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(Part- III : MINERAL REVIEWS)

59th Edition

MANGANESE ORE

(ADVANCE 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 indicators of growth in the industrial economy of any country. In recent years, the trade volume of manganese ore has grown worldover. 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 ($Mn_2O_3.H_2O$, Mn about 62.4%); and (iv) braunite ($3Mn_2O_3$, $MnSiO_8$, Mn about 62% and SiO_2 about 10%).

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

Statewise, 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 2% resources (Table- 1).

EXPLORATION & DEVELOPMENT

The exploration and development details, if any, are covered in the Review on "Exploration & Development" under "General Reviews".

PRODUCTION AND STOCKS

The production of manganese ore at 2,904 thousand tonnes during 2019-20 increased by about 3% as compared to that in the previous year.

There were 131 reporting mines during the year 2019-20 as against 148 in the previous year. Besides, manganese ore production was reported as associate mineral by 12 mines in 2019-20.

In 2019-20, twenty four Public Sector mines jointly accounted for 45% of the total production. The contribution of captive mines was 12% of the total production.

As per the gradewise composition of production during 2019-20, 71% of the total production was of lower grade (Below 35% Mn), 19% of medium grade (35-46% Mn) and 9% was of higher grade (Above 46% Mn). Production of manganese dioxide was at 22,572 tonnes (1%) during the year.

Madhya Pradesh is the leading producing State of manganese ore accounting for 33% of total production during 2019-20 followed by Maharashtra 25% and Odisha 19% (Tables- 2 to 6).

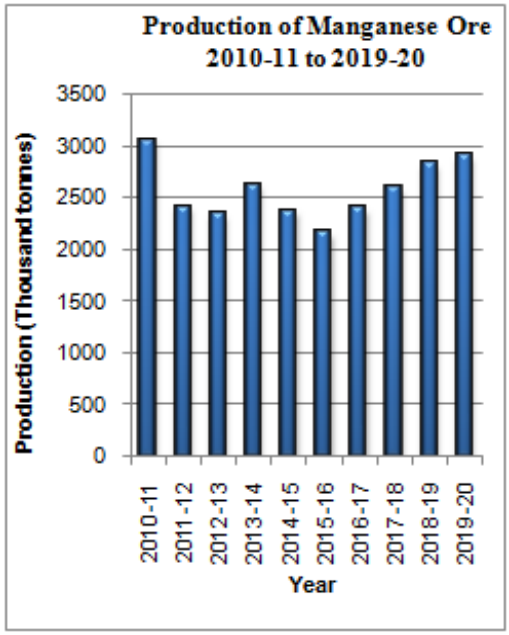


Table – 1 : Reserves/Resources of Manganese Ore as on 01.04.2015

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

Figures rounded off

The mine-head closing stock was 3,127 thousand tonnes for the year 2019-20 as against 2,884 thousand tonnes for the previous year [(Tables - 7 (A) and 7 (B)].

The average daily employment of labour in manganese ore mines was 12,620 in 2019-20 as against 13,164 in the previous year.

Table – 2 : Principal Producers of Manganese Ore, 2019-20

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 Bhandara Nagpur
Tata Steel Ltd, Bombay House, 24, Homi Mody Street, Fort, Mumbai- 400 001, Maharashtra	Odisha	Keonjhar
Sandur Manganese & Iron Ores Ltd, No. 9, Bellary Road, Sadashivanagar, Bengaluru- 560 080. Karnataka	Karnataka	Ballari
R.B.S.S. Durga Prasad & F.N. Das, Sriram Nagar, Garividi Railway Station, Distt Vizianagaram-535 101 Andhra Pradesh	Andhra Pradesh	Vizianagaram
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, Distt Keonjhar, Odisha-758 035.	Odisha	Keonjhar
S.K. Sarawagi & Co. Pvt. Ltd, 10/1/31, Signature Towers, Level -4, Waltair Uplands, Distt - Visakhapatnam, Andhra Pradesh-530 003	Andhra Pradesh	Vizianagaram
S. R. Ferro Alloys, 9, Sidheswar Colony, Distt Jhabua- 457 661. Madhya Pradesh.	Madhya Pradesh	Jhabua
Shobha Minerals 765, Napier Town, Distt Jabalpur - 482 001 Madhya Pradesh	Madhya Pradesh	Jabalpur
Aryan Mining & Trading Corporation (P) Ltd, P1, Hide Lane, Aryan House, 8th Floor, Kolkata - 700 073	Odisha	Sundargarh

Table–3 : Principal Producers of Manganese Dioxide, 2019-20

Name & address of Producer	Location of mine	
	State	District
MOIL Ltd, MOIL Bhavan, 1A-Katol Road, Nagpur-440 013, Maharashtra.	Maharashtra	Bhandara
Tata Steel Ltd, Bombay House 24, Homi Mody Street, Fort, Mumbai- 400 001, Maharashtra.	Odisha	Keonjhar
Rungta Mines Ltd, 8A, Express Tower, 42A, Shakespeare Sarani, Kolkata-700 017, West Bengal.	Odisha	Sundargarh
Mangilal Rungta, Rungta Office, Main Road, Distt Keonjhar, Barbil-758 035, Odisha.	Odisha	Keonjhar
Bonai Industrial Company Ltd, Rungta Office, Main Road, Distt Keonjhar, Barbil-758 035, Odisha.	Odisha	Keonjhar

Table – 4 : Production of Manganese Ore, 2017-18 to 2019-20
(By States)

(Quantity in tonnes; Value in ₹'000)

State	2017-18		2018-19		2019-20 (P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	**2599815**	**19907474**	**2832315**	**21640165**	**2904373**	**19416386**
Andhra Pradesh	172174	706314	293679	1039486	331030	1317483
Gujarat	18362	11496	-	-	-	-
Jharkhand	4783	44527	4785	39839	4785	35577
Karnataka	294261	1541069	332162	2276289	333425	2284994
Madhya Pradesh	837041	6760106	942738	7147719	958164	6160735
Maharashtra	731457	7243631	761985	7999939	721520	6127232
Odisha	516862	3497593	476821	3048997	537742	3409984
Rajasthan	7502	22506	9410	28230	9937	29811
Telangana	17373	80232	10735	59666	7770	50570

