable dilution of metallurgical education in India with the conversion of metallurgical engineering into materials engineering, and most faculty members work on material science. The HRD ministry not only needs to introduce metallurgical engineering courses in more institutes/ universities but it also needs to increase the number of seats in metallurgical engineering.
- The curriculum in engineering colleges is outdated. There is a need for dedicated and customised courses on iron and steel manufacture in engineering institutes to suit industry requirements. China's example is noteworthy here, as they have customised courses at the BA and MA levels.
- The government should provide funds to increase the capacity of vocational education.
- The ministry may consider setting up a Steel University so that industry-ready engineers become

available. This university can cover courses as per the requirements of industry and can initiate R&D activities through academic-industrial collaboration. The best example is the four Railway Universities that will be set up shortly in India.

- Students should be given an opportunity to work in steel plants as interns to understand the work culture and develop their interest in the steel sector. Efforts should also be made to enhance student-industry interaction and to develop mentorship programmes and industrial online projects to enhance their knowledge about the industry.
- Collaborative R&D projects should be set up between academics, research institutes, reputed laboratories and industry.
- Additional skill development centres should be set up with a focus on steel-making programmes. The government target is to upgrade 300 ITIs per year and convert them into centres of excellence in specific trades and skills through PPP. Interest has been shown by various companies in different sectors, such as Hero Honda, ITC, Larsen & Toubro and Tata. In line with this, steel companies can also establish tie-ups with ITIs to solve labour shortage issues.
- The private sector has been taking various initiatives on its own and in collaboration with the government and international entities to upgrade in-house training facilities for existing and potential employees to make them ready for new and upcoming technologies. Several large corporations, such as Larsen & Toubro, Bharti Group, Hero Group and Maruti, have established training facilities to offer world-class training programmes that create an environment of e-learning and innovation.
- The Sector Skills Council (SSC) model, which is a national partnership organisation adopted from the UK that brings together academia, industry, labour and the government, has proved useful in addressing human resource gaps in the country. This model can be extended to the steel sector. Korea's skilling programmes provide a clue to their efficiency in production; around 90 per cent of the Korean workforce is skilled.
- Faculty development centres may be opened to impart training to the faculty in steel vocational institutes.
- Industry needs to make the steel sector more attractive by offering attractive salary packages, incentives and benefits and employing safety measures.
- The safety record of the Indian steel industry is not satisfactory. The death rate is one of the highest in the world. In the medium and small-scale sectors, such incidents go unreported. The lost time injury frequency rate (LTIFR) in the Indian steel industry is between 0.3 and 0.8 against international performance of 0.2 to 0.3. Hence, safety and health of employees should be ensured.
- Industry should find ways to investigate how more women might be brought into India's male-dominated mining industry and moved up the value-chain. Industry desperately needs skilled people, and this is one area where semi-literate rural women could be extensively employed. With focused skilling, many of them could be moved up and out of their current 'bottom of the pile' role where they work as head loaders, cleaners, etc. They could easily be trained to be electricians, bricklayers, plumbers, etc. If they are taught to drive (as Rio Tinto and Tata Steel have been doing), it is easy to 'upskill' them into becoming bulldozer and excavator operators in open cast mines. JCB India and Jindal Stainless have been hiring and training rural and semi-urban women welders, furnace operators, etc., who work alongside their male colleagues in all aspects of manufacturing operations.

- Industry should work with the ministry to relax the restrictions on women working in underground mining or at factory outlets. Women should be given an equal chance to show their strengths in this sector as well.
- Steel companies in developing countries, which are normally smaller in capacity, look for quick returns before they invest further in production facilities. As a result, R&D programmes, which are long-term strategies, do not get due recognition. When the industry develops in tandem with economic growth, investment in long-term options like R&D becomes considerably profitable. In Japan, the US and some EU countries, government investment in R&D is minimal, whereas in developing countries like China and Russia the government directly or indirectly facilitates R&D for all sectors of the economy including steel. The Indian situation is similar to these developing countries and government support and intervention are logical and necessary for pursuing fundamental as well as applied research in a vital sector of the economy such as steel. Such a positive intervention is also considered necessary to step up initiatives and investments in R&D.
- The Government of India has allowed tax benefits under Section 35 of the IT Act by which any expenditure (revenue and capital) on scientific research is eligible for a deduction up to 200 per cent from the total taxable income of the company, thereby encouraging R&D. However, this incentive has not been increased R&D investment in the steel industry, and therefore further streamlining is required with regard to its coverage of R&D activities.
- For research activities, there is a need to create the required infrastructure, identify relevant research programmes, develop a dedicated team and provide an adequate budget.
- The government is supplementing R&D in the iron and steel sector in the country through the State Development Fund (SDF) and government budgetary support. However, most of the projects under the SDF have been directed at a problem-solving approach with incremental benefits and it lacks a focus on disruptive/ path-breaking innovation. It is, therefore, important to modify the strategy and include large-value innovative/ breakthrough programmes for raw material beneficiation for the benefit of the steel industry. A good example is the Co-operative Research Centres of Australia, which are industry-led and very successful.
- Some of the major steel companies have in-house R&D establishments, though with limited focus and programmes. This position calls for a change. R&D establishments in the steel sector, particularly in steel PSUs, have to be revamped and fortified, and they have to attract R&D experts with their financial packages and career path. To change the present state of affairs it is essential to recruit people who have the necessary qualifications and an aptitude for R&D, either through direct recruitment or through lateral entries.

For Best Practices, refer to Annexure Table.

CHAPTER XII

Supply of Logistical Facilities

The steel industry is heavily dependent on raw materials and bulk movement. The production of one tonne of steel requires the transportation of more than 4 tonnes of materials for which an efficient and cost-effective transport system is necessary. Unfortunately, the present transport system in the country does not provide the necessary support to the industry. Apart from congestion and delays, steel plants face high freight costs in India. The cost of logistics in India is 20 per cent of product cost against 6–8 per cent in China. Freight cost from Jamshedpur to Mumbai is $50/tonne compared to only $34 from Rotterdam to Mumbai. According to one estimate, steel-related traffic is expected to go up to 195 million tonnes by 2025. Of this, the coking coal import traffic is likely to go up by 110–130 mt, iron ore import traffic by 20–50 mt and steel export traffic by 10–15 mt, which comes to about 140–195 mt for overall steel-related traffic. As Indian steel production increases in the coming years, the demand for raw materials such as coking coal and iron ore is likely to go up. Given the nature of the bulk commodities moved in the steel industry and the higher energy efficiency of railways, rail is the preferred mode for transport in the industry. Also, with globalisation and the increased share of external trade in raw materials and finished products, maritime transport will be in increasing demand. Road transport is a less preferred mode due to the distorted infrastructure for railways and ports. Hence, providing the necessary infrastructural support to steel plants is going to be a major challenge for the government.

Present Scenario and Issues

There are four major transportation modes through which the freight of the Indian steel industry can be transported: roadways, railways, waterways and port ways. The present condition and shortcomings of each of these are discussed below.

a. Roadways

The share of road traffic is high (55 to 60 per cent) as against 35 to 40 per cent in the US and 20 to 25 per cent in China. Road traffic emits 84g CO_2/tkm as against 28g in the case of rail transport and 15g in the case of waterways. Road traffic is four times more expensive than waterways and twice that of railways. National highways form just 2 per cent of the total road network but carry 40 per cent of the total road traffic. This results in congestion and high transit times. Road quality is poor, with motorable roads being only 10 per cent of the total network. The capacity of commercial vehicles is low, with as many as 60 per cent having a capacity of only 7.5 mt. The trucking industry is highly fragmented and the percolation of technology is slow. There are not enough special vehicles to carry heavy machinery of non-standard dimensions. A truck has to pass through multiple checkpoints, causing delays. Truck drivers are not skilled enough to record delivery details, understand delivery documents and handle queries. Traffic snarls on highways, delays at toll plazas, accidents and political blockades annually cost the economy nearly Rs.40 billion in lost truck-operating hours, according to the Second Report on Operational Efficiency of Freight Transportation by Road in India. To compare the route statistics with 2008–2009 and 2011–12 surveys on the Delhi–Bangalore highway, on average the toll stoppage delay is 67 per cent, a rise of 18 per cent. In India, safety is another area of concern in road transport. Over 1.3 lakh people die in road accidents annually and this number is rising. This is about 10 per cent of world figure.

b. Railways

The share of railways in the total plan outlay is currently only 5.5 per cent vis-à-vis about 11 per cent for the other transport sectors. That these numbers are low is indicated by a comparison with China. As a share of GDP, China has invested around three times as much as India on average over the period 2005–2012. In per capita terms, China has invested on average 11 times as much over the same period even though both countries have similar populations. In India since independence, the rail route kilometre has increased by 3 per cent and the track kilometre by 6.6 per cent, while freight and passenger traffic has increased by 54 per cent. In freight services, customers have to opt for a full rake constituting 3,500 metric tonnes of material. This take-it-or-leave-it situation has made the Indian railways suitable only for carrying bulk traffic like coal, ores and minerals and food grain. Consequently, the railways have been steadily losing its share of freight movement—down to 36 per cent from 89 per cent in 1951. According to a McKinsey study (2013), the share may decline to 25 per cent in 2020, causing a loss of 5 per cent of GDP.

Apart from these issues, there are other problems. Transit times are high: up to one week for 2,000 km. Railway tariffs are high. Railways are reluctant to carry mixed trains of cargo for delivery to different customers. Special wagons are not available for loading special products. The freight operations of Indian railways are less efficient than in other countries. The average payload carried per wagon in India is 3 mt per km per annum compared to 4.6 mt per km for China and 7.3 mt per km for the US. The average speed of freight trains in India is about 25 km per hour compared with 41 km per hour in the US. The railways' share of freight traffic is close to 50 per cent in large economies like the US and China. Trunk rail routes, which form just about 16 per cent of the network, are dangerously oversaturated, with the bulk running at 80 per cent and several in excess of 120 per cent of their designed capacity.

c. Coastal Shipping/Ports

Most of the steel plants do not have proper connectivity through the rail network to mines and ports. There are 13 major ports under government control with a total capacity of 750 mt, which operate at 75 per cent capacity. The turnaround time at Indian ports is high at 2.5 to 6.5 days against international performance of 1 to 1.5 days. Indian ports are not deep enough to receive large vessels. Kandla handles the maximum traffic of around 85 mtpa. In contrast, Shanghai in China, which is the world's largest port, handles 650 mt, Singapore port, the third largest port, has a turnover of 463 mtpa and Rizhao in China, the fifteenth largest port in the world, handles 225 mtpa. Total port traffic in India is currently around 1000 mtpa, with private ports contributing 45 per cent. Apart from this, the cost of coastal shipping in the country is higher than in many other economies.

d. Waterways

The share of water transport in domestic freight traffic is just about 6 per cent compared to large economies such as China (47 per cent), the US (12.4 per cent) and Japan (34 per cent). An amount of only Rs 1,120 crore has been spent since 2010 to develop waterways. This is the cheapest transport mode. There are five identified national waterways: Ganga (1,620 km), Brahmaputra (891 km), West coast canal system (205 km), Godavari & Krishna river and Buckingham Canal (1,078 km) and Brahmani & Mahanadi rivers and east coast canal (588 km). Barak River in Assam will be the sixth national waterway. National waterways 1, 2 & 6 will be connected after the Indo–Bangladesh protocol. There is inadequate port and land-side infrastructure for coastal shipping.

Looking forward, tripling steel production by 2025 will require at least a tripling of transport facilities[12]. If the modal mix between rail and road is to change from 35:65 to 50:50 as visualised by the Transport Development Policy Report, the railway transport capacity for steel has to increase by 4.5 times. An even greater increase is required in water transport, both marine and inland.

Latest Initiatives

While the 12th Plan envisages an investment of $1 trillion in infrastructure, progress in the implementation of infrastructure projects leaves significant scope for improvement. More than Rs 6 trillion ($100 billion) worth of projects in India had been stalled as of 31 March 2014, according to the Centre for Monitoring Indian Economy Pvt. Ltd (CMIE), a Mumbai-based independent think tank. And investment in infrastructure had slipped to just about 5 per cent of GDP, which is half of what India needs if it aspires to move back to near double-digit growth rates, according to the rating agency Crisil Ltd.

Steel Policy 2012 has also highlighted that due to rising demand anticipated in the Twelfth Plan period, the already overburdened domestic infrastructure, particularly in mineral-rich states, requires immediate attention. Apart from ensuring adequate rail–road connectivity, the National Investment and Manufacturing Zones (NIMZs) proposed in the National Manufacturing Policy may provide an excellent option for the future location of new steel plants due to their proximity to consumers. However, for this to happen, the perspective planning for NIMZs has to consider some of the NIMZs in the eastern region of mineral-rich states. Steel Policy 2012 also laid special emphasis on linking infrastructure in mineral-bearing areas.

Budget 2015–16 proposes the following measures for infrastructure development in India:

- Sharp increase in outlays on roads and railways. Capital expenditure of public sector units to also go up.
- National Investment and Infrastructure Fund (NIIF) to be established with an annual flow of Rs 20,000 crore to it.
- Tax-free infrastructure bonds for projects in the rail, road and irrigation sectors.
- PPP mode of infrastructure development to be revisited and revitalised.
- Concerns of IT industries for a more liberal system of raising global capital, incubation facilities in centres of excellence, funding for seed capital and growth, and ease of doing business etc. will be addressed in order to create hundreds of billion dollars in value.
- Self-Employment and Talent Utilisation (SETU) to be established as a techno-financial, incubation and facilitation programme to support all aspects of start-up business. Rs 1,000 crore to be set aside as the initial amount in NITI Aayog.
- Ports in the public sector will be encouraged to corporatise and become companies under the Companies Act to attract investment and leverage the huge land resources.
- An expert committee to be set up that will examine the possibility of replacing multiple prior permissions with a pre-existing regulatory mechanism and prepare draft legislation. This will facilitate India becoming an investment destination.

