

GS GEOGRAPHY SERIES · BOOK 4 OF 4

Human & Economic Geography

Resources, energy, industries, transport, ports, trade, population, migration, settlements and tribes of India and the world, mapped for the UPSC Civil Services Examination: Prelims, GS Paper I and GS Paper III

RESOURCES

INDUSTRIES

TRADE

POPULATION

**27**

chapters

500+

maps, diagrams and photos

440+

previous-year questions

2026

edition, updated to Oct 2026

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Four parts, twenty-seven chapters. Each chapter ends with its own Previous Year Questions.

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HUMAN & ECONOMIC GEOGRAPHY

PRELIMS · GS PAPER I

Iron and Steel Industry

To make one tonne of steel in a blast furnace, a plant swallows roughly one and a half tonnes of iron ore and close to a tonne of coking coal, and loses most of that weight as gas and slag. For a century this arithmetic tied steel to coalfields and ore belts: the Ruhr, Pittsburgh, the Donbas and India's own Chotanagpur crescent. Cheap ocean freight, scrap-melting electric furnaces and gas- or coal-based direct reduction have since loosened the tie, pulling new plants to coasts and markets. India, the world's second largest producer since 2018, made 170 million tonnes of crude steel in 2025-26 and aims at 300 million tonnes of capacity by 2030-31, while the industry everywhere faces the hardest question of all: how to make steel without coal.

SYLLABUS

PRELIMS

Indian and World Geography: Economic Geography of India and the World (steel-making processes, raw materials, major plants and producing regions, policies and data in the news)

MAINS · GS PAPER I

Factors responsible for the location of secondary sector industries in various parts of the world (including India); distribution of key natural resources. GS III links: infrastructure and industrial policy, effects of liberalisation on industry, trade remedies, industrial pollution and decarbonisation

CONTENTS

01 Iron and Steel: The Basic Industry	02 How Steel Is Made
03 Raw Materials and Factors of Location	04 Growth of the Indian Industry
05 Integrated Steel Plants of India	06 Coastal Plants and the New Map
07 Mini Steel Plants and the Secondary Sector	08 Production, Consumption and Trade
09 Policy: NSP 2017, PLI, Trade Remedies, Green Steel	10 Problems and Prospects
11 The World Steel Industry	12 Major Steel Regions of the World
13 World Trade in Iron Ore and Steel	14 Previous Year Questions

This chapter covers:

- pig iron, cast iron, steel and alloy steels; the blast furnace–oxygen furnace, direct reduction, electric arc and induction furnace routes; hydrogen-based green steel;
- raw materials and the changing pulls on location: forest, coalfield, ore field, coast, market and scrap;
- the history of the Indian industry, every major integrated plant with its ore, coal, water and port links, the coastal plants, and the secondary sector of sponge-iron and induction-furnace units;
- production, consumption, trade, the National Steel Policy 2017, PLI for specialty steel, the 2025 safeguard duty, the green steel taxonomy, problems and prospects;

- world production, the great steel regions from Pittsburgh and the Ruhr to Anshan and Minas Gerais, and the seaborne trade in iron ore and steel.

Iron ore and the ferro-alloy metals are mapped in Chapter 02 and coking coal in Chapter 05; this chapter treats steel as an industry. The next chapter covers the non-ferrous metal industries.

01 Iron and Steel: The Basic Industry

Steel is the material on which almost every other industry stands: rails, bridges, ships, machines, cars, pipelines, power towers and the reinforcement inside concrete. That is why the iron and steel industry is called a **basic** (or key) industry, and why its scale of inputs and outputs makes it the classic **heavy industry**. Its plants create dense linkages: backward to mines, collieries, railways and ports; forward to engineering, construction, automobiles and defence. A steel town such as Jamshedpur, Bhilai or Bokaro grows a whole urban economy around one works. Steel use per person is still the most quoted single index of how far a country has industrialised.

Iron, steel and their alloys

Iron ore is an oxide; iron-making removes the oxygen, steel-making then removes most of the carbon and other impurities and adds what is wanted. The forms differ mainly in carbon content.

