

MANGANESE ORE



Indian Minerals Yearbook 2018

(Part- III : MINERAL REVIEWS)

57th Edition

MANGANESE ORE

(FINAL RELEASE)

**GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES**

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20 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 steel is one of the most important key indicators in the industrial economy of any country. In recent years, the trade volume of manganese ore has grown world over and also in India. Presently India is one of the major importers of manganese ore in the world. 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 ($Mn_2O_3 \cdot H_2O$, Mn about 62.4%); and (iv) braunite ($3Mn_2O_3 \cdot MnSiO_8$, Mn about 62% and SiO_2 about 10%).

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

RESERVES/RESOURCES

The total reserves/resources of manganese ore in the country as on 1.04.2015 have been placed at 495.87 million tonnes as per NMI database, based on UNFC system. Out of these, 93.47 million tonnes are categorised as reserves and the balance 402.40 million tonnes are in the remaining resources category. Gradewise, Ferromanganese grade accounts for 7%, Medium grade 11%, BF grade 28% and the remaining 54% are of Mixed, Low, Others, Unclassified, and Not-known grades including 0.17 million tonnes of battery/chemical grade.

State-wise, Odisha tops the total reserves/resources with 44% share followed by Karnataka 22%, Madhya Pradesh 12%, Maharashtra & Goa 7% each, Andhra Pradesh 4% and Jharkhand 2%. Rajasthan, Gujarat, Telangana and West Bengal together shared the remaining about 2% resources (Table- 1).

EXPLORATION & DEVELOPMENT

The exploration and development details are given in the review on "Exploration & Development" in "General Reviews".

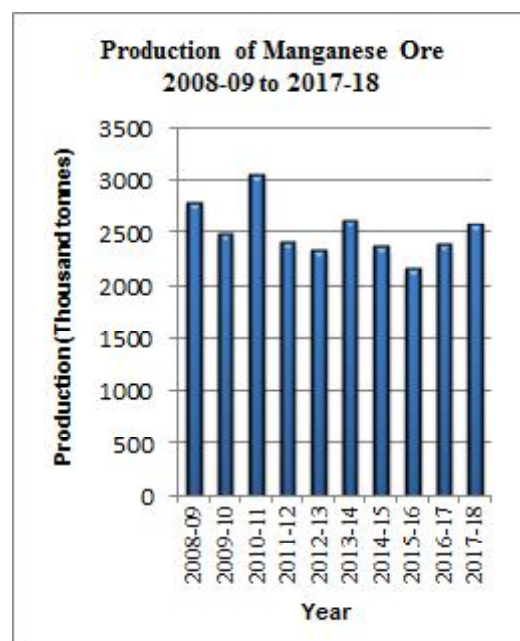
PRODUCTION AND STOCKS

The production of manganese ore was 2,589 thousand tonnes during 2017-18 which increased by about 8% as compared to that in the previous year.

There were 143 reporting mines during 2017-18 as against 153 in the previous year. Besides, manganese ore production was reported as associate mineral by 11 mines in 2017-18.

In 2017-18, twenty three Public Sector mines jointly accounted for 47% of the total production. The contribution of captive mines was 10% of the total production.

As regards grade-wise composition of production in 2017-18, 66% of the total production was of lower grade (below 35% Mn), 23% of medium grade (35-46% Mn) and 10% was of high grade (above 46% Mn). Production of manganese dioxide was 15,782 tonnes (1%) during the year.



MANGANESE ORE

**Table – 1 : Reserves/Resources of Manganese Ore as on 01.04.2015
(By Grades/States)**

State/Grade	Reserves										Remaining Resources						Total Resources (A+B)		
	Proved		Probable		Total		Pre-feasibility		Measured		Indicated		Inferred		Reconnaissance			Total	
	STD111	STD121	STD122	STD121	STD122	(A)	STD211	STD221	STD222	STD331	STD332	STD333	STD334	STD333	STD334	(B)		(A+B)	
All India : Total	62982	19715	10778	19715	10778	93475	70742	44606	73823	18189	42803	135722	16513	135722	16513	402399	495874		
By Grades																			
Battery/Chemical	-	-	-	-	-	-	4	9	12	4	26	112	-	112	-	167	167		
Ferro-manganese	7069	1740	2428	1740	2428	11237	4241	3219	4230	1288	5236	6602	466	6602	466	25282	36520		
Medium	2299	-	975	-	975	3274	11545	2053	12489	448	1333	21424	116	21424	116	49409	52683		
BF	8195	873	2167	873	2167	11235	29841	7823	21114	3011	10853	51731	5288	51731	5288	129662	140897		
Mixed	1199	3	310	3	310	1512	224	495	3361	2262	62	11988	1126	11988	1126	19518	21030		
Medium & BF mixed	6812	1506	1482	1506	1482	9800	4571	2367	4199	5215	5353	16032	221	16032	221	37957	47757		
Ferro-manganese, medium & BF mixed	25038	12515	291	12515	291	37844	5952	4497	11255	414	9532	10195	33	10195	33	41878	79723		
Ferro-manganese & BF	580	1402	636	1402	636	2618	137	8185	4811	1358	912	3317	4560	3317	4560	23280	25898		
Low (<)25% Mn	1087	349	469	349	469	1905	8575	743	6483	3916	4040	3547	82	3547	82	27386	29291		
Beneficiable	1389	974	1423	974	1423	3786	680	8401	226	-	260	1437	4560	1437	4560	15565	19531		
Others	8456	166	176	166	176	8798	2810	1459	1390	188	87	2845	-	2845	-	8780	17578		
Unclassified	802	147	421	147	421	1370	2094	5353	4184	84	4953	5384	62	5384	62	22115	23484		
Not-Known	56	39	-	39	-	95	68	-	68	-	156	1108	-	1108	-	1400	1495		
By States																			
Andhra Pradesh	2235	637	2086	637	2086	4958	675	387	773	188	3220	6987	457	6987	457	12687	17645		
Goa	-	-	-	-	-	-	13954	1511	9177	48	262	9464	-	9464	-	34416	34416		
Gujarat	708	-	-	-	-	708	-	-	-	-	-	2180	-	2180	-	2888	2888		
Jharkhand	1840	-	328	-	328	2168	1710	795	1476	-	178	4177	1126	4177	1126	9461	11629		
Karnataka	9196	-	150	-	150	9346	14003	10225	11430	1498	7306	54333	2923	54333	2923	101718	111064		
Madhya Pradesh	20227	6760	2904	6760	2904	29891	5802	2779	6421	325	10481	2015	-	2015	-	27823	57713		
Maharashtra	10867	1787	1055	1787	1055	13710	1974	4966	7207	-	5350	3369	43	3369	43	22910	36619		
Odisha	16703	10528	3413	10528	3413	30643	32622	23942	37292	16130	15119	48764	11889	48764	11889	185760	216403		
Rajasthan	1051	-	647	-	647	1697	-	-	-	-	-	4030	-	4030	-	4030	5727		
Telangana	156	3	196	3	196	355	2	-	46	-	886	203	76	203	76	1214	1568		
West Bengal	-	-	-	-	-	-	-	-	-	-	-	200	-	200	-	200	200		

Figures rounded off

MANGANESE ORE

Madhya Pradesh being the leading manganese ore producing State accounted for 32% of the total production in 2017-18. Next in the order of production were Maharashtra (28%) and Odisha (20%) (Tables- 2 to 6).

