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MANGANESE ORE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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34 Manganese Ore

Manganese occurs as silvery grey in colour and is very hard and brittle in nature. It is always available in combination with iron, laterite and other minerals. Manganese in alloy form is an essential input in steel making and is one of the most important metals in an industrial economy. Manganese ores of major commercial importance are: (i) pyrolusite (MnO_2, Mn about 63.2%); (ii) psilomelane (manganese oxide, containing water and varying amounts of oxides of Ba, K and Na as impurities; Mn commonly 45-60%); (iii) manganite (Mn_2O_3. H_2O, Mn about 62.4%); and (iv) braunite ($3Mn_2O_3$, $MnSiO_3$, Mn about 62% and SiO_2 about 10%).

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

RESOURCES

The total resources of manganese ore in the country as on 1.04.2013 are placed at 475 million tonnes as per UNFC system. Out of these, 95.87 million tonnes are categorised as reserves and the balance 379.31 million tonnes are in the remaining resources category. Grade-wise, ferro-manganese grade accounts for 7%, medium grade 10%, BF grade 32% and the remaining 51% are of mixed, low, others, unclassified, and not-known grades including 0.35 million tonnes of battery/ chemical grade.

State-wise, Odisha tops the total resources with 45% share followed by Karnataka 20%, Madhya Pradesh 11%, Maharashtra 8%, Goa 7%, Andhra Pradesh 4% and Jharkhand 3%. Rajasthan, Gujarat, Telangana and West Bengal together shared the remaining about 2% resources (Table- 1).

EXPLORATION & DEVELOPMENT

Details of exploration carried out for manganese ore by GSI and other agencies (State Govt Departments, MOIL Ltd etc.) during 2014-15 are furnished in Table- 2.

PRODUCTION, STOCKS AND PRICES

The production of manganese ore at 2,345 thousand tonnes during 2014-15 decreased by 11% as compared to that in the previous year.

There were 146 reporting mines during 2014-15 as against 163 in the previous year. Besides, manganese ore production was reported by five mines of iron ore, two mines of laterite and one mine of limestone in 2014-15 against seven mines of iron ore and one mine each of laterite, limestone in 2013-14. In all, 73 producers reported production of manganese ore in 2014-15. Eight principal producers operating 38 mines contributed 84% of the total production. About 75% of the total production was reported by 16 mines including one associate mine, each producing more than 40,000 tonnes per annum, while 12% was contributed by 10 mines (including one associate mine) each falling in the production range of 20,001 to 40,000 tonnes. The remaining 13% production was covered by 122 manganese ore and 6 associate mines each producing up to 20,000 tonnes.

In 2014-15, twenty two public sector mines jointly accounted for 49% of the total production. The contribution of captive mines was 9% of the total production.

As regards grade-wise composition of production in 2014-15, 68% of the total production was of lower grade (below 35% Mn), 20% of medium grade (35-46% Mn) and 11% was of high grade (above 46% Mn). Production of manganese dioxide was 20,358 tonnes (1%) during the year as against 37,305 tonnes (1%) in the previous year.

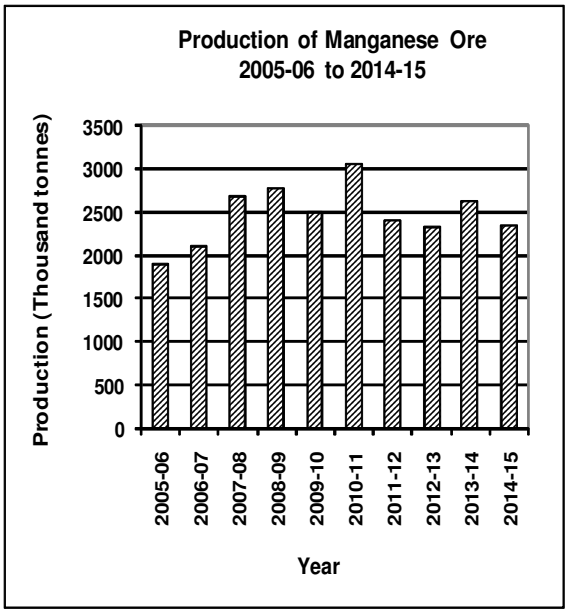


Table – 1 : Reserves/Resources of Manganese Ore as on 01.04.2013

(By Grades/States)

(In '000 tonnes)

State/Grade	Reserves				Remaining Resources								Total Resources
	Proved	Probable		Total	Feasibility	Pre-feasibility		Measured	Indicated	Inferred	Reconnsaissance	Total	
	STD111	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	(B)	(A+B)
All India : Total	**64105**	**23461**	**8306**	**95871**	**65550**	**41588**	**68477**	**6184**	**31884**	**160678**	**4952**	**379314**	**475185**
By Grades													
Battery/Chemical	-	10	-	10	4	75	12	4	26	112	–	233	243
Ferro-manganese	5866	3146	1259	10271	1550	2655	3711	900	2904	8204	466	20389	30660
Medium	2834	64	981	3879	9818	3099	11644	538	1403	18480	116	45099	48979
BF	9101	1886	629	11616	37472	9970	22775	2231	10862	58282	941	142535	154150
Mixed	558	-	310	868	-	1109	563	–	–	12028	3226	16926	17794
Medium & BF mixed	4544	2766	3041	10351	3935	912	4100	48	1279	21865	-	32140	42491
Ferro-manganese, medium & BF mixed	27472	12558	291	40321	5318	4722	10642	414	9810	10040	-	40946	81267
Ferro-manganese & BF	1411	496	655	2561	540	7783	4826	1358	912	7889	–	23308	25869
Low (-) 25% Mn	432	176	11	619	3360	1790	2614	237	3713	2610	54	14377	14996
Others	9044	1618	701	11364	1385	4588	1068	188	518	5332	-	13079	24443
Unclassified	2787	701	417	3906	1801	4136	5036	266	130	11115	150	22633	26539
Not-Known	56	39	11	106	366	748	1487	–	326	4721	–	7649	7755
By States													
Andhra Pradesh	3582	660	484	4726	414	373	256	188	3220	9010	12	13473	18199
Goa	-	-	-	-	14398	1505	9102	48	262	9558	–	34874	34874
Gujarat	–	–	–	–	–	–	–	–	–	2954	–	2954	2954
Jharkhand	2976	665	328	3970	2509	1386	513	–	–	4177	1126	9711	13681
Karnataka	3629	570	709	4908	13793	3959	10311	1516	7374	52748	257	89959	94867
Madhya Pradesh	22347	6949	1289	30585	4556	1887	5667	-	4370	5062	–	21542	52127
Maharashtra	12371	1812	1001	15184	1974	4966	6999	–	5268	3323	29	22558	37742
Odisha	17959	12802	3625	34386	27904	27511	35583	4433	10502	69413	3410	178756	213142
Rajasthan	1104	–	647	1751	–	–	–	–	–	4030	–	4030	5781
Telangana	136	3	223	362	2	1	45	-	886	203	118	1256	1618
West Bengal	–	–	–	–	–	–	–	–	–	200	–	200	200

Figures rounded off.

Table – 2 : Details of Exploration Activities for Manganese Ore, 2014-15

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
GSI							
Odisha							
Angul	Bhagwanpur-Santipur and Tentalapani	-	-	-	-	-	G-4 stage investigation was carried out to identify potential zones of manganese ore bands. Manganese ore occurs as E-W trending 2-3 m wide discontinuous bands for 60 m with low to moderate dip towards north. Five discontinuous bands have been exposed in the trenches. Pyrolusite and psilomelane are the major ore minerals. Strike continuity has been established for 60 m, 50 m, 50 m, 20 m, and 15 m approximately. Analytical results of trench samples show manganese and phosphorus from 5.02-21.03% and 0.28 to 2.48% respectively. Work will continue in F.S. 2015-16.
DMG							
Jharkhand							
Singhbhum (West)	Babriya and Pukhariya	1:4000	1.77	-	-	18	The chemical analysis of the samples shows Mn content 22-30 percent.
Singhbhum (West)	Hesapi and Halamtburu	1:25000 1:4000	10 1.79	-	-	25	The chemical analysis of the samples shows Mn content 22-30 percent.
Directorate of Mines and Minerals							
West Bengal							
Medinipur (West)	Belpahari	1:10000	100	-	-	50	The chemical analysis of the samples is awaited. Resources were not yet estimated.
MOIL							
Madhya Pradesh							
Balaghat	Bharveli Mine	-	-	03	1910	-	As on 01.04.2015, total manganese ore resources were estimated at 23.72 million tonnes with grade (30-50% Mn), out of which 11.44 million tonnes were placed under reserves & 12.28 million tonnes remaining resources.
	Ukwa Mine	-	-	-	-	-	As on 01.04.2015, about 10.09 million tonnes resources were estimated, out of which 4.09 million tonnes were placed under reserves & 6.00 million tonnes under remaining resources.
	Tirodi Mine	-	-	03	574	-	As on 01.04.2015, about 0.99 million tonnes resources were estimated, out of which 0.55 million tonnes were placed under reserves & 0.45 million tonnes under remaining resources.