PRODUCT	CARBON	NATURE AND USE
Pig iron (hot metal)	about 3.5–4.5%	Liquid iron from the blast furnace, hard and brittle; feedstock for steel and foundries. India is a net exporter.
Cast iron	about 2–4%	Remelted pig iron poured into moulds: engine blocks, pipes, manhole covers, cookware. Strong in compression, brittle in tension.
Wrought iron	below 0.1%	Nearly pure, soft, fibrous and easily worked; the old iron of gates and railings. Delhi's Iron Pillar is a famous early example.
Sponge iron (DRI)	low, variable	Ore reduced without melting; porous solid, about 85–94% metallic iron; charged into electric or induction furnaces.
Carbon steel	below 2% (mild steel about 0.05–0.25%)	Strong, tough and ductile; bars, sections, sheets, pipes. The bulk of all steel.
Alloy and specialty steels	varies	Stainless (at least 10.5% chromium, often nickel) resists corrosion; tungsten , molybdenum and vanadium give tool steels that stay hard when hot; manganese steel resists wear (rails, crushers); silicon gives electrical steel (CRGO) for transformers. Coated and plated steels (galvanised, tin-plate) also count as specialty steel.

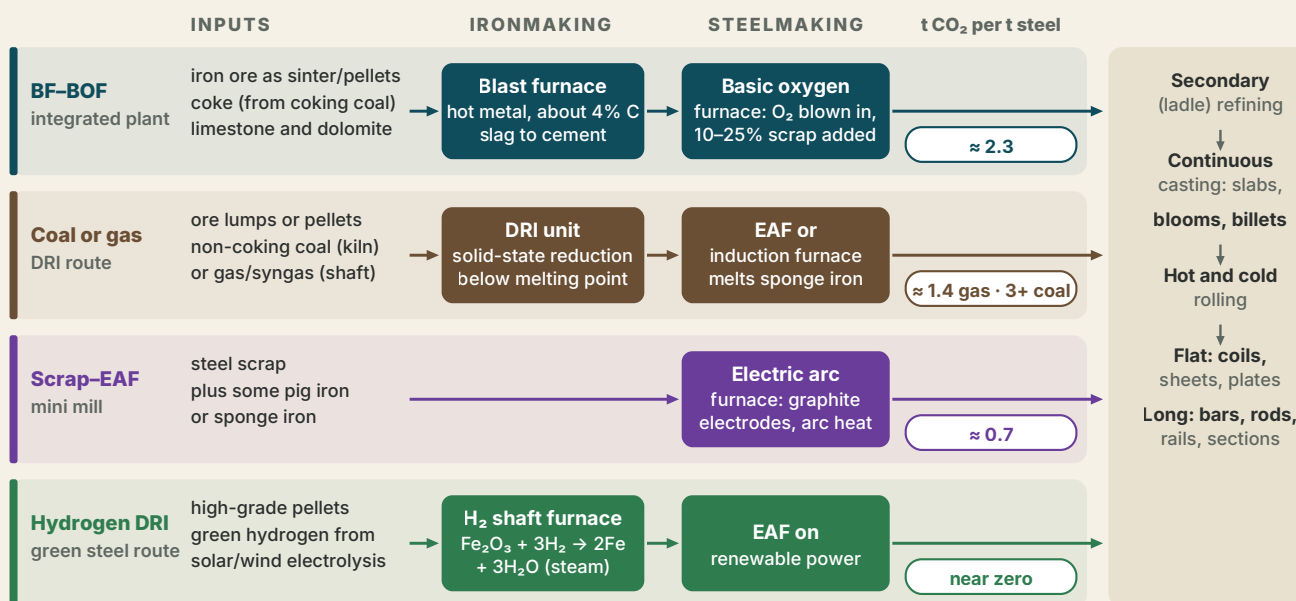
PRELIMS POINTER

Each alloying element has a job (Chapter 02): chromium for corrosion resistance, nickel for toughness, manganese as deoxidiser and for wear resistance, tungsten for hardness at high temperature, vanadium for strength, silicon for magnetic properties. The products of the integrated plant are classed as **flat** (slabs rolled into coils, sheets and plates for autos, appliances, ships and pipes) and **long** (billets and blooms rolled into bars, rods, rails and structural sections for construction).

02 How Steel Is Made

Every steel works performs two jobs: **iron-making**, which strips oxygen from the ore, and **steel-making**, which refines the iron (or melts scrap) into steel of the required chemistry. Downstream, all routes then share secondary refining, continuous casting and rolling. Four routes matter today (Fig. 11.1).

The Four Routes to Steel



CO₂: typical intensities incl. power (worldsteel averages; coal DRI from Indian estimates). Casting and rolling are common to all routes.