[12]*India Transport Report: Moving India to 2032,* Routledge, 2014, New Delhi prepared by National Transport Development Policy Committee assumes elasticity of freight transport with respect to GDP at 1.2. It also assumes that rail:road ratio for freight will increase from the current 35:65 to 50:50 by 2032.

- Introduction of five new ultra mega power projects, each of 4,000 MW in the plug-and-play mode.
- Excise duty on rails for the manufacture of railway or tramway track construction material exempted retrospectively from 17 March 2012 to 2 February 2014, if CENVAT credit of duty paid on such rails is availed of.
- Part of the Delhi–Mumbai Industrial Corridor (DMIC)—Ahmedabad–Dhaulera Investment region and Shendra–Bidkin Industrial Park)—is now in a position to start work on basic infrastructure.

A report by McKinsey (2010) observes that "India's logistic infrastructure is not adequately equipped to meet rapidly rising freight traffic, changing consumption patterns and increasing number of production centres". The report states that dedicated freight corridors (DFCs) are the most cost-effective way to add freight traffic capacity. Globally, among the countries that have DFCs, the most prominent are Australia, South Africa, China, the Netherlands and the US. Recently, the Ministry of Railways, under the direction of the Government of India, has taken up the DFC project, which involves the construction of six freight corridors traversing the entire country in order to provide a safe and efficient freight transportation system. The Ministry of Railways has sanctioned the implementation of the Western Dedicated Freight Corridor (WDFC) and the Eastern Dedicated Freight Corridor (EDFC) with freight train speeds of a maximum of 100 kmph. The alignment for both the WDFC and the EDFC has been finalised. The WDFC starts at Jawaharlal Nehru Port Trust (JNPT), Mumbai, passes through Maharashtra, Gujarat, Rajasthan and Haryana, and terminates at Dadri in Uttar Pradesh; its total length is about 1,500 km. The EDFC starts at Sahnewal near Ludhiana in Punjab, passes through Haryana, Uttar Pradesh, Bihar and Jharkhand and terminates at Dankuni in West Bengal; its total length is 1,856 km. Excluding the Sonnagar–Dankuni section of the EDFC, the WDFC and the EDFC are targeted to be completed by December 2019. The other four corridors are north-south (Delhi–Tamil Nadu), east-west (West Bengal–Maharashtra), east-south (West Bengal–Andhra Pradesh) and south-south (Tamil Nadu–Goa). These four corridors are still at the planning stage.

Apart from freight corridors, two new ports in the government sector and one in the private sector are coming up on the east coast. The private sector is expanding the port capacity on the west coast. The National Highway Authority of India is taking up several projects to strengthen the road sector.

The Way Forward

A national integrated logistics policy should be formulated that aims to achieve at least 45 per cent freight handling by rail, 9 per cent by water, 1 per cent by air and the remaining 45 per cent by road by 2020. The policy should cover, among other things, the following aspects:

- This sector requires a large increase in investments. Special emphasis needs to be given to linking infrastructure in mineral-bearing areas.
- Create the necessary additional infrastructure (including railway electrification) and remove system bottlenecks, if any, in the existing rail, road and port sectors to reduce the turnaround time of railway wagons, trucks and ships.

- Investing in the construction of rail DFCs and coastal freight corridors would be good step in this direction. Develop dedicated freight corridors similar to the DMIC in the Ruhr-like belt of iron ore and coal in the states of Odisha, Jharkhand and Chhattisgarh.
- Develop national expressways (road). Improve rail and road links to ports, mines and industrial centres.
- Construct more warehouses with the required infrastructure and multimodal logistics parks.
- Manufacture higher tare load railway wagons and high-capacity trucks.
- Improve the quality of roads and increase the percentage of motorable roads to at least 50 per cent. Introduce electronic tolling in the case of road transportation.
- Increase railway transport capacity for steel by 4.5 times. Improve the railways in terms of freight capacity, reduced costs and the adoption of new technologies and professionals.
- Greater increase is required in water transport, both inland and marine. Increase the depth at major ports to enable them to handle larger vessels.
- Develop the skills of personnel in the logistics sector.
- Provide conveying systems and slurry pipelines for transportation wherever possible. The benefits of the pipeline route are: no transport costs except for power; more economical because road/rail transport requires lots of wagons or number of trucks which are limited in India; a few minerals pass through Naxalite areas, so in those areas an underground pipeline route is safer; it avoids losses due to delays and accidents.
- Apart from ensuring adequate rail–road connectivity, the National Investment and Manufacturing Zones (NMIZs) proposed in the National Manufacturing Policy may provide an excellent option for the location for new steel plants due to their proximity to consumers. For this, there is need to consider locating some of the NIMZs in the eastern region, which has mineral-rich states.

CHAPTER XIII

Managing Environment

One tonne of steel requires transporting, storing, and processing under high temperature about four tonnes of raw material much of which of fine quality. Thus, the steel industry has high inherent potential for environmental degradation, and in the early phase of its history the industry did have a high degree of pollution of air, water and land along with high levels of CO_2 emission. However, over time and with improved technology, environmental management by the global steel industry has improved tremendously and the best global practices have low environmental footprints and new technologies are being constantly developed to improve environmental management. Since most of the expansion of the Indian steel industry is in the future, India has a good opportunity to leapfrog to environmentally-friendly technologies and come out ahead of other old steel plants around the world.

While the steel industry has some inherent potential for environmental degradation, it also has great potential for re-use and recycling. Highlighting this aspect, World Steel Association had suggested that one should look at Life Cycle Assessment (LCA), which is an approach that tries to identify areas of potential impacts during the life cycle at all stages ranging from manufacturing, product usage and its end-of-life, including the recycling, re-use and disposal stages. It is one of the most efficient ways to assess the impact of the steel industry on the environment. This approach considers emissions both from the manufacturing side (steel products) and during the usage of new generation steels in building stronger and lighter products that reduce energy consumption. Steel is a 100 per cent recyclable product, which means that it can be re-used again and again. For every tonne of steel scrap that is re-used in making new steel, over 740 kg of coal, 1,400 kg of iron ore and approximately 120 kg of limestone on average can be saved. Greenhouse gas (GHG) emissions are a rising concern at the global level and recycling of steel products will be a step forward in mitigating these concerns about high CO_2 emissions. Also, by-products of the steel industry can be used within the industry to reduce such emissions, such as the steel-making slag, which is used as civil work aggregate, or blast furnace slag, which is used in the cement industry. This will help curtail the emissions significantly and have no adverse impact on the environment.

Despite these long-term possibilities, the current condition of the Indian steel industry from the point of view of the environment is not satisfactory. The report entitled *Into the Furnace: the Lifecycle of the Indian Iron and Steel Industry* (2012) prepared by the Centre for Science and Environment (CSE), New Delhi gives a damning account of the performance of the steel industry in terms of its environmental performance. The report was prepared by a team of experts based on data over the period 2006–7 to 2009–10 relating to 21 companies accounting for about 68 per cent (51 million tonnes) of steel production capacity in India in 2009–10. Of the 21 companies, 13 (accounting for 35 mtpa) agreed to co-operate with the project; for others, information was obtained from publicly available sources.

The report concludes that of the five sectors it has reviewed (paper, chlor-alkali, automobile, cement and steel), the steel sector has performed the worst. Equally damning is the attitude of the sector towards environmental issues: "The Indian steel industry is powerful. It has got its way all along because it is regarded as a 'core' sector of the economy. This has made this sector uncaring about public opinion. The industry on the whole does not believe in disclosure and transparency. Neither does it want to be scrutinised by independent agencies." The report concludes: "Our final assessment: all is bad with the steel sector."

Such strong judgments coming from a reputable organisation such as the CSE are a matter of concern. The steel industry with its susceptibility to volatility needs public policy support and an image of its indifference to public opinion and environment can be damaging for it. There is an urgent need for further independent evaluation of the environmental record of the industry. Our own anecdotal evidence suggests that the CSE report is somewhat out of date and its language and judgments are unduly harsh. In what follows we summarise the evidence produced by the CSE and then add the perspectives obtained from our own subject expert.

CSE Assessment on Environmental Issues

a) Air pollution

Large number of complaints have been made against the stack emissions from sinter/pellet plants, by-product coke ovens and coal-based captive power plants during the steel-making process through the blast furnace–basic oxygen furnace process (BF-BOF). Thick red dust emissions are released in the form of secondary emmissions from steel-melting shops through the roof which travel long distances and pollute the environment. It has been seen that owing to poor canopy hoods and inadequate roof dust collection systems, thick dust emissions and fumes are directly released into the atmosphere, through electric induction furnace route. The report points out that a large number of these problems are due to poor planning and the faulty layout of the plant, since most of the dust-prone areas are situated close to villages. Although the central pollution control board has made it mandatory to develop a green belt around the plant, the plants seem to ignore these regulations.

The steel plants generate huge amounts of air pollution irrespective of the process route they adopt. Air emissions are caused by coal charging, coking and coke discharge. Even the leakage and fugitive emissions from oven doors, lids, battery tops and pipes are toxic. Some of the major sources of air pollutants are particulate matter (PM), along with oxides of nitrogen (NOx) and sulphur (SOx), benzopyrene and polycyclic aromatic hydrocarbon (PAH). Even the suspended particulate matter (SPM) has been a major cause of concern with regard to air pollutants.

Particulate matter includes all the dust emissions that have been gathered from the process stage. A steel plant needs to have a de-dusting system to capture both primary and secondary emission that gives all the information about the point source emission load. The same cannot be said about Indian steel plants, which are only able to capture primary emissions, and secondary emissions are released as fugitive dust. In some plants, even the primary emissions are not captured, which reflects that the particulate emissions load reported by the plant are generally poorly captured and do not reflect the true picture. While European plants account for over 50 per cent of the PM load in the blast furnace through the sinter wind box dust exhaust, Indian plants account for over 90 per cent of this PM emission load through the BF-BOF process and the remainder is emitted from the coke oven and BOF process. Coal direct reduced iron (DRI) plants are more pollution-intensive than BF-BOF plants. Carbon monoxide (CO), SO_2, NOx and suspended particulate matter (SPM) are some of the key pollutants required for measuring the ambient air quality (AAQ) in Indian steel plants. The new norms for ambient air quality standards in India (Table XIII.1).

Table XIII.1: New Norms For Ambient Air Quality Standards In India

Monitotring norms (Validity)	SPM (ug/m^3)	PM10 (ug/m^3)	SO_2 (ug/m^3)	NOx (ug/m^3)	CO (ug/m^3)
Norms until November 2009	500	150	120	120	5
Norms from November 2009	-	100	80	80	2

Note: SPM=Suspended Particulate Matter, PM= Particulate Matter, SO^2= Sulphur dioxide, NOx= Nitrogen oxides, CO= Carbon monoxide, ug/m3= Micro gram per cubic metre.

Source: CSE (2012). Green Rating of the Indian Iron and Steel Sector, New Delhi.

As per the report, SO_2 and NOx were found within limits, but the SPM and carbon monoxide were found to be non-compliant in the steel plants. Some of the plants were also found to be violating the carbon monoxide norms, which points to leakage of excessive waste gas (Bf gas, coke oven gas or Linz Donawitz [LD] gas).

The reports concludes: "The industry generates huge amounts of air pollution from all processes—from handling of raw materials to their preparation, from production of iron and steel to disposal of solid wastes. The expansion plans of most steel plants do not take into consideration their impact on the air environment…the air quality near large steel factories is all set to become even more unbreathable."

b) Solid waste

According to the report, Indian plants dispose of 0.5 tonne of solid waste for one tonne of steel production, which is five times the global practice. In contrast, coal DRI-based plants dispose of more than 1.2 tonnes of waste for every tonne of steel produced, and gas DRI-EAF plants dispose of the lowest amount of waste, around 0.25 tonne for every one tonne of crude steel produced.

Fly ash from captive power plants, wastes from direct reduced iron (DRI) and SMS slag are some of the key sources of the waste generation in steel plants. Solid wastes such as cooler discharge, electrostatic precipitator (ESP) dust, unburnt coal (char) and waste from the dust settling chamber (DSC) are generated from coal DRI plants. The process-based wastes such as tar decanter sludge, coke oven effluent treatment, tar acid sludge, plant active sludge, benzol plant sludge and sulphur are hazardous. Bf gas cleaning dust, BF flue gas and LD slag is generated from BF-BOF plants. SMS slag, which should be ideally used by the BF-BOF plants for rail or road ballast and for making pavments, largely remain unutilised and only a small percentage of this slag is used, as huge mountains of this slag are found around the plants. In gas DRI plants, spent nickel catalyst is one of the hazardous wastes generated and steel melting shop (SMS) slag is a major solid waste. To use the advantage of merchant power sale, several coal DRI plants have shifted to exporting power and a huge amount of fly ash is found dumped outside these plants. After recovering a small amount of metal from the SMS slag generated through the induction and electric arc furnace, the remaining slag is dumped outside. Similarly, char is mostly dumped rather than used as a fuel as the plants generally claim. Solid waste disposal creates vast amounts of air pollution, because the airborne particles are carried by wind, and it also contaminates ground water. Such dust can even make agricultural land unproductive.

c) Water Pollution

BF-BOF configuration plants generate a huge amount of water pollution and has the highest share in this sector compared to all the other routes. Sometimes metallurgical waste water is discharged from the blast furnace and steel melting shops (SMS) into the drains which opens into the pond or a lake. Also, coke oven effluent treatment plants are considered to be the main source of toxic waste water. Cyanide and phenol, ammonical nitrogen, oil and grease are some of the water pollutants. Surface water, soil and groundwater are severely impacted by the raw material storage process during the rainy season. As the run-off from these raw material contains suspended solids and the floors are unpaved, this would lead to leaching, which would affect the quality of groundwater for several years. The global best practice is no untreated wastewater discharge.

With only 20 per cent of wastewater being treated, all the untreated waste flows freely into the river and waterbeds, raising the pollution levels. The government has proposed to levy a cess of over 2 per cent in

accordance with its Swach Bharat Abhiyan plan on all or certain services if need be. One major concern has been the non-utilisation of these funds as has happened in the past, with large funds lying unutilised under various schemes. It is time that the government makes the most of these funds.