The mine-head closing stocks were

1,941 thousand tonnes for the year 2017-18 as against 1,218 thousand tonnes in the previous year [(Tables - 7 (A) and 7 (B)].

The average daily employment of labour in manganese ore mines was 12,444 in 2017-18 as against 12,505 in the previous year.

Table – 2 : Principal Producers of Manganese Ore, 2017-18

Name & address of Producer	Location of mine	
	State	District
MOIL Ltd, MOIL Bhavan, 1A, Katol Road, Chhaoni, Nagpur- 440 013 Maharashtra.	Madhya Pradesh Maharashtra	Balaghat 1. Bhandara 2. Nagpur
Sandur Manganese & Iron Ores Ltd, No. 9, Ballari Road, Sadashiv Nagar, Bengaluru- 560 080. Karnataka.	Karnataka	Ballari
Tata Steel Ltd, Bombay House, 24, Homi Mody Street, Fort, Mumbai- 400 001, Maharashtra.	Odisha	Kendujhar
M/S Suryavansham Mining & Minerals (p) Ltd, 67/2, Patrakar Colony, Indore- 452 001 Madhya Pradesh.	Madhya Pradesh	Indore
Mangilal Rungta, Rungta Office, Main Road, Barbil, Dist. Kendujhar, Odisha-758 035.	Odisha	Kendujhar
RBSSDurga Prasad & FN Das, Sriram Nagar, Garividi Railway Station, Distt. Vizianagaram-535 101 Andhra Pradesh.	Andhra Pradesh	Vizianagaram
Orissa Manganese & Minerals Ltd, Lansdowne Towers, 6 th floor, 2/1A Sarat Bose Road, Kolkata-700 020. West Bengal.	Odisha	Sundargarh
S. R. Ferro Alloys, 9, Sidheswar Colony, Distt. Jhabua- 457 661. Madhya Pradesh.	Madhya Pradesh	Jhabua
Aryan Mining & Trading Corpn. Private Ltd, P. O. Koira Dist. Sundargarh-770 048 Odisha.	Odisha	Sundargarh

MANGANESE ORE

Table – 3 : Principal Producers of Manganese Dioxide, 2017-18

Name & address of Producer	Location of mine	
	State	District
Tata Steel Ltd, Bombay House 24, Homi Mody Street, Fort, Mumbai- 400 001, Maharashtra.	Odisha	Kendujhar
MOIL Ltd, MOIL Bhavan, 1A-Katol Road, Nagpur-440 013, Maharashtra.	Maharashtra	Bhandara
Orissa Manganese & Minerals Ltd, Landsdowne Tower, 6 th floor, 2/1A, Sarat Bose Road, Kolkata- 700 020, West Bengal.	Odisha	Sundargarh
Rungta Mines Ltd, 8A, Express Tower, 42A, Shakespeare Sarani, Kolkata-700 017, West Bengal.	Odisha	Sundargarh
Mangilal Rungta, Rungta Office, Main Road, Barbil-758 035, Kendujhar, Odisha.	Odisha	Kendujhar

**Table – 4 : Production of Manganese Ore, 2015-16 to 2017-18
(By States)**

(Quantity in tonnes; Value in `000)

State	2015-16		2016-17		2017-18 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	2166947	8545510	2395134	16248429	2589271	19717530
Andhra Pradesh	186632	328949	232257	729003	166872	737163
Gujarat	46153	19633	43057	20605	18362	11183
Jharkhand	509	3161	508	3440	4785	43579
Karnataka	145623	410733	261372	1159755	294711	1456474
Madhya Pradesh	766776	3334907	650316	4532518	831348	6840493
Maharashtra	620672	2803625	604300	6181596	731458	6941500
Odisha	390233	1616875	587517	3547363	516865	3583768
Rajasthan	3457	10350	2545	7635	7497	22307
Telangana	6892	17277	13262	66514	17373	81062

MANGANESE ORE

**Table – 5 (A) : Gradewise Production of Manganese Ore, 2016-17
(By Sectors/States/Districts)**

(Quantity in tonnes; Value in `000)

State/ District	No. of mines	MnO ₂	Production By Grades: Mn Content				Total	
			46% and above	35% to below 46%	25% to below 35%	below 25%	Quantity	Value
India	153(12)	27968	228334	554216	1175949	408667	2395134	16248429
Public Sector	24	535	158400	345146	503173	44657	1051911	9575218
Private Sector	129(12)	27433	69934	209070	672776	364010	1343223	6673211
Andhra Pradesh	26	-	-	11539	119276	101442	232257	729003
Vizianagaram	26	-	-	11539	119276	101442	232257	729003
Goa*	6	-	-	-	-	-	-	-
South Goa	6	-	-	-	-	-	-	-
Gujarat	2	-	-	-	-	43057	43057	20605
Panchmahal	1	-	-	-	-	38485	38485	19319
Vadodara	1	-	-	-	-	4572	4572	2286
Jharkhand	5	-	-	-	502	6	508	3440
Singhbhum (West)	5	-	-	-	502	6	508	3440
Karnataka	9(1)	-	-	16858	182300	62214	261372	1159755
Ballari	1(1)	-	-	16858	165965	49692	232515	1037053
Chitradurga	3	-	-	-	-	7653	7653	12393
Davangere	2	-	-	-	16335	4069	20404	108582
Tumakuru	3	-	-	-	-	800	800	1727
Madhya Pradesh	48(7)	-	141723	107196	300421	100976	650316	4532519
Balaghat	37(1)	-	131647	89628	266007	22453	509735	3929990
Chhindwara	4	-	10076	17568	10866	2732	41242	382330
Jabalpur	6(6)	-	-	-	-	75791	75791	145340
Jhabua	1	-	-	-	23548	-	23548	74859
Maharashtra	19	535	27411	288718	273340	14296	604300	6181595
Bhandara	2	535	2888	188947	181969	-	374339	4299053
Nagpur	17	-	24523	99771	91371	14296	229961	1882542
Odisha	32(4)	27133	59200	129905	294819	76460	587517	3547362
Kendujhar	19(2)	25135	59039	81630	165778	20082	351664	1743352
Sundargarh	13(2)	1998	161	48275	129041	56378	235853	1804010
Rajasthan	1	-	-	-	2545	-	2545	7635
Banswara	1	-	-	-	2545	-	2545	7635
Telangana	5	300	-	-	2746	10216	13262	66515
Adilabad	5	300	-	-	2746	10216	13262	66515

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

* Only labour reported.