Fig. 11.1 The integrated blast furnace–basic oxygen furnace route, the direct-reduction route (gas or coal) feeding electric arc or induction furnaces, scrap melting in electric arc furnaces, and the emerging hydrogen route. All end in casting and rolling. Indicative CO₂ figures per tonne of crude steel.

1. Blast furnace–basic oxygen furnace (BF–BOF)

The **blast furnace** is a tall shaft charged from the top with iron ore (as lumps or, better, as **sinter** and **pellets** made from fines), **coke** and **limestone**. Hot air blown in at the bottom burns the coke. Coke does three jobs at once: it is the **fuel** that supplies heat, its gas (carbon monoxide) is the **reducing agent** that takes oxygen away from the ore, and its strong lumps hold the charge open so gas can rise. Limestone acts as a **flux**: it combines with silica and alumina in the ore to form a light liquid **slag** that floats on the iron and is tapped off. Ordinary coal cannot replace coke because it would crumble and carry too much ash and volatile matter; only **coking coal**, baked in coke ovens, works (Chapter 05). The product is liquid **hot metal** (pig iron) with about 4% carbon.

The hot metal goes to a **basic oxygen furnace** (the LD converter, first run at Linz and Donawitz in Austria in 1952), where pure oxygen is blown in to burn carbon down to steel levels in well under an hour; some scrap is added to cool the charge. It replaced the slower open-hearth furnace, which India's older plants used until the 1990s and 2000s. Modern plants inject pulverised coal to save coke and use slag in cement and roads. The route is efficient at scale (3–10 Mt a year at one site) but needs huge capital and long gestation, and is the most carbon-intensive in common use.



Fig. 11.2 Blast furnaces with their stoves and gas mains at an integrated works.

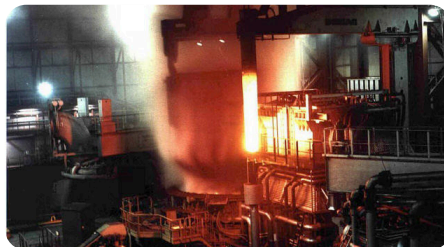


Fig. 11.3 An electric arc furnace: arcs from graphite electrodes melt scrap or sponge iron.



Fig. 11.4 Hot briquetted iron, sponge iron pressed into dense pillow shapes so it can be shipped.

2. Direct reduced iron (DRI) or sponge iron

In **direct reduction** the ore is reduced in the solid state, below its melting point (roughly 800–1,050 °C), so no coke is needed. Two technologies exist. **Gas-based** shaft furnaces (the Midrex and HYL/Energiron designs) use natural gas reformed into hydrogen and carbon monoxide; they dominate Iran, the Gulf, Egypt and Mexico. **Coal-based** rotary kilns use cheap non-coking coal; this is India's distinctive route, run by hundreds of units near ore and coal in Chhattisgarh,

Odisha, Jharkhand, West Bengal and Karnataka. A third variant, at Jindal's Angul plant, gasifies high-ash Talcher coal into a synthesis gas for a shaft furnace. The product, **sponge iron**, is melted in electric arc or induction furnaces; pressed into briquettes (**HBI**) it can travel by sea. India has been the world's largest DRI producer every year since 2003 and made 38% of the world's DRI in 2025.

3. Electric arc and induction furnaces

An **electric arc furnace** (EAF) melts a charge of scrap, sponge iron and some pig iron with an arc struck from graphite electrodes, and can refine it with oxygen and fluxes. Fed with scrap, it is the classic **mini mill**: small, cheap, quick to build and close to cities that generate scrap and buy steel. An **induction furnace** (IF) melts metal by electromagnetic induction. It is cheaper still, but it cannot remove phosphorus and sulphur, so the steel's quality depends entirely on the charge. India is unusual in making well over a third of its steel in induction furnaces.

4. Green steel and hydrogen

Steel causes about 7–9% of global CO₂ emissions, and India's plants emit about 2.5 tonnes of CO₂ per tonne of crude steel, above the world average of about 1.9, because of coal-based DRI and high-ash coal. Ways to cut it: more **scrap** melted in EAFs on renewable power; **gas-based DRI** as a bridge; **hydrogen DRI**, in which green hydrogen replaces carbon as the reductant ($\text{Fe}_2\text{O}_3 + 3\text{H}_2 \rightarrow 2\text{Fe} + 3\text{H}_2\text{O}$, so the waste is steam); hydrogen injection into blast furnaces; biomass and charcoal in place of some coke; and carbon capture. Sweden's HYBRIT pilot made the first fossil-free sponge iron in 2021; India's green steel rules are in Section 09.