(Contd.)

Table-2 (Concld.)

Agency/ State/ District	Location Area/ Block	Mapping		Drilling		Sampling (No.)	Remarks Reserves/Resources estimated
		Scale	Area (sq km)	No. of boreholes	Meterage		
Maharashtra							
Bhandara	Dongri-Buzurg Mine Teh. Tumsar	-	-	03	640	-	As on 01.04.2015, about 11.37 million tonnes in-situ manganese ore resources were estimated, out of which 4.56 million tonnes were placed under reserves & 6.81 million tonnes under remaining resources.
	Chikla Mine Post- Sitasaongi Teh. Tumsar	-	-	02	400	-	As on 01.04.2015, about 4.71 million tonnes of manganese ore resources were estimated, out of which 2.86 million tonnes were placed under reserves & 1.85 million tonnes under remaining resources.
Nagpur	Gumgaon Mine Vill. Teghai Teh. Saoner	-	-	03	811	139	As on 01.04.2015, about 4.25 million tonnes of manganese ore resources were estimated, out of which 2.25 million tonnes were placed under reserves & 1.00 million tonnes under remaining resources.
	Kandri Mine Teh. Remtek	-	-	06	905	-	As on 01.04.2015, about 8.17 million tonnes of manganese ore resources were estimated, out of which 1.43 million tonnes were placed under reserves & 6.74 million tonnes under remaining resources.
	Mansar mine Teh. Ramtek	-	-	18	2950	-	As on 01.04.2015, about 5.76 million tonnes of manganese ore resources were estimated, out of which 2.07 million tonnes were placed under reserves & 3.69 million tonnes under remaining resources.
	Beldongri	-	-	07	280	-	As on 01.04.2015, about 0.55 million tonnes of manganese ore resources were estimated, out of which 0.15 million tonnes were placed under reserves & 0.40 million tonnes under remaining resources.

Madhya Pradesh being the leading manganese ore producing State accounted for 38% of the total production in 2014-15. Next in the order of production were Maharashtra (29%), Odisha (14%), Andhra Pradesh (11%) and Karnataka (8%). Jharkhand and Rajasthan contributed very nominal production during the year (Tables- 3 to 7).

The mine-head closing stock for the year 2014-15 were at 1,098 thousand tonnes as against 726 thousand tonnes in the previous year (Tables - 8 (A) and 8 (B).

The average daily employment of labour strength in manganese ore mines was 14,031 in 2014-15 as against 16,659 in the previous year. Prices of manganese ore are furnished in the General Review on "Prices".

Table – 3 : Principal Producers of Manganese Ore, 2014-15

Name & address of Producer	Location of mine	
	State	District
MOIL Ltd, MOIL Bhavan, 1A, Katol Road, Chhaoni, Nagpur- 440 013.	Madhya-Pradesh Maharashtra	Balaghat 1. Bhandara 2. Nagpur
Tata Steel Ltd, Bombay House, 24, Homi Mody Street, Fort, Mumbai- 400 001. Maharashtra.	Odisha	1. Kendujhar 2. Sundergarh
The Sandur Manganese & Iron Ores Ltd, No. 9, Bellary Road, Sadashiv Nagar, Bengaluru- 560 080 Karnataka.	Karnataka	Ballari
RBSSD & FN Das Garividi- 535 101, Shreeram Nagar, Distt. Vizianagaram, Andhra Pradesh.	Andhra-Pradesh	Vizianagaram

(Contd.)

Table-3 (Concld.)

Name & address of Producer	Location of mine	
	State	District
Mangilal Rungta, Rungta office, Main Road, Barbil, Dist. Kendujhar, Odisha-758 035.	Odisha	Kendujhar
SR Ferro Alloys, Plot No. 101-102, Industrial Area Meghnagar, Dist. Jhabua- 457 779 Madhya Pradesh.	Madhya-Pradesh	Jhabua
Shobha Minerals 765/1, Napier Town, Jabalpur-482 001 Madhya Pradesh.	Madhya-Pradesh	Jabalpur
S. K. Sarawagi & Co. (P) Ltd, 10/1/31, Signature Towers, 'Level-4,Waltair Uplant, Visakhapatnam-530 003 Andhra Pradesh.	Andhra Pradesh	Vizianagaram

Table – 4 : Principal Producers of Manganese Dioxide, 2014-15

Name & address of Producer	Location of mine	
	State	District
Tata Steel Ltd, 24, Homi Mody Street, Fort, Mumbai- 400 001, Maharashtra.	Odisha	Kendujhar
Mangilal Rungta, Rungta Office, Main Road,Barbil-758 035 Kendujhar, Odisha.	Odisha	Kendujhar
MOIL Ltd, MOIL Bhavan, 1A, Katol Road, Chhaoni, Nagpur- 440 013, Maharashtra.	Maharashtra	Bhandara
*Devka Bai Velji, Football Ground, Barajamda, Singhbhum (West)-833 221 Jharkhand.	Jharkhand	Singhhum (West)
*Rahas Bihari Das, Choudhury Bazar, Cuttack- 753 501, Odisha.	Odisha	Kendujhar

** Associated with iron ore.*

Table – 5 : Production of Manganese Ore, 2012-13 to 2014-15 (By States)

(Quantity in tonnes; Value in ₹'000)

State	2012-13		2013-14		2014-15 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**2342169**	**12836200**	**2626291**	**15181757**	**2345361**	**13625514**
Andhra Pradesh#	353302	503713	334265	716420	253675	470420
Goa	50	396	-	-	-	-
Jharkhand	4266	25150	4779	20276	4449	18592
Karnataka	39540	221931	144528	673035	194123	875841
Madhya Pradesh	714730	4850053	796496	5157453	883784	5158694
Maharashtra	683185	4686800	666191	5222536	669813	5315595
Odisha	527966	2485010	663710	3339180	326117	1748608
Rajasthan	4987	12737	5401	14442	5965	15294
Telangana#	14143	50410	10921	38415	7435	22470

 # Figures mentioned above for 2012-13 and 2013-14 are of districts which are part of present Andhra Pradesh and Telangana.

Table – 6 (A) : Grade-wise Production of Manganese Ore, 2013-14 (By Sectors/States/Districts)

(Quantity in tonnes; Value in ₹'000)

State/ District	No. of mines	MnO_2	Production By Grades: Mn Content				Total	
			above 46%	35%-46%	25%-35%	below 25%	Quantity	Value
India	**163(9)**	**37305**	**275604**	**500080**	**1469608**	**343694**	**2626291**	**15181757**
Public Sector	23	704	202183	311575	632500	1549	1148511	9132275
Private Sector	140(9)	36601	73421	188505	837108	342145	1477780	6049482
Andhra Pradesh	**31**	**-**	**-**	**13320**	**237244**	**83701**	**334265**	**716420**
Vizianagaram	31	-	-	13320	237244	83701	334265	716420
Goa*	**5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
South Goa*	5	-	-	-	-	-	-	-
Gujarat*	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Panchmahal*	1	-	-	-	-	-	-	-
Jharkhand	**5(1)**	**-**	**20**	**69**	**3463**	**1227**	**4779**	**20276**
Singhbhum (West)	5(1)	-	20	69	3463	1227	4779	20276
Karnataka	**11**	**-**	**-**	**1159**	**101952**	**41417**	**144528**	**673035**
Ballari	4	-	-	1159	79280	20192	100631	526712
Chitradurga	3	-	-	-	-	12477	12477	17135
Davanagere	2	-	-	-	22672	8688	31360	128998
Tumakuru*	2	-	-	-	-	60	60	190
Madhya Pradesh	**45(4)**	**-**	**171292**	**95347**	**392667**	**137190**	**796496**	**5157453**
Balaghat	34	-	158306	84520	291956	26981	561763	4347026
Chhindwara	3	-	12986	10827	10585	25094	59492	364911
Jabalpur	6(4)	-	-	-	12	71715	71727	123847
Jhabua	2	-	-	-	90114	13400	103514	321669
Maharashtra	**21**	**704**	**45481**	**250062**	**361504**	**8440**	**666191**	**5222536**
Bhandara	3	704	18552	168492	242900	15	430663	3390496
Nagpur	18	-	26929	81570	118604	8425	235528	1832040
Odisha	**38(4)**	**36601**	**58811**	**140123**	**367347**	**60828**	**663710**	**3339180**
Kendujhar	17(3)	33448	57797	111839	244803	22722	470609	1992528
Rayagada	1	-	-	-	-	-	-	-
Sundergarh	20(1)	3153	1014	28284	122544	38106	193101	1346652
Rajasthan	**1**	**-**	**-**	**-**	**5401**	**-**	**5401**	**14442**
Banswara	1	-	-	-	5401	-	5401	14442
Telangana	**5**	**-**	**-**	**-**	**30**	**10891**	**10921**	**38415**
Adilabad	5	-	-	-	30	10891	10921	38415#

Figures mentioned above for 2012-13 and 2013-14 are of districts which are part of present Andhra Pradesh and Telangana.