MANGANESE ORE

Table – 5 (B) : Gradewise Production of Manganese Ore, 2017-18 (P)
(By Sectors/States/Districts)

(Quantity in tonnes; Value in `000)

State/ District	No. of mines	Production By Grades: Mn Content					Total	
		MnO ₂	46% and above	35% to below 46%	25% to below 35%	below 25%	Quantity	Value
India	143(11)	15782	259093	596312	1283314	434770	2589271	19717530
Public Sector	23	2994	178722	364582	634511	40834	1221643	11782708
Private Sector	120(11)	12788	80371	231730	648803	393936	1367628	7934822
Andhra Pradesh	24	-	-	19380	56811	90681	166872	737163
Vizianagaram	24	-	-	19380	56811	90681	166872	737163
Goa	4	-	-	-	-	-	-	-
South Goa	4	-	-	-	-	-	-	-
Gujarat	1	-	-	-	-	18362	18362	11183
Panchmahal	1	-	-	-	-	18362	18362	11183
Vadodara	-	-	-	-	-	-	-	-
Jharkhand	3(1)	-	-	1831	2947	7	4785	43579
Singhbhum (West)	3(1)	-	-	1831	2947	7	4785	43579
Karnataka	9(2)	-	-	37816	178873	78022	294711	1456474
Ballari	1(2)	-	-	37816	169230	58460	265506	1354548
Chitradurga	3	-	-	-	-	12017	12017	25451
Davangere	4	-	-	-	9643	6245	15888	73455
Tumakuru	1	-	-	-	-	1300	1300	3020
Madhya Pradesh	41(4)	-	156657	106731	3195628	178722	831348	6840494
Balaghat	30(1)	-	149424	89961	311821	23611	574817	5521566
Chhindwara	4	-	7233	16770	13992	3351	41346	495518
Jabalpur	6(3)	-	-	-	-	151760	151760	579918
Jhabua	1	-	-	-	63425	-	63425	243491
Maharashtra	24	2994	29927	310534	359321	28682	731458	6941500
Bhandara	3	2994	7386	199977	262570	12566	485493	4471245
Nagpur	21	-	22541	110557	96751	16116	245965	2470255
Odisha	31(4)	12788	72509	120020	283939	27609	516865	3583768
Kendujhar	18(2)	9993	71332	108455	160734	15345	365859	2272901
Sundargarh	13(2)	2795	1177	11565	123205	12264	151006	1310867
Rajasthan	1	-	-	-	7497	-	7497	22307
Banswara	1	-	-	-	7497	-	7497	22307
Telangana	5	-	-	-	4688	12685	17373	81062
Adilabad	5	-	-	-	4688	12685	17373	81062

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

* Only labour reported.

MANGANESE ORE

**Table – 6 : Production of Manganese Ore, 2016-17 and 2017-18
(By Frequency Groups)**

(Quantity in tonnes)

Production Group	No. of mines		Production		Percentage in total Production		Cumulative %	
	2016-17	2017-18 (P)	2016-17	2017-18 (P)	2016-17	2017-18 (P)	2016-17	2017-18 (P)
Total	153(12)	143(11)	2395135	2589273	100.00	100.00	-	-
Up to 1000	87(1)	65	13309	8163	0.56	0.32	0.56	0.32
1001 - 5000	22(5)	36(5)	71851	107350	3.00	4.15	3.56	4.47
5001 - 10000	10(2)	12(1)	88543	94170	3.70	3.64	7.26	8.11
10001 - 20000	9(1)	8(3)	134147	152242	5.60	5.88	12.86	13.99
20001 - 30000	7)	3	167942	70222	7.01	2.71	19.87	16.70
30001 - 40000	6(1)	3	260018	103733	10.86	4.01	30.73	20.71
40001 - 50000	2(1)	2(1)	136216	132949	5.69	5.13	36.42	25.84
50001 and above	10(1)	14(1)	1523109	1920444	63.59	74.17	100.00	100.00

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

**Table – 7 (A) : Mine-head Closing Stocks of Manganese Ore, 2016-17
(By States and Grades)**

(In tonnes)