An Alternative Perspective

SAIL and Tata Steel plants have been operating for several years. They were set up based on technologies available at that time and naturally their performance is not as per international standards. They are all modernising, which is a continuous process. SAIL is also dragged down by an obsolete IISCO plant (a brand new plant is being commissioned here). JSW, JSPL, Essar and other new generation plants are continuously adding capacity and in each year some unit or the other is under commissioning or stabilisation. It takes a couple of years for any process to stabilise. No doubt, the overall performance is inferior to international practice, but there is continuous improvement. The Table XIII.2 shows their performance during the past few years.

Table XIII.2: Some Indicators of Environmental Performance in Indian Steel Industry

Parameter/Plant	2010–11	2011–12	2012–13	2013–14
a. Specific dust emission, kg/tcs	International standard is 0.22			
SAIL (Bhilai)	1.11 (0.73)	1.01 (0.72)	0.88	0.86
Tata Steel	0.84	0.79	0.76	
RINL	0.61	0.58	0.60	
JSWL	1.48	1.43	1.59	
Essar Steel	0.45	0.15	0.16	
b. Solid Waste Utilisation, %	International: Nucor USA = 99%, BaoSteel China= 98.6%			
SAIL	BF Slag=91%, LD Slag=85%	Overall: Bhilai=90.5%, RSP=75.5%	Rourkela=89.6%	
Tata Steel	78	75	84	
RINL	BF Slag=99%, LD Slag=78%	BF Slag=100% LD Slag=78%	BF Slag=100% LD Slag=37%	
JSWL	75	75	84	
C. Specific Effluent discharge, m^3/tcs	International norm=Zero			
SAIL (Bhilai)	2.49 (0.13)	2.26 (0.12)	2.22	2.16
Tata Steel	Nil	Nil	Nil	
RINL	0.76	0.63	0.63	
JSWL	Zero	Zero	Zero	
d. Specific Water Consumption, m^3/tcs	International norm=1.5 to 2.0			
SAIL (Bhilai)	4.05 (3.04)	3.86 (2.99)	3.73	3.67

(Contd...)

Table XIII.2: (Contd...)

Tata Steel	6.04	5.84	5.74	
RINL	2.49	2.25	2.37	
JSWL (Ispat)	5.36 (2.10)	5.70	5.70	
JSPL	3.00	2.57	2.34	2.57
Essar Steel	2.63			

Source : Annual Report of Various Steel Companies, World Steel Association and Centre for Science and Environment.
Note: kg/tcs = kg per tonne of crude steel, m^3/tcs = cubic meter per tonne of crude steel

During modernisation and expansion, all plants have made considerable capital expenditure towards controlling air pollution and gradual improvement is visible. Essar has come up to international standards. In many cases, stack emissions are lower than the norms set by the central pollution control board. Performance is not satisfactory only in the case of JSWL.

Sealing and covering raw material storage and handling operations, a suggestion made by the CSE, is not practical, because it involves huge capital expenditure. It may be noted that central pollution control board has prescribed fugitive emission standards for raw material handling plants and steel companies are meeting these standards.

The international figure quoted for solid waste generation by CSE is not correct. For instance, slag generation in BF as per international practice is around 250 kilograms per tonne of hot metal (kg/thm). In India, it is between 300 and 350 kg/thm. Higher slag arising in blast furnace is due to the poor quality of raw materials. It can be seen from the table that the performance of Indian companies is satisfactory in respect of utilisation of solid wastes. (Originally, in SAIL plants and Tata Steel, BF slag was tapped into ladles and moved by locomotive to a dumping site.) With the advent of cast house slag granulation, the utilisation of blast furnace slag has almost reached 100 per cent. All plants have either tied up with cement plants or have a subsidiary cement unit. Wastes such as coke fines, flue dust and mill scale, are used in sinter plants. Metal scrap is recovered from slag, continuous casting plants and rolling mills and reused in SMS. Utilisation is low only in the case of SMS slag, because of following problems.

- It has high phosphorous content and hence has limited use in SP/BF/BOF/EAF.
- It has free lime, which causes volume instability. The problem can be tackled by weathering/ seasoning but the operation requires space and time.
- It can be used as a soil conditioner, but the transportation costs are very high.

In spite of the above, efforts are being made to increase its use in landfills, road construction and as a soil conditioner.

Several plants have now achieved zero effluent discharge through process water. SAIL and RINL are also working towards the same and it is expected that they will achieve it in the next few years.

RINL, JSPL and Essar have considerably reduced water consumption and they are expected to achieve international levels in the next few years. SAIL plants are also continuously improving and after the current modernisation is completed, water consumption will drastically come down. Tata Steel and JSWL are also working towards reducing water consumption. Huge power plants and townships are not built in steel plants abroad.

The performance of the Indian steel industry with regard to energy consumption and CO_2 emission is shown in the Table XIII.3.

Table XIII.3: Energy Consumption and CO_2 Emission in India Steel Industry

Parameter/Plant	2010–11	2011–12	2012–13	2013–14
a. Specific energy consumption, GCal/T	International average in 2013=4.8; Nucor Steel, USA=4.26; POSCO, South Korea= 5.7			
SAIL	6.91	6.86	6.66	6.59
Tata Steel	6.01	6.11	6.08	6.02
RINL	6.12	6.06	6.31	6.19
JSWL	6.45	5.97	5.66	
JSPL	6.38	7.06	7.44	7.29
Essar Steel	6.20			7.69
b. CO_2 emission, t/t	International average=1.8; POSCO, South Korea=1.68			
SAIL	2.73 (Bhilai)	2.83 (Bhilai)	2.75	2.69
Tata Steel	2.51	2.50	2.52	2.42
RINL	2.61	2.61	2.66	2.66
JSWL	2.62	2.95	2.87	2.64
JSPL	2.59			
Essar Steel	1.67	2.10	2.49	3.07

Source: Annual Report of Various Steel Companies, World Steel Association and Centre for Science and Environment.
Note: GCal/T= Giga Calories/tonne, t/t = tonnes of CO_2 emitted per tonne of liquid steel produced

In respect of energy consumption, Tata Steel, RINL and JSWL are doing reasonably well. This is expected to improve further with further process control measures in the pipeline. SAIL also will improve after the current modernisation is complete. JSPL and Essar Steel have to take steps to reduce energy consumption. One reason for high CO_2 emission is higher fuel rates in blast furnaces due to the low level of process intensification. Several furnaces with >4000 m^3 volume and high degree of process intensification have recently been commissioned and some more are in the pipeline; once they are fully stabilised, CO_2 emissions will come down. Another reason is coal-based DRI plants with low levels of technology absorption. While there are only three gas-based DRI plants, the supply of natural gas to these plants has been more than halved between 2005 and 2013. This partially explains the increase in CO_2 emission in Essar Steel. In addition to the standard measures, some of the latest measures adopted or under adoption by the steel industry to reduce energy consumption and control emissions are:

- Dry cooling of coke and generation of power from the heat recovered.
- Pushing emission control system in coke ovens.
- Power generation from waste heat recovered from coolers in sinter plants.
- Increasing coal dust injection in blast furnaces along with oxygen enrichment of blast. This implies that due to shortage and high price of good quality coking coal, part of this material is replaced by non-coking coal by injecting it in pulverised form at the tuyere level. Since injection of a solid material

will have a cooling effect at the tuyere level, oxygen content in air blast is enriched to maintain the temperature profile.

- Waste heat recovery from hot blast stoves of blast furnaces.
- High top pressure operation in blast furnaces and power generation through top recovery turbines.
- Secondary fume extraction system in SMS.
- Complete recovery of BOF gas, cleaning and usage as a by-product fuel in the plant.
- Waste heat recovery from rolling mills reheating furnaces.
- Recovery of bled BF gas and bled BOF gas.
- Adopting the latest technologies in all areas and going in for large-sized production equipment.

Secondary Sector

In 2013–14, the share of the main steel plants comprising SAIL (Bhilai, Durgapur, Rourkela, Bokaro, IISCO and Bhadravati), RINL, Tata Steel, JSWL (including Ispat), JSPL and Essar was only 54 per cent in respect of crude steel and 48 per cent in respect of finished steel. The secondary sector contributed the balance. The secondary sector comprises merchant coke oven plants, MBF units, small coal-based DRI plants (200 TPD or below), induction furnace units, mini steel plants based on small size EAFs (below 50/60T), standalone long product rolling mills, merchant cold-rolled steel (CR) and Galvanised plain sheets and Galvanised Corrugated Sheets (GP/GC), etc. Energy consumption in these units is high and emission rates are also on the high side. Overall, the performance of the steel industry takes a beating because of these units. These units would like to keep their capital costs low and hence are averse to investing in energy saving or for emission control. The Ministry of Steel, Government of India has to intervene in a big way. They have already taken up a project in collaboration with the UNDP to reduce energy consumption in long product rerolling mills. However, progress has not been very satisfactory and many more mills remain to be covered. The government should reduce its stake in SAIL and RINL to 51 per cent and the funds thus generated should be utilised for reducing energy consumption and reducing emission rates in the secondary sector units.

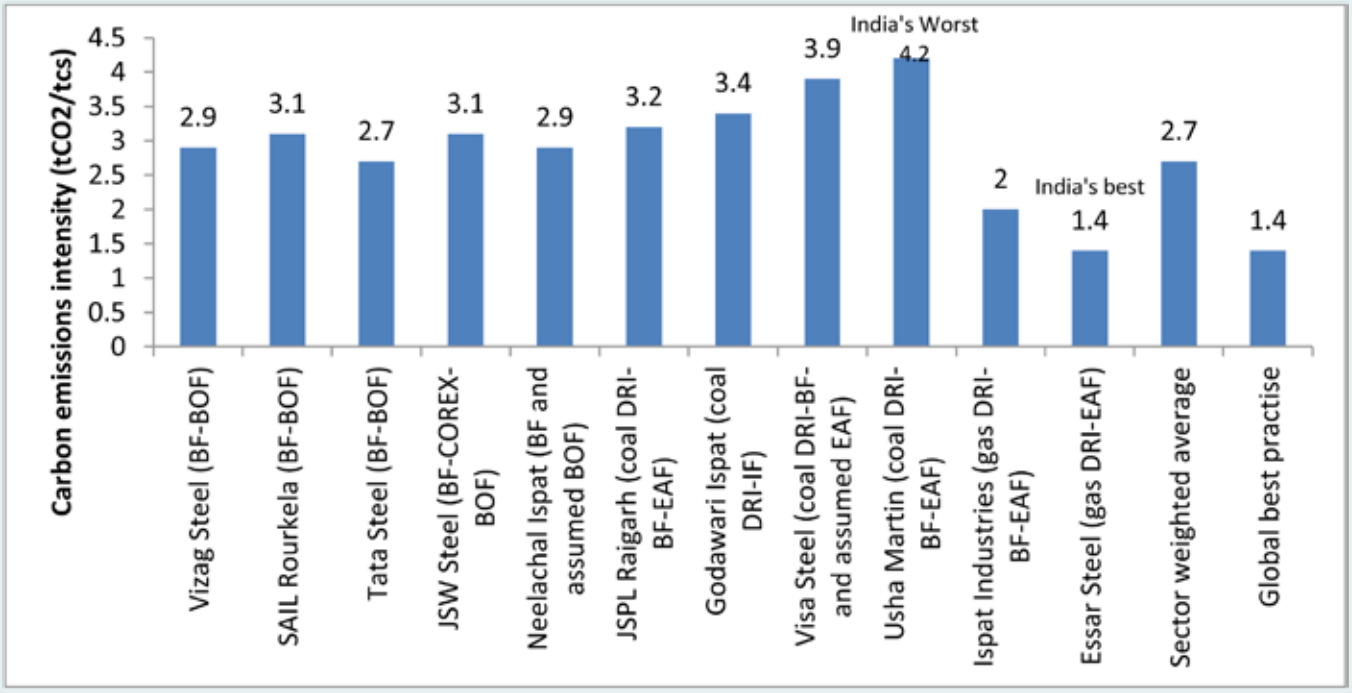
d) CO_2 Emission

One important area of environmental mangement relates to carbon emission which constitues a threat to humanity. India must do its share in emission mitigation and the role of the steel industry will be an important component in that effort.

In 2010, the International Energy Agency stated that the iron and steel industry accounted for 6.7 per cent of the total CO_2 emissions. The steel sector covers over 10 per cent of the carbon footprint among all sectors. The world average CO_2 emission is 1.8 t/tcs, but some companies are achieving even lower emission rates. Ultra-low CO_2 steel making (ULCOS) is now being pursued vigorously through the World Steel Association. European countries are working together in this mission and they have targeted a 50 per cent cut in CO_2 emission by 2050. In India, 2.7 tonnes of CO_2 are emitted for one tonne of crude steel produced, which is quite dangerous.

Scrap-based EAF or IF has a lower carbon emission intensity of 0.5–0.7 CO_2/tcs. With scrap prices rising upwards in the international market cheaper coal DRIs are seen as a subsitute for steel-making. India has a large number of coal-based plants and a rising trend towards the coal DRI-EF route points towards higher carbon emissions and the reduction of these emissions is not foreseeable in the near future. Essar Steel, which is a gas-based DRI-EAF plant, emits around 1.4 tonnes of CO_2/ tcs, which corresponds to the global best practice, while the Tata plant in Jamshedpur emits more than 2.7 tonnes of CO_2/ tcs through the coal-based BF-BOF route.

Figure XIII.1: Carbon Emission Intensity of Primary Steelmaking in Indian Plants, 2009–10



Source: CSE (2012). Into the Furnace: The lifecycle of the Indian Iron and Steel Industry.

With a trend towards greater use of coal-based DRI-EFs, the potential for curbing emissions in the steel industry remains limited in the next 15–20 years.