03 Raw Materials and Factors of Location

An integrated works needs iron ore, coking coal (or gas, or non-coking coal for DRI), limestone and dolomite as flux, manganese and other ferro-alloys, refractories, huge volumes of water for cooling, and power. Typical world figures for one tonne of crude steel by the BF–BOF route are about **1.4 t of iron ore, 0.8 t of coking coal, 0.3 t of limestone and 0.1–0.2 t of scrap**; the scrap–EAF route needs about 0.7 t of scrap plus some iron, a little coal, and roughly 600–650 kWh of electricity. Because the inputs weigh several times the output and most of their weight is lost, steel is the textbook **weight-losing industry** of Weber's theory (Chapter 10), drawn towards its heaviest raw material unless transport changes the sums.

How the pull has shifted over time

- **Charcoal and the forest (before about 1750).** Iron was smelted with charcoal near forests and small ore deposits. Bhadravati in Karnataka used forest charcoal till the 1950s, then hydroelectricity from Sharavati (Jog).
- **The coalfield (1750–1950).** Early furnaces burnt many tonnes of coal per tonne of iron, so it was cheaper to bring ore to coal: South Wales, the English Midlands and Sheffield, the Ruhr, Pittsburgh, the Donbas, Kuzbass. In India, Jamshedpur, Burnpur, Durgapur and Bokaro grew on or near the Damodar coalfields.
- **The ore field.** As coke rates fell, ore became the heavier input in many places: Lorraine (minette ore), the Urals (Magnitogorsk), Bhilai (Dalli–Rajhara), Rourkela (Bonai–Keonjhar belt), Vijayanagar (Ballari–Hospet). Where ore and coal lie close together, as in India's Chotanagpur–Odisha crescent or Alabama's Birmingham district, the site is ideal.
- **The coast, a break-of-bulk point.** Once large bulk carriers made ocean freight cheap, plants that import ore, coal or both moved to deep-water ports: Japan's tidewater works, Pohang and Gwangyang in Korea, Baoshan, Taranto and Dunkirk, IJmuiden, and in India Visakhapatnam, Hazira, Dolvi and the Paradip–Kalinganagar belt (Section 06).
- **The market and scrap.** Mini mills melt scrap, which comes from cities; steel products are bulky and costly to haul. Market location therefore pays twice: the city is both the source of raw material and the buyer. The US mini mills of Nucor and Steel Dynamics, the induction-furnace clusters of Mandi Gobindgarh, Jalna and Raipur, and Türkiye's scrap-fed plants are examples.

Other factors

FACTOR	HOW IT WORKS, WITH EXAMPLES
Transport	Bulk rail, inland waterways and pipelines cut costs and widen site choice. The Great Lakes linked Minnesota ore with Appalachian coal; the Rhine feeds Duisburg; slurry pipelines carry ore concentrate from Bailadila to Visakhapatnam and Nagarnar and from Barbil to Paradip.
Power and water	EAFs and induction furnaces need cheap, reliable electricity; integrated plants need rivers or reservoirs (Subarnarekha and Kharkai at Jamshedpur, DVC reservoirs for Bokaro and Durgapur, Tandula for Bhilai, Sankh-Koel for Rourkela).
Fuel substitutes	Cheap gas pulls DRI to the Gulf, Iran, Trinidad, Mexico and Hazira; cheap hydropower attracted electric steel to Sweden and Norway; future green-hydrogen hubs may pull steel to sunny, windy coasts.
Government policy	Public-sector plants were placed to develop backward tribal regions (Bhilai, Rourkela, Bokaro); the freight equalisation policy (1952–93) made steel and coal cost the same across India, blunting the advantage of the mineral east; the Soviet Union spread plants east for strategic reasons; states now compete with land and mineral offers.
Industrial inertia	Once built, plants stay: sunk capital, skilled workers, linked industries and rail lines hold them after the original advantage fades. Jamshedpur now uses mostly imported coking coal; the Ruhr imports almost all its ore and coal.

84 Growth of the Indian Industry

India smelted iron for over two millennia; the rust-free Iron Pillar at Mehrauli (Gupta period) and the crucible **wootz** steel of south India, prized as Damascus steel, are proof. Modern, coal-based iron-making came later and slowly.

