Indian Iron Ore Industry in Global Perspective

- By Sanjay Sengupta

Introduction :

Iron ore continues to be the main input for the BF-BOF route of hot metal production globally and in 2005, this route of crude steel production accounted for 65.4 percent of world production. In addition to the BF-BOF process, many new technologies have been developed over the years which uses iron ore pellets, fines and concentrates in EAFs and IFS (specially in India).

In the last decade or more, many alternative technologies of iron making have emerged but according to experts, even if these technologies find wide acceptance in future, the blast furnace route will be the dominant in iron making. This is because of the fact that BF-BOF process has continued to remain most up-to-date and competitive due to the various innovative developments that has not only led to more efficient process technology but also due the improved design and efficient engineering equipment that has been placed in the system. In fact the global consumption o iron ore has increased substantially from 986 Mt in 1994 to 1379.9 Mt. in 2004.

Global Scenario :

Global production and trade in respect of iron ore between 1994 and 2004 is shown in Table 1

Table 1 : Global Production & Trade in Iron Ore (Mt. of Actual Weight)

Year	Production	Trade
1994	986.2	431.9
1995	1028.6	457.9
1996	1034.4	461.0
1997	1070.1	489.9
1998	1008.9	476.4
1999	1008.9	451.7
2000	1050.6	503.8
2001	1051.8	500.0
2002	1131.6	536.7
2003	1222.3	592.5
2004	1379.9	681.9

Data Source : IISI, Brussels

It is observed from the above table that the average yearly growth in the global production of iron ore between 1994 and 2004 has been 3.99 percent and the average yearly increase in the global trade or iron ore has been 5.79 percent.

In 2004, China was the highest producer of iron ore in the world at 335.6 Mt. (Fe-content 28 percent) followed by Brazil at 270.5 Mt. (Fe-content 66 percent) & Australia at 234.7 Mt (Fe-content 65 percent). India was the fourth highest producer of iron ore in the world at 120.6 Mt. (Fe-content 61 percent) in 2004.

In 2004, Brazil was the highest exporter of iron ore at 236.8 Mt. followed by Australia at 210.5 Mt. India was the third highest global exporter at 62.7 Mt.

In the same year, China was the highest importer of iron ore at 208.1 Mt. followed by Japan at 134.9 Mt.

During 2004, China's consumption of iron ore reached 543.7 Mt. highest in the world, followed by Japan with a consumption of 134.9 Mt. India was the third highest consumer at 59.0 Mt.

World Iron Ore Reserves :

World iron ore reserves of iron ore as on 2004 are shown countrywise in Table 2.

Table 2 : World Iron Ore Reserve (Mt)

Country	Reserve
Ukraine	30,000
Russia	25,000
China	21,000
Australia	18,000
India	13,400
United States	6,900
Brazil	7,600
Canada	1,700
Kazakstan	8,300
Mauritania	700
South Africa	1,000
Sweden	3,500
Other Countries	12,900
World Total	**150,000**

It is apparent from the above table that Ukraine had the highest reserve of iron ore in the world but the Fe-content in its ore is low at 30 percent, Russia's iron ore has an Fe-content of 56 percent and China's reserve has an Fe-content of 33 percent. The reserves for Australia, India and Brazil has iron ore deposits with Fe-content varying between 61 to 63 percent.

New Capacities :

According to global media reports about 200 Mtpy. of new capacity for iron ore production are in the pipeline mainly in Australia and Brazil and by the middle of 2006 an additional production capacity of 120 Mt was likely to be achieved.

Global Demand of Iron Ore :

The global demand of iron ore is furnished in Table 3.

Table 3 : Global Demand of Iron Ore (Mt)

Year	Demand
2001	1050
2002	1120
2003	1200
2004	1260
2007(F)	1400

Source : JPC Bulletin, April 2004 (F) = Forecast

The demands shown in the above table seem to be on the lower side. For example, as per IISI, Brussels, the apparent consumption of iron ore in the world has been 1223.3 Mt. and 1379.9 Mt. in 2003 and 2004 respectively.

The Indian Scenario :

India's massive deposits of high quality iron ore provide great support to the growth of the country's iron and steel industry. In 2004, India had a reserve of about 11.8 percent share in the global reserve of iron ore.