Figures in parentheses indicate associated mines of iron ore, laterite and limestone.

** Only labour reported.*

Table – 6 (B) : Grade-wise Production of Manganese Ore, 2014-15 (P) (By Sectors/States/Districts)

(Quantity in tonnes; Value in ₹'000)

State/ District	No. of mines	Production By Grades: Mn Content					Total	
		MnO_2	above 46%	35%-46%	25%-35%	below 25%	Quantity	Value
India	**146(8)**	**20358**	**252586**	**479027**	**1172437**	**420953**	**2345361**	**13625514**
Public Sector	22	2082	208248	350740	569301	24605	1154976	9043242
Private Sector	124(8)	18276	44338	128287	603136	396348	1190385	4582272
Andhra Pradesh	**27**	**-**	**-**	**6320**	**150183**	**97172**	**253675**	**470420**
Vizianagaram	27	-	-	6320	150183	97172	253675	470420
Goa	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
South Goa*	3	-	-	-	-	-	-	-
Gujarat	**1**	-	-	-	-	-	-	-
Panchmahal*	1	-	-	-	-	-	-	-
Jharkhand	**4(1)**	**94**	**40**	**-**	**2656**	**1659**	**4449**	**18592**
Singhbhum (West)	4(1)	94	40	-	2656	1659	4449	18592
Karnataka	**10**	**-**	**-**	**7842**	**144731**	**41550**	**194123**	**875841**
Ballari	4	**-**	-	7842	134835	29748	172425	803661
Chitradurga	2	**-**	-	-	-	4960	4960	11845
Davangere	1	**-**	-	-	9096	6016	15112	57891
Tumakuru	3	**-**	-	-	800	826	1626	2444
Madhya Pradesh	**41(4)**	**-**	**168775**	**102711**	**381533**	**230765**	**883784**	**5158694**
Balaghat	30	-	158152	93878	287345	59305	598680	4274885
Chhindwara	4	-	10623	8833	7747	12241	39444	298799
Jabalpur	6(4)	-	-	-	5	152851	152856	280682
Jhabua	1	-	-	-	86436	6368	92804	304328
Maharashtra	**20**	**2082**	**50448**	**283641**	**319723**	**13919**	**669813**	**5315595**
Bhandara	3	2082	21531	195940	206270	-	425823	3467016
Nagpur	17	-	28917	87701	113453	13919	243990	1848579
Odisha	**35(3)**	**18182**	**33323**	**78513**	**167646**	**28453**	**326117**	**1748608**
Kendujhar	19(3)	18182	33233	77280	152484	17367	298546	1596706
Sundergarh	16	-	90	1233	15162	11086	27571	151902
Rajasthan	**1**	**-**	**-**	**-**	**5965**	**-**	**5965**	**15294**
Banswara	1	-	-	-	5965	-	5965	15294
Telangana	**4**	**-**	**-**	**-**	**-**	**7435**	**7435**	**22470**
Adilabad	4	-	-	-	-	7435	7435	22470

Figures in parentheses indicate associated mines of iron ore, laterite and limestone.
** Only labour reported.*

Table – 7 : Production of Manganese Ore, 2013-14 and 2014-15 (By Frequency Groups)

(Quantity in tonnes)

Production Group	No. of mines		Production		Percentage in total Production		Cumulative %	
	2013-14	2014-15 (P)	2013-14	2014-15 (P)	2013-14	2014-15 (P)	2013-14	2014-15 (P)
Total	**163(9)**	**146(8)**	**2626291**	**2345361**	**100.00**	**100.00**	**-**	**-**
Up to 1000	89(2)	74(2)	10021	11383	0.38	0.49	0.38	0.49
1001 - 5000	28(3)	27(2)	82910	70440	3.16	3.00	3.54	3.49
5001 - 10000	13	10(1)	94503	68130	3.60	2.90	7.14	6.39
10001 - 20000	8(2)	11(1)	134440	169958	5.12	7.25	12.26	13.64
20001 - 30000	3(1)	6(1)	108071	162174	4.11	6.91	16.37	20.55
30001 - 40000	2	3	61397	108050	2.34	4.61	18.71	25.16
40001 - 50000	3	1(1)	131796	89736	5.02	3.83	23.73	28.99
50001 and above	17(1)	14	2003153	1665490	76.27	71.01	100.00	100.00

Figures in parentheses indicate associated mines of iron ore, laterite and limestone.

Table – 8 (A) : Mine-head Closing Stocks of Manganese Ore, 2013-14 (By States and Grades)

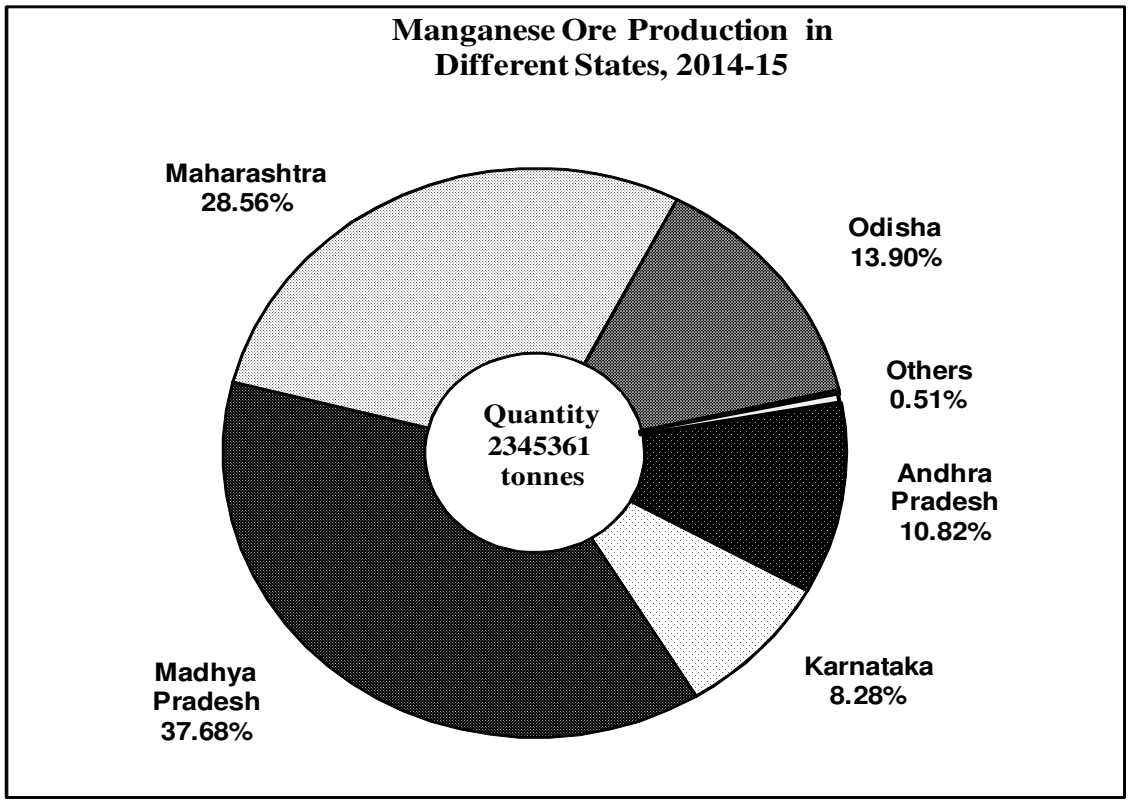
(In tonnes)