Table – 5 (A) : Gradewise Production of Manganese Ore, 2018-19 (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	**148(12)**	**35783**	**291845**	**579028**	**1207254**	**718405**	**2832315**	**21640165**
Public Sector	25	29689	167385	366973	650567	72714	1287328	13239609
Private Sector	123(12)	6094	124460	212055	556687	645691	1544987	8400556
Andhra Pradesh	**28**	**-**	**-**	**14240**	**51471**	**227968**	**293679**	**1039486**
Vizianagaram	28	-	-	14240	51471	227968	293679	1039486
Goa	**2***	**-**	**-**	**-**	**-**	**-**	**-**	**-**
South Goa	2*	-	-	-	-	-	-	-
Gujarat	**1***	**-**	**-**	**-**	**-**	-	-	-
Panchmahal	1*	-	-	-	-	-	-	-
Jharkhand	**4(1)**	**-**	**-**	**1134**	**3642**	**9**	**4785**	**39839**
Singhbhum (West)	4(1)	-	-	1134	3642	9	4785	39839
Karnataka	**11**(2)	**-**	**-**	**65092**	**173704**	**93366**	**332162**	**2276289**
Ballari	2(2)	**-**	-	65092	162909	61871	289872	2138223
Chitradurga	3	**-**	-	-	-	11930	11930	24100
Davanagere	4	**-**	-	-	10795	18615	29410	110430
Tumakuru	2	**-**	-	-	-	950	950	3536
Madhya Pradesh	**41(5)**	**-**	**149748**	**101107**	**439130**	**252753**	**942738**	**7147719**
Balaghat	31(1)	-	144874	87826	365799	42531	641030	6148359
Chhindwara	4	-	4874	13281	6809	7991	32955	365252
Jabalpur	5(4)	-	-	-	10	202231	202241	331211
Jhabua	1	-	-	-	66512	-	66512	302897
Maharashtra	**23**	**29689**	**22632**	**314211**	**330362**	**65091**	**761985**	**7999939**
Bhandara	3	29689	319	184853	241492	48275	504628	4916022
Nagpur	20	-	22313	129358	88870	16816	257357	3083917
Odisha	**31(4)**	**6094**	**119465**	**83244**	**194963**	**73055**	**476821**	**3048997**
Keonjhar	17(2)	5437	119236	78030	127132	72148	401983	2342651
Sundargarh	14(2)	657	229	5214	67831	907	74838	706346
Rajasthan	**1**	**-**	**-**	**-**	**9410**	**-**	**9410**	**28230**
Banswara	1	-	-	-	9410	-	9410	28230
Telangana	**6**	**-**	**-**	**-**	**4572**	**6163**	**10735**	**59666**
Adilabad	6	-	-	-	4572	6163	10735	59666

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

** Only labour reported.*

Table – 5 (B) : Gradewise Production of Manganese Ore, 2019-20 (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	**131(12)**	**22572**	**270019**	**554104**	**1244372**	**813306**	**2904373**	**19416386**
Public Sector	24	20701	151401	363891	603094	157831	1296918	10660233
Private Sector	107(12)	1871	118618	190213	641278	655475	1607455	8756155
Andhra Pradesh	**25**	**-**	**-**	**23770**	**75723**	**231537**	**331030**	**1317483**
Vizianagaram	25	-	-	23770	75723	231537	331030	1317483
Goa	**2***	**-**	**-**	**-**	**-**	**-**	**-**	**-**
South Goa	2*	-	-	-	-	-	-	-
Gujarat	**1***	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Panchmahals	1*	-	-	-	-	-	-	-
Jharkhand	**2(1)**	**-**	**-**	**-**	**4785**	**-**	**4785**	**35577**
Singhbhum (West)	2(1)	-	-	-	4785	-	4785	35577
Karnataka	**9(2)**	**-**	**525**	**42799**	**209529**	**80572**	**333425**	**2284994**
Ballari	1(2)	-	525	42799	199449	53676	296449	2159479
Chitradurga	2	-	-	-	-	11296	11296	27861
Davanagere	4	-	-	-	10080	15600	25680	97654
Tumakuru	2*	-	-	-	-	-	-	-
Madhya Pradesh	**41(5)**	**-**	**124736**	**106473**	**403046**	**323909**	**958164**	**6160735**
Balaghat	31	-	124496	101673	344014	106863	677046	5254222
Chhindwara	4	-	240	2140	11068	5985	19433	115558
Jabalpur	5(5)	-	-	-	-	202115	202115	498100
Jhabua	1	-	-	2660	47964	8946	59570	292855
Maharashtra	**19**	**20701**	**27152**	**294482**	**297140**	**82045**	**721520**	**6127232**
Bhandara	2	20701	2303	209047	126430	63615	422096	3568394
Nagpur	17	-	24849	85435	170710	18430	299424	2558838
Odisha	**26(4)**	**1871**	**117606**	**86580**	**236442**	**95243**	**537742**	**3409984**
Keonjhar	15(2)	1504	117606	81493	158132	94444	453179	2591817
Rayagada	1	-	-	8	644	-	652	5056
Sundargarh	10(2)	367	-	5079	77666	799	83911	813111
Rajasthan	**1**	**-**	**-**	**-**	**9937**	**-**	**9937**	**29811**
Banswara	1	-	-	-	9937	-	9937	29811
Telangana	**5**	**-**	**-**	**-**	**7770**	**-**	**7770**	**50570**
Adilabad	5	-	-	-	7770	-	7770	50570

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

** Only labour reported.*

Table – 6 : Production of Manganese Ore, 2018-19 and 2019-20 (By Frequency Groups)

(Quantity in tonnes)

Production Group	No. of mines		Production		Percentage in total Production		Cumulative percentage	
	2018-19	2019-20 (P)	2018-19	2019-20 (P)	2018-19	2019-20 (P)	2018-19	2019-20 (P)
Total	**148(12)**	**131(12)**	**2832315**	**2904373**	**100.00**	**100.00**	**-**	-
Up to 1000	73(1)	60(1)	9535	8341	0.34	0.29	0.34	0.29
1001 – 5000	25(5)	21(4)	81444	68047	2.88	2.34	3.22	2.63
5001 – 10000	18(1)	14(1)	144284	119746	5.09	4.12	8.31	6.75
10001 – 20000	8(1)	11(3)	132711	195724	4.69	6.74	13	13.49
20001 – 30000	4(1)	6	110633	146764	3.91	5.05	16.91	18.54
30001 – 40000	4(1)	3	171901	103484	6.07	3.56	22.98	22.1
40001 – 50000	2(1)	2(1)	145223	142813	5.13	4.92	28.11	27.02
50001 and above	14(1)	14(2)	2036584	2119454	71.91	72.97	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, 2018-19 (By States/Grades)

(In tonnes)