India's total reserve of iron ore as on 01.04.2000 was as follows :

Type of Ore	Proved	Probable	Possible	Total (Mt)
Hematite	6800	2122	3395	12317
Magnetite	1770	1807	1818	5395
Total	8570	3929	5213	17712

Source : SEAISI Newsletter, November 2005

In the Hematite iron ore reserve, Orissa has the highest share of 33 percent, followed by Jharkhand at 26 percent, Chattisgarh 20 percent, Karnataka 11 percent and Goa 7.5 percent.

In the Magnetite ore reserve, Karnataka has the highest reserve of about 82 percent followed by Andhra Pradesh at 12.5 percent.

National Steel Policy on Iron Ore :

According to the formulations of the National Steel Policy (NSP) announced in November, 2005, in order to support a steel production of 110 Mt. by 2019-20, at 100 percent capacity utilization, Indian steel industry world need 190 Mt of iron ore as against 54 Mt in 2004-05.

The NSP says that at present, the in-site reserves of relatively rich iron ore in India Ore 11.43 billion tonnes of haematite and 10.68 billion tonnes of magnetite ores.

The NSP also states that in order to ensure availability of 190 Mt of iron ore for domestic production of steel by 2019-20, Government would encourage investments in creation of an additional modern mining and beneficiation capacity of 200 Mt. The size of these investments will be around Rs. 20,000 crore. The current policy of captive mining leases for the private sector would continue, but it is necessary that investment plans be put in place for idle mining leases only against credible mining investment plans in a specified period. The Government would lay down priorities and guidelines for the State Governments to recommend fresh mining leases, having regard to the entrepreneur's mining investment plans, and technical / financial capabilities of the 600 mining leases only 245 were operated in 2003-04.

Environmental and forest clearances, would be granted within a pre-specified time frame. Though local value addition would be given priority, the Government would encourage trading in order to make this essential raw material available to the iron and steel industry, throughout the country. The Government would encourage investments in adding value to the iron ore mines. Scientific mining and economics of scale would be encouraged through CONSORTIA of small users and by prescribing a minimum economic size for mines.

NSP of Export of Iron Ore :

Export of iron ore from India has reached 78 Mt in 2004-05 on the back of large export of iron ore fines to China. Fines an concentrates, which have little use in India except as a negative environmental externality, make up about 90 percent of Indian iron ore currently. As investments are made into beneficiation, sintering and pelletisation in the country, which will use these fines the growth in exports of iron ore is likely to decline. Exports have thus been estimated to be around 100 Mt by 2019-20.

In terms of future policy, export of iron ore, especially high-grade lumps, would be leveraged for imports of coking coal or for investment in India. Long-term export supply of iron ore would be confined to a maximum of five year contracts. This duration would be reviewed from time to time. A judicial balance would continue to be maintained between exports and domestic supply of iron ore.

Production and Exports of Iron Ore by India :

Production and exports of iron ore by India between 1992-93 and 2004-05 are shown in Table 4.

Table 4 : Production and Exports of Iron Ore by India (Mt)

Year	Production	(Y-o-Y Growth) (%)	Exports	(Y-o-Y Growth) (%)	Export as % of Production
1992-93	57.5	--	26.8	--	46.61
1993-94	59.6	3.65	29.9	11.57	50.17
1994-95	64.5	8.22	28.3	5.35	43.88
1995-96	67.4	4.50	28.1	0.71	41.69
1996-97	68.2	1.19	29.5	4.98	43.26
1997-98	73.2	7.33	31	5.42	42.49
1998-99	77.0	5.19	32.4	4.18	42.08
1999-2000	74.9	2.73	32.9	1.54	43.92
2000-01	80.8	7.88	37.5	13.98	46.41
2001-02	86.2	6.68	41.6	10.93	48.26
2002-03	99.1	14.97	48.0	15.38	48.44
2003-04	120.6	21.70	62.2	29.58	51.58
2004-05	145.0	20.23	78.0	25.40	53.79

Data Source : Up to 2003-04 JPC and IBM, Nagpur, 2004-05-NSP

It is observed that growth in both production and exports of iron ore has been Quite high in the years between 2002-03 and 2004-05.

Gradewise Production of Iron Ore in India :

The grade-wise production of iron ore India is furnished in Table 5.