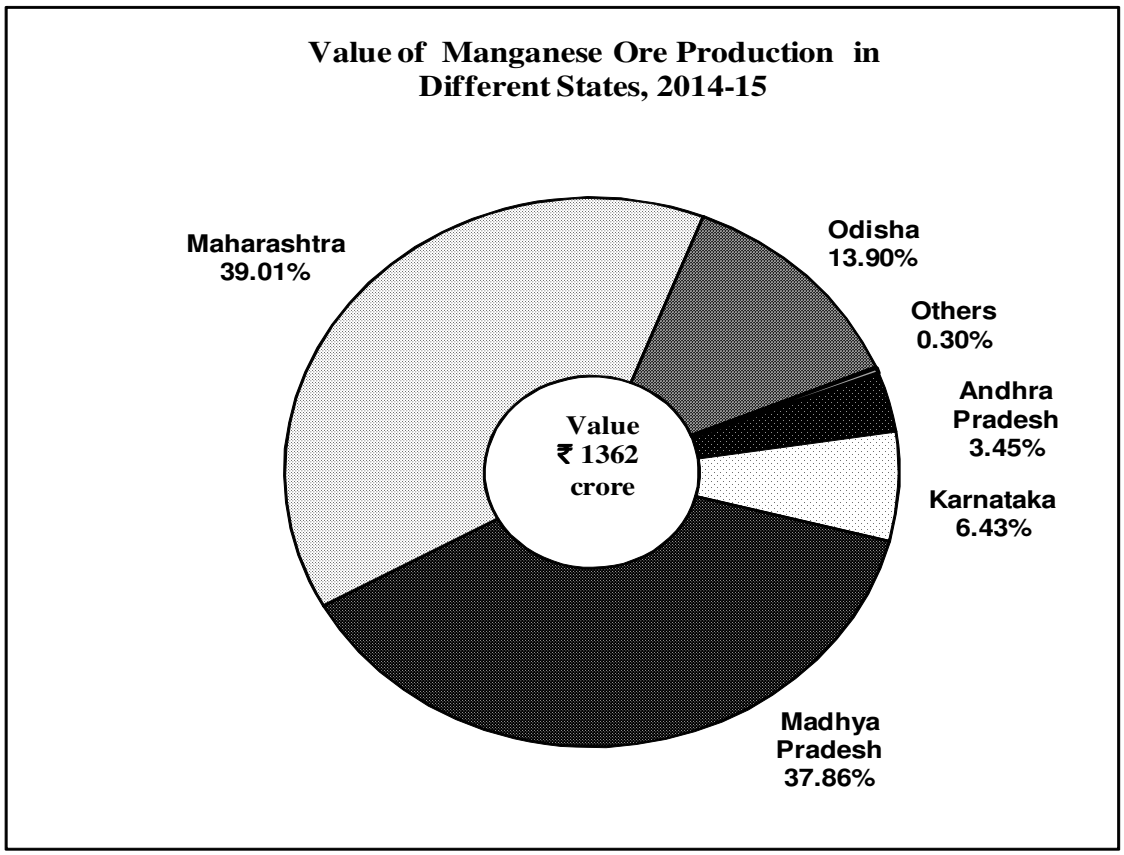
State	Grades : Mn content					
	MnO_2	above 46%	35% - 46%	25% - 35%	below 25%	Total
India	**5223**	**20440**	**75325**	**288610**	**336639**	**726237**
Andhra Pradesh	-	-	10	37872	8472	46354
Goa	-	-	-	100	-	100
Jharkhand	10	24	16	3899	170	4119
Karnataka	-	-	5331	28329	132840	166500
Madhya Pradesh	-	6608	11685	29208	87330	134831
Maharashtra	2140	7925	12994	9259	14573	46891
Odisha	3073	5883	45289	179305	92202	325752
Rajasthan	-	-	-	624	-	624
Telangana	-	-	-	14	1052	1066

Table – 8 (B) : Mine-head Closing Stocks of Manganese Ore, 2014-15 (P) (By States and Grades)

(In tonnes)

State	Grades : Mn content					
	MnO_2	above 46%	35% - 46%	25%-35%	below 25%	Total
India	**9479**	**49825**	**162436**	**454108**	**421830**	**1097678**
Andhra Pradesh	-	-	20	39616	15477	55113
Goa	-	-	-	-	100	100
Jharkhand	1	24	16	4276	1007	5324
Karnataka	-	-	4460	68468	129906	202834
Madhya Pradesh	-	32043	24848	63400	174590	294881
Maharashtra	3387	13175	67346	61661	7709	153278
Odisha	6091	4583	65746	215328	91406	383154
Rajasthan	-	-	-	1345	-	1345
Telangana	-	-	-	14	1635	1649


Manganese Ore Production in Different States, 2014-15
Maharashtra 28.56%
Odisha 13.90%
Others 0.51%
Andhra Pradesh 10.82%
Karnataka 8.28%
Madhya Pradesh 37.68%
Quantity 2345361 tonnes


Value of Manganese Ore Production in Different States, 2014-15
Maharashtra 39.01%
Odisha 13.90%
Others 0.30%
Andhra Pradesh 3.45%
Karnataka 6.43%
Madhya Pradesh 37.86%
Value ₹ 1362 crore

MINING, PROCESSING, MARKETING & TRANSPORT

Manganese ore mining in the country is carried out by opencast as well as by underground methods. Of the 146 mines, 8 are underground (3 in Madhya Pradesh and 5 in Maharashtra). Seven underground mines were operated by MOIL, a public sector company, and one by M/s J.K. Minerals, Balaghat (Madhya Pradesh), a private company. All the underground mines are mechanised or semi-mechanised and adopt cut and fill method of stoping. In Kandri mine, hydraulic sand stowing is introduced in place of manual filling system. This system is faster, cheaper and requires less manpower. Conventional timber supports are replaced by cable bolting pre-mining support to increase safety and productivity. In Balaghat underground mechanised mine, overhand flat back cut and fill method with rock bolting support and sand stowing is being practised to fill up the voids with a level interval of 30 m and size of stope block as 30 m x 30 m to 60 m x 30 m. Side Dump Loaders (SDL) of 0.66 cu m bucket capacity were also deployed in underground levels for mechanised loading of run of mine (r.o.m.) in stopes. Tyre mounted Rocker shovel was also introduced in Balaghat mine for mechanised loading of ore from ore drive at stripping area. Deepening of vertical shaft was completed in Balaghat and Beldongri mines of MOIL. Sinking of vertical shafts is in progress at Mansar and Ukwa mines.

The open-pits are worked manually by benching method, using portable compressors, jackhammers and dumper trucks. Tirodi mine of MOIL is worked by opencast mechanised method. Height of the benches in overburden is kept at 7.5 m and that in the ore at 6 m. Drills of 100 mm dia with 0.9 to 1.7 m^3 capacity of shovels and 20-25 tonnes dumpers are used for production, loading & transport.

The workings vary from shallow depth in lateritoid-type deposits in Odisha, Karnataka and Goa to deep operations in deposits of a more regular nature found in Madhya Pradesh, Maharashtra and Andhra Pradesh. Bulldozers are used where the overburden is soft. In a few cases, tramways are laid up to the working face and loaded tubs pushed manually to the dumping ground. In Odisha, Goa and Karnataka, ore is worked by loosening the ground either with crowbars or by blastings. After picking up manganese ore, the waste is removed to the dumping ground. Mining of bedded ore in Madhya Pradesh and Maharashtra is generally carried out by drilling and blasting.

Hand sorting and visual grading are adopted widely to upgrade the ore. Scrubber is also used for washing the ore at some mines. Manual as well as mechanised jigging is done in a few mines.

MOIL has set up an integrated manganese ore beneficiation plant at Dongri Buzurg mine in Bhandara district, Maharashtra, with 4 lakh tonnes annual capacity to process r.o.m. The plant is equipped with handling, crushing, wet screening, drying and magnetic separation facilities in one complex. MOIL has installed a manganese ore beneficiation plant of 500,000 tonnes per annum capacity at Balaghat mine in order to conserve mineral and profitably utilise low/medium grade ore. The plant facilities include crushing, wet screening, classification and jigging operations.

The plant upgrades the low/medium fines into high grade and the value addition is around 3-4 times, in case of low grade fines. The company is planning to set up a sintering plant for agglomeration of these fines. After agglomeration, these fines will be utilised in ferro-alloys production.

Most of the producers market manganese ore directly to the industrial units. In a few cases, especially in case of supplies of special type of ore or a semi-processed product, middlemen are found to be involved in marketing. Ore from mines is usually sold to the domestic consumers, either at the rail-head or ex-plant. In case of integrated iron & steel and ferro-manganese industry, the

units draw their supplies largely from captive mines. However, special ore types for specific purposes are obtained from other producers. In case of ore meant for export, producers other than MOIL supply it to MMTC, the canalising agency, either at rail-head or at the port. MOIL exports its own ore.

Transport of manganese ore from mines to rail-head is generally done by trucks from where it is transported to ports by rail wagons. From the mine of MOIL in Balaghat district, Madhya Pradesh, the ore is transported by aerial ropeways to the loading bins at the rail-heads. Battery loco was introduced for underground transport of r.o.m. tub from ore pass chute to skip bunker. In Goa, ore, in bulk is carried by road-cum-river routes up to Marmugao harbour and in a few cases by rail where the mines are close to the railways. The ore loading at river-head into barges is carried out mechanically.

ENVIRONMENTAL PROTECTION

MOIL carried out mass afforestation work and planted 33,000 saplings during 2014-15 to maintain ecological balance at mines. The cumulative plantation till date is about 18.46 lakh saplings. The company has also set up a wind energy farm of 20 MW capacity. R&D work was taken up by MOIL for reclamation of old mined out areas and to ascertain the impact of manganese mining on ecology, including air and water pollution. At Gumgaon mine, a sericulture project has been established as a part of socio-economic programme, while on waste debris dumps, a forest has been developed.