According to the Economic Survey of 2014–15, a cess of Rs 100 on one tonne of coal is similar to a carbon tax of $1 of CO_2. The survey has suggested increasing this cess from its current levels, which if done 3 times would lead to 129 million tonnes of CO_2 reduction annually. This is equivalent to 7 per cent of India's current emissions. A five-fold increase in the cess would bring the domestic price of coal on par with international prices. This would lead to an annual deduction of CO_2 to 214 million tonnes, which is roughly more than 11 per cent of India's emissions.

With the objective of boosting environmental initiatives, the finance minister in his Budget for the year 2015 has raised the clean energy cess form Rs 100 to Rs 200 per metric tonne of coal. This will pose an additional challenge, as the cess would be levied on both domestic and imported coal, leading to a higher power tariff charge of over 4 to 6 paise per unit of power consumption. India is one of the largest emitters of greenhouse gases. The installed power generation capacity of India is around 255,681.46 megawatts (mw), with 60 per cent of this capacity being met by coal-based sources.

The cess levied on coal at the current level would add Rs 6,000 crore every year to the government. This also highlights that India is one of the few countries that has moved from a carbon-subsidising nation to a carbon-taxing nation, which is a step in the right direction. The impact of this cess will largely be felt by power consumers, which will see an increase in the power tariff and they would have to pay about 4 paisa extra per unit of power consumed.

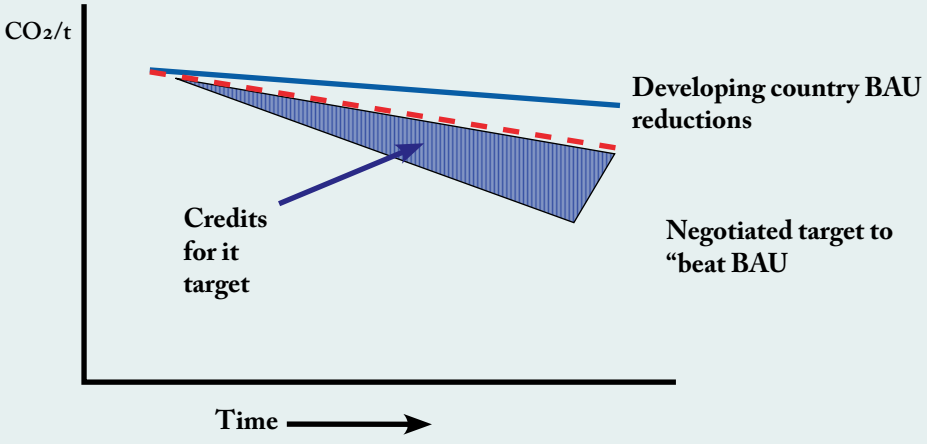
Over a long time horizon there are important possibilities for reducing carbon emission by Indian steel. In 15–20 years time, availability of scrap may increase in China and India and if India can position itself to use scrap-based EAF or induction furnace process, it can lower carbon emission by 2040 and beyond which is a possible target date for peaking of emission in India.

The other opportunity for reducing emission will lie in greater use of gas-based DRI-EAF processes. The shale gas revolution is leading to a switch to DRI plants in the US, and if the shale revolution occurs in India too, this would be another avenue for reducing emissions. Increased supply of gas from Central Asia and Iran are other important possibilities for increasing the use of gas-based DRI processes.

According to the world steel association more than 1.8 tonnes of CO_2 is emitted on average for every tonne of steel produced. The International Energy Agency estimates that iron and steel accounts for 6.7 per cent of the total world CO_2 emissions. The American Iron and Steel Institute in its paper 'Greenhouse Gas-Sector Crediting Mechanism: A Real Threat of Institutionalizing Trade Distortions in Steel' has proposed the concept of sectoral crediting. Under this mechanism, if a developing country within a specific sector is able to set an intensity target lower than 'business as usual' (BAU, dashed line), then outperforming the set credit would be an opportunity for sale in international markets (shaded region) (Figure XIII.2).

Developing countries that use outdated techniques need to upgrade, which can be possible if developed countries provide a replacement. The sectoral crediting mechanism helps finance these replacements by developed countries to developing countries. The outdated capacity is shuttered by lowering the energy intensity in steel industry, which moves the target to a lower level of 'better than BAU target'. This generates the credit for sale, which provides cash to finance new facilities. This mechanism, as a whole, alters competitiveness.

Figure XIII.2: Proposed Sectoral Crediting Mechanism



Source: American Iron and Steel Institute (AISI).

e) Western Ghats

The Western Ghats is one of the many ecologically sensitive zones (ESZs) in the country. It has been classified as a world heritage site by UNESCO. It extends from Satpura range in the north through Karnataka into Kerala and Tamil Nadu and ends at Kanyakumari. It is home to the Godavari and Krishna rivers.

Under the Madhav Gadgil Committee, it was decided to categorise the Western Ghats into three levels of ecological zones. But the report was faced with stiff opposition from the government, which has decided not to follow the Gadgil report or its recommendation.

The Gadgil report was followed by the Kasturirangan report, which is said to be a milder version of the Gadgil report. It is important to understand the difference between the two reports.

The Western Ghats Ecology Expert Panel (WGEEP) or Gadgil report classified the entire Western Ghats region into an ecologically sensitive zone that is divided into three categories. It gives a list of activities that will be allowed in these Ghats, after taking into account the land use and ecological richness of that zone.

This report recommended that there should be no mining in the Goa region; for other regions, it recommended that zones in the first two categories should not have any polluting industry. Non-polluting industries can be allowed in these zones only if strict and stringent rules and regulations are followed, along with social audit of these industries. Also, no new mining licence should be issued and current activities should be phased out by 2016.

While the Kasturirangan committee does not classify the entire region as an ecologically sensitive zone (ESZ), it separates crop plantations like rubber and other agricultural fields from ESZs and it does not include them in these zones. The panel also clearly distinguishes between natural and cultural landscape. This was done to remove any conflicting zones within the territory. This led them to categorise 60,000 hectares of land as ESZ in the Western Ghats, which is far lower than the 137,000 hectares mentioned by the Gadgil Panel.

All the red category industries, which include mining, quarrying and thermal plants, along with buildings over 20,000 sq. metres that come within the periphery of these ESZ would be banned. A ban on mining in different states was imposed in 2011 for Karnataka and in 2012 for both Odisha and Goa. But the Supreme Court of India in 2013 gave its nod for partial resumption of mining activities in Karnataka with a cap of 30 million tonnes per annum. Similarly, Goa, which was responsible for more than half the iron ore exports before the ban came into force, was free to mine iron ore with a cap of 20 million tonnes of annual production.

f) Underground Mining

According to the Energy and Environment profile of the U.S. mining industry in the underground mechanism, a shaft is dug that helps transport the ore to the surface. Miners use an elevator to bring the ore to the surface through a car called a skip. Ventilation systems are installed so that the gases do not accumulate at one place and to allow miners to breathe fresh air. To access the ore, miners cut down

tunnels, which are then connected through an opening called raises. The ores are broken and mined in the chambers. Finally these ores are carried through conveyors to the shaft, and is then elevated to the surface.

Major mining companies like Rio Tinto, Anglo American Plc, ALCOA and VALE spend considerable sums of money on research regarding mining in ecologically sensitive areas. They work in close co-operation with NGOs and environmental groups. Governments in those countries support these ventures by investing up to 10 per cent of tax revenues from mining companies in R&D. With such measures, these companies are able to mine in ecologically sensitive areas without disturbing the ecological balance of the area. Mining in such areas is subject to strict adherence to the standards prescribed.

Best Practices: Kiruna-LKAB, Sweden

To understand underground mining better, we look at the Kiruna iron ore mine of Sweden. It is the largest and the most modern underground iron ore mine. The ore body is over 4 km long with a depth of 2 km and is over 80 metres thick. The mining mechanism is divided into eight stages, with each having its own ventilations systems and groups for iron ore passing. Through drilling technology and raise borers, several ore passes are created. Sub-level caving is used to create space for blasts. After the blasts, large dump machines are used to carry the ore to the nearest pass and are loaded into one of the automatically operated trains. After primary crushing of the ore content, the magnetite and apatite contents are sampled out to the surface. The ore is then processed through concentrators and the sorting plant to get sinter fine and pellets.

CHAPTER XIV

Concluding Remarks

This Report has highlighted the high potential of the steel industry in India over the long term. This is not just a general statement of a bright future that could be India's. The point here is that for all major countries in the world, the steel industry has 'aged'. The prospects of capacity expansion in developed countries and China seem to be limited. There would be investment for replacement and for new techniques in these countries. But, by and large, these expansion plans will be at best in tens of millions of tonnes. On the other hand, India has a high probability of needing hundreds of millions of tonnes of additional steel capacity. Our baseline estimate of demand for additional steel production capacity by 2050 is 600 million tonnes. Even if we allow for a variation of 25 per cent around the base, the capacity expansion needed is at least 450 million tonnes, a potential unmatched by any other country. Thus, India is likely to be the place for suppliers of steel machinery and the incremental supply of raw materials for steel over the next few decades. Also, while many old steel producers will be struggling with the difficult task of retrofitting, India as a late-comer has the advantage of leapfrogging to the latest technology, which is efficient and eco-friendly.

Nothing, however, is certain in life. The Indian steel industry and policymakers have to strive to realise the bright future that is in sight. Unfortunately, the steel industry is currently under stress and under the BAU scenario, the steel industry is unlikely to meet the goals of the Twelfth Five-Year Plan or the goal of 300 million tonnes of steel production by 2025 as proposed in the Draft Steel Policy 2012.

The Report has diagnosed as many as eleven roadblocks that stand in the way of realising India's potential in steel and has proposed a reform programme in each of these areas. It has also argued that to remove these roadblocks, transformative reforms are needed and not just tinkering with present policies and practices. The past practice of 'reform through stealth' must be given up in favour of building consensus on basic reforms and then implementing them with vigour. Our argumentative nature must be tempered with the need for consensus-building and speedy implementation.

The eleven-point reform programme emerging from the report has been elaborated in the text and summarised in the Executive Summary. At the risk of repetition and excessive simplification, we note below these eleven points.

- Maintain a buoyant macro-economic environment with robust growth in investment in general and infrastructure investment in particular.
- Adopt an appropriately aggressive exchange rate policy and trade policy to protect the domestic steel industry from unfair competition from abroad.
- Provide long-term finance to the steel industry at a cost that is in line with the long-term rate of return on investment in the industry.
- Avoid excessive taxation of mining of raw materials for the industry.
- Make adequate land available for the steel industry, first by better utilisation of the land already under the industry (in particular, under the public sector) and second by making advance arrangements for migration and rehabilitation of the population occupying the land to be acquired.

- Reduce the delays in implementation of projects in mining and steel-making.
- Improve the system of allocation of mines to ensure a steady supply of raw materials to the steel industry at affordable prices.
- Vastly increase the resources allocated to mineral explorations along with improvements in the system of allocating exploration rights.
- Vastly improve the availability of skills for the industry, along with increased support for technology improvement, for better utilisation of India's resources.
- Improve supply and reduce the cost of logistical facilities in line with those of India's competitors.
- Leapfrog to technologies and practices in the steel industry that are environment-friendly.

The transformative reforms required for the steel industry go beyond the mandate of the Ministry of Steel. It involves issues of trade, taxation, finance, mining, logistics, etc. that involve many other ministries. It is NITI Aayog that would be a good forum for reaching consensus on the way forward. The Ministry of Steel will, of course, play a key role in this process. But other ministries as well as think tanks in the country should be involved under the auspices of NITI Aayog to form that consensus.

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ANNEXURES TABLES

Table A1: Crude Steel Production (in million metric tonnes)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Rank
China	128.5	151.6	182.2	222.3	272.8	355.8	421.0	489.7	512.3	577.1	638.7	702.0	731.0	822.0	822.7	1
Japan	106.4	102.9	107.7	110.5	112.7	112.5	116.2	120.2	118.7	87.5	109.6	107.6	107.2	110.6	110.7	2
United States	101.8	90.1	91.6	93.7	99.7	94.9	98.2	98.1	91.9	59.4	80.5	86.4	88.7	86.9	88.3	3
India	26.9	27.3	28.8	31.8	32.6	45.8	49.5	53.5	57.8	63.5	69.0	73.5	77.3	81.3	83.2	4
Russia	59.1	59.0	59.8	61.5	65.6	66.1	70.8	72.4	68.5	60.0	66.9	68.9	70.4	68.9	70.7	5
South Korea	43.1	43.9	45.4	46.3	47.5	47.8	48.5	51.5	53.6	48.6	58.9	68.5	69.1	66.1	71.0	6
Germany	46.4	44.8	45.0	44.8	46.4	44.5	47.2	48.6	45.8	32.7	43.8	44.3	42.7	42.6	42.9	7
Turkey	14.3	15.0	16.5	18.3	20.5	21.0	23.3	25.8	26.8	25.3	29.1	34.1	35.9	34.7	34.0	8
Brazil	27.9	26.7	29.6	31.1	32.9	31.6	30.9	33.8	33.7	26.5	32.9	35.2	34.5	34.2	33.9	9
Ukraine	31.8	33.1	34.1	36.9	38.7	38.6	40.9	42.8	37.3	29.9	33.4	35.3	33.0	32.8	27.2	10
Italy	26.8	26.5	26.1	27.1	28.6	29.4	31.6	31.6	30.6	19.8	25.8	28.7	27.3	24.1	23.7	11
World	850.2	852.2	905.2	971.1	1062.5	1147.8	1250.1	1348.1	1343.3	1238.3	1432.8	1537.2	1559.5	1649.3	1637.0	
India's Share (%)	3.2	3.2	3.2	3.3	3.1	4.0	4.0	4.0	4.3	5.1	4.8	4.8	5.0	4.9	5.1	
BRIC Countries	242.4	264.6	300.4	346.7	403.9	499.3	572.2	649.3	672.4	727.1	807.6	879.5	913.3	1006.3	1010.5	

Source: World Steel Association (WSA).