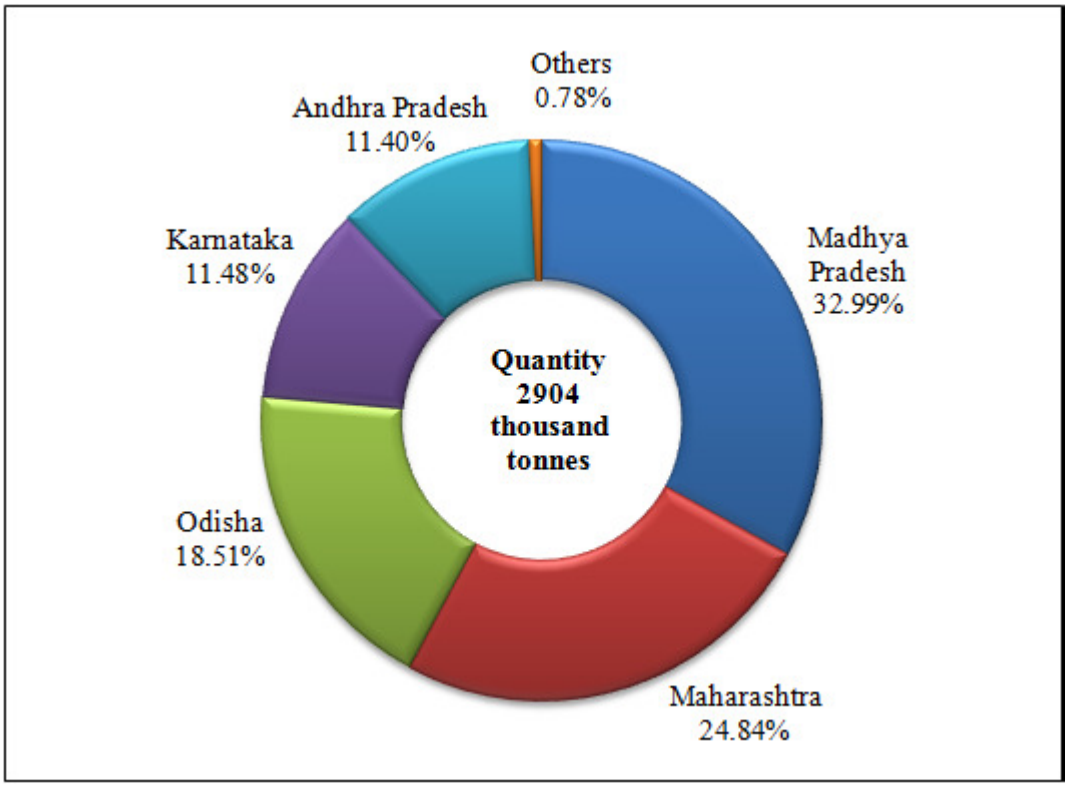
State	Grades : Mn content					Total Quantity
	MnO_2	46% and above	35% to below 46%	25% to below 35%	below 25%	
India	**17446**	**20774**	**74310**	**384587**	**2386414**	**2883531**
Andhra Pradesh	-	-	19	33597	19112	52728
Goa	-	-	-	-	-	-
Gujarat	-	-	-	-	597329	597329
Jharkhand	1	23	779	3596	189	4588
Karnataka	-	-	98	25174	214916	240188
Madhya Pradesh	-	14664	19469	49172	477045	560350
Maharashtra	15077	734	17715	22972	23053	79551
Odisha	2368	5353	36096	247660	1053553	1345030
Rajasthan	-	-	-	1529	-	1529
Telangana	-	-	134	887	1217	2238

Table – 7 (B) : Mine-head Closing Stocks of Manganese Ore, 2019-20 (P) (By States/Grades)

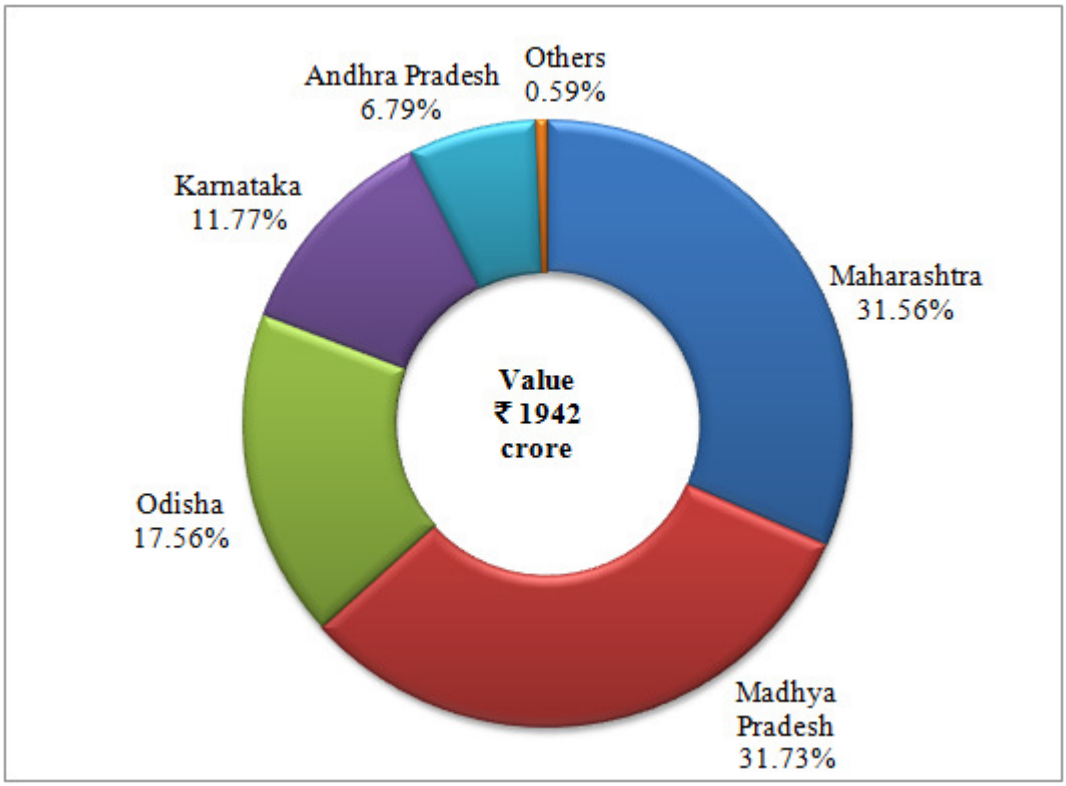
(In tonnes)