Table 5 : Grade-wise Production of Iron Ore in India ('000 Tonnes)

Grade	2000-01	2002-02	2002-03	2003-04	2004-05
Lumps	33,567 (41.56)	34,572 (40.09)	39,581 (39.95)	47,420 (39.32)	57,590 (40.35)
Fines	41,189 (51.00)	45,224 (52.45)	52,994 (53.49)	67,052 (55.60)	79,976 (56.04)
Concentrates	6,006 (7.44)	6,430 (7.46)	6,497 (6.56)	6,129 (5.08)	5,145 (3.61)
Total	**80,762**	**86,226**	**99,072**	**120,601**	**142,711**

Data Source : IBM, Nagpur (P) = Provisional

N.B. : Figures in parenthesis ( ) indicate the contribution of lumps, fines and concentrates in total production.

The provisional data for total iron ore production in 2004-05 differs from 145 Mt mentioned in the NSP.

Grade-wise Exports of Indian Iron Ore :

Mr. R.K. Sharma, Secretary General, Federation of Indian Mineral Industries (FIMI) has furnished the details of grade-wise exports of iron ore 2002-03 and 2005-06 which are presentation Table 6.

Table 6 : India's Iron Ore Export Lump / Fines (Mt)

Year	Fines	Lumps	Total
2002-03	35.72 (74.39)	12.30 (25.61)	48.02 (100)
2003-04	49.12 (78.50)	13.45 (21.50)	62.57 (100)
2004-05	64.60 (82.67)	13.54 (17.33)	78.14 (100)
2005-06	77.67 (87.00)	11.61 (13.00)	89.28 (100)

Source : JPC Bulletin : June 2006 (P) = Provisional

N.B. : 1) Figures in parenthesis ( ) indicate percentage to the total exports.

2) Pellets included in lumps and concentrates in fines.

Capacity Expansion :

The tenth Five Year Plan projected the iron ore demand of the country at about 122 Mt by 2006-07 and 156 by 2011-12. To meet the estimated consumption of 122 Mt in 2006-07 including exports, a capacity expansion of 135 Mt will be needed at 90 percent capacity utilisation.

The additional capacity is expected to come from the following regions.

(a) Bellary Hospect Region : The present production level of 14 Mtpy can be increased to 25 Mtpy by consolidating the mining leases and developing new deposits.

(b) Eastern Region : The region has the maximum share of the total iron ore resources in India. Capacity of this region is proposed to be increased from the existing level of 27 Mtpy to 45 Mtpy by 2006-07 and further to 70 Mtpy by 2011-12.

(c) Bailadila Region : Speedy implementation of the expansion plans for this region may enhance the capacity from the existing 17 Mtpy to a level of 26-27 Mtpy.

(d) Goa Redi Region : Present capacity has now come up to 20 Mtpy. Experts opine that consolidation in this region may further augment the capacity by another 5 Mtpy.

(e) Karnataka Region : About 800 Mt of proven reserve of magnetite ore deposit in Bababudan area can be lapped after overcoming environmental hurdles.

In general, to meet the increased requirement, the existing production capacities will have to be expanded in mines like Bolani and new mines will have opened up in Chiria in Jharkhand, Rowghat and other deposits of Bailadila in Chattisgarh, Malangtoli in Orissa, Ramandurg in Karnataka.

Use of Higher Capacity Equipment :

In India, iron ore production is achieved through the combination of large mechanized mines, semi-mechanised mines and small mines. About 12/13 years ago, the iron ore producers were using dumpers from 25-30 tonnes with excavators between 1.9 to 5.5 cu. Meters and single pass drills with diameters from 150 to 300 mm. But at present most of the Indian producers are using 50 to 60 tonnes dumpers, excavators of 6 to 8 cu.meters and single pass drill with diameters ranging from 250 to 300mm. Crushing equipment of 5000 / 6000 kph capacity is being installed in bigger mines.

Expansion Programmers Undertaken by NMDC & SAIL :

NMDC and SAIL are the two leading producers of iron ore in India. Their expansion programmes are summerised below :

(a) NMDC : NMDC has planned to increase its production capacity from the existing 20 Mt level to 31 Mt. level by 2009-10. The increase will be achieved by opening of the following mines.

(i) Kumaraswamy Blocks B&C : This mine will be initially developed for 3 Mtpy capacity and in conjunction with the existing Donimalai mines would be augumenting the production capability to 7 Mtpy of ROM. As and when Donimalai is exhaused, 7 Mtpy would be continuously produced from Kumaraswamy Blocks B and C.

(ii) Bailadila : Deposits 11B : The lease of Bailadila 11B capacity is already with NMDC and its capacity would be expanded by 6 Mtpy.