Chandrapur Ferro Alloys Plant of SAIL (formerly Maharashtra Electrosmelt Ltd) has continuously taken steps towards gainful utilisation of high MnO slag in silico-manganese production, lumpy silico-manganese slag as rail ballast and for road construction as a step towards solid waste management.

Manganism - a health condition attributed to manganese poisoning - has been reported to be detected in case of five persons working with BHP Billiton's Metalloys, a manganese alloy plant in South Africa. Manganism shows symptoms similar to Parkinson's disease and psychotic behaviour but conditions of development of the disease are not properly understood.

USES & SPECIFICATIONS

Classification of manganese ore, ferruginous manganese ore, siliceous manganese ore, dioxide manganese ore, and manganiferous iron ore is laid down by BIS vide specification no. IS: 11895- 2006 (Reaffirmed 2008). Manganese ore is an important material in iron and steel metallurgy, where it is used both in the ore form as such and as ferro-manganese. Manganese improves strength, toughness, hardness and workability of steel, acts as a deoxidiser and desulphuriser and also helps in getting ingots free from blowholes. About 90 to 95% world production of manganese ore is used in metallurgy of iron and steel. Manganese has no satisfactory substitute in its major applications. The specifications of manganese ore by different industries are detailed below:

In iron and steel industry, the BIS:11281-2005 (Reaffirmed 2008) specification is laid down for manganese ore. However, specifications based on the user industry indicate that normally manganese ore containing 28 to 35% Mn is used. Ore size generally varies from 10 to 40 mm. For other constituents general stipulations are Fe: 16 to 22%, SiO_2: 2 to 8%, Al_2O_3: 5 to 8% and P: 0.3% maximum.

For manganese ore used in ferro-manganese industry, besides manganese content, other important considerations are high manganese to iron ratio and a very low content of deleterious phosphorus. Specifications of manganese ore for ferro-manganese are prescribed by the Bureau of Indian Standards vide IS: 4763-2006, (Second Revision, Reaffirmed 2010). BIS has also laid down the specifications of manganese ore sinters for blending for ferro-manganese production vide IS:12596-1989 (Reaffirmed 2009). User's specifications of manganese ore for ferro-manganese/silico-manganese industries are furnished in Table- 9.

Table – 9 : User's Specifications of Manganese Ore in Different Ferro-manganese/Silico-manganese Units

Name and location of plant	Specifications of ore consumed
Andhra Pradesh	
Ferro-Alloys Corp. Ltd, Shreeram Nagar, Dist. Vizianagram.	Mn: 70-75% C: 6-8%
Nav Bharat Ferro-Alloys Ltd, Paloncha, Khammam.	Mn: 28-50%, P: 0.1-0.3%, SiO_2: 8-30% Fe :5-8%
Chhattisgarh	
Sarda Energy & Minerals Ltd Raipur.	Mn: 28-30% (Low P) Mn: 37-40%, 42-44%, 46% (High P)
Monnet Ispat & Energy Ltd, Raipur	Mn: 28 - 46% Fe : 5 - 16% SiO_2: 6 - 34% S & P: 0.05 - 0.28% Size: 0 - 100% (lumps & fines)
Hira Power & Steel Ltd, Raipur	
i) Jain Carbides & Chemicals Ltd, Raipur (Unit-I).	Mn: 32-35%
ii) Jain Carbides & Chemicals Ltd, Raipur (Unit-II).	Mn: 32-35%
Karnataka	
S. R. Chemicals & Ferro Alloys, Belgaum. Thermit Alloys Ltd, Shivamogga.	Mn: 38-40%, Fe: 18-23% Mn: 48-54%
Kerala	
INDSIL Hydro Power and Manganese Ltd, Pallatheri Palakkad.	Fe-Mn ratio 1:3 to 5% (50%) 1:5 to 8% (50%) P: 0.05% max Al_2O_3: 3 to 5% max
Madhya Pradesh	
MOIL, Ferro-manganese Plant, Bharveli, Dist. Balaghat.	Mn: 46-48%
Maharashtra	
Chandrapur Ferro Alloys Ltd, (Formerly Maharashtra Electro-Smelt Ltd) Chandrapur.	Mn: 38-46%, Fe: 6-17% SiO_2+Al_2O_3: 10-16% P: 0.5-0.25% max +100 mm 10% max +10-100 mm, 80-85% min +5-10 mm 10% max
Nagpur Power & Industries Ltd, Nagpur.	Mn: 42-46%, Fe: 7-8%, SiO_2: 3.6%, Al_2O_3: 6-7%, P: 0.10-0.12% Size: 5-25 mm
Natural Sugar & Allied Ind. Ltd, Sai Nagar Ranjani, Dist. Osmanabad	Size: 10-80 mm
Odisha	
Tata Steel Ltd, Joda, Kendujhar.	Mn: 43%, min. (for FeMn) 36% min. (for SiMn), Size: 10-75 mm (for FeMn & SiMn) **Captive Mn Ore — Size (mm)** Below 35% — (10-75) + 5% 35% to 46% — (10-75) + 5% 46% to 49% — (10-75) + 5% Dioxide + 49% — (10-75) + 5% **MOIL, Mn Ore** Below 35% — (10-75) + 5% Imported Mn 46 to 49% — (10-75) + 5%
Tamil Nadu	
Silcal Metallurgical Ltd, Ramanuja Nagar, Coimbatore.	Mn: 35-40% & above Size: 35 mm
West Bengal	
Cosmic Ferro Alloys Ltd, Bankura.	Size: 75 mm

Manganese dioxide is used for manufacturing dry cell batteries in which it functions as a depolariser of hydrogen. For use in dry cell battery, BIS has prescribed Specification No. IS:11153-1996 (First Revision, Reaffirmed 2010) for manganese dioxide. Suitability of ore depends not only on manganese dioxide content but also on its crystallographic structure. Ore having predominant gamma structure is required. The ore must have high manganese dioxide and low iron content, a certain degree of porosity and moderate hardness. It should be free from metallic compounds such as copper, nickel, cobalt, arsenic, lead and antimony, which are electronegative to zinc (container). The user industry specifications are MnO_2 70% (min), Fe 6% (max), moisture 4% (max), Cu 0.02% (max) and Ni 0.02% (max). The size requirement lays down that 90% material should pass through 300 mesh and 100% through 100 mesh. User industry specifications for electrolytic manganese dioxide (EMD) used in dry cell battery are MnO_2 90% (min), Fe (as oxide) 0.05% (max), moisture 4% (max), Pb 0.15% (max) and pH 4.5 to 5.6. The size requirements are same as those for manganese dioxide ore.

In chemical industry, generally high-grade material is used for potassium permanganate. Ore containing MnO_2 80% (min), SiO_2 5% (max), Fe_2O_3 5% (max) and 200 to 250 mesh ore size is used. In glass industry, ore analysing MnO_2 80% (preferably 86% min), Fe_2O_3 5% (preferably 0.75% max), SiO_2 2.8% (max), Al_2O_3 1.1% (max), BaO 1.3% (max), CaO 0.4% (max) and MgO 0.4% (max) is consumed.

Requirement of manganese dioxide for explosive and pyrotechnic industries as laid down in IS : 5713-1981 (First Revision, Reaffirmed 2011) by BIS is as follows: MnO_2 80% by mass (min), moisture 1% (max), matter soluble in water 0.2% (max) and water soluble chlorides (as NaCl) 0.05% (max). There are three types of material with above composition depending upon the particle size: Type A, Type B and Type C. Particle size (max) is 600 micron for Type A, 150 micron for Type B and 74 micron for Type C ore. In addition, grit content should be 1% (max) for Type A ore. For match industry, the MnO_2 content shall be 50% (min).

Pyrolusite is used generally to impart glaze to the pottery and to make coloured bricks. It also finds use as driers for oils, varnishes and paints. Manganese sulphide is used in the manufacture of salts and in calico printing. Manganese chloride is used in cotton textile as a bronze dye. Manganese salts are used in photography and in leather and matchbox industries.

CONSUMPTION

The consumption of manganese ore in all industries was about 4.19 million tonnes in 2014-15 as against 4.18 million tonnes in 2013-14. Silico-manganese (63%) and ferro-manganese (30%) industries together accounted for about 93% consumption followed by iron & steel (6%). The remaining (1%) was shared by battery, chemical, zinc smelter, alloy steel and glass industries (Table- 10).

The consumption of ferro-manganese in 2014-15 decreased slightly to 123 thousand tonnes from 124.8 thousand tonnes in the previous year. Iron & steel industry was the bulk consumer of ferro-manganese accounting for about 94% consumption in 2014-15. The remaining 6% was consumed in alloy steel, foundry and electrode industries. Consumption of silico-manganese which was 219.6 thousand tonnes in 2013-14 increased marginally to 219.8 thousand tonnes in 2014-15 (Tables- 11 & 12).