State	Grades : Mn content					
	MnO_2	46% and above	35% to below 46%	25% to below 35%	below 25%	Total Quantity
India	22187	22224	97020	384179	2601677	3127287
Andhra Pradesh	-	-	19	35384	32464	67867
Goa	-	-	-	-	-	-
Gujarat	-	-	-	-	549066	549066
Jharkhand	-	18	1	3634	-	3653
Karnataka	-	525	8639	50122	202085	261371
Madhya Pradesh	-	13689	21400	35628	662111	732828
Maharashtra	19838	3541	33147	30513	56186	143225
Odisha	2349	4451	33814	227058	1098498	1366170
Rajasthan	-	-	-	1408	-	1408
Telangana	-	-	-	432	1267	1699

Quantity of Manganese Production in Different States, 2019-20



Value of Manganese Production in Different States, 2019-20



MINING, PROCESSING, MARKETING & TRANSPORT

Manganese ore mining in the country is carried out by opencast as well as by underground methods. Of the 131 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 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 is in progress. Sinking of high speed vertical shafts up to 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 m^3 capacity of shovels and 20–25 tonnes dumpers are used for production, loading and 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. It has also 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 has plans to set up a sintering plant for agglomeration of these fines. After agglomeration, these fines will be utilised in ferroalloys 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 Ferromanganese 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.

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.

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 March, 2019). Manganese ore is an important material in iron and steel metallurgy, where it is used both in the ore form 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 & Steel Industry, the BIS:11281-2005 (Reaffirmed March, 2021) 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 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 production of ferromanganese are prescribed by the Bureau of Indian Standards vide IS: 4763-2006, (Second Revision, Reaffirmed January, 2017). BIS has also laid down the specifications of manganese ore sinters for blending for ferromanganese production vide IS:12596-1989 (Reaffirmed March, 2019). User's specifications of manganese ore for Ferromanganese/Silico-manganese industries are furnished in Table-8.

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_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 Sept. 2015) 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 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.

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 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 compositions as laid down in IS : 5713-1981 (First Revision, Reaffirmed April 2021) by BIS.

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 2.62 million tonnes in 2019-20 as against 2.89 million tonnes in 2018-19. Ferroalloys industries accounted for about 91% consumption followed by Iron & Steel (8%). The remaining (1%) was shared by Battery, Electrode, Chemical, Zinc Smelter and Alloy Steel industries (Table- 9).

Table – 9 : Estimated Consumption* of Manganese Ore, 2017-18 to 2019-20 (By Industries)

(In tonnes)

Industry	2017-18	2018-19 (R)	2019-20 (P)
All Industries	**2701700**	**2886000**	**2616000**
Ferroalloys	2538100	2695900	2387600
Iron & steel	128100	167700	204200
Others: (Chemical, Electrode, Pelletisation, Sponge Iron etc.)	35500	22400	24200

Figures rounded off

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

Note: The apparent consumption of manganese ore during 2019-20 has been estimated at 6.9 million tonnes.

INDUSTRY

Manganese alloys are the largest produced ferroalloys in the world with a share of about 41% of the global production of ferroalloys. For production of one tonne of ferromanganese, 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/ silicomanganese 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. In 2019-20, about 925 tonnes of EMD was produced as against 992 tonnes in 2018-19.Ferromanganese plant of 10,000 tonnes per annum capacity has been set up at Bharveli, Balaghat. In 2019-20, 10,421 tonnes of ferro-manganese was produced as compared to 11,003 tonnes in the previous year.

Ferromanganese

The total production of various types of manganese alloys (high-carbon ferromanganese, medium-carbon ferromanganese and low-carbon ferromanganese) was about 5.18 lakh tonnes in 2018-19 as per Monthly Statistics of Mineral Production (March, 2020). Further, production of ferromanganese during 2019-20 is not available in the source. It is to be noted that the data coverage is partial and does not reflect the actual production. Sale of ferromanganese has decreased from 12,199 tonnes in the year 2018-19 to 6,817 tonnes in the year 2019-20.

Silicomanganese

Silicomanganese is a combination of 60-70% Mn, 10-20% silica and about 20% carbon. As per Monthly Statistics of Mineral Production (March, 2020), production of silico-manganese was reported at 3,20,594 tonnes in 2019-20 as compared to 3,42,591 tonnes in 2018-19. It is to be noted that the data coverage is partial and does not reflect the actual production. MOIL was considering setting up of ferro-manganese and silicomanganese 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 ferromanganese and 37,000 tpy silicomanganese 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 and consequently no further development in respect of both these joint venture companies were reported during the year were reported.

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 2018-19 and 2019-20 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. Sale quantity of EMD has decreased slightly from 987 tonnes in the year 2018-19 to 930 tonnes in the year 2019-20.

RESEARCH & DEVELOPMENT

The CSRI-Institute of Scientific and Industrial Research, Bhubaneswar, in its Annual Report has reported that during 2019-20, a project was carried out for manganese ore beneficiation with an objective to meet the increased demand for manganese alloys and compounds for various industries and to offset the shortage of manganese ore to serve this demand. World manganese resources are classified into 3 major categories, i.e., oxide, siliceous and carbonate ores considering the beneficiation characteristics. Selection of the appropriate beneficiation process depends on the gangue minerals and their association. Gravity separation methods are applied on the siliceous ores and these are in industrial practice. Iron ore minerals are always found as an impurity in all kind of manganese ores, however, these are successfully removed using variety of magnetic separation processes or reduction roasting followed by magnetic separation. The Mn value could be enhanced from 28% to 40%.

With the high-grade non-renewable Mn ore depleting at a faster rate, the attention shifts to alternative routes, such as, lean-grade Mn ore to produce ferro-manganese. CSIR-IMMT, Bhubaneswar, made efforts to perform smelting reduction studies of lean-grade manganese ore

supplied. The obtained lean-grade Mn ore was subjected to crushing and grinding operation followed by scrubbing, reduction roasting studies and wet magnetic separation to separate out the magnetic and non-magnetic fractions. Finally, smelting reduction studies in a plasma arc furnace were conducted to the produce ferro-manganese from the non-magnetic fraction of the sinter and pig iron from the magnetic fraction of the sinter. The attempts taken to produce ferro-manganese by enriching the lean-grade Mn ore was successfully achieved by this novel pyrometallurgical technique.

Manganese Ore India Ltd. (MOIL), in its Annual Report during 2019-20, efforts taken under its R&D in the area of Mine Environment, Mining Technology-Subsidence and Patent, Mineral Conservation, Sustainable Development Framework, Underground Mechanization, Mineral Beneficiation, Metallurgical Studies, Exploration & Petrography, Remote Sensing Study, R & D in cement Concrete and XRF analyzer. Some of the R & D activities are given below:

(A) In area of mine environment, Ventilation reorganization studies for deeper levels have been conducted at Balaghat Mine and sinking has been commenced for 5m diameter ventilation drifts.