Table A2: Per Capita Consumption of Finished Steel (in kg)

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
France	286.7	258.1	273.4	289.4	267.0	184.0	229.9	241.1	208.1	213.5
Germany	439.4	427.2	474.9	517.7	513.7	342.2	439.8	495.4	457.4	463.2
Italy	569.8	539.1	616.8	603.9	555.8	333.2	423.6	436.1	352.8	359.5
Turkey	226.4	270.6	307.3	339.6	302.5	250.9	323.9	365.7	381.9	415.4
Russia	182.2	203.4	243.3	281.8	247.4	174.4	249.2	286.0	296.5	304.6
Canada	544.2	521.7	555.3	470.4	440.4	283.1	414.2	412.6	449.2	402.8
United States	399.1	355.0	399.2	358.2	322.7	192.4	257.4	284.9	304.6	300.8
Brazil	99.6	90.4	98.6	116.2	125.5	96.1	133.9	127.3	126.9	132.1
Iran	169.5	189.5	180.3	259.4	205.6	235.0	264.3	280.0	240.4	219.0
China	212.1	265.7	287.3	316.6	336.4	413.1	438.0	475.8	487.6	545.0
India	31.4	35.0	39.4	43.9	43.2	47.9	53.0	56.2	57.5	57.8
Japan	608.1	607.1	624.6	641.7	616.0	417.1	502.4	506.7	505.7	516.8
South Korea	1008.3	1001.7	1061.5	1162.2	1227.0	946.8	1087.3	1165.3	1112.8	1061.2
World (average)	154.6	163.8	177.3	187.5	185.8	171.7	193.3	206.4	207.9	219.3

Source: World Steel Association (WSA).

Table A3: GDP, Investment and Manufacturing & Mining growth rate (1991–2014) (in percentage)

Period	Finished Steel Consumption	Crude Steel Production	GDP at MP	Gross Fixed Capital Formation	Construction	Manufacturing	Mining and Quarrying
1992–93	6.6	5.9	5.5	9.0	3.5	3.1	0.9
1993–94	2.0	0.2	4.8	(–) 0.9	0.6	8.6	1.4
1994–95	21.3	6.2	6.7	9.5	5.4	10.8	9.3
1995–96	14.4	14.1	7.6	16.3	6.0	15.5	5.9
1996–97	4.1	8.0	7.5	3.0	1.9	9.5	0.6
1997–98	2.2	2.8	4.0	8.9	10.5	0.1	9.8
1998–99	3.8	(–)3.8	6.2	9.7	6.3	3.1	2.8
1999–00	6.6	3.5	8.8	7.9	8.4	5.4	4.2
2000–01	4.9	10.8	3.8	(–) 1.4	6.1	7.3	2.3
2001–02	3.2	1.4	4.8	15.3	4.0	2.3	1.9
2002–03	7.6	5.6	3.8	(–) 0.4	8.3	6.9	8.4

(Contd...)

Table A3: (Contd...)

2003–04	8.0	10.3	7.9	10.6	12.4	6.3	2.7
2004–05	9.8	2.7	7.9	24.0	16.3	7.4	7.9
2005–06	13.9	40.3	9.3	16.2	12.8	10.1	1.3
2006–07	12.9	8.0	9.3	13.8	10.3	14.3	7.5
2007–08	11.4	8.1	9.8	16.2	10.8	10.3	3.7
2008–09	0.4	8.1	3.9	3.5	5.3	4.3	2.1
2009–10	13.3	9.9	8.5	7.7	6.7	11.3	5.9
2010–11	11.9	8.6	10.3	11.0	5.7	8.9	6.5
2011–12	6.9	6.5	6.6	12.3	10.8	7.4	0.1
2012–13	3.5	5.2	4.7	0.8	1.1	1.1	(–)2.2
2013–14	0.8	5.2	5.0	3	1.6	(–)0.7	(–)1.4
2014–15*	1.5	2.3	7.5	4.1			

Note: *Projected estimates.
Source: Planning Commission, WSA, CSO

Table A4: Steel – Production, Imports, Exports, Consumption (in million tonnes)

Steel Products	Steel Category	Production for sale	Export	Import	Consumption	Change in Stock/ Inventory
Finished Steel	2006–07	52.5	5.2	4.9	46.8	0.0
	2007–08	56.1	5.1	7.0	52.1	0.1
	2008–09	54.2	4.3	5.3	49.0	0.3
	2009–10	56.8	3.1	6.3	52.8	0.6
	2010–11	61.8	3.0	6.0	62.1	0.4
	2011–12	75.7	4.6	6.9	71.0	0.5
	2012–13	81.7	5.4	7.9	73.5	(–)1.0
	2013–14	85.1	5.6	5.4	73.9	(–)1.0
Bars and Rods	2006–07	18.8	0.3	0.3	18.8	0.0
	2007–08	20.2	0.2	0.4	20.4	0.0
	2008–09	20.4	0.2	0.4	20.6	0.1
	2009–10	21.8	0.2	0.6	21.6	0.5
	2010–11	25.9	0.1	0.4	26.4	(–)0.2
	2011–12	28.1	0.2	0.4	28.0	0.3
	2012–13	28.8	0.4	0.5	29.4	(–)0.5
	2013–14	30.0	0.6	0.3	30.1	(–)0.4

(Contd...)

Table A4: (Contd...)

HR Coil / Strip – Sheet and Skelp	2006–07	11.9	1.6	1.6	12.0	(–)0.1
	2007–08	12.4	1.4	3.0	14.0	0.0
	2008–09	11.8	0.9	2.3	13.1	0.1
	2009–10	12.6	0.5	3.1	14.8	0.2
	2010–11	12.9	0.5	2.4	14.6	(–)0.2
	2011–12	17.0	1.3	1.9	17.4	0.1
	2012–13	19.9	1.9	2.0	20.3	(–)0.2
	2013–14	19.9	1.8	1.2	19.6	(–)0.3
CR Coil/ Sheets	2006–07	4.3	0.4	0.6	4.5	0.0
	2007–08	4.4	0.5	0.8	4.7	0.0
	2008–09	4.6	0.3	0.7	5.0	0.0
	2009–10	5.9	0.3	0.9	6.3	0.1
	2010–11	5.8	0.3	1.1	6.6	0.0
	2011–12	7.0	0.3	1.5	8.2	0.0
	2012–13	7.7	0.4	1.6	8.8	0.0
	2013–14	8.6	0.5	1.3	9.4	(–)0.1

Source: Joint Plant Committee (JPC).

Table A4.a: Crude Steel Capacity and Production, Finished Steel Production, Consumption & EXIM and Industry profits

Period	Crude Steel Capacity	Crude Steel Production	Finished Steel Production	Export of Finished Steel	Import of Finished Steel	Net Trade	Consumption of Finished Steel	Industry Profits	Industry PBDITA
	Million Tonnes							Rs crore	
1994–95		19.3	20.085	0.944	1.775	(–) 0.831	19.55	305.02	2818.96
1995–96		22.0	24.293	1.35	1.617	(–) 0.267	22.37	975.27	4223.4
1996–97		23.8	26.324	1.662	1.632	0.03	23.294	111.07	4432.4
1997–98		24.4	27.42	1.934	1.648	0.286	23.808	83.64	7075.3
1998–99		23.5	27.558	1.86	1.194	0.666	24.71	(–) 2782.46	5382.74
1999–00		24.3	30.495	2.782	1.678	1.104	26.348	(–) 3231.61	5597.07
2000–01		26.9	32.356	2.671	1.491	1.18	27.649	(–) 3153.46	6746.47
2001–02		28.0	33.376	2.709	1.373	1.336	28.523	(–) 4397.14	5303.31
2002–03		34.7	37.166	4.517	1.663	2.854	30.677	931.5	11351.27
2003–04		38.7	40.709	5.207	1.753	3.454	33.119	6554.31	17409.72
2004–05	48	43.4	43.513	4.705	2.293	2.412	36.377	16326.27	31865.65
2005–06	51	46.5	46.566	4.801	4.305	0.496	41.433	10814.27	25119.75
2006–07	57	50.8	52.529	5.242	4.927	0.315	46.783	15547.38	34209.42
2007–08	60	53.9	56.075	5.077	7.029	(–) 1.952	52.125	19615.22	42492.61
2008–09	66	58.4	57.164	4.437	5.841	(–) 1.404	52.351	14661.61	41911.21

(Contd...)

Table A4 a: (Contd...)

2009–10	75	65.8	60.624	3.251	7.382	(–) 4.131	59.339	17263.94	42356.43
2010–11	80	69.6	68.621	3.637	6.664	(–) 3.027	66.423	17537.45	45775.15
2011–12	91	73.6	75.696	4.588	6.863	(–) 2.275	71.021	15218.51	49036.31
2012–13	97	76.7	81.681	5.368	7.925	(–) 2.557	73.482	6816.33	38592.77
2013–14	100	81.7	87.675	5.985	5.450	0.535	74.096	–	–
2014–15 (Prov.)		88.3	90.609	5.501	9.321	(–) 3.82	76.363	–	–

Source: JPC and CMIE.

Table A4.b: Steel Industry - Total Income, Profit percentage

Periods	Industry TI (Rs crore)	PBDITA	Profit after tax	PBDITA as % of TI	PAT as % of TI
1999–2000	45,776.08	5,300.56	(–) 3,196.77	11.58	(–)6.98
2000–01	49,615.61	7,129.76	(–)1,930.80	14.37	(–)3.89
2001–02	51,173.57	5,084.00	(–)3,946.98	9.93	(–)7.71
2002–03	66,150.40	11,104.03	1,225.74	16.79	1.85
2003–04	82,308.31	16,987.14	6,892.76	20.64	8.37
2004–05	115,315.26	31,548.53	16,609.72	27.36	14.4
2005–06	118,988.70	25,206.06	11,309.14	21.18	9.5
2006–07	148,118.68	33,991.03	15,888.17	22.95	10.73
2007–08	177,318.62	41,809.13	19,757.11	23.58	11.14
2008–09	193,549.59	39,070.72	15,183.59	20.19	7.84
2009–10	193,966.57	41,650.00	17,980.49	21.47	9.27
2010–11	216,684.58	42,516.37	16,982.26	19.62	7.84
2011–12	259,522.10	46,914.21	15,287.83	18.08	5.89
2012–13	265,715.39	42,672.43	9,141.32	16.06	3.44
2013–14	264,535.11	47,800.22	10,813.64	18.07	4.09

Source: CMIE.

Table A4.c: Production Process – By Country and In India

Country	Oxygen	Electric	Other	Production (MT)
Austria	91.6	8.4		8
Belgium	66.5	33.5		7.1
Czech Republic	92.9	7.1		5.2

(Contd...)

Table A4 c: (Contd...)

France	65	35		15.7
Germany	68.4	31.6		42.6
Italy	28.8	71.2		24.1
Netherlands	98	2		6.7
Poland	55.3	44.7		8
Spain	30.5	69.5		13.8
UK	83.6	16.4		11.9
Turkey	28.7	71.3		34.7
Russia	66.3	30.2	3.5	68.7
Ukraine	74	6	20	32.8
Canada	55.1	44.9		12.4
Mexico	29.3	70.7		18.2
USA	39.4	60.6		86.9
Argentina	48.8	51.2		5.2
Brazil	74.9	25.1		34.2
Egypt	8	92		6.8
South Africa	59.6	40.4		7.2
Iran	13.1	86.9		15.4
Saudi Arabia	-	100		5.5
China	90.5	9.5		779
India	31.5	68.3	0.2	81.2
Japan	77.5	22.5		110
South Korea	61	39		66.1
Taiwan	53.6	46.4		22.3
Australia	77.7	22.3		4.7
World	71.2	28.2	0.6	1606

Source: World Steel Association (WSA).

Table A4.d: Production by Process – In India

	Crude Steel Production by Process Route (in %)							
Process	2005–06	2006–07	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14
Basic Oxygen Furnace	53	50	44	45	45	43	43	44
Electric Arc Furnace	18	20	25	25	25	24	25	23
Induction Furnace	29	30	31	30	30	33	32	33

Source: Indian Steel Industry report – A reference book by N.M Rao.

Table A5: Capacity, Production and Utilisation Rate

Producer	2010–11			2011–12			2012–13			2013–14		
	Working Capacity	Production	Utilisation (%)	Working Capacity	Production	Utilisation (%)	Working Capacity	Production	Utilisation (%)	Working Capacity	Production	Utilisation (%)
BSP	3.9	5.3	136	3.9	4.9	125	3.9	5.0	128	3.9	5.1	131
DSP	1.8	2.0	109	1.8	1.9	106	1.8	2.0	113	1.8	2.0	112
RSP	1.9	2.2	114	1.9	2.2	114	1.9	2.2	116	1.9	2.3	121
BSL	4.4	3.6	82	4.4	3.6	84	4.0	3.8	94	4.0	3.8	94
ISP	0.5	0.4	82	0.5	0.3	66	0.5	0.1	27	0.5	0.1	25
ASP	0.2	0.2	85	0.2	0.2	85	0.2	0.1	56	0.2	0.1	52
SSP				0.2	0.1	53	0.2	0.1	41	0.2	0.1	51
VISL	0.1	0.1	92	0.1	0.1	77	0.1	0.1	54	0.1	0.0	11
SAIL	12.8	13.7	107	13.0	13.3	103	13.0	13.4	103	13.0	13.5	104
RINL	2.9	3.2	110	2.9	3.1	107	2.9	3.1	106	2.9	3.2	110
Tata Steel	6.8	6.9	101	6.8	7.1	105	9.6	8.1	85	9.6	9.2	95
Majors (includes Essar SL, JSW Ispat, JSW Steel, JSPL)	18.4	14.5	79	25.5	17.0	67	25.5	18.4	72	25.5	18.3	72
Other EAF units - COREX/ MBF	9.1	9.3	102	11.6	9.7	84	12.0	9.7	81	13.5	9.9	73
Induction Furnace	30.2	22.9	76	31.0	23.9	77	34.0	25.6	76	36.5	27.5	76
Total	80.4	70.6	88	90.9	74.2	82	97.0	78.4	81	101.0	81.6	81

Source: Annual report 2013–14 by Ministry of Steel.