Table – 10 : Consumption of Manganese Ore[1/*], 2012-13 to 2014-15 (By Industries)

(In tonnes)

Industry	2012-13	2013-14 (R)	2014-15 (P)
All Industries	**4177300**	**4185800**	**4194900**
Battery[2/]	14600(6)	14600(6)	14600(6)
Chemical	1600(2)	2900(3)	2900(2)
Ferro-manganese	1243200(e)	1243200(e)	1243200(e)
Silico-manganese	2661100(e)	2661100(e)	2661100(e)
Iron & steel	254800(24)	262000(24)	271100(24)
Zinc smelters	1700(2)	1700(2)	1700(2)
Others: (Alloy steel electrode glass)	300(3)	300(3)	300(3)

Figures rounded off.

Figures in parentheses denote the number of units in organised sector.

** Includes actual reported consumption and/or estimates made wherever required.*

1/ Besides, there are a number of SSI units manufacturing ferro-manganese and silico-manganese, data for which are not available. Excludes consumption of manganese ore fines which are used in making sinters which are in turn used in the manufacture of ferro-manganese, data for which are not available.

2/ Excludes consumption of indigenous and imported electrolytic manganese dioxide (EMD) which was estimated at about 7000 tonnes, in each of the last three years (i.e. during 2012-13 to 2014-15, respectively). Also excludes consumption of natural manganese dioxide in the manufacture of EMD.

Also excludes consumption of natural MnO_2 in manufacture of EMD.

** Paucity of data, hence consumption may not be complete.*

Table – 11 : Consumption* of Ferro-manganese, 2012-13 to 2014-15 (By Industries)

(In tonnes)

Industry	2012-13	2013-14 (R)	2014-15 (P)
All Industries	**124200**	**124800**	**123000**
Alloy steel	6400(9)	6400(9)	6400(9)
Electrode	1200(21)	1300(21)	1000(21)
Foundry	500(19)	500(20)	500(20)
Iron & steel	116100(16)	116600(17)	115100(17)

Figures rounded off.

Figures in parentheses denote the number of units in organised sector reporting consumption*

(Includes actual reported consumption and/or estimates made wherever required).*

Paucity of data, hence consumption may not be complete.

Table – 12 : Consumption* of Silico-manganese, 2012-13 to 2014-15 (By Industries)

(In tonnes)

Industry	2012-13	2013-14	2014-15 (P)
All Industries	**217700**	**219600**	**219800**
Alloy steel	2000(3)	2000(3)	2000(3)
Electrode	100(1)	100(1)	100(1)
Foundry	100(1)	100(1)	100(1)
Iron & steel	215550(24)	217400(24)	217600(24)

Figures rounded off.
Figures in parentheses denote the number of units in organised sector.
Paucity of data, hence consumption may not be complete.

INDUSTRY

Manganese alloys are the largest produced ferro-alloys in the world with a share of about 41% of the global production of ferro-alloys. Manganese is an essential requisite for iron and steel production due to its capability for sulphur fixing, de-oxidising and good alloying properties. For production of one tonne of ferro-manganese, about 2.6 tonnes of manganese ore, 0.5 tonne of reductant and 3 MWh of electricity inputs are required. As per Indian Ferro Alloys Producers' Association (IFAPA), the total installed capacity of manganese alloys including ferro-manganese/silico-manganese in the country was estimated to be around 2.75 million tonnes per annum.

MOIL had set up a High Intensity Magnetic Separation Plant and 1,000 tpy Electrolytic Manganese Dioxide (EMD) Plant at Dongri Buzurg mine. The plant is under expansion to 1,500 tpy capacity. In 2014-15, about 950 tonnes of EMD was produced as against 923 tonnes in 2013-14. Ferro-manganese plant of 10,000 tonnes per annum capacity has been set up at Bharveli, Balaghat. In 2014-15 total 10,045 tonnes of ferro-manganese was produced as compared to 10,042 tonnes in the previous year.

Ferro-manganese

The total production of various types of manganese alloys (high carbon ferro-manganese, medium carbon ferro-manganese and low carbon ferro-manganese) was about 5.18 lakh tonnes in 2014-15, as per Monthly Statistics of Mineral Production (March, 2016). It is to be noted that the data coverage is partial and does not reflect the actual production.

Silico-manganese

Silico-manganese is a combination of 60-70% Mn, 10-20% silica and about 20% carbon. As per Monthly Statistics of Mineral Production (March, 2016), production of silico-manganese was reported at 2.56 lakh tonnes in 2014-15 as compared to 2.25 lakh tonnes in 2013-14. It is to be noted that the data coverage is partial and does not reflect the actual production. MOIL is considering setting up ferro-manganese and silico-manganese plants through joint venture companies with RINL and SAIL. SAIL & MOIL Ltd will set up 31,000 tpy ferro-manganese and 75,000 tpy silico-manganese plants at Nandini near Bhilai, Chhattisgarh. The other joint venture company RINL and MOIL Ltd will set up a 20,000 tpy ferro-manganese and 37,000 tpy silico-manganese plants at Bobbili, Vizianagaram district, Andhra Pradesh.

Preparation of feasibility reports of the above projects, taking into consideration, the revised requirements of ferro alloys of SAIL and RINL is in progress.

The major factor driving the production of manganese alloys is high production growth of low nickel austenitic stainless steel. India emerging as the largest producer of this steel where manganese is added substituting the expensive nickel.

Iron & Steel

Iron & steel industry was the second major consumer of manganese ore wherein manganese ore is used directly as a blast furnace feed. Details on consumption, specifications and source of supply of manganese ore to major iron & steel plants in the country in 2013-14 and 2014-15 are given in Table-13.

Table – 13 : Consumption, Specifications and Source of Supply of Manganese Ore in Different Iron and Steel Plants, 2013-14 and 2014-15

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2013-14	2014-15 (P)	2013-14	2014-15 (P)		
Bhilai Steel Plant, Bhilai Nagar, Durg Chhattisgarh.	Hot metal 5202000	Hot metal 5202000[e]	25656	NA	Size: 25 to 85 mm Mn: 30% min SiO_2: 30% max Al_2O_3: 5% max P: 0.3% max	MOIL/ Ramtek Goberwahi, Gua Mines SAIL, RMD
Bokaro Steel Plant, Bokaro, Jharkhand.	Hot metal 4100093	Hot metal 4253271	NA	NA	Mn: 30% max SiO_2+Al_2O_3 : 20.5% max -10 mm -15% max +40 mm -10% max	-
Durgapur Steel Plant, Durgapur, West Bengal.	Hot metal 2190686	Hot metal 2296707	NA	NA	Mn: 30.0% min Fe: 15-28% SiO_2: 3.3% max Al_2O_3: 7.5% max	-
Rourkela Steel Plant, Rourkela, Odisha.	Hot metal 2538322	Hot metal 2591417	NA	NA	-	-
IISCO Steel Plant, Burnpur, Dist. Burdwan, West Bengal- 713 325.	Hot metal 219641	Hot metal 566244	NA	NA -	Mn (dry) 30% (min.) -10 mm - 10.0% max +40 mm - 15% max	-
Visvesvaraya Iron and Steel Ltd, Bhadravati, Shivamogga, Karnataka.	Hot metal 20986	Hot metal 67603	NA	NA	-	-
KIOCL Ltd, Pellet Plant, Mangaluru, Dakshina Kannada, Karnataka.	Hot metal NA	Hot metal NA	NA	NA	Fe: 25-50% min MnO_2: 44% min SiO_2 +Al_2O_3 : 12% max	Milan Minerals, Karnataka
Visakhapatnam Steel Plant, Visakhapatnam, Andhra Pradesh.	NA	NA	11400	NA	Mn: 28%, (min) Fe: 16% SiO_2: 25% max Size: 10-60 mm(BF) (-) 10 mm (SP)	Garividi, Andhra Pradesh
IDCOL, Kalinga Iron Works Ltd, Barbil, Kendujhar, Odisha.	Hot metal 17773	Hot metal 7793	338	68	Size: 10-40 mm	From own/ local mines
Gordan Steel India Ltd, Jaonbulapadu, Anantapur, Andhra Pradesh.	Hot metal 30427	Hot metal 30427[e]	728	2292	Mn 28-35% Mn	-
Tata Steel Ltd, Jamshedpur, Jharkhand.	Hot metal 9898502	Hot metal 10162917	NA	NA	NA	-

(Contd.)