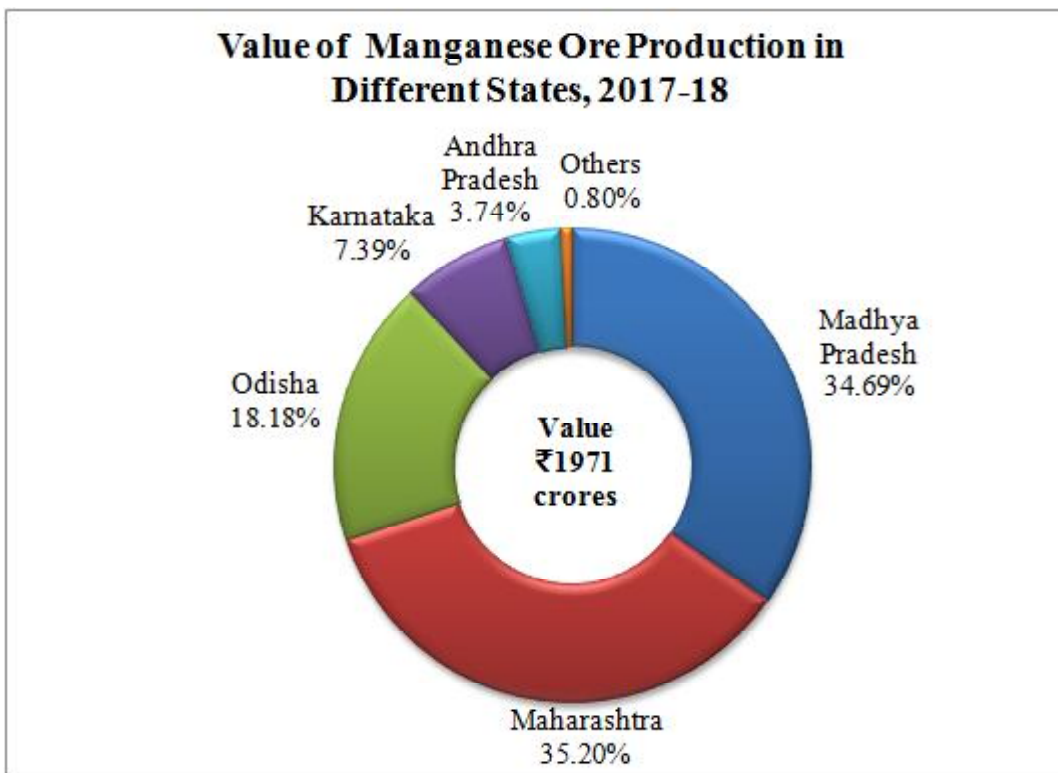
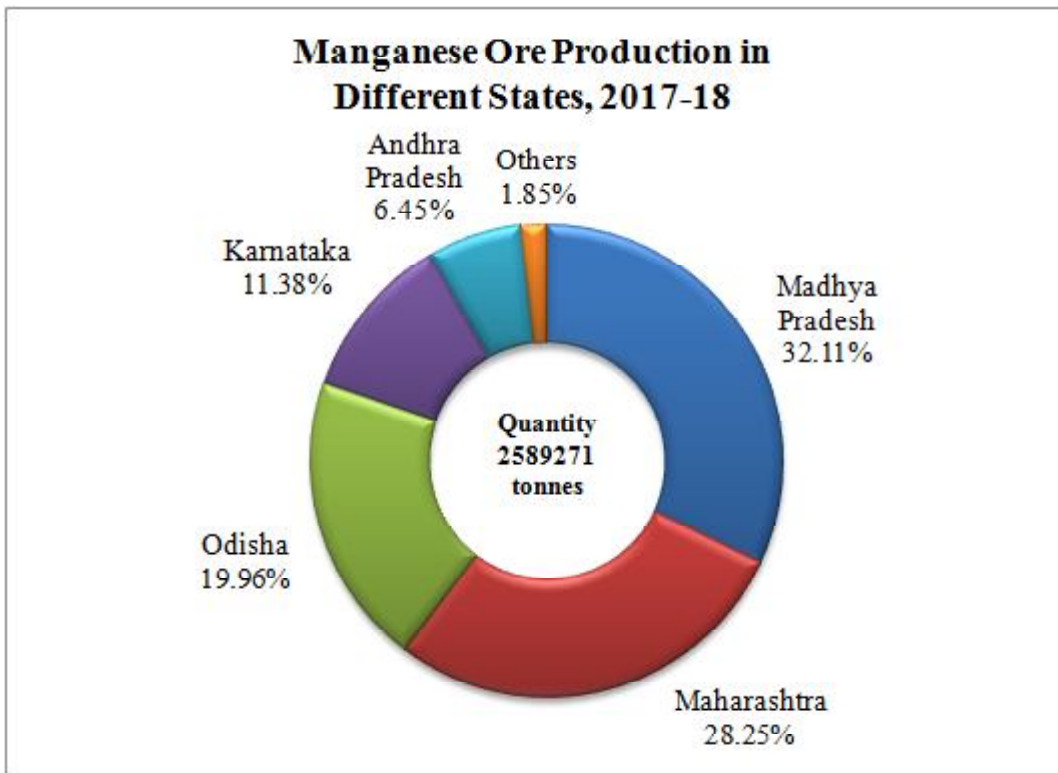
State	Grades : Mn content					Total
	MnO ₂	46% and above	35% to below 46%	25% to below 35%	below 25%	
India	3045	44318	104881	497335	568642	1218221
Andhra Pradesh	-	-	1099	53405	17326	71830
Jharkhand	-	24	22	5621	174	5841
Karnataka	-	-	2562	90396	165549	258307
Madhya Pradesh	-	34373	15702	49172	258570	357817
Maharashtra	757	3151	38058	27975	15687	85628
Odisha	2288	6770	47438	268042	106831	431369
Rajasthan	-	-	-	1207	-	1207
Telangana	-	-	-	1517	4505	6022

**Table – 7 (B) : Mine-head Closing Stocks of Manganese Ore, 2017-18
(By States and Grades)**

(In tonnes)

State	Grades : Mn content					Total
	MnO ₂	46% and above	35% to below 46%	25% to below 35%	below 25%	
India	3587	26318	100198	467489	1343342	1940934
Andhra Pradesh	-	-	29	44774	17906	62709
Gujarat	-	-	-	-	646042	646042
Jharkhand	1	23	1846	5270	245	7385
Karnataka	-	-	250	51993	205703	257946
Madhya Pradesh	-	22127	16176	40732	347445	426479
Maharashtra	1167	968	34308	31708	19345	87496
Odisha	2419	3200	47589	291137	104427	448772
Rajasthan	-	-	-	1367	-	1367
Telangana	-	-	-	508	2230	2738

MANGANESE ORE



MINING, PROCESSING, MARKETING & TRANSPORT

Manganese ore mining in the country is carried out by opencast as well as by underground methods. Of the 142 mines, 8 are underground (3 in Madhya Pradesh and 5 in Maharashtra). Seven underground mines were operated by MOIL Ltd, 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 has been 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 high speed vertical shaft up to 750 m is in progress in Balaghat, up to 169 m in chikla mine, up to 245 m in Kandri mine and up to 160 m in mansar mine of MOIL. Sinking of high speed vertical shafts upto 160 m, 330 m and 324 m is in progress at Mansar, Gumgaon and Ukwa mines respectively. MOIL has also plans to increase its production from present level of 1.2 million tonnes to 3.00 million tonnes by 2030.

The open-pits are usually 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 m³ 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 are 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 5,00,000 tonnes per annum capacity at Balaghat mine in order to conserve mineral and profitably utilise the low/medium grade ore. The plant facilities include crushing, wet screening, classification and jigging operations.

The plant upgrades the low/medium grade 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 cases 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 exports, producers other than MOIL Ltd supply it to MMTC, the canalising agency, either at rail-head or at the port. MOIL Ltd did not export manganese ore in the year 2017-18.

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 Mormugao 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

In order to embark upon low carbon growth trajectory, MOIL has taken up some measures such as, recycle and reuse of water for beneficiation, construction of strong parapet walls and afforestation in all its mines. The Company has also set up a wind energy farm of 20 MW capacity at Dewas, Madhya Pradesh. The company has also plans to install 10.5 MW capacity solar power plant at all its mines in Maharashtra and Madhya Pradesh. R&D work was taken up by MOIL to improve the safety, productivity and environmental standards in the mines by introducing newer technology in consultation with reputed academic and CSIR-R&D institutions of the country. Ventilation reorganisation studies for deeper levels have been conducted at Gumgaon and Chikla mines by IIT, Kharagpur. Recommendations are implemented at Gumgaon mines and in progress at Chikla mines.