Table A6: PAT, Sales Revenue, Raw material and Labour costs

Company	Fields	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14
Bhushan Steel	Total income (Rs. crore)	1759.91	2874.72	3085.32	4282.26	4745.40	5427.61	6121.09	7645.81	10819.97	11817.34	10629.54
	Raw material (% TI)	71.85	77.06	66.33	72.90	69.86	63.07	68.88	64.69	52.41	66.09	54.95
	Compensation to employees (% of TI)	0.96	0.82	1.18	1.19	1.56	1.86	2.30	1.61	1.33	1.47	1.77
	Profit after tax (Rs. crore)	90.30	153.35	154.45	313.26	423.73	421.30	845.80	1005.09	1011.01	908.89	619.6
	PBT (Rs. crore)	103.96	165.65	159.66	413.57	559.63	560.78	1151.37	1375.66	1352.76	1213.99	943.7
	PBDITA (Rs. crore)	276.33	412.15	411.78	711.23	912.83	1118.64	1582.48	2120.46	3162.87	3350.64	27686.9
	PBT as % of total income	5.89	5.84	8.43	9.02	10.87	8.32	7.83	11.80	11.14	9.17	0.89
	PBDITA as % of total income	12.83	12.19	14.86	16.93	20.63	22.90	26.48	28.47	28.84	28.78	26.05
	PAT as % of total income	4.73	4.70	7.03	6.59	8.20	6.74	5.96	8.62	7.31	5.98	0.58
	Interest cover (times)	2.82	2.56	2.48	1.88	1.78	1.55	1.40	1.58	1.48	1.38	1.03
	Debt to equity ratio (times)	1.64	2.54	3.98	3.11	3.46	3.65	3.81	3.61	3.28	3.96	3.9
Tata Steel	Total income (Rs. crore)	12238.63	16203.61	17496.48	20344.09	23164.63	27495.24	28045.71	33338.35	38314.89	42933.10	46913.25
	Raw material (% TI)	12.08	10.58	13.54	17.54	16.12	21.99	20.15	19.20	20.92	23.01	20.63
	Compensation to employees (% of TI)	12.91	8.70	8.03	7.90	8.22	8.64	8.81	8.51	7.93	8.39	7.86
	Profit after tax (Rs. crore)	1746.22	3474.16	3506.38	4222.15	4687.03	5201.74	5046.80	6861.15	6696.42	5062.97	6412.19

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Table A6: (Contd...)

	PBT (Rs. crore)	2666.92	5325.32	5240.76	6262.62	7067.31	7316.61	7215.30	9773.59	9859.05	7838.60	9715.50
	PBDITA (Rs. C rore)	3654.11	6156.58	6162.52	7351.34	8991.21	9828.28	10175.76	12660.92	13443.87	12719.62	14148.85
	PBT as % of total income	21.79	32.87	29.95	30.78	30.51	26.61	25.73	29.32	25.73	18.26	20.71
	PBDITA as % of total income	29.86	38.00	35.22	36.14	38.81	35.75	36.28	37.98	35.09	29.63	30.16
	PAT as % of total income	14.27	21.44	20.04	20.75	20.23	18.92	17.99	20.58	17.48	11.79	13.67
	Interest cover (times)	11.22	27.14	30.13	25.65	8.48	5.82	4.64	6.39	5.49	4.83	5.57
	Debt to equity ratio (times)	0.78	0.40	0.26	0.69	1.08	1.32	0.68	0.58	0.48	0.48	0.44
SAIL	Total income (Rs. crore)	24908.99	32863.42	33415.79	40822.07	47454.82	51374.62	48387.64	49366.10	53182.86	50999.09	54768.03
	Raw material (% TI)	24.65	25.99	33.06	29.40	25.96	34.64	31.11	41.51	43.73	41.96	35.65
	Compensation to employees (% of TI)	19.12	11.61	12.99	12.78	16.88	16.82	12.01	15.48	14.96	16.79	17.99
	Profit after tax (Rs. crore)	2512.08	6816.97	4012.97	6202.29	7536.78	6170.40	6754.37	4904.74	3542.72	2170.35	2616.48
	PBT (Rs. crore)	2630.55	9409.34	5707.33	9456.52	11471.43	9454.52	10207.26	7209.08	5157.17	3240.75	3111.60
	PBDITA (Rs. crore)	5232.19	11469.78	7452.98	11055.71	13018.12	11356.29	12023.85	9216.00	8223.77	5670.78	6095.51
	PBT as % of total income	10.56	28.63	17.08	23.17	24.17	18.40	21.09	14.60	9.70	6.35	5.68
	PBDITA as % of total income	21.01	34.90	22.30	27.08	27.43	22.10	24.85	18.67	15.46	11.12	11.13
	PAT as % of total income	10.09	20.74	12.01	15.19	15.88	12.01	13.96	9.94	6.66	4.26	4.78
	Interest cover (times)	3.83	16.24	13.84	30.26	48.62	29.45	12.77	15.61	7.62	5.10	2.64

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Table A6: (Contd...)

	Debt to equity ratio (times)	1.87	0.58	0.35	0.24	0.13	0.27	0.50	0.52	0.41	0.53	0.59
JSPL	Total income (Rs. crore)	1415.04	2471.27	2913.39	3981.07	6256.19	8673.86	8148.25	10781.62	15172.43	17330.08	16983.40
	Raw material (% TI)	16.46	13.67	15.39	19.42	21.26	30.81	27.32	25.32	29.86	28.52	25.12
	Compensation to employees (% of TI)	2.31	2.06	2.91	2.35	2.32	2.09	2.67	2.62	2.55	2.58	3.25
	Profit after tax (Rs. crore)	305.46	515.71	572.94	702.99	1236.96	1536.48	1479.68	2064.12	2110.65	1592.55	1291.95
	PBT (Rs. crore)	355.25	673.82	727.85	944.84	1502.51	2001.88	1907.46	2752.94	2843.01	2228.50	1600.64
	PBDITA (Rs. crore)	546.27	932.29	1061.35	1478.13	2405.94	2872.23	2800.47	3987.15	4844.11	5118.58	4630.00
	PBT as % of total income	25.11	27.27	24.98	23.73	24.02	23.08	23.41	25.53	18.74	12.86	9.42
	PBDITA as % of total income	38.60	37.73	36.43	37.13	38.46	33.11	34.37	36.98	31.93	29.54	27.26
	PAT as % of total income	21.59	20.87	19.67	17.66	19.77	17.71	18.16	19.14	13.91	9.19	7.61
	Interest cover (times)	6.89	10.83	8.61	6.93	7.73	9.53	7.69	5.00	3.54	2.44	1.79
	Debt to equity ratio (times)	1.20	1.14	1.49	1.41	1.03	0.92	1.24	1.39	1.45	1.66	1.87
JSW Steel	Total income (Rs. crore)	4027.18	7082.26	7268.67	9465.91	12940.45	15478.42	20027.58	25569.14	34899.97	39128.47	49626.48
	Raw material (% TI)	34.66	41.71	42.91	41.88	45.47	56.44	52.23	57.89	60.06	57.73	53.81
	Compensation to employees (% of TI)	1.06	1.52	1.75	1.85	2.12	1.87	1.82	2.09	1.79	1.71	1.61
	Profit after tax (Rs. crore)	528.68	870.11	856.53	1292.00	1728.19	458.50	2022.74	2010.67	1625.86	1801.22	1334.51
	PBT (Rs. crore)	690.40	1473.13	1373.63	1931.33	2450.96	669.72	2820.17	2778.53	2094.56	2504.12	1955.33

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Table A6: (Contd...)

	PBDITA (Rs. crore)	1476.58	2367.85	2238.70	2961.38	3638.54	3124.33	4852.68	5073.53	5811.47	6574.62	9383.85
	PBT as % of total income	17.14	20.80	18.90	20.40	18.94	4.33	14.08	10.87	6.00	6.40	3.94
	PBDITA as % of total income	36.67	33.43	30.80	31.28	28.12	20.19	24.23	19.84	16.65	16.80	18.91
	PAT as % of total income	13.13	12.29	11.78	13.65	13.35	2.96	10.10	7.86	4.66	4.60	2.69
	Interest cover (times)	1.73	4.27	4.78	4.97	5.30	1.48	3.47	3.28	2.38	2.42	1.70
	Debt to equity ratio (times)	6.25	1.53	1.16	0.87	1.06	1.51	1.26	0.72	0.89	0.93	1.19
Essar Steel	Total income (Rs. crore)	4611.09	6552.88	7249.52	9170.36	12067.94	12888.96	11761.27	13939.36	18192.14	16713.53	17049.80
	Raw material (% TI)	22.02	22.56	22.09	27.85	20.87	19.30	29.06	49.62	47.58	57.05	43.14
	Compensation to employees (% of TI)	1.06	1.12	1.32	1.63	1.87	1.79	1.84	2.16	2.14	1.87	2.09
	Profit after tax (Rs. crore)	(–)31.76	590.15	530.18	436.49	428.62	185.20	22.45	(–)166.27	(–)1251.56	(–)2784.94	(–)1597.14
	PBT (Rs. crore)	2.45	794.24	699.51	684.82	811.55	296.10	72.00	(–)377.51	(–)1282.60	(–)4227.28	(–)2314.74
	PBDITA (Rs. crore)	942.93	1912.93	1797.93	2085.31	2425.28	2433.93	1859.76	1867.25	2031.41	539.17	3482.42
	PBT as % of total income	0.05	12.12	9.65	7.47	6.72	2.30	0.61	(–)2.71	(–)7.05	(–)25.29	(–)13.58
	PBDITA as % of total income	20.45	29.19	24.80	22.74	20.10	18.88	15.81	13.40	11.17	3.23	20.42
	PAT as % of total income	(–)0.69	9.01	7.31	4.76	3.55	1.44	0.19	(–)1.19	(–)6.88	(–)16.66	(–)9.37
	Interest cover (times)	0.88	3.16	2.02	2.20	2.36	1.72	1.06	0.65	0.62	0.34	(–)0.24
	Debt to equity ratio (times)	4.54	4.40	5.07	1.70	1.37	1.59	2.01	2.13	2.97	4.24	5.92

Source: CMIE.

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Table A6.a: Standalone Financial Results

Nine Months ended			
Company	**Fields**	**31st December 2014 (Unaudited)**	**31st December 2013 (Unaudited)**
SAIL	Total Income (Rs crore)	34,125.7	33,221.6
	Raw Material (% of TI)	39.4	43.5
	Employee Cost (% of TI)	20.9	21.2
	Provision for Tax (% of TI)	1.0	1.4
	PAT (% of TI)	5.2	6.5
	Absolute PAT	1,758.5	2,163.9
Tata Steel	Total Income (Rs crore)	31,150.1	29,519.8
	Raw Material (% of TI)	28.9	23.5
	Employee Cost (% of TI)	11.0	9.8
	Provision for Tax (% of TI)	7.3	7.4
	PAT (% of TI)	18.1	15.0
	Absolute PAT	5,625.0	4,433.6
JSPL	Total Income (Rs crore)	10,061.8	10,343.9
	Raw Material (% of TI)	31.8	30.6
	Employee Cost (% of TI)	4.8	3.9
	Provision for Tax (% of TI)	(0.8)	3.4
	PAT (% of TI)	(0.8)	8.3
	Absolute PAT	(76.1)	861.1
Bhushan Steel	Total Income (Rs crore)	8,225.9	7,165.5
	Raw Material (% of TI)	55.1	53.8
	Employee Cost (% of TI)	2.2	1.9
	Provision for Tax (% of TI)	-	0.5
	PAT (% of TI)	(10.9)	1.1
	Absolute PAT	(893.1)	81.5
JSWL	Total Income (Rs crore)	35,105.0	32,808.3
	Raw Material (% of TI)	60.2	59.7
	Employee Cost (% of TI)	2.0	1.8
	Provision for Tax (% of TI)	2.7	0.7
	PAT (% of TI)	5.6	1.6
	Absolute PAT	1,977.8	532.6

Source: Standalone Financial statement of Companies ended 31 December 2014.

Table A7: Iron Ore Reserves

Raw Material	Reserves (in Mt)	Remaining Resources (in Mt)	Total Resource (in Mt)
Haematite	8,093	9,788	17,881
Magnetite	22	10,623	10,644

Source: Long Term Perspectives for Indian Steel Industry by A.S. Firoz.

Table A7.a: Reserves of Coal and Coking Coal

Type of Coal	Category			Total (in BT)
	Proved (in Bt)	Indicated (in Bt)	Inferred (in Bt)	
Prime Coking	4.62	0.7	0	5.31
Med. Coking	12.57	12	1.88	26.45
Semi-Coking	0.48	1	0.22	1.71
Non-Coking	95.74	123.67	31.49	250.9
Tertiary Coal	0.59	0.1	0.8	1.49
Total	114	137.47	34.39	285.86

Source: Long Term Perspectives for Indian Steel Industry by A.S. Firoz.

Table A8: Competitiveness in the Indian Context

Cost Competitiveness	Company	2011–12	2012–13
Iron Ore (Rs/ T)	Tata Steel	1079	1344
	SAIL	1163	1423
	JSWL	2936	3212
	JSPL	2132	2492
Coking Coal (Rs /T)	Tata Steel	8722	8058
	SAIL	13197	11386
	JSWL	12997	10708
	JSPL	12713	13210
Purchased Power (Rs / Kwh)	Tata Steel	3.88	3.98
	SAIL	4.31	4.51
	JSWL	4.82	4.5
	JSPL	5.06	5.08

Source: Indian Steel Industry: A reference book by N.M Rao.