(B) For the mine safety, MOIL conducted (i) In-house 3-D analysis of subsidence parameters has been carried out by MOIL and found no noticeable movements in any orthogonal direction above the ground at Munsar Mine. (ii) CSIR-CIMFR, Nagpur and Dhanbad centre have been engaged to design support system for better safety and productivity of ROM at Balaghat and Ukwa underground mines. (iii) Designed in-house rock mechanics software 'MOIL-RMR' for rock mass characterization and support design. (iv) Modern rock mechanics instruments like MPBX, Strain Bars, Load Cells for indicating displacement/load on travelling/ haulage road, stopes have been installed in all the underground mines of the company for immediate information of failure in transport and travelling roadways for safety.

(C) Mine Planning and Design Department has conducted the in-house R&D study of overburden material and bottom ash to use as a fill material in underground by hydraulic transportation at Munsar Mine.

(D) For mechanical handling of ROM in drills and stopes SDL along with modern electro-hydrostatic drill machine-Universal Drilling Machine (UDM) has been introduced on experimental basis at Chikla and Gumgaon Mine.

(E) For Mineral Beneficiation, R&D studies on "Bench scale beneficiation study on a manganese ore sample from Balaghat mine' have been carried out by Modern Mineral Processing Laboratory and Pilot Plant, Indian Bureau of Mines, Nagpur for recovery of sand and manganese separately.

(F) In the area of exploration and remote sensing study, Hydrostatic high penetration core drilling machine has been introduced in the Company for exploration. Further, MOIL has signed MoU with National Remote Sensing Centre (NRSC), Hyderabad for remote sensing studies of four districts of Madhya Pradesh, namely Balaghat, Chindwada, Jabalpur & Jhabua for identification of manganese bearing area. NRSC has submitted the report. On the basis of report MOIL has carried out field survey and applied for permission core drilling from Govt. of Madhya Pradesh in potential zone. This will help generate new mining leases in the said area.

(G) In the field of Cement concrete, pre-cast concrete columns and beams have been prepared for concreting work in underground drifts. This has improved the safety standard and reduced time for erecting of concrete supports in underground drifts. Installation is in progress at Gumgaon Mine.

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.

Table – 12 : Consumption, Specifications and Source of Supply of Manganese Ore in different Iron and Steel Plants, 2018-19 and 2019-20

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2018-19	2019-20 (P)	2018-19	2019-20 (P)		
Bhilai Steel Plant, Bhilai Nagar, Durg Chhattisgarh.	Hot metal 4751515	Hot metal NA	6186	NA	Size: 25 to 85 mm Mn: 30% min. SiO_2: 30% max. Al_2O_3: 5% max. P: 0.3% max.	MOIL/ Tirodi Balaghat
Bokaro Steel Plant, Bokaro, Jharkhand.	Hot metal 4209268	Hot metal 4086135	NA	NA	NA	-
Durgapur Steel Plant, Durgapur, West Bengal.	Hot metal 2515068	Hot metal 2403284	NA	NA	NA	-
Rourkela Steel Plant, Rourkela, Odisha.	Hot metal 3836421	Hot metal 3624686	NA	NA	-	-
IISCO Steel Plant, Burnpur, Dist. Burdwan, West Bengal- 713 325.	Hot metal 2200348	Hot metal 2505193	NA	NA	NA	-
Visvesvaraya Iron and Steel Ltd, Bhadravati, Shivamogga, Karnataka.	Hot metal NA	Hot metal NA	NA	NA	-	-
KIOCL Ltd, Pellet Plant, Mangaluru, Dakshina Kannada, Karnataka.	Hot metal NA	Hot metal NA	NA	NA	NA	-
Visakhapatnam Steel Plant, Visakhapatnam, Andhra Pradesh.	NA	NA	NA	3205	25% to below 35% Mn Below 25% Mn	-
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 NA	Hot metal NA	NA	NA	Mn 28-35% Mn	-

(contd)

Table - 12 (contd)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2018-19	2019-20 (P)	2018-19	2019-20 (P)		
Tata Steel Ltd, Jamshedpur, Jharkhand.	Hot metal 10839210	Hot metal 10774978	296	-	Mn 25% to below 35%	Bichakundi Mine, Keonjhar
Kirloskar Ferrous Industries Ltd, Bevinahalli, 583 234, Koppal, Karnataka.	Pig iron 397046	Pig iron 385510	8159	NA	NA	NA
LANCO Industries Ltd, Chittoor, Andhra Pradesh.	Pig iron+ (molten metal) NA	Pig iron+ (molten metal) NA	NA	NA	NA	NA
Visa Steel Ltd, Kalinganagar, Jajpur, Odisha.	Hot metal 11920	Hot metal -	-	-	25% to below 35% Mn	-
Sunflag Iron & Steel Co. Ltd, Warrthy, Bhandara, Maharashtra.	Hot metal 311821	Hot metal 304265	659	-	25% to below 35% Mn	-
Jaiswal Neco Industries Ltd, Siltara, Raipur, Chhattisgarh.	Hot metal 607856	Hot metal 622867	NA	NA	NA	-
Jaiswal Neco Industries Ltd, Ballari, Karnataka.	Hot metal NA	Hot metal NA	-	-	NA	NA
JSW Steel Ltd, Salem, Tamil Nadu- 636 453.	Hot metal 950800	Hot metal 959212	NA	NA	NA	NA
JSW Steel Ltd, Vidyanagari, Ballari, Karnataka.	Hot metal 11598167	Hot metal 11195349	NA	NA	NA	NA
Rashmi Metaliks Ltd, Gokulpur, West Midnapore, West Bengal.	Hot metal 172612	Hot metal 179987	450	662	NA	NA
Sona Alloys P. Ltd, Lonad, Pune, Maharashtra.	Hot metal NA	Hot metal NA	NA -	NA -	NA -	NA -
Aparant Iron & Steel Pvt. Ltd, Goa.	Pig Iron NA	Pig Iron NA	NA	NA	NA	NA
Uttam Galva Metallics Ltd, Bhugaon- 442 001, Wardha, Maharashtra.	Hot metal 476535	Hot metal 487214	NA	NA	NA	NA
Tata Metaliks Ltd, Gokulpur, Maheshpur West Bengal.	Hot metal 518170	Hot metal 543932	9576	8976	25% to below 35% Mn Below 25% Mn	NA