Various energy saving projects are under process such as installation of solar roof top at administrative buildings at all mines; five MW solar power projects in mine areas in Maharashtra; 5.5 MW solar power projects in Madhya Pradesh as well as installation of small size compressors in underground mines for energy saving.

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 ferromanganese. 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. High amount of phosphorous makes the manganese ore unsuitable for its metallurgical use, whereas, high phosphorous and high iron contents make it unsuitable for battery industry. 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%, SiO₂: 2 to 8%, Al₂O₃: 5 to 8% and P: 0.3% maximum.

For manganese ore used in Ferromanganese Industry, besides manganese content, other important considerations are high manganese to iron ratio and a very low content of deleterious phosphorous. Specifications of manganese ore for ferromanganese 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 ferromanganese production vide IS:12596-1989 (Reaffirmed 2009). User's specifications of manganese ore for Ferromanganese/Silico-manganese industries are furnished in Table- 8.

MANGANESE ORE

Table – 8 : User's Specifications of Manganese Ore in different Ferromanganese/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). ii) Jain Carbides & Chemicals Ltd, Raipur (Unit-II).	Mn: 32-35% Mn: 32-35%
Karnataka S. R. Chemicals & Ferro Alloys, Belagavi. 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 ₂ O 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 ₂ O 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 ₂ O 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 ORE

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). User industry specifications are MnO₂ 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 MnO₂ 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.

Manganese ore is also used in the manufacture of various chemicals such as potassium permanganate, hydroquinone, manganese sulphate, manganese chloride, manganese phosphate, etc. In chemical industry, generally high-grade material is used for potassium permanganate. Ore containing MnO₂ 80% (min.), SiO₂ 5% (max.), Fe₂O₃ 5% (max.) and 200 to 250 mesh ore size is used. In glass industry, ore analysing MnO₂ 80% (preferably 86% min.), Fe₂O₃ 5% (preferably 0.75% max.), SiO₂ 2.8% (max.), Al₂O₃ 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: MnO₂ 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 which show variation in their particle size: Type A, Type B and Type C. Particle size (max.) is 600 microns for Type A, 150 microns for Type B and 74 microns for Type C ore. In addition, grit content should be 1% (max.) for Type A ore. For Match Industry, the MnO₂ 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 2.65 million tonnes in 2017-18 as against 2.87 million tonnes in 2016-17. Ferro-alloys industries accounted for about 94% consumption followed by Iron & Steel (5%). The remaining (1%) was shared by Battery, Electrode, Chemical, Zinc Smelter and Alloy Steel industries (Table- 9).

The consumption of ferro-manganese in 2017-18 decreased by 36% to 51 thousand tonnes from 79 thousand tonnes in the previous year. Iron & steel industry was the bulk consumer of ferro-manganese accounting for about 87% consumption in 2017-18. The remaining 13% was consumed in alloy steel, foundry and electrode industries. Consumption of silico-manganese which was 161 thousand tonnes in 2016-17 decreased to 123 thousand tonnes in 2017-18 (Tables- 10 & 11).

MANGANESE ORE

**Table – 9 : Estimated Consumption* of Manganese Ore, 2015-16 to 2017-18
(By Industries)**

(In tonnes)			
Industry	2015-16	2016-17 (R)	2017-18 (P)
All Industries	3334000	2868300	2653900
Ferro-alloys	3193400	2707500	2496900
Iron & steel	125600	131600	128600
Others: (Alloy steel, chemical, zinc smelter, Battery & electrode)	15000	29200	28400

Figures rounded off

* Includes actual reported consumption and/or estimates made wherever required. Paucity of data, hence coverage may not be complete.

**Table – 10 : Consumption* of Ferromanganese, 2015-16 to 2017-18
(By Industries)**

(In tonnes)			
Industry	2015-16	2016-17 (R)	2017-18 (P)
All Industries	130700	79300	50800
Alloy steel	11900	6600	6600
Iron & steel	117100	72200	44100
Other	1700	500	100

Figures rounded off

* Includes actual reported consumption and/or estimates made wherever required; Paucity of data has posed restriction to the data coverage on consumption.

**Table – 11 : Consumption* of Silico-manganese, 2015-16 to 2017-18
(By Industries)**

(In tonnes)			
Industry	2015-16	2016-17 (R)	2017-18 (P)
All Industries	256400	161400	122600
Alloy steel	12600	9900	9900
Iron & steel	243500	151400	112700
Others (Electrode, Foundry)	300	100	++

Figures rounded off

* Includes actual reported consumption and/or estimates wherever required; Paucity of data has posed restriction to the data.

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. 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 ferromanganese/silico-manganese in the country was estimated to be around 3.16 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 2017-18, about 872 tonnes of EMD was produced as against 731 tonnes in 2016-17. Ferro-manganese plant of 10,000 tonnes per annum capacity has been set up at Bharveli, Balaghat. In 2017-18, 10,573 tonnes of ferromanganese was produced as compared to 9,950 tonnes in the previous year.

Ferro-manganese

The total production of various types of manganese alloys (high carbon ferromanganese, medium carbon ferro-manganese and low carbon ferromanganese) was about 5.18 lakh tonnes in 2017-18 which was the same in the year 2016-17 as per Monthly Statistics of Mineral Production (March, 2018- Final Release). 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, 2018- Final Release), production of silico-manganese was reported at 3,11,326 tonnes in 2017-18 as compared to 3,00,625 tonnes in 2016-17. It is to be noted that the data coverage is partial and does not reflect the actual production. MOIL was considering setting up ferro-manganese and silico-manganese plants through joint venture

companies with RINL and SAIL, namely, 31,000 tpy ferromanganese and 75,000 tpy silico-manganese plants at Nandini near Bhilai, Chhattisgarh and a 20,000 tpy ferro-manganese and 37,000 tpy silico-manganese plants at Bobbili, Vizianagaram district, Andhra Pradesh with RINL. These projects are not viable at present especially on account of the present power tariffs of the State Electricity Boards. Activities in respect of both these joint venture companies have been put on hold.

The major factor driving the production of manganese alloys is high production growth of low nickel austenitic stainless steel. India is 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 2016-17 and 2017-18 are furnished in Table-12.

Dry Battery

Dry battery Industry also consumes EMD along with natural manganese dioxide ore. The only one plant of 1,000 tpy capacity producing EMD is owned by MOIL and is located in Bhandara district of Maharashtra.

SUBSTITUTES

Cost and technology militate against 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.