(iii) Bailadila : Deposits 13 : As and when the Bailadila deposit 14 is exhausted, this deposit would be developed with a capacity of 8/10 Mtpy. It is expected that this deposit could be developed by the year 2007-08.

(b) SAIL : SAIL has decided to increases its supply of iron ore from its eastern sector mines to 18 Mtpy through its Raw Materials Division (RMD). To meet the requirement of hot metal production which will reach much higher levels from the company's eastern sector plants viz. Bokaro, Rourkela, Durgapur and IISCO, the RMD has decided to supply 18 Mtpy of its iron ore from its seven mines including Gua and Chiria. The development pattern of SAIL mines is presented below :

- Expansion of Bolani iron ore mines in Orissa and its expansion to 5 Mtpy capacity. SAIL has set up a new 6000 tph capacity crushing and screening plant at Bolani. Bolani mine is SAIL's principal source of iron ore for Durgapur Steel Plant.
- The central block at Meghahatuburu and South block at Kiriburu are also being developed.
- RMD of SAIL is developing the 'TALDIH' deposit in Borsua Taldilkarta area. SAIL has entered into MOU to form a joint venture company with Kudremukh Iron Ore Company (KIOCL). MECON has been appointed to prepare a feasibility report. A 2-Mtpy capacity Pelletalisation Plant has also been planned. After completion of the project, the J V Company would be able to supply additional iron ore up to 4.25 Mtpy including 2 Mtpy of pellets.
- The Chiria mine which has a reserve of iron ore with Fe-content of 61-63 percent is strategically located to cater to the iron ore requirements of all the four SAIL plants in the eastern sector. After modernisation, Chiria mine will start producing 7 Mtpy of iron ore from 2011-12. Work has already been undertaken on preparing Environment Impact Assessment / Environment Management Plan for the development of Chiria Mine.
- The supply of iron ore to Bhilai Steel Plant will be met by the enhanced capacities of its own group of mines at Dalli Rajhara.

Overall, SAIL would be expanding its supply of iron ore to 35 Mtpy by 2011-12.

Cost Implications :

RDCIS, SAIL, experts have outlined the following benefits for the improvement of the quality of iron ore :

i. Increase in the Fe-content in iron ore burden by 1 percent will increase productivity o hot metal by 1.5 to 2 percent and decrease Coke rate by 0.8 to 1.2 percent. This will amount to a cost reduction in hot metal by Rs. 60-70 per tonne of hot metal.

ii. Lowering of alumina content in iron ore burden by 1 percents will reduce the cost of hot metal by Rs. 200-250 per tonne of hot metal.

iii. Lowering of Silica content by 1 percent in iron ore burden will reduce the cost of hot metal by 50 100 per tonne of hot metal.

iv. Reduction in undersize lump ore by 1 percent will reduce the cost of hot metal by Rs. 50-60 per tonne of hot metal.

v. Reduction in fluctuations in Fe-chemistry by 1 percent

will reduce the cost of hot metal by Rs. 40-50 per tonne of hot metal.

vi. Even if a reduction of 0.5 percent in alumina in the burden to blast furnace as well as 5 percent reduction in undersize and improvement in physical and chemical consistency is achieved, it is expected that a saving of Rs. 150 crore or more may be possible for a 4 Mtpy hot metal production plant.

Quality of Indian Iron Ore :

Experts maintain that Indian iron ores are characterised by high alumina / silica ratio. The alumina content lies between 2-4 percent in the lumps and 4-6 percent in the fines. Sinter produced from such fines contains much higher alumina compared to other countries. The high alumina inputs through the ferruginous feed, coke and flux results in formation of highly viscous slag countaining 22-26 percent alumina and as consequence, blast furnace operation and its performance is severly affectd.

The ROM materials and the feed stock, therefore, needs to be properly characterized and beneficiated through suitable technique prior to use in blast furnace.

The beneficiation scheme broadly comprise crushing to the required size followed by scrubbing and / or wet screeing and classification to separate slime from fines. By this process, although the adhering clay matter is removed, the alumina cannot be significantly lowered. This necessitates development of improved beneficiation technique, capable of removing the adhered alumina without sacrificing recovery of valuable iron bearing constituents.

Lowering alumina and silica helps in substantial cost savings as mentioned earlier.

Pelletisation :

Pelletisation is the process is converting iron ore fines into uniformed size iron ore pellets which can be charged into the blast furnaces or for production on of DRI (Sponge Iron). Pellets are of Uniform Size, with purity of 63-68 percent contributing to faster reduction and high metallisation rates. According to experts, pellets with their high, uniform mechanical strength and high abrasive strength can increase production of sponge iron by 25-30 percent with the same amount of fuel.