(contd)

Table - 12 (concld)

Plant	Production of pig iron/hot metal (tonnes)		Consumption of Mn-ore (tonnes)		Specifications of ore consumed	Source
	2018-19	2019-20 (P)	2018-19	2019-20 (P)		
Vedanta Ltd, Navelim Amona, Marcela, Goa.	683025	682726	-	642	Below 25% Mn	-
Neelachal Ispat Nigam Ltd, Kalinga Nagar,	NA	NA	NA	NA	-	-
Duburi, Jajpur, Odisha. Suraj Products Ltd, Barpali, Rajgangpur, Sundargarh, Odisha.	NA	NA	NA	NA	-	-
Jindal Saw Ltd, Mundra, Gujarat.	478861	491626	3801	3164	Mn 25% to below 35%	-
SLR Metaliks Ltd, Narayan Devara Kere, Hagari Bommana Halli, Karnataka	246651	229646	NA	61.44	-	-

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 as per ITC (HS), 2018 schedule 2 as follows:

HS Code	Item description	Policy
2602 00	Manganese ores and concentrates including ferruginous Manganese ores and concentrates with Manganese content of 20% or more calculated on the dry wet.	Free

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 reserves of manganese ore is approximately 1,300 million tonnes of metal content which is unevenly distributed (Table-13). Reserves are located in South Africa (40%), Brazil (21%), Australia (18%), Gabon (5%), China (4%) and India (3%). Only a small fraction of global manganese reserves is economical. This fact continues to prompt and support interests 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 reportedly has less than 1% world reserves and the United States is said have lean-grade reserves which would

potentially entail high extraction cost. This situation has created an active global trade in manganese ore and manganese alloys.

World production of manganese ore in 2019 was estimated to be around 57 million tonnes as compared to 55 million tonnes in 2018. South Africa was the leading producer contributing about 30% followed by Gabon (13%), Australia (12%), China (11%), Ghana (10%), Brazil (6%), India (5%), Ukraine (3%) and Ivory Cost (2%) (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)	**1300000**
Australia[(a)]	230000
Brazil	270000
Burma	NA
China	54000
Cote d'Ivoire	NA
Gabon	61000
Georgia	NA
Ghana	13000
India*	34000
Kazakhstan, (concentrate)	5000
Malaysia	NA
Mexico	5000
South Africa	520000
Ukraine, (concentrate)	140000
USA	-
Other countries	Small

Source: *USGS Mineral Commodity Summaries, 2021.*

(a): Joint Ore Reserve Committee compliant reserves were about 76 million tonnes gross weight.

NA: Not Available; - : Zero

**: 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.*

FOREIGN TRADE

Exports

Exports of manganese ore (total) increased marginally by 4% to 58,198 tonnes in 2019-20 from 55,845 tonnes in 2018-19. Out of the total exports in 2019-20, only 5 tonnes of manganese ore having +46% Mn of value ₹3,00,000 was exported. Exports

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

(In '000 tonnes)

Country (Rounded off)	2017	2018	2019
World:Total	**52300**	**54600**	**56600**
South Africa	14144	14919	17009
Gabon	5079	6542	7186
Australia	6172	7212	6649
China	11333	7977	6500
Ghana	3004	4552	5383
Brazil	3273	3200	3200
India*	2600	2820	2956
Ukraine	1758	1845	1854
Ivory Cost	475	792	1200
Other countries	4471	4737	4651

Source: *BGS, World Mineral Production, 2015-2019.*

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

** India's production of manganese ore in 2017-18, 2018-19 and 2019-20 was 2,600 thousand tonnes, 2,832 thousand tonnes and 2,904 thousand tonnes, respectively.*

of manganese ore (others) were at 49,206 tonnes as compared to 55,843 tonnes in the preceding year. About 47% of exports were to China followed by to Indonesia with 37% and UAE with 10%. In term of value, UAE (35%), Indonesia (23%) and China (22%) and Oman (19%) were among the leading countries in term of export of manganese ore. Exports of manganese oxide (total) increased by 58% to 28,486 tonnes in 2019-20 as against 18,035 tonnes in 2018-19. Manganese dioxide exports in 2019-20 increased manifolds by 351% to 11,413 tonnes from 2,529 tonnes in 2018-19. Exports were mainly to UAE (53%), Iran (20%), USA (10%) and Kenya, UK, Netherlands & Poland (2% each). In 2019-20, exports of manganese & alloys (including waste & scrap) decreasemarginally by 8% to 418 tonnes as compared to 456 tonnes in the previous year. Exports of manganese & alloys (wrought & unwrought) in 2019-20 decreased drastically by 67% to 136 tonnes as compared to 414 tonnes in the previous year. Export of manganese oxide is increased by 58% to 28,486 tonnes in 2019-20 as compared to previous year (Tables- 15 to 28).

Imports

Imports of manganese ore (total) increased drastically by 55% to 4.32 million tonnes in 2019-20 from 2.78 million tonnes in the previous year. South

Africa (67%), Australia (11%), Gabon (5%), Brazil & UAE (4% each) and Singapore (3%) were the main suppliers of manganese ore in 2019-20. Out of the total manganese ore imported, the contribution of manganese ore having +46% Mn was 1,91,765 tonnes (4%), manganese ore having 35-46% Mn was 18,71,739 tonnes (43%), manganese ore having 30 to 35% Mn was 4,32,072 tonnes (10%) and manganese ore (others) was 17,73,356 tonnes (41%). In 2019-20, imports of manganese dioxide were 10,607 tonnes. Imports were mainly from China (66%), Belgium (19%) and Peru (14%). In 2019-20 imports of manganese oxide (total) were 18,239 tonnes. During 2019-20, imports of manganese & alloys (including waste and scrap) were 45,197 tonnes, out of which manganese & alloys (wrought/unwrought) comprised 44,581 tonnes. Imports of manganese & alloys NES were 598 tonnes during 2019-20. Imports of manganese waste & scrap were at 17 tonnes in 2019-20 (Tables- 29 to 43).