MANGANESE ORE

Table – 12 : Consumption, Specifications and Source of Supply of Manganese Ore in different Iron and Steel Plants, 2016-17 and 2017-18

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2016-17	2017-18 (P)	2016-17	2017-18 (P)		
Bhilai Steel Plant, Bhilai Nagar, Durg Chhattisgarh.	Hot metal 7036999	Hot metal 6505004	25656 18079	NA 5848	Size: 25 to 85 mm Mn: 30% min. SiO ₂ : 30% max. Al ₂ O ₃ : 5% max. P: 0.3% max.	MOIL/ Ramtek Goberwahi, Gua Mines SAIL, RMD
Bokaro Steel Plant, Bokaro, Jharkhand.	Hot metal 3700004 ^e	Hot metal 3700004 ^e	NA	NA	Mn: 30% max. SiO ₂ +Al ₂ O ₃ : 20.5% max. -10 mm -15% max. +40 mm -10% max.	-
Durgapur Steel Plant, Durgapur, West Bengal.	Hot metal 2318006	Hot metal 2318006	NA	NA	Mn: 30% min. Fe: 15-28% SiO ₂ : 3.3% max. Al ₂ O ₃ : 7.5% max.	-
Rourkela Steel Plant, Rourkela, Odisha.	Hot metal 3093948	Hot metal 3319348	NA	NA	-	-
IISCO Steel Plant, Burnpur, Dist. Burdwan, West Bengal- 713 325.	Hot metal 566244 ^e	Hot metal 566244 ^e	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 216000	Hot metal 53115	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 ₂ O ₃ : 12% max.	Milan Minerals, Karnataka
Visakhapatnam Steel Plant, Visakhapatnam, Andhra Pradesh.	NA	NA	11400 ^e	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 NA	Hot metal NA	NA NA	NA NA	Size: 10-40 mm	From own/ local mines
Gordan Steel India Ltd, Jaonbulapadu, Anantapur, Andhra Pradesh.	Hot metal 30427 ^e	Hot metal 30427 ^e	728	2292	Mn 28-35% Mn	-
Tata Steel Ltd, Jamshedpur, Jharkhand.	Hot metal 10825697	Hot metal 10948835	NA	NA	167	-

(Contd.)

MANGANESE ORE

Table - 12 (Contd.)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2016-17	2017-18 (P)	2016-17	2017-18 (P)		
Kirloskar Ferrous Industries Ltd, Berinahalli, 583 234, Koppal, Karnataka.	Pig iron 291273	Pig iron 338301	8159	8159	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 ^e	Pig iron+ (molten metal) 198036 ^e	NA	NA	NA	NA
Visa Steel Ltd, Kalinganagar, Jajpur, Odisha.	Hot metal NA	Hot metal NA	302 ^e	NA	below 35% Mn Mines	Siljoda
Sunflag Iron & Steel Co. Ltd, Bhandara, Maharashtra.	Hot metal 323352	Hot metal 365060	NA	NA	-	-
Jaiswal Neco Industries Ltd, Siltara, Raipur, Chhattisgarh.	Hot metal 524575 ^e	Hot metal 524575 ^e	2170 ^e	1871	Mn:26-28% Size:10-60 mm	-
Jaiswal Neco Industries Ltd, Ballari, Karnataka.	Hot metal 574053	Hot metal 569716	-	-	NA	NA
Tata Metalliks Ltd, Kharagpur, Medinipur, West Bengal.	Hot metal 292575 ^e	Hot metal 292575 ^e	7048 ^e	10502 ^e	NA	NA
JSW Steel Ltd, Salem, Tamil Nadu- 636 453.	Hot metal 886900	Hot metal 849100	- -	- -	NA	NA
JSW Steel Ltd, Vidyanagari, Ballari, Karnataka.	Hot metal 9683092 ^e	Hot metal 9683092 ^e	-	-	NA	NA
Rashmi Metaliks Ltd, Gokulpur, West Midnapur, West Bengal.	Hot metal 192039	Hot metal 169910	NA	NA	NA	NA
Sona Alloys P. Ltd, Lonad, Pune, Maharashtra.	Hot metal 250000 ^e	Hot metal 250000 ^e	NA -	3640 -	NA -	NA -
Aparant Iron & Steel Pvt.Ltd, Goa.	Pig Iron 20237 ^e	Pig Iron 20237 ^e	1380	334	NA	NA
Uttam Galva Metallics Ltd, Bhugaon- 442 001, Wardha, Maharashtra.	Hot metal 574416	Hot metal 533036	NA	NA	NA	NA
Tata Metalliks Ltd, Gokulpur, Maheshpur West Bengal.	Hot metal 195132	Hot metal 499540	7240	9679	NA	NA

(Contd.)

MANGANESE ORE

Table - 12 (Concl'd.)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2016-17	2017-18(P)	2016-17	2016-18(P)		
Vedanta Ltd, Navelim Amona, Marcela, Goa.	620984 ^e	12151 ^e	13689 ^e	594 ^e	-	-
Neelachal Ispat Nigam Ltd, Kalinga Nagar, Duburi, Jajpur, Odisha.	605310	362726	Nil	Nil	-	-
Suraj Products Ltd, Barpali, Rajgangpur, Sundargarh, Odisha.	12151 ^e	13689 ^e	594 ^e	1139 ^e	-	-
SLR Metallks Ltd, A-2/452, Sector-8 Rihini, Delhi, 110 085.	150583	18982	275	1511	-	-
Jindal Saw Ltd, Mundra, Gujarat.	446477	455205	2680	7081	-	-
SLR Metallks Ltd, Narayan Devarakere, Hagari Bommanhalli, Karnataka	18982	150583	1511	275	-	-

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 ferromanganese 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, 2015-20 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.

WORLD REVIEW

The total world reserve of manganese ore is approximately 760 million tonnes of metal content which is unevenly distributed (Table-13). Reserves are located in South Africa (30%), Ukraine (18%), Brazil (14%), Australia (13%), China (7%) and India (4%). 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 have 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 2017 was estimated to be around 51.60 million tonnes as compared to 46.90 million tonnes in 2016. South Africa was the leading producer contributing about 27% followed by China (24%), Australia (12%), Gabon (8%), Brazil (6%), India (5%) and Ukraine (3%) (Table-14). 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.

Table – 13 : World Reserves of Manganese Ore (By Principal Countries)

(In '000 tonnes of metal content)	
Country	Reserves
World: Total (rounded off)	760000
Australia ^(a)	99000
Brazil	110000
China	54000
Gabon	65000
Ghana	13000
India*	33000
Kazakhstan, concentrate	5000
Mexico	5000
South Africa	230000
Ukraine, concentrate	140000
Other countries	Small

Source: Mineral Commodity Summaries, February, 2019. (a): Joint Ore Reserve Committee compliant reserves were about 46 million tonnes of manganese content.