Pelletisation has not been popular in previous years with owners of iron ore mines in India due to huge investment cost of projects. This has completed them to export fines generated at throw away prices. Export of pellets had shares of 5 percent and 7 percent in the total export of iron ore by India in 2000-04 and 2004-05 respectively. Against this, the shares of fines export were about 58 percent and 65 percent respectively.

Upto 2002-03, the pelletisation plants had a total installed capacity of about 13 Mtpy. Except Mandovi and Kudremukh, other two pelletisation plants of Tata Steel at Noamundi and Chowgule Co. Pvt. Ltd. at Pale and Goa were not functioning probably due to the high cost of furnace oil. Tota Steel has installed India's first zigging plant at Noamundi for recovery of iron ore fines. JVSL (now under JSW Ltd.) has installed a 3 Mtpy Pellet Plant in their steel expanded for future increased capacity.

Essar Steel Ltd. has already acquired Hy. Grade Pelllets Ltd. (HGPL) Plant at Visakhapatnam which had a capacity of 3.3 Mtpy initially. The capacity of this Pellet Plant is being expanded to 8 Mtpy Essar has also constructed a 267-Km Long Slurry pipeline, second longest in the Chattisgarh to the HGPL plant at Vizagin A.P.

Essar is installing a Pellet Plant and on iron ore benefication plant in Orissa.

SAIL is also constructing a 2 Mtpy capacity Pellet Plant in Orissa as mentioned earlier.

Illegal Mining :

The widespread illegal mining of iron ore in the Bellary district of Karnataka has been published in the media. A virtual parallel administration, completed with elaborate machinery to counter fed permits and authorisation has come up to support illegal mining. This has deprived the Kanataka Government estimates.

Experts feel that long term damage can still be contained in Karnataka because the illegal mining is not more than six years old. Unless the government acts quickly and take remedial measures, Karnataka will suffer in the long run.

Debate on Export of Iron Ore :

(a) Observations of Iron Ore Industry :

The iron ore producers of the country maintain that :

- There is no shortage of iron ore for the domestic iron and steel companies.
- The clamour of shortage is to influence the Government of India for putting restrictions on exports so that the steel plants get iron ore at depressed prices.
- The intention of the iron and steel industry is to depress the prices of domestic supplies, since their cost of production of iron ore in their captive mines, is higher.
- The iron ore industry is only interested in an economic outlet and has no interest only in export. If they get more or the same price in the domestic market, they would like sell in domestic market rather than export.
- Only surplus production of iron ore, mostly iron ore fines, is exported.

(b) FICCI Study :

A study made by the Federation of Indian Chambers of Commerce and Industry (FICCI) on export and domestic use of iron ore lumps, fines and pellets in India, has stressed for steps to ensure priority in supply of iron ore to domestic steel industry over exports.

The study has estimated an increase in demand for iron ore in 2004-05 by 28 percent, 11 percent in 2005-06 and 10 percent in 2006-07. The iron ore production in India has picked up at an average annual rate of 4.1 percent in six years up to 2002-03. The study has called for immediate steps for increasing the availability of iron ore to the domestic steel producers through grater access to the captive mines.

The study has revealed that presently, the captive mines of the private producers accounts for only about 9 percent of the total iron ore production in the country, even though they contribute around 60 percent of the total steel production of the country. A new formula to balance the conflicting views : not a ban but a cap on exports is veering towards a policy that makes it mandatory for foreign importers to setup steel plants in India. As per media report, an official of the Planning Commission said "The aim should be to encourage value-added exports.. let them convert ore into steels for their car making or other needs here itself."

Conclusion :

To ensure availability of iron ore to the level of 190 Mt for domestic production and 100 Mt for export by 2019-20 as projected in the NSP would need opening up of new mines and expansion of the existing ones in a big way. India has presently a reserve of over 27 billion tonnes of iron ore of which only about 530 Mt were exploited between 2000 and 2005.

Technology upgradation and eco-friendly production should be the goal of iron ore miners. The railway, road and port infrastructure will have to be immensely improved to handle the huge traffic for domestic and export needs by 2019-20.

If a concerted effort is undertaken by iron ore industry, steel industry and the Central / State Governments, the Indian iron industry would become a dominant player in the global arena of iron ore of high quality.

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