Table A9: Efficiency Indicators in Global context

Fields	India	Japan & Korea or Developed Countries
Labour Productivity per Capita	90–100 tonnes	600–700 Tonnes
Crude Steel Requirement / tonne saleable steel	1.2 tonne	1.1 tonne
Material Efficiency	92–94%	94–98%
Solid wastes	600–800 kg/ tonne	400–500 kg
Greenhouse Gas Emissions	2.5 to 3 TCO_2 / T	1.8 TCO_2/T
BF Productivity (t/day/m3 of working volume)	1.5–2.5	2.5–3.5
Energy Consumption (G-cal/ TCS)	6–6.5	4.4–5.5
CO_2 Emission (t/TCS)	2.8–3.0	1.7–1.9
Water Consumption (m^3/t)	3.5	1.2

Table A10: R& D Expenditure – Comparative View

	2011–12		2012–13		2013–14	
Company	R&D (Rs crore)	R&D as % Turnover	R&D (Rs crore)	R&D as % Turnover	R&D (Rs crore)	R&D as % Turnover
Tata Steel	53	0.15	60	0.15	80	0.19
Sail	134	0.27	147	0.3	111	0.21
Bhushan Steel	NA	NA	NA	NA	2.7	0.025
JSW Steel	62	0.19	48	0.13	35	0.08
Essar Steel	26	0.15	29	0.19	NA	NA
RINL	21	0.14	31	0.23	50	0.37

Source: Ministry of Steel, R&D roadmap document.

Table A11: R&D Expenditure of Global Steel Companies as percent (%) of sales turnover

Company Name	Country	2008–09	2009–10
Nippon Steel	Japan	0.9	1.0
JFE	Japan	1.1	1.1
POSCO	South Korea	1.2	1.3
Thyssen Krupp	Germany	0.6	0.7
KOBE Steel	Japan	1.4	1.4
ArcelorMittal	Luxembourg	0.2	0.4
Sumitomo Metal	Japan	1.2	1.2
Bao Steel	China	1.2	1.7

Table A12: Enhanced Explorations- Global Best Practices

Best Global Practices for Enhanced Explorations	
Mineral Exploration by Wildlife Management-British Columbia (US)	Much of the mining and mineral exploration in B.C. occurs in rural areas and has the potential to affect wildlife habitat. In particular, caribou are vulnerable to development and the province is taking action to recover a number of herds. The work includes developing plans that balance habitat protection and management with the development of industries such as mining, forestry and oil and gas. Actions supporting the plans include: protecting caribou habitat; collaborating with industry to fund habitat restoration and research; establishing management practices for development activities within certain caribou habitat areas; and managing predators and caribou populations.
The Kemess South Mine: North Central British Columbia	The Kemess South Mine in north central B.C. is one of the largest-scale reclamation projects now being implemented. The mine is in remote, mountainous terrain. Native plant species are not easily purchased and vegetation growth is limited by a severe climate and minimal soil resources. Despite these challenges, the site has been extensively replanted with native species. Local communities have become involved with annual native-seed collection campaigns. To date, over 750,000 stems of various native species have been planted, and progressive reclamation has been completed on approximately 250 hectares.
Best practice environmental policies for metals recovery programme in Canada (NRC, 2010).	In many communities around Canada the following programmes have become extremely popular and their effective implementation has resulted in enhanced metals recovery over the last several years. Some programmes include: (1) Targeting small metal items. (2) Adding to an existing white goods drop-off program. (3) Adding to white goods curbside collection program. (4) A special pick-up once or twice a year. (5) Removing refrigerant, mercury switches, sensors and PCB capacitors. (6) Enhanced promotion and emphasis on other metals. (7) Financial incentives: (i) Paying cash or kind for scrap metal, (ii) User pays for waste collection, (iii) Tipping fees that favour source separation, (iv) Enhancement and encouragement of reuse activities.
Explorations Through Best Energy Efficient Technologies	
China	The promotion and energy-saving technologies that have become an important step for increasing energy efficiency and reducing energy consumption of steel enterprises especially in the 11th plan (2006–2010) and 12th five-year plan (2011–2015) include: Coke Dry Quenching (CDQ), Top Pressure Recovery Turbine (TRT), recycling converter gas, continuous casting, slab hot charging and hot delivery, Coal Moisture Control (CMC), and recycling waste heat from sintering.

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Table A12: (Contd...)

Australian Technologies	In addition to increasing productivity and reducing costs, the use of Zebedee in autonomous operation of robotic vehicles has the potential to open up opportunities for mining in environments hostile to humans, including deep underground. Three-dimensional (3D) mobile mapping technology Zebedee is a lower cost, easy to use system that provides globally consistent maps that are set to benefit the Australian mining industry. The system enables companies to create 3D maps of both underground and indoors in real time without using GPS or being supervised by humans. Zebedee has a diverse range of applications and is currently being used to map and preserve the world's oldest and most significant archaeological and cultural heritage sites.
	CSIRO has enhanced **telerobotic systems** for the mining industry by developing a tele-operated rock breaker and ship loader that can be operated in real time. With a higher level of immersion and situational awareness, they can effectively control and make decisions from a remote location. The rock breaker and ship loader can be controlled remotely in real time from a distant control station. Rock breakers are used to smash oversized rocks. By tele-operating the machinery, industry is able to offer employees better working environments and an improved work-life balance.
	NITA II analyser is cutting operating costs and energy usage in the mining industry by providing a faster and more accurate means of quality control in iron ore, manganese and coal production. NITA, which stands for neutron inelastic scattering and thermal analysis, utilises the penetrating power of neutron radiation to analyse a large volume of ore on a conveyor. It determines the concentration of different elements in the ore and provides valuable information on ore quality. According to ScanMin Africa, the technology is a big breakthrough in the energy sector, where it provides important coal quality parameters that are seen as an integral part of the future of coal quality management, particularly in energy use reduction.
	CSIRO's breakthrough **Low Frequency Microwave (LFM) Moisture Analyser** is used by the mining industry for online measurement of moisture in bulk ore materials. Many of these systems have been sold in Australia and overseas and are being used by the mining industry for dust extinction control and ensuring the moisture level in coal is appropriate for shipment. Controlling dust and the moisture limit helps to avoid process disruption due to upsets such as chute blockages in iron ore and coal applications.
	Adopted by major Australian iron ore produces Rio Tinto and Fortescue Metals Group and intensively used for research, **Mineral4/Recognition4** is the only software of its kind to be made commercially available. It has a unique set of features that set it apart from generic tools used for similar purposes. Based on the latest Zeiss technology, the software enables comprehensive characterization of ores and textural classification and sinters to predict downstream processing performance and improve resource evaluation, making it a valuable tool for Australian industry.

(Contd...)

Table A12: (Contd...)

Explorations Through Reconciling the Interests of Tribals	
Canada	• Legally-binding private contracts: voluntarily initiated by resource developers and used by aboriginals to influence decision making in their lands and address concerns about mining impact on their environment, land, and their traditional way of life. ➢ Legislative agreements: by particular aboriginals and federal government of Canada. ➢ Commercial agreements: between mining companies and the aboriginals • The above are categorised as socio-economic agreements which include direct (profit sharing arrangements like cash or compensation funds) or indirect payments (employment, business opportunities and finance or equity provisions) • Such agreements encourage joint ventures between aboriginals and non-aboriginals. • Fair method: uphold the rights of people who have traditional authority over the land.
Australia	• Central authority to collect mining royalty and disburse to the aboriginals under the Land Rights Act. ➢ 40 per cent is paid to the land councils to cover administrative costs, 30 per cent is forwarded to the councils for distribution to aboriginal organisations in affected areas while the remaining 30 per cent goes towards projects that benefit the community. • Native Title Act: Agreements are a central feature of the relationship between aboriginals and mining companies. • Individual agreements are defined depending on goals pursued by particular indigenous groups.
Botswana	Government of Botswana (a country heavily dependent on revenues from production and exports of diamonds) follows a formal investment rule (Lange and Wright, 2004) whereby it ensures that all non-investment expenditure by the government is funded out of recurrent revenues (non-mineral revenue). This ensures that mineral revenue is not spent on government consumption.

Table A13: Mining Allocation Procedures - Worldwide

Region	Exploration Rights	Transferability	Mining Rights
Western Australia	Non-exclusive FCFS	Automatic	FCFS
Quebec, Canada	Exclusive FCFS	Automatic	FCFS
Western United States	Exclusive FCFS	Automatic	Auction (lease by application procedure)

(Contd...)

Table A13: (Contd...)

Queensland, Australia	Non-exclusive FCFS (Recent contemplation to introduce auction)	Automatic	FCFS (recent contemplation to introduce auction)
Chile	Exclusive FCFS	Automatic	FCFS
Russia	Exclusive FCFS (Auction if > 2 bidders)	Conditional	Auction (for strategic assets, discretion may be used)
Brazil	Exclusive FCFS	Automatic	FCFS (recent contemplation to introduce auction)
South Africa	Exclusive FCFS	Conditional	FCFS
China	Auction	Conditional	Auction

Source: Report of the CII Task Force on Bulk Mineral Allocation Methodology, with Specific Reference to Coal, 2013.

Table A14: Tax Incentives to Encourage Mining - Worldwide

Country	Tax Incentive
Argentina Mining Investment Law	Grants an additional deduction for exploration expenditures
Australia	Allows a new asset used in exploration or prospecting to be written off provided the miner satisfies certain criteria as set forth in the Taxation Act.
Canada	Flexible and generous tax regime for exploration expenditures, only for base metals, precious metals and diamonds. Provincial tax incentives are also available to mining companies.
Indonesia	On-site exploration expenses are generally deductible in the year the expenses are incurred, provided the expenses relate to the contract area. Mine development expenditures in Indonesia are generally capitalised and amortised.
Mexico	Allow a taxpayer to deduct disbursements made in pre-operating stages including the mine development stage when the expenditures are made. The tax losses generated in pre-production years are allowed to decrease taxable profits of the next 10 years.
Tanzania	An immediate deduction is given for developmental capital expenditures.

Table A15: Best Practices: Private Sector Initiatives in Various Manufacturing Sectors

Sector	Company	Initiative
Steel	Tata Steel	Tata Steel has signed MOUs with the Jharkhand government to upgrade polytechnics and ITIs. Tata Steel already had a track record for supporting vocational training institutes. Shavak Nanavati Technical Institute (formerly the Jamshedpur Technical Institute) was set up in 1921 in Jamshedpur and is operated by Tata Steel. It offers courses in metallurgy, advanced electrical and mechanical engineering, telecommunications, accounting, first aid, safety, computerisation of accounts and practical training. Its flagship programme is a three-year residential programme for students who have passed Class 10. Students receive free accommodation and a monthly stipend. On graduation, they can apply to Tata Steel for a job.
	Essar Steel, India	Worker retention is a priority for Essar's Human Resources (HR) department.
Construction	Larsen & Tubro	Established construction skills training institute (CSTIs) in 7 metro cities all over India to impart construction vocational training.
Automotive	Maruti Suzuki India Ltd	• Has tied up with 17 ITIs and plans to ramp up its network to 53 ITIs. It has placed 400 students in the service network. • Has launched a Technical Training Centre (TTC) for employees in manufacturing and to train them in the latest technologies. • Has tied up with institutes such as BGS Institute of Science and Management and ABT Technical Institute to construct Maruti certified courses.
Electronics	Godrej	Tied up with George Telegraph Training Institute (East India) to launch specialised courses in refrigeration, air conditioning and washing machine technology. On completion of the course, deserving candidates are employed in Godrej.
Services Sector	Companies like ITC (retail), Infosys (IT), Pawan Hans Helicopters (aviation), Grand Hyatt (hospitality) and ICICI Bank (financial services) have taken training initiatives to build human resource skills.	

Table A16: Promising Alternative Technologies

Process Characteristics	Merits / Demerits	Status
COREX PROCESS		
COREX is a two-stage process: in the first stage (Reduction Shaft), iron ore is reduced to DRI using the reduction gas (65–70% CO+20–25% H2) from the Melter Gasifier and in the second stage (Melter Gasifier), the DRI produced in the reduction shaft is melted to produce hot metal.	Merits: Cost saving (up to 15%) and environment friendly vis-à-vis coke oven-sinter plant.-BF route. Demerits: Limited modular size (the largest COREX plant is of 1.5 million tonne capacity); dependence on lumps/ pellets/ coke/ weak coking coal; high consumption (cost) of oxygen; necessity of gainful utilisation of Corex gas and generated coal fines.	COREX is a proven smelting-reduction (SR) process developed by Siemens VAI for cost-effective and environment-friendly production of hot metal. Well established in India and abroad. JSW Steel and Essar steel successfully adopted the Corex process (C-2000 Module).
FINEX PROCESS		
Finex involves two reactors: Fluidised Bed Reactor (FBR) and Melter Gasifier (MG). In the FBR, iron ore fines are reduced to sponge iron fines FINEX: an innovative iron-making technology developed by Siemens VAI and POSCO. Like Corex, which are compacted to produce Hot Compacted Iron (HCI). The HCI is then charged in the MG where non-coking coal briquettes (65%) are also charged. The balance coal (35%) is injected in the MG as PCI. The top gas from the FBRs is treated to remove CO_2 and part of gas (30%) is re-cycled for use in the FBRs.	Merits: Direct use of iron ore fines, no need of lumps/pellets. Significant reduction of SOx, NOx and dust emissions. Limitations: i) Needs inputs in melter gasifier largely in lumpy form (lumps/ briquettes) ii) Needs either lumpy coal or coal briquettes. iii) Like Corex gas, Finex gas is of high calorific value and needs to be utilised gainfully to make the process economically viable. iv) The claims on lower CO_2 emission vis-à-vis the blast furnace route are yet to be established and need further investigation.	The FINEX process has been successfully demonstrated at Pohang, POSCO in two modules: at 0.75 MTPA and 1.5 MTPA. Adoption of this process is also being considered for POSCO's venture in Odisha. SAIL has signed an MOU with POSCO to incorporate the technology under JV for creating 2.5–3.0 MTPA additional capacity at Bokaro Steel Plant.

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Table A16: (Contd...)