**: India's total reserves/resources of manganese ore as per NMI database based on UNFC system have been estimated at 495.87 million tonnes as on 1.4.2015.*

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

(In '000 tonnes)			
Country	2015	2016	2017
World: Total	51500	46900	51600
Australia	6281	5327	6173
Brazil	2817	2881	2880 ^e
China ^e	13000	11650	12500
Gabon	4184	3413	4163
Ghana	1563	2018	3004
India*	2167	2395	2589
Kazakhstan	1626	1601	1492
Malaysia	481	701	1226
South Africa ^e	15979	13736	13889
Ukraine	1477	1328	1758
Other countries	1881	1833	1883

Source: World Mineral Production, 2013-2017.

(a): Years ended 31st March following that stated.

** India's production of manganese ore in 2015-16, 2016-17 and 2017-18 was 2,167 thousand tonnes, 2,395 thousand tonnes and 2,589 thousand tonnes, respectively.*

FOREIGN TRADE

Exports

Exports of manganese ore increased substantially to 44,167 tonnes in 2017-18 from 244 tonnes in 2016-17. Out of the total exports in 2017-18, negligible quantity of manganese ore having +46% Mn of value in ` 29,000 was exported. Exports of manganese ore (others) were 19,367 tonnes. More than 98% of exports was to China and 1% exports to Netherlands. Exports of manganese oxide (total) increased to 20,771 tonnes in 2017-18 as against 15,659 tonnes in 2016-17. Manganese Dioxide exports in 2017-18 increased to 2,545 tonnes from 2,389 tonnes in 2016-17. Exports were mainly to Iran (51%), Bangladesh (9%) and Poland & Kenya (8% each). In 2017-18, exports of manganese and alloys (including waste & scrap) increased to 304 tonnes as compared to 278 tonnes in the previous year. Exports of manganese & alloys (wrought/unwrought) in 2017-18 were at 268 tonnes as compared to 226 tonnes in the previous year (Tables- 15 to 22).

Imports

Imports of manganese ore increased to 3.57 million tonnes from 1.91 million tonnes in the previous year. South Africa (58%), Australia (14%) and Gabon (13%) were the main suppliers of manganese ore in 2017-18. Out of the manganese ore (total) imported, manganese ore having +46% Mn contributed 3,27,431 tonnes, manganese ore having 35-46% Mn was 20,095,807 tonnes, manganese ore having 30 to 35% Mn was 4,94,928 tonnes and manganese ore (others) was 5,98,421 tonnes. In 2017-18, imports of manganese dioxide were 7,760 tonnes. Imports were mainly from China (98%) and Indonesia (2%). Imports of manganese oxide (total) were 14,662 tonnes. During 2017-18, imports of manganese & alloys (including waste and scrap) were 55,818 tonnes, out of which manganese & alloys (wrought/unwrought) comprised 55,766 tonnes. Imports of manganese & alloys NES were 52 tonnes mostly from China (99%) (Tables- 23 to 33).

MANGANESE ORE

**Table – 15 : Exports of Manganese Ore : Total
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	244	12377	44167	508784
China	-	-	43800	490448
Netherlands	150	7690	167	9342
Turkey	87	4500	72	4092
Chile	-	-	45	2809
Nepal	7	35	20	1083
Sri Lanka	-	-	27	523
Uganda	-	-	32	418
Tanzania	-	-	3	31
Bangladesh	-	-	++	29
Zambia	-	-	1	8
Other countries	++	152	-	-

**Table – 16 : Exports of Manganese Ore (46% or more Mn)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	++	13	++	29
Bangladesh	-	-	++	29
China	-	-	-	-
Australia	++	13	-	-

**Table – 17 : Exports of Manganese Ore (Others)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	237	12329	19367	177005
China	-	-	19000	158698
Netherlands	150	7690	167	9342
Turkey	87	4500	72	4092
Chile	-	-	45	2809
Nepal	-	-	20	1083
Sri Lanka	-	-	27	523
Uganda	-	-	32	418
USA	-	-	++	1
Tanzania	-	-	3	31
Zambia	-	-	1	8
Other countries	-	139	-	-

MANGANESE ORE

**Table – 18: Exports of Manganese Oxide : Total
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	15659	572813	20771	1016497
Turkey	875	28795	1475	76431
Russia	1343	43356	1622	75464
Vietnam	1326	51292	1465	75167
France	300	9473	1931	72303
Iran	600	17003	1300	70778
Spain	684	24513	1361	66683
Indonesia	765	33335	1161	60265
Thailand	743	29910	1075	54467
Canada	858	37481	989	53997
Australia	923	31164	999	49605
Other countries	7242	266491	7393	361337

**Table – 19: Exports of Manganese Dioxide
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	2389	77853	2545	123550
Iran	500	13203	1300	70778
Poland	295	14225	197	10586
Bangladesh	228	6043	233	6834
Saudi Arabia	++	1	76	4654
UK	51	2052	55	4602
Malaysia	130	7106	60	3600
Kenya	175	2476	201	3309
Korea, Rep. of	18	1269	40	2935
Italy	100	2621	50	2524
UAE	19	1047	37	2019
Other countries	873	27810	296	11709

MANGANESE ORE

**Table – 20: Exports of Manganese Oxide
(Other than Manganese Dioxide)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	13270	494960	18226	892947
Canada	858	37480	989	53997
Australia	923	31164	999	49605
Denmark	-	-	500	25790
Argentina	150	6638	200	9038
Dominican Rep.	25	835	76	3975
Belgium	50	1629	25	1534
Cyprus	-	-	25	1513
Brazil	-	-	25	1322
Burgundi	-	-	2	16
Bangladesh	3	117	-	-
Other countries	11261	417097	15385	746157

**Table – 21: Exports of Manganese & Alloys
(Incl. Waste & Scrap)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	278	178614	304	207273
France	113	59985	165	107543
China	61	50964	58	45633
Croatia	3	3646	9	12318
Indonesia	13	2520	18	5277
Italy	5	8944	3	5192
Romania	2	3459	3	5100
Malaysia	5	3430	3	3769
Hong Kong	++	771	2	2403
Slovenia	7	8792	1	1944
Philippines	19	4229	10	1877
Other countries	50	31874	32	16217

**Table – 22: Exports of Manganese & Alloys :
(Wrought/Unwrought)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	226	169430	268	199911
France	78	52978	144	102595
China	61	50964	58	45623
Croatia	3	3646	9	12318
Indonesia	13	2520	18	5277
Italy	5	8944	3	5192
Romania	2	3459	3	5100
Malaysia	3	3144	3	3769
Hong Kong	++	771	2	2403
Slovenia	7	8792	1	1944
Philippines	19	4183	10	1877
Other countries	35	30029	17	13813