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**55845**	**138120**	**58198**	**254643**
UAE	-	-	5887	88687
Indonesia	22535	75396	21600	59179
China	33000	49003	27500	55197
Oman	-	-	3098	48698
Bangladesh	-	-	40	991
Sri Lanka	50	1023	25	548
Uganda	64	864	21	527
Kenya	11	255	16	417
Lebanon	-	-	5	298
Tanzania	3	35	4	48
Other countries	182	11544	2	53

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2**	**55**	**5**	**300**
Lebanon	-	-	5	298
Nepal	-	-	++	1
Turkey	2	55	-	-

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**55843**	**138063**	**49206**	**116934**
Indonesia	22535	75396	21600	59179
China	33000	49003	27500	55197
Bangladesh	-	-	40	991
Sri Lanka	50	1023	25	548
Uganda	64	864	21	527
Kenya	11	255	16	417
Tanzania	3	35	4	48
Burundi	-	-	++	17
Nepal	8	438	++	11
Netherlands	100	6559	-	-
Other countries	72	4490	-	-

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**18035**	**928690**	**28486**	**1382052**
UAE	563	28037	6143	307406
Iran	-	-	2300	104356
Indonesia	1282	73447	1876	99850
Vietnam	1441	81604	1457	79180
France	3153	138637	2805	78860
Spain	786	40177	1400	70245
USA	429	29893	1373	68893
Turkey	548	29244	1105	60290
Canada	1151	68183	1070	58998
UK	815	51023	975	53249
Other countries	7867	388444	7983	400725

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2529**	**118447**	**11413**	**549640**
UAE	480	23665	6063	303005
Iran	-	-	2300	104356
USA	6	1175	1122	49979
UK	240	20029	250	16495
Netherlands	21	1725	175	11535
Poland	319	19509	195	11409
Bangladesh	269	7576	161	5595
Kenya	253	4494	254	5133
Malaysia	105	6543	60	3949
Ireland	-	-	50	3525
Other countries	835	33730	782	34659

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**15506**	**810243**	**17073**	**832412**
Indonesia	1282	73387	1850	98570
France	3153	138637	2805	78860
Vietnam	1339	78499	1356	76325
Spain	775	39278	1375	68411
Canada	1151	68182	1050	57356
Turkey	521	28108	1057	57032
Thailand	438	24165	862	47558
Australia	1232	54774	867	42872
Russia	533	29400	842	42312
UK	575	30994	725	36754
Other countries	4507	244818	4284	226361

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**456**	**312178**	**418**	**343898**
France	282	197735	299	242114
China	51	46336	42	37917
Croatia	9	12804	8	12323
Brazil	6	8270	5	8113
Italy	3	5406	3	6977
Philippines	22	4409	22	5655
Romania	2	4424	3	4709
Poland	3	4488	3	4332
Indonesia	3	1485	9	4143
Malaysia	3	3577	3	3332
Other countries	72	23243	22	14284

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**414**	**300771**	**136**	**119132**
China	51	46323	42	37917
France	241	186443	21	18395
Croatia	9	12804	8	12323
Brazil	6	8270	5	8113
Italy	3	5406	3	6790
Philippines	22	4409	22	5655
Romania	2	4424	3	4709
Poland	3	4488	3	4332
Indonesia	3	1478	9	4143
Malaysia	3	3577	3	3332
Other countries	72	23148	18	13422

Figures rounded off

Table - 23 : Exports of Manganese :Wrought (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**12**	**2636**	**1**	**305**
UK	++	41	1	110
Malaysia	1	146	1	109
Philippines	-	-	++	26
Egypt	-	-	++	19
Pakistan	2	319	++	19
Bulgaria	-	-	++	11
Kenya	++	52	++	11
Nigeria	5	1178	-	-
Saudi Arabia	2	433	-	-
Taiwan	2	389	-	-
Other countries	++	77	-	-

Figures rounded off

Table - 24: Exports of Manganese & Alloys Unwrought (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**402**	**298135**	**135**	**118827**
China	51	46323	42	37917
France	241	186443	21	18395
Croatia	9	12804	8	12323
Brazil	5	8193	5	8113
Italy	3	5406	3	6790
Philippines	22	4409	22	5629
Romania	2	4424	3	4709
Poland	3	4488	3	4332
Indonesia	3	1478	9	4143
Malaysia	2	3431	2	3223
Other countries	61	20734	17	13252

Figures rounded off

Table - 25 : Exports of Manganese & Alloys : NES (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**++**	**82**	**258**	**218851**
France	-	-	258	218534
Italy	-	-	++	187
Switzerland	-	-	++	92
UAE	++	6	++	30
Bhutan	++	5	++	3
Congo	-	-	++	3
Serbia	++	30	++	++
UK	-	-	++	++
Uganda	++	35	-	-
Indonesia	++	6	-	-
Other countries	++	++	-	-

Figures rounded off

Table - 26 : Exports of Manganese Ore (35% Or More but Below 46% Mn) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**-**	**-**	**8987**	**137409**
UAE	-	-	5887	88687
Oman	-	-	3098	48698
Australia	-	-	2	24

Figures rounded off

Table – 27 : Exports of Manganese Ore (Ferruginous, 10% or More but Below 30% Mn) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**++**	**2**	**-**	**-**
Maldives	++	2	-	-

Figures rounded off

Table – 28 : Exports of Manganese Waste & Scrap (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**41**	**11325**	**24**	**5916**
France	41	11292	20	5184
Saudi Arabia	-	-	4	732
Spain	++	21	-	-
China	++	13	-	-

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2784473**	**48484512**	**4316572**	**41282102**
South Africa	1254315	20953738	2901445	20518427
Australia	224161	5129502	461946	6947206
Gabon	227873	3529302	219280	3284695
Brazil	210423	4169187	178362	2923246
Singapore	159424	3401667	133117	2306104
UAE	160487	2451109	185788	1847279
Cote d'Ivoire	218262	2931916	97624	1203534
Hong Kong	53108	852987	56692	748617
Zambia	38324	690991	27632	462095
France	41630	916413	21850	434181
Other countries	196466	3457701	32835	606717

Figures rounded off

Table – 30 : Imports of Manganese Ore (46% or more Mn) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**219962**	**5275365**	**191765**	**3997776**
Australia	100095	2401033	61274	1293696
South Africa	15863	307341	46805	869014
Brazil	38306	953476	34477	727823
Singapore	5211	203253	14965	366368
Cote d'Ivoire	12396	326806	12607	305908
Tanzania	11145	243190	7069	137129
Zambia	9317	171483	6932	128117
UAE	18640	452561	2111	50035
China	425	13578	1515	49088
Senegal	5066	114773	2147	45490
Other countries	3499	87871	1864	25107