HISMELT PROCESS		
Direct use of iron ore and coal fines in a single-step reactor. Involves moderate to high degree (70% and above) of post-combustion. The gas generated during the reactions is post-combusted to around 50% just above the bath and the heat energy of the post-combustion is transferred back to the main process through a liquid fountain of molten iron bath, instead of recovering it as export gas. This reduces the coal and oxygen requirements of the process.	A distinguishing feature of the process is the oxidation level of the slag bath (5% FeO in slag), which helps partition a large portion of phosphorous to slag. Further, silicon is practically absent, making the hot metal an ideal feed for BOF. Being a bed-less process, the problem faced in BF in handling high alumina ore is resolved to a large extent. The process seems to have considerable promise in the Indian context. However, the process is not yet fully proven.	First demonstration plant 0.8 MTPA commissioned in 2005 at Kwinana, Western Australia. Major shutdown in February 2006 for modification. Since its restart in March 2006, the plant has achieved a capacity utilisation of about 60%. Plans to scale up the size (internal diameters) of the SRV from 6m to 8m to achieve a production of 2 MTPA from the single module. However, due to market softening in 2008, the demonstration unit was put down without any definite plans for restart. Remains closed. JSPL signed an agreement with Rio Tinto for the transfer of the existing plant to the JSPL site to take the development forward.
HISARANA PROCESS		
Combines coal preheating and partial pyrolysis in a reactor, a cyclone furnace for ore melting of partially reduced ore and a smelter reduction vessel for final ore reduction and iron production. The three separate technologies associated with Hisarna have been proven independently on a small scale.	Significantly less coal usage and thus reduces the amount of carbon dioxide (CO_2) emissions. A flexible process that allows partial substitution of coal by biomass, natural gas or even hydrogen (H_2).	Developed as part of the EU-ULCOS programme, can produce hot metal from iron ore fines (incl. slime) using non-coking or thermal coal or charcoal. Rio Tinto and Tata Steel have commissioned a 65,000 tpa pilot plant at the IJmuiden Steel Works in the Netherlands. The process is claimed to be the most energy efficient with the least CO_2 emissions, having a 20% reduction in CO_2 emission and 50% when combined with CCS.
TECHNORED PROCESS		
A new approach to iron-making using cold bonded self-reducing pellets/ briquettes produced from iron ore fines, iron-bearing residues plus low-cost solid fuels (green pet coke fines, coal/ coke, charcoal/ biomass or carbon-bearing residues. Pellets/briquettes are smelted in a unique shaft furnace with very low stack height, using a combination of hot & cold blast requiring no additional oxygen.	Merits: Flexibility to used different types of raw materials. Eliminates need for coke oven, sinter plant and tonnage oxygen plant, i.e., lower investment and operation cost (30%). Clean & green technology. Demerits: Limited module size but flexible; can be combined to add capacity.	A demo plant of 75,000 tpa is under operation in Sao Paulo, Brazil. Technology is still at the first stage of maturity. Proposal to set up a 300,000 tpa industrial plant (4 modules of 75000 tpa) in the next two years.

Source: Technology road map for Indian steel industry, by A.C.R. Das.

Table A17: Reasons for stalling of steel projects with cost

Company Name	Project Name	Cost (Rs. million)	Project Status	Ownership Group	Project Type	Reason for Stalling of Projects
AML Steel & Power Ltd.	Dubri Steel Project	2,086.70	Shelved	Private (Indian)	New Unit	Lack of clearances (non-environmental)
ArcelorMittal India Pvt. Ltd.	Kendujhar Steel Project	400,000.00	Abandoned	Private (Foreign)	New Unit	Land acquisition problem
Bhushan Power & Steel Ltd.	Automotive Grade Steel Plant Project	20,000.00	Shelved	Private (Indian)	New Unit	Lack of promoter interest
Bhushan Steel Ltd.	Bellary H R Coil Project	60,000.00	Shelved	Private (Indian)	New Unit	Not available
Bhushan Steel Ltd.	Cold Rolled & Galvanising Plant Project	8,000.00	Abandoned	Private (Indian)	New Unit	Land acquisition problem
Bhushan Steel Ltd.	Jajpur H R Coil Project	5,350.00	Shelved	Private (Indian)	New Unit	Not available
Bhushan Steel Ltd.	Orissa Steel Phase-III Project	194,000.00	Under Implementation	Private (Indian)	Subs. Expn.	Fuel/feedstock/ raw material supply problem
Bhushan Steel Ltd.	Raipur Steel Billets & Slabs Project	12,350.00	Shelved	Private (Indian)	New Unit	Lack of clearances (non-environmental)
Bhushan Steel Ltd.	Salanpur Greenfield Steel Phase-I Project	200,000.00	No Information, but Live	Private (Indian)	New Unit	Land acquisition problem
Bhushan Steel Ltd.	Salanpur Greenfield Steel Phase-II Project		Announced & Stalled	Private (Indian)	Subs. Expn.	Land acquisition problem
Government of Orissa	Paradip Steel Project	200,000.00	Shelved	State Government	New Unit	Lack of promoter interest

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Table A17: (Contd...)

JSW Bengal Steel Ltd.	Salboni Steel Project Phase I	150,000.00	Implementation Stalled	Om Prakash Jindal Group	New Unit	Lack of clearances (non-environmental)
JSW Bengal Steel Ltd.	Salboni Steel Project Phase II	200,000.00	Implementation Stalled	Om Prakash Jindal Group	Subs. Expn.	Lack of clearances (non-environmental)
JSW Jharkhand Steel Ltd.	Jharkhand Steel & Captive Power Project	350,000.00	Announced	Om Prakash Jindal Group	New Unit	Not available
JSW Steel Ltd.	Dolvi Hot Rolled Coils Expansion Project Phase I	81,650.00	Under Implementation	Om Prakash Jindal Group	Subs. Expn.	Unfavourable market conditions
JSW Steel Ltd.	Dolvi Hot Rolled Coils Expansion Project Phase II	170,000.00	Announced	Om Prakash Jindal Group	Subs. Expn.	Lack of promoter interest
JSW Steel Ltd.	Torangallu Steel Expansion Phase-III Project	300,000.00	Under Implementation	Om Prakash Jindal Group	Subs. Expn.	Fuel/feedstock/ raw material supply problem
Jayaswal Neco Inds. Ltd.	Chhattisgarh Integrated Steel Project	26,500.00	Announced & Stalled	NECO Group	New Unit	Land acquisition problem
Jayaswal Neco Inds. Ltd.	Integrated Steel Project	8,000.00	Shelved	NECO Group	New Unit	Not available
Jindal Coated Steel Pvt. Ltd.	Colour Coated Steel Project	1,800.00	Shelved	Om Prakash Jindal Group	New Unit	Not available
Jindal Iron & Steel Co. Ltd. [merged]	Steel Project	30,000.00	Shelved	Om Prakash Jindal Group	New Unit	Not available
Jindal Steel & Power Ltd.	Angul Steel Phase-I Project	300,000.00	Under Implementation	Om Prakash Jindal Group	New Unit	Others
Jindal Steel & Power Ltd.	Raigarh Integrated Steel & Captive Power Project	423,450.00	Under Implementation	Om Prakash Jindal Group	New Unit	Land acquisition problem
Jindal Steel & Power Ltd.	Steel Capacity Expansion Project		Abandoned	Om Prakash Jindal Group	Subs. Expn.	Not available

(Contd...)

Table A17: (Contd...)

KIOCL Ltd.	Anantapur Integrated Steel Project	65,000.00	Announced & Stalled	Central Govt. - Commercial Enterprises	New Unit	Others
KIOCL Ltd.	Karnataka Integrated Steel Plant Project	80,000.00	Announced & Stalled	Central Govt. - Commercial Enterprises	New Unit	Lack of clearances (non-environmental)
Kalyani Steels Ltd.	Ginigera Steel Project	4,500.00	Shelved	Kalyani (Bharat Forge) Group	New Unit	Lack of promoter interest
Kalyani Steels Ltd.	West Bengal Steel Project	65,000.00	Shelved	Kalyani (Bharat Forge) Group	New Unit	Not available
Mesco Kalinga Steel Ltd.	Daitari Steel Project	27,290.00	No Information	Mesco Group	New Unit	Unfavourable market conditions
Mukand Vijaynagar Steels Ltd.	H R Steel Project	54,628.10	Shelved	Bajaj Group	New Unit	Not available
NMDC Ltd.	Bellary Integrated Steel Plant project	180,000.00	Announced	Central Govt. - Commercial Enterprises	New Unit	Lack of promoter interest
NMDC Ltd.	Jharkhand Ultra Mega Steel Plant Project	360,000.00	Announced	Central Govt. - Commercial Enterprises	New Unit	Lack of promoter interest
NMDC Ltd.	Karnataka Ultra Mega Steel Plant Project	360,000.00	Announced	Central Govt. - Commercial Enterprises	New Unit	Lack of promoter interest
Orissa Sponge Iron & Steel Ltd.	Steel Expansion Project	2,600.00	Shelved	State and Private sector	New Unit	Lack of funds
Posco India Pvt. Ltd.	Halligudi Steel Project	323,000.00	Shelved	Private (Foreign)	New Unit	Land acquisition problem
Posco India Pvt. Ltd.	Paradip Steel Phase-III Project	166,500.00	Announced & Stalled	Private (Foreign)	Subs. Expn.	Others
Posco India Pvt. Ltd.	Paradip Steel SEZ Phase-I Project	166,500.00	Implementation Stalled	Private (Foreign)	New Unit	Others

(Contd...)

Table A17: (Contd...)

Posco India Pvt. Ltd.	Paradip Steel SEZ Phase-II Project	166,500.00	Implementation Stalled	Private (Foreign)	Subs. Expn.	Others
Posco Maharashtra Steel Pvt. Ltd.	Mangaon (Vile-Bhagad) Galvanising Plant Phase-III Project		Shelved	Private (Foreign)	Subs. Expn.	Not available
Rashtriya Ispat Nigam Ltd.	Odisha Ultra Mega Steel Plant Project	360,000.00	Announced	Central Govt. - Commercial Enterprises	New Unit	Lack of promoter interest
Rashtriya Ispat Nigam Ltd.	Steel Project	12,020.00	Shelved	Central Govt. - Commercial Enterprises	Ren./Mod.	Not available
SAIL Salem SEZ Pvt. Ltd.	Salem Steel S E Z Project		Abandoned	Private (Indian)	New Unit	Others
SAIL Sindri Projects Ltd.	Sindri Integrated Greenfield Steel Plant Project	250,000.00	Abandoned	Central Govt. - Commercial Enterprises	New Unit	Land acquisition problem
Steel Authority of India Ltd.	Burnpur IISCO Modernisation & Expansion Project	179,600.00	Completed	Central Govt. - Commercial Enterprises	Ren./Mod.	Others
Steel Authority of India Ltd.	Chhattisgarh Ultra Mega Steel Plant Project	360,000.00	Announced	Central Govt. - Commercial Enterprises	New Unit	Lack of promoter interest
Steel Authority of India Ltd.	Durgapur Bar & Rod Mill Project	7,380.00	Shelved	Central Govt. - Commercial Enterprises	New Unit	Lack of promoter interest
Steel Authority of India Ltd.	Gaya Steel Processing Unit Project		Implementation Stalled	Central Govt. - Commercial Enterprises	New Unit	Land acquisition problem
Steel Authority of India Ltd.	Kangra Steel Processing Plant Project	3,000.00	Under Implementation	Central Govt. - Commercial Enterprises	New Unit	Lack of clearances (non-environmental)
Steel Authority of India Ltd.	Mahnar Steel Processing Plant	2,000.00	Implementation Stalled	Central Govt. - Commercial Enterprises	New Unit	Others

(Contd...)

Table A17: (Contd...)

Steel Authority of India Ltd.	Rajasthan steel processing plant	2,000.00	Shelved	Central Govt. - Commercial Enterprises	New Unit	Others
Steel Authority of India Ltd.	Rourkela C R Project	11,000.00	Shelved	Central Govt. - Commercial Enterprises	Ren./Mod.	Not available
Steel Authority of India Ltd.	Rourkela Cold Rolling Mill Revamping Project		Shelved	Central Govt. - Commercial Enterprises	Ren./Mod.	Lack of promoter interest
Tata Metaliks Ltd.	Kharagpur Steel Billets Project	8,000.00	Shelved	Tata Group	New Unit	Land acquisition problem
Tata Metals & Strips Ltd. [merged]	Steel Project	1,640.00	Abandoned	Tata Group	New Unit	Not available
Tata Sponge Iron Ltd.	Orissa Steel Project	10,000.00	Announced	Tata Group	New Unit	Lack of promoter interest
Tata Steel Ltd.	Gopalpur Steel Project	75,000.00	Shelved	Tata Group	New Unit	Not available
Tata Steel Ltd.	Haveri Integrated Steel Project	350,000.00	Under Implementation	Tata Group	New Unit	Fuel/feedstock/ raw material supply problem
Tata Steel Ltd.	Jamshedpur Bars & Rods Mill Project	8,000.00	Shelved	Tata Group	New Unit	Not available
Tata Steel Ltd.	Jharkhand Steel Phase-I Project	200,000.00	Implementation Stalled	Tata Group	New Unit	Land acquisition problem
Tata Steel Ltd.	Jharkhand Steel Phase-II Project	220,000.00	Announced & Stalled	Tata Group	Subs. Expn.	Land acquisition problem
Usha Martin Inds. Ltd. [merged]	Steel Billets Plant Project	1,670.00	Abandoned	Usha Martin Group	Ren./Mod.	Not available

(Contd...)

Table A17: (Contd...)

Visa Steel Ltd.	Jharkhand Mild Steel Project	72,000.00	Shelved	Visa Group	New Unit	Unfavourable market conditions
Visa Steel Ltd.	Raigarh Steel Project	80,000.00	Implementation Stalled	Visa Group	New Unit	Fuel/feedstock/ raw material supply problem
Welspun Maxsteel Ltd.	Salav Steel & Gas Based Power Project	60,000.00	Implementation Stalled	Welspun Group	New Unit	Fuel/feedstock/ raw material supply problem

Source: CAPEX database in CMIE.

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NATIONAL COUNCIL OF APPLIED ECONOMIC RESEARCH

Parisila Bhawan, 11 Indraprastha Estate, New Delhi 110002, India

Tel: + 91 11 2337 9861-3 **Fax:** + 91 11 2337 0164 infor@ncaer.org

www.ncaer.org

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