Table - 13 (Concld.)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2013-14	2014-15 (P)	2013-14	2014-15 (P)		
Kirloskar Ferrous Industries Ltd, Berinahalli, 583 234, Koppal, Karnataka.	Pig iron 277026	Pig iron 324053	6721	7163	Mn: 28% min Fe: 20% min SiO_2 : 8% max Alkalies: 1% max Size: 10 to 40 mm 90% min under & over size: 5% max each	SMIORE, Adarsha Mining Co., Omkaramma
LANCO Industries Ltd, Chittoor, Andhra Pradesh.	Pig iron+ (molten metal) 198036	Pig iron+ (molten metal) 198036[e]	NA	NA	NA	NA
Visa Steel Ltd, Kalinganagar, Jajpur, Odisha.	Hot metal NA	Hot metal NA	302	NA	below 35% Mn Mines	Siljoda
Sunflag Iron & Steel Co. Ltd, Bhandara, Maharashtra.	Hot metal 208224	Hot metal 208224[e]	NA	NA	-	-
Jaiswal Neco Industries Ltd, Siltara, Raipur, Chhattisgarh.	Hot metal 548753	Hot metal 524575	2170	1871	Mn:26-28% Size:10-60 mm	-
Jaiswal Neco Industries Ltd, Bellari, Karnataka.	Hot metal 8492000	Hot metal 9029390	-	-	NA	NA
Tata Metalliks Ltd, Kharagpur, Medinipur, West Bengal.	Hot metal 302999	Hot metal 292575	7048	10502	NA	NA
JSW Steel Ltd, Salem, Tamil Nadu- 636 453.	Hot metal 860000	Hot metal 914000	- 14	- -	NA	NA
JSW Steel Ltd, Vidyanagari, Bellari, Karnataka.	Hot metal 9029390	Hot metal 9683092	-	-	NA	NA
Rashmi Metaliks Ltd, Gokulpur, West Midnapur, West Bengal.	Hot metal 163911	Hot metal 136832	1494	852	NA	NA
Sona Alloys P. Ltd, Lonad, Pune, Maharashtra.	Hot metal 250000	Hot metal 250000[e]	NA -	3640 -	NA -	NA -
Aparant Iron & Steel Pvt.Ltd, Goa.	Pig Iron 20237	Pig Iron 20237[e]	1380	334	NA	NA
Uttam Galva Metallics Ltd, Bhugaon- 442001, Wardha, Maharashtra.	Hot metal 487	487[e]	30	118	NA	NA

Dry Battery

Consumption of manganese dioxide ore in this industry was reported by six units which together accounted for 14,600 tonnes in 2014-15, (excluding EMD). The demand was met through imports, supported by indigenous production of manganese dioxide and EMD.

Dry battery industry also consumes EMD along with natural manganese dioxide ore. There is only one plant producing EMD owned by MOIL in Bhandara district with 1,000 tpy capacity (under expansion to 1,500 tpy capacity).

SUBSTITUTES

Cost and technology militate substitution in major applications. However, for economic reasons, there is only limited substitution in minor applications in chemical and battery industries. The steel industry has, however, made great strides in economising the use of manganese, largely through changes in steel-making techniques.

TECHNICAL POSSIBILITIES

The deep-sea nodules can be a potential resource of manganese in the next decades to come. There is a trend towards using lower grades of ores in ferro-manganese production. New steel-making practices and techniques are reducing the amount of manganese consumed in the process. However, counter balancing this to some extent is a trend towards higher manganese specifications for modern steels.

TRADE POLICY

Export Policy

The Foreign Trade Policy, 2009-14 and the policy on export puts restrictions on exports of manganese ore as follows:

HS Code	Item description	Policy	Nature of restriction
2602 0000	Manganese ores excluding the following: Lumpy/blended manganese ore with more than 46% Mn	State Trading Enterprise	Exports through (a) MMTC (b) MOIL for manganese ore produced in MOIL mines
2602 0010	Lumpy/blended manganese ore with more than 46% Mn	Restricted	Export permitted under licence

Import Policy

Imports of manganese ore and concentrates including ferruginous manganese ores and concentrates containing 20% or more manganese (calculated on dry weight basis), agglomerated manganese ore sinters, etc. are freely allowed.

There is no change in the policy for the period 2015-20.

WORLD REVIEW

The total world reserve of manganese ore is approximately 570 million tonnes of metal content which is unevenly distributed (Table-14). Reserves are located in South Africa (26%), Ukraine (25%), Australia (17%), Brazil and India (9% each). Only a small fraction of global manganese reserves is clearly economic. This fact continues to support interest in deep-sea manganese nodules, which constitute an enormous untapped resource. Most nodules are found in areas of deep-sea floor at water depths of 5 to 7 km. The Pacific Ocean alone is estimated to contain about 2.5 billion tonnes nodules containing about 25% Mn, making them similar in abundance to low-grade land-based deposits. Most major steel-making nations lack manganese resources. North America had less than 1% world reserves. Besides, United States has lean grade reserves and potentially high extraction cost. This situation has created an active global trade in manganese ore and manganese alloys.

World production of manganese ore in 2014 was estimated to be around 54.7 million tonnes as compared to 53.3 million tonnes in 2013. China was the leading producer contributing about 29% followed by South Africa (25%), Australia (14%), Gabon (7%), Kazakhstan (5%) and India (4%) (Table-15). The production of manganese ore is linked with the production of steel. The steel industry consumes it in the form of ore and manganese alloys.

China

China was the world's largest producer and consumer of manganese ore. The production increased by 3% as compared to the previous year. China is also a producer of manganese alloys and electrolytic manganese metal (EMM).

South Africa

Manganese ore production (contained manganese) increased by 26% in 2014 from that in 2013. This increase was primarily a result of higher production capacity at Tshipi Kalahari Manganese Mine.

Brazil

Brazil was one of the leading manganese ore and ferro alloy producer which produced 2.5 million tonnes of manganese ore in 2014 (a decrease of about 12%) from previous year.

FOREIGN TRADE

Exports

Exports of manganese ore decreased to about 11 thousand tonnes in 2014-15 from 66 thousand tonnes in 2013-14. Out of the total exports in 2014-15, no exports of manganese ore having +46% Mn were carried out. Similarly, there was no exports of ore having 30 to 35% Mn and that of manganese ore (others) were 11,026 tonnes. More than 99% of exports were to Pakistan. Exports of manganese oxide (total) increased marginally to 16,449 tonnes in 2014-15, as against 15,763 tonnes in the previous year. Manganese oxide exports in 2014-15 comprised manganese dioxide 3,261 tonnes and other than manganese oxides 13,188 tonnes. Exports were mainly to Spain (9%), Germany (7%) and Russia (6%). In 2014-15, exports of manganese and alloys (including waste & scrap) decreased to 134 tonnes compared to 199 tonnes in the previous year. Exports of (wrought/unwrought) manganese & alloys in 2014-15 were at 114 tonnes as compared to 156 tonnes in the previous year (Tables- 16 to 24).

Imports

Imports of manganese ore increased to about 3.17 million tonnes in 2014-15 from 2.18 million tonnes in 2013-14. South Africa (64%), Australia (24%), Gabon (8%) and Cote d' Ivore (2%) were the main suppliers of manganese ore in 2014-15. Out of the manganese ore (total) imported, manganese ore having +46% Mn contributed 892,093 tonnes, manganese ore having 35 to 46% Mn were 2,090,840 tonnes, manganese ore having 30 to 35 % Mn were 170,570 tonnes and manganese ore (others) were only 1 tonne. In 2014-15, imports of manganese dioxides were 7,847 tonnes. Imports of manganese dioxides comprised manganese oxide and other than manganese dioxides 4,654 tonnes. Imports were mainly from China (73%), Indonesia (16%) and South Africa (10%). During 2014-15, imports of manganese & alloys (including waste and scrap) were 30,932 tonnes, out of which manganese & alloys (unwrought) comprised 20,226 tonnes. Imports of manganese & alloys were 1,072 tonnes solely from China. (Tables- 25 to 35).

Table – 14 : World Reserves of Manganese Ore (By Principal Countries)

(In '000 tonnes of metal content)

Country	Reserves
World: Total (rounded)	**620000**
Australia	91000
Brazil	50000
China	44000
Gabon	22000
Ghana	13000
India*	52000
Kazakhstan	5000
Mexico	5000
South Africa	200000
Ukraine	140000
Other countries	Small

Source: *Mineral Commodity Summaries, 2015.*
** India's total UNFC resources of manganese ore as on 1.4.2013 are estimated at 475 million tonnes.*

Table – 15 : World Production of Manganese Ore (By Principal Countries)

(In '000 tonnes)

Country	2012	2013	2014
World:Total(rounded)	**47800**	**53300**	**54700**
Australia	7179	7426	7587
Brazil	2796	2833	2498
China[(e)]	14500	15500	16000
Gabon	3363	4091	4000[e]
Ghana	1491	1998	1353
India*	2342	2588	2166
Kazakhstan	2975	2852	2609
Malaysia	1100	1125	835
South Africa	8943	10952[e]	13857[e]
Ukraine[@]	1234	1525	1526
Other countries	1936	2392	2229

Source: *World Mineral Production, 2010-2014.*
@: Marketable
** India's production of manganese ore in 2012-13, 2013-14 and 2014-15 was 2.34 million tonnes 2.63 million tonnes and 2.34 million tonnes, respectively.*

Table – 16 : Exports of Manganese Ore : Total (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**66030**	**189342**	**11026**	**65399**
Pakistan	-	-	11000	64088
Netherlands	-	-	25	1310
Brunei	-	-	1	1
Other countries	66030	189342	-	-