Figures rounded off

Table – 31 : Imports of Manganese Ore (35% or more but below 46% Mn) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1641885**	**29972598**	**1871739**	**26995931**
South Africa	749657	13966672	943644	13567431
Australia	92253	1972141	362861	4961059
Gabon	185054	3002040	183230	2852359
Brazil	90203	1671243	118233	1924127
Cote d' Ivoire	92464	1329363	72677	793527
Singapore	126289	2592572	40806	638022
UAE	85534	1345064	49769	626849
HongKong	23430	416729	44749	621055
France	41630	916413	21850	434181
Zambia	23825	424623	18648	298504
Other countries	131547	2335738	15272	278817

Figures rounded off

Table – 32 : Imports of Manganese Ore (30% or more but below 35% Mn) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**395736**	**4809679**	**432072**	**4049808**
South Africa	205999	2440126	280837	2676028
UAE	44818	554253	102281	869313
Gabon	35851	445957	16815	189349
Hong Kong	29678	436257	10945	113897
Cote d' Ivoire	71331	838567	12336	104073
Brazil	1052	13798	3095	31532
Singapore	-	-	1980	19681
Turkey	1708	19260	1367	16486
Zambia	-	-	959	16031
Seychelles	-	-	1290	11474
Other countries	5299	61460	167	1944

Figures rounded off

Table – 33 : Imports of Manganese Ore (Others) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**428446**	**7545577**	**1773356**	**5844007**
South Africa	248937	3949261	1606830	3207626
Singapore	27924	605842	72414	1253884
Australia	31813	756329	37811	692451
Gabon	6968	81305	19235	242987
Brazil	80862	1530670	22558	239765
UAE	996	8614	10984	137245
Senegal	1345	27251	1429	28817
Zambia	5182	94885	1093	19443
Tanzania	10533	212027	973	19219
China	-	-	25	2317
Other countries	13886	279393	4	254

Figures rounded off

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

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**9164**	**892943**	**10607**	**963138**
China	6199	743044	6961	841248
Belgium	1417	68718	2041	68780
Peru	1257	41528	1453	40095
UAE	12	5261	64	5999
Netherlands	-	-	70	3409
Italy	-	-	6	1873
USA	9	2287	9	1452
UK	++	153	++	153
Germany	++	132	3	115
Canada	-	-	++	12
Other countries	270	31821	++	3

Figures rounded off

Table – 35 : Imports of Manganese Oxide (Other than Manganese Dioxide) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**14813**	**552990**	**7632**	**362571**
South Africa	12960	313552	6226	164107
Belgium	816	126879	620	92853
China	370	60939	224	32701
Malaysia	-	-	99	24340
Germany	17	6828	35	13308
Spain	-	-	150	10218
USA	63	7875	76	9621
UAE	27	11253	16	6386
France	-	-	30	2868
Italy	2	368	26	1747
Other countries	558	25296	131	4424

Figures rounded off

Table –36 : Imports of Manganese & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**45868**	**7676645**	**45197**	**6188385**
China	43752	7031795	43709	5629033
France	379	281390	427	310078
Sweden	136	125498	130	127017
Hong Kong	895	132905	654	82810
Korea, Rep. of	83	13143	115	14899
Br. Virgin Is	74	10241	50	6831
South Africa	65	9133	20	4541
Saudi Arabia	5	1205	38	4428
Germany	++	143	25	3764
Singapore	125	20015	25	3016
Other countries	354	51177	4	1969

Figures rounded off

Table –37 : Imports of Manganese & Alloys (Wrought/Unwrought) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**45839**	**7674482**	**44581**	**5882184**
China	43751	7031668	43485	5599584
Sweden	136	125498	130	126941
Hong Kong	895	132905	654	82810
France	375	280812	39	35019
Korea, Rep. of	83	13143	115	14899
Br. Virgin Is	74	10241	50	6831
South Africa	40	8542	20	4541
Saudi Arabia	5	1205	38	4428
Germany	-	-	24	3517
Singapore	125	20015	25	3016
Other countries	354	50454	++	599

Figures rounded off

Table –38 : Imports of Manganese (Wrought) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**10223**	**1757913**	**1834**	**250991**
China	10223	1757913	1834	250991

Figures rounded off

Table –39 : Imports of Manganese & Alloys NES (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1**	**993**	**598**	**303085**
France	-	-	370	271963
China	++	127	224	29449
UAE	++	271	3	467
UK	++	284	1	461
Italy	-	-	++	336
Germany	++	143	++	247
USA	++	124	++	87
Sweden	-	-	++	77
Austria	++	42	-	-
Belgium	++	2	-	-

Figures rounded off

Table – 40 : Imports of Manganese Ore (Ferruginous, 10% or more but Below 30% Mn) (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**98443**	**881293**	**47639**	**394579**
South Africa	33860	290337	23329	198328
UAE	10499	90617	20643	163837
Singapore	-	-	2952	28148
Kenya	650	5548	665	3758
Nigeria	-	-	50	508
Cote d'Ivoire	37446	393260	-	-
Korea, Rep. of	14714	93020	-	-
Albania	735	4800	-	-
Turkey	539	3712	-	-

Figures rounded off

Table –41 : Imports of Manganese Oxide (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**23977**	**1445933**	**18239**	**1325709**
China	6569	803983	7185	873948
South Africa	12960	313552	6226	164107
Belgium	2233	195597	2661	161633
Peru	1574	51035	1453	40095
Malaysia	-	-	99	24340
Germany	17	6960	38	13423
UAE	39	16514	80	12385
USA	71	10161	85	11073
Spain	-	-	150	10218
Italy	2	368	32	3620
Other countries	511	47763	231	10869

Figures rounded off

Table - 42 : Imports of Manganese & Alloys: Unwrought (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**35616**	**5916569**	**42747**	**5631193**
China	33529	5273754	41651	5348593
Sweden	136	125498	130	126941
Hong Kong	895	132905	654	82810
France	375	280812	39	35019
Korea, Rep. of	83	13143	115	14899
Br Virgin Is	74	10241	50	6831
South Africa	40	8542	20	4541
Saudi Arabia	5	1205	38	4428
Germany	-	-	24	3517
Singapore	125	20015	25	3016
Other countries	354	50454	++	599

Figures rounded off

Table – 43 : Imports of Manganese Waste and Scrap (By Countries)

Country	2018-19 (R)		2019-20 (P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**28**	**1169**	**17**	**3116**
France	3	578	17	3096
USA	-	-	++	20
South Africa	25	591	-	-

Figures rounded off

FUTURE OUTLOOK

As per World Steel Association, in 2019-20 India's per capita steel consumption is about 74.7 kg as against the world's per capita consumption of 230.3 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 89.79 million tonnes in 2015-16 to 109.14 million tonnes in 2019-20 registering a CAGR of 5 per cent. 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 production 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" has targets 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.