MANGANESE ORE

**Table – 23: Imports of Manganese Ore : Total
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	1908258	24028138	3567271	50633967
South Africa	1046820	12724937	2058104	25889562
Australia	426002	6757034	482439	9254873
Gabon	205026	2258075	476301	6802381
Ivory Coast/ Cote-D Ivoire	75733	913035	248064	4089651
Brazil	17684	200802	209888	3134341
Zambia	360	7265	38943	679297
Malaysia	77134	447955	24725	215916
Singapore	4975	185681	4897	172930
Tanzania	682	13564	8585	151454
Senegal	365	3468	3840	79262
Other countries	53477	516322	11485	164300

**Table – 24 : Imports of Manganese Ore
(46% or more Mn)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	349679	4713328	327431	5971223
Australia	231920	3005488	225430	4437683
South Africa	106534	1430214	58521	658103
Zambia	-	-	21392	378006
Singapore	4975	185681	4872	172068
Brazil	723	15908	6326	115947
Ivory Coast/ Cote-D Ivoire	2307	16294	3422	65019
Tanzania	-	-	3509	58416
Senegal	365	3468	2351	49999
Peru	774	12248	935	20244
Indonesia	-	-	330	8110
Other countries	2081	44027	343	7628

**Table – 25 : Imports of Manganese Ore
(35% or more but below 46% Mn)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	1058082	12582178	2095807	30130889
South Africa	709546	8144996	1274430	17105173
Gabon	166982	1752138	384281	5732586
Australia	99229	1794650	148282	2943513
Ivory Coast/ Cote-D Ivoire	25097	333961	150531	2250716
Brazil	16702	179049	113767	1714590
Zambia	-	-	16761	280992
Myanmar	2982	26779	4471	46343
Tanzania	-	-	1452	24386
Senegal	-	-	789	17839
Turkey	671	11355	714	10452
Other countries	36873	339250	392	4299

**Table – 26 : Imports of Manganese Ore
(30% or more but below 35%)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (`'000)	Qty (t)	Value (`'000)
All Countries	90339	794569	494928	4658514
South Africa	21891	242630	412809	3810428
Gabon	15955	222482	68189	674440
Ivory Coast/ Cote-D Ivoire	-	-	12104	154131
Turkey	-	-	953	11553
Kenya	-	-	548	4942
Morocco	-	-	325	3020
Malaysia	41978	220469	-	-
Egypt	10515	108988	-	-

MANGANESE ORE

**Table – 27 : Imports of Manganese Ore (Others)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	380089	5705102	598421	9452943
South Africa	207132	2893583	286385	4111376
Australia	94853	1956896	108727	1873677
Ivory Coast/ Cote-D Ivoire	48329	562780	82007	1619785
Brazil	-	-	89795	1303804
Gabon	20189	246748	23894	395355
Tanzania	252	3919	3624	68652
Indonesia	-	-	1128	31933
Zambia	360	7265	790	20299
Senegal	-	-	700	11424
Iran	-	-	505	7084
Other countries	8974	33911	866	9554

**Table – 28 : Imports of Manganese Dioxide
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	9572	760079	7760	771226
China	7241	707589	7610	739269
Belgium	31	8432	140	27851
Germany	2	1403	4	1989
USA	++	250	6	1834
UK	++	249	++	243
Korea, Rep. of	-	-	++	20
Australia	-	-	++	20
Indonesia	2286	34280	-	-
Netherlands	12	7876	-	-

**Table – 29 : Imports of Manganese Oxide
(Other than Manganese Dioxide)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	9930	321253	6902	302587
Belgium	685	97346	945	134510
South Africa	8953	181498	4768	96115
Peru	-	-	800	24218
Norway	58	9342	41	7245
Brazil	-	-	75	4291
Japan	++	603	1	1260
Chinese Taipei/ Taiwan	-	-	1	167
UK	++	102	++	97
Australia	2	96	++	27
Saudi Arabia	++	74	-	-
Other countries	232	32192	271	34657

**Table –30 : Imports of Manganese & Alloys
(Incl. Waste & Scrap)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	37436	4778615	55818	6878790
China	36458	4454022	54207	6462674
France	230	162404	306	199341
Gabon	167	23548	524	66397
Sweden	31	25820	57	45798
South Africa	480	66234	286	36223
Germany	4	3161	191	25604
USA	41	39792	21	19219
Korea, Rep. of	-	-	120	15794
Australia	-	-	81	4836
Hong Kong	25	3315	25	2474
Other countries	++	319	++	475

MANGANESE ORE

**Table –31 : Imports of Manganese & Alloys
(Wrought/Unwrought)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	37288	4756709	55766	6871294
China	36358	4438911	54156	6457154
France	227	160906	306	199341
Gabon	125	21493	524	66397
Sweden	31	25820	57	45791
South Africa	480	66234	286	36223
Germany	1	275	190	24187
USA	41	39755	21	18985
Korea, Rep. of	-	-	120	15749
Australia	-	-	81	4836
Hong Kong	25	3315	25	2474
Other countries	-	-	++	157

**Table –33 : Imports of Manganese & Alloys, NES
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	106	19851	52	7496
China	100	15111	51	5520
Germany	3	2886	1	1417
USA	++	37	++	234
UK	++	220	++	224
Austria	++	99	++	94
Sweden	-	-	++	7
France	3	1498	-	-

**Table –32 : Imports of Manganese (Wrought)
(By Countries)**

Country	2016-17		2017-18	
	Qty (t)	Value (` '000)	Qty (t)	Value (` '000)
All Countries	11759	1419935	9903	1191910
China	11759	1419935	9819	1182125
Gabon	-	-	84	9783
UK	-	-	++	2

FUTURE OUTLOOK

As per World Steel Association, in 2017 India's per capita steel consumption is about 65.2 kg as against the world's per capita consumption of 214.5 kg. This difference in the per capita consumption of steel in itself reflects opportunities that are bound to occur for Steel Industry which in turn would positively impact the demand for manganese ore. Production of crude steel is the single most important factor that influences the demand for manganese ore. Steel Industry accounts for approximately 90% of the world demand for manganese. India's crude steel production grew from 97.94 million tonnes in 2016-17 to 102.34 million tonnes in 2017-18 registering a growth of 4.49 percent. This indicates strong growth of steel industry in the country as steel is the principal market accounting for 65 to 70% manganese consumption.

India has set a capacity target of 300 million tonnes of steel by 2030-31. The demand for manganese ore is expected to raise commensurately to about 10 million tonnes per year in the coming years.

India's largest manganese ore producing company 'MOIL Ltd' is planning to increase its production to 3 million tonnes by 2030, the gap in the demand will continue to be filled by imports in years to come.