Table – 17 : Exports of Manganese Ore (46% or more Mn) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**20**	**1102**	**-**	**-**
Philippines	20	1102	-	-
Other countries	-	-	-	-

Table – 18 : Exports of Manganese Ore (30% or more but below 35% Mn) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**5380**	**25996**	**-**	**-**
China	5380	25996	-	-

Table – 19 : Exports of Manganese Ore (Others) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**66000**	**188209**	**11026**	**65399**
Pakistan	-	-	11000	64088
Netherlands	-	-	25	1310
Brunei	-	-	1	1
Other countries	66000	188209	-	-

Table – 20 : Exports of Manganese Oxide : Total (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**15763**	**692934**	**16449**	**642152**
Spain	1335	57705	1553	60873
Germany	1600	72837	1181	44705
Canada	568	27689	953	44006
Russia	910	38976	1043	39165
UK	1125	53166	750	31961
Iran	-	-	790	30441
Thailand	901	34566	868	29998
Poland	377	18102	650	27968
Belgium	500	22072	700	27843
Australia	947	45080	659	27547
Other countries	7500	322741	7302	277645

Table – 21 : Exports of Manganese Dioxide (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1639**	**63567**	**3261**	**105080**
Iran	-	-	750	28413
Chile	100	1753	601	10149
Bangladesh	204	4687	352	9042
Poland	50	3074	150	8413
Kenya	195	6998	154	5535
Malaysia	90	4200	105	5483
Japan	40	998	213	4951
USA	33	3316	35	4221
Thailand	226	4532	243	4105
Kuwait	94	2983	120	3627
Other countries	607	31026	538	21141

Table – 22 : Exports of Manganese Oxide (Other than Manganese Dioxide) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**14124**	**629366**	**13188**	**537072**
Spain	1335	57705	1508	57652
Germany	1600	72789	1181	44705
Canada	568	27689	929	43070
Russia	910	38976	1043	39165
UK	1125	53166	750	31961
Australia	947	45080	659	27547
Indonesia	801	35714	640	27183
Belgium	475	20808	675	26666
Thailand	675	30034	625	25894
Vietnam	575	26276	605	25566
Other countries	5113	221129	4573	187663

Table – 23 : Exports of Manganese & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**199**	**100365**	**134**	**111364**
Korea, Rep. of	26	37899	33	48329
Chinese Taipei/ Taiwan	++	221	7	11416
Slovenia	++	177	8	11206
Italy	2	2799	4	6005
Malaysia	31	8555	5	5074
Romania	2	3360	2	4378
Brazil	11	8625	8	3564
Indonesia	59	18636	15	3536
Philippines	10	2140	14	3090
Poland	1	1092	1	2193
Other countries	57	16861	37	12573

Table – 24 : Exports of Manganese & Alloys : (Wrought/Unwrought) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**156**	**91716**	**114**	**107093**
Korea, Rep. of	26	37856	33	48329
Chinese Taipei/ Taiwan	++	221	7	11385
Slovenia	++	177	8	11206
Italy	2	2799	4	6005
Malaysia	30	8356	5	4881
Romania	2	3360	2	4378
Philippines	10	2140	14	3090
Brazil	6	6970	3	2450
Indonesia	56	17865	10	2431
Poland	1	1092	1	2193
Other countries	23	10880	27	10745

Table – 25 : Imports of Manganese Ore : Total (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2179334**	**28306272**	**3172858**	**34669120**
South Africa	1315385	15094636	2043506	19932204
Australia	499839	7889186	748671	9900464
Gabon	232109	3431474	263274	3314330
Ivory Coast/ Cote d' Ivoire	32101	453294	75124	931845
Singapore	8352	286127	6350	233138
Malaysia	4703	35182	14710	92041
Morocco	7013	70400	6821	72475
Senegal	-	-	3666	54623
Zambia	5803	99856	3073	51272
Turkey	1417	15797	4315	37719
Other countries	72612	930320	3348	49009

Table – 26 : Imports of Manganese Ore (46% or more Mn) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**677467**	**10380640**	**892093**	**11730476**
Australia	424124	6847124	595815	8212297
South Africa	181003	2191884	216394	2222393
Gabon	52207	866120	55164	779168
Singapore	8352	286127	6350	233138
Ivory Coast/ Cote d' Ivoire	3790	57938	10924	157641
Zambia	4616	79183	2853	47818
Senegal	-	-	3089	47389
Peru	695	10105	929	15768
Colombia	20	900	180	7958
Madagascar	258	4220	365	6497
Other countries	2402	37039	30	409

Table – 27 : Imports of Manganese Ore (35% or more but below 46% Mn) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1396939**	**16778809**	**2090849**	**21380159**
South Africa	1068556	12238007	1697148	16606003
Gabon	175902	2519146	191444	2394448
Australia	53019	712379	126965	1489494
Ivory Coast/ Cote d' Ivoire	28311	395356	64199	774199
Morocco	5452	55756	4727	52651
Turkey	1417	15797	4315	37719
Senegal	-	-	577	7234
Georgia	-	-	421	5098
Nigeria	-	-	353	4362
Mali	-	-	284	3693
Other countries	64282	842368	416	5258

Table – 28 : Imports of Manganese Ore (30% or more but below 35%) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**20726**	**169297**	**170570**	**1426501**
South Africa	17524	142182	125329	1063871
Australia	-	-	25891	198674
Gabon	-	-	16666	140714
Morocco	1561	14644	2094	19824
Georgia	-	-	590	3418
Other countries	1641	12471	-	-

Table – 29 : Imports of Manganese Ore (Others) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**71918**	**879816**	**1**	**2373**
South Africa	41719	471659	++	2367
Ivory Coast/ Cote d' Ivoire	-	-	1	6
Other countries	30199	408156	-	-

Table – 30 : Imports of Manganese Dioxide (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**6556**	**614428**	**7847**	**651540**
China	5865	536978	5760	528860
South Africa	635	62151	760	71196
Indonesia	23	556	1244	30868
Belgium	24	10483	53	11957
USA	3	2616	24	6262
Germany	3	615	5	1524
Japan	++	7	1	770
UK	3	1022	++	103
Other countries	-	-	-	-

Table – 31 : Imports of Manganese Oxide (Other than Manganese Dioxide) (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1451**	**202046**	**4654**	**275496**
Belgium	893	142080	810	122591
China	268	43338	415	61960
South Africa	60	3897	2011	45900
Indonesia	188	3926	1328	33549
USA	23	4717	49	5766
Germany	8	2481	9	2846
Canada	-	-	1	1364
UK	10	1134	5	784
Zambia	-	-	26	736
Other countries	1	473	-	-

Table –32: Imports of Manganese & Alloys (Incl. Waste & Scrap) By Countries

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**24114**	**3341014**	**30932**	**4232257**
China	23189	3140341	30197	4019763
France	80	77132	135	131602
South Africa	223	28626	506	36438
Sweden	7	6052	18	16230
USA	17	7844	11	13500
UK	1	356	20	9808
Germany	23	5768	20	3176
UAE	-	-	5	667
Italy	-	-	++	622
Korea, Rep. of	++	37	20	433
Other countries	574	74858	++	18

Table – 33: Imports of Manganese & Alloys Unwrought By Countries

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**13640**	**1936084**	**20226**	**2806722**
China	13313	1825737	19534	2602832
France	72	68685	135	131602
South Africa	202	25093	464	29484
Sweden	7	6052	18	16201
USA	2	4260	10	12740
UK	-	-	20	9594
Germany	20	3027	20	3169
UAE	-	-	5	667
Korea, Rep. of	-	-	20	433
Other countries	24	3230	-	-

Table – 34: Imports of Manganese : Wrought (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**8270**	**1092974**	**9634**	**1281601**
China	7699	1017813	9592	1274647
South Africa	21	3533	42	6954
Other countries	550	71628	-	-

Table – 35: Imports of Manganese & Alloys, NES (By Countries)

Country	2013-14		2014-15 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2204**	**311956**	**1072**	**143934**
China	2177	296791	1071	142284
USA	15	3584	1	760
Italy	-	-	++	622
UK	1	356	++	214
Sweden	-	-	++	29
Austria	-	-	++	18
Germany	3	2741	++	7
Other countries	8	8484	-	-

FUTURE OUTLOOK

Production of crude steel is the single most important factor in the demand for manganese ore. Steel industry accounts for approximately 90% world demand for manganese. Carbon steel is the principal market accounting for 65 to 70% manganese consumption.

As per the Report of the Working Group for 12th Plan Period (2012-17), Planning Commission of India (now NITI Aayog) estimated production of manganese ore to be about 4.56 million tonnes by 2011-12 and 6.70 million tonnes by 2016-17 at 8% growth rate. The apparent consumption is estimated at 7.31 million tonnes by 2016-17 at 8% growth rate.