Milestones of the Indian Steel Industry

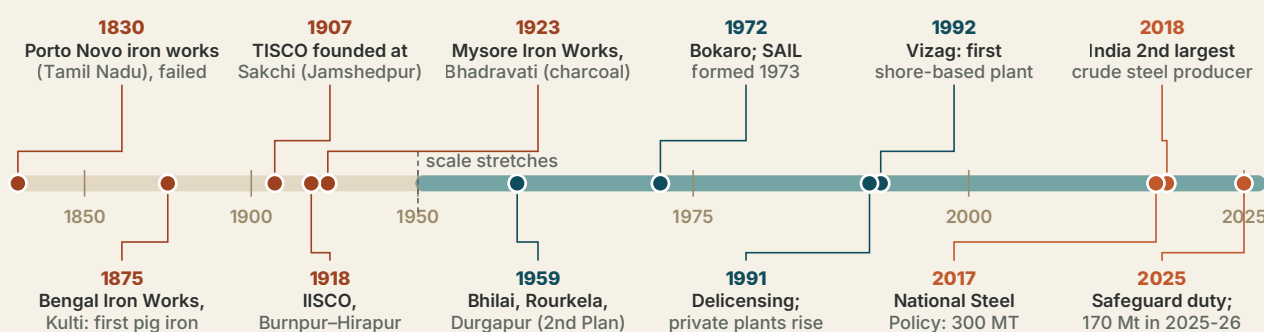


Fig. 11.5 From the failed Porto Novo works to a 170-million-tonne industry. The scale is compressed before 1950.

Before independence

The first attempt on modern lines, at **Porto Novo** (Parangipettai) on the Tamil Nadu coast in 1830, failed, as did others in the nineteenth century. The **Bengal Iron Works** at **Kulti** near Asansol made the first successful pig iron from coal in the 1870s. The real beginning was the **Tata Iron and Steel Company (TISCO)**, founded by the Tata group in 1907 at Sakchi, at the meeting of the Subarnarekha and Kharkai rivers; it made pig iron from 1911 and steel from 1912, and the town was renamed Jamshedpur. The **Indian Iron and Steel Company (IISCO)** followed in 1918 at Hirapur–Burnpur on the Damodar, later absorbing the Kulti works, and the Mysore government's **Mysore Iron Works** at Bhadravati (1923) used charcoal. At independence India had only these three works and a capacity of about one million tonnes.

The planning era (1951–1990)

Steel was reserved largely for the state under the 1956 Industrial Policy Resolution. In the **Second Five-Year Plan** three public-sector integrated plants of one million tonnes each were built by Hindustan Steel Ltd: **Bhilai** with Soviet help, **Rourkela** with West German (Krupp–Demag) help and **Durgapur** with British help, all producing by 1959–62. **Bokaro**, again Soviet-assisted, was begun in 1964–65 and made its first iron in 1972. The **Steel Authority of India Ltd (SAIL)** was formed in 1973 as the holding company; IISCO came under state management in 1972 (nationalised 1976) and was merged into SAIL in 2006; Bhadravati, renamed Visvesvaraya Iron and Steel Ltd, joined SAIL in 1989. Three southern projects of the Fourth Plan era, at **Salem** (stainless steel, 1981–82), **Vijayanagar** (Hospet) and **Visakhapatnam**, were

placed partly for regional balance (the Vijayanagar site later passed to the private Jindal, now JSW, group); Visakhapatnam, under Rashtriya Ispat Nigam Ltd (RINL, 1982), was commissioned in 1992 as India's first shore-based integrated plant. Controls, licensing and freight equalisation kept growth slow.

Liberalisation and after (1991 to now)

The 1991 reforms took iron and steel off the reserved list, ended licensing (1991), price and distribution control (1992) and freight equalisation, and opened the sector to foreign investment. Private plants rose fast: Essar at Hazira, Ispat at Dolvi, Jindal at Vijayanagar and Raigarh, Lloyds and others, and Tata expanded. Consolidation followed the insolvency law of 2016: Tata Steel bought Bhushan Steel (Meramandali) in 2018, ArcelorMittal and Nippon Steel took Essar Steel in 2019 as AM/NS India, JSW took Bhushan Power and Steel (Jharsuguda) in 2021, and Tata Steel bought Neelachal Ispat Nigam (Kalinganagar), a venture of MMTC and Odisha, in 2022. India overtook Japan as the second largest producer in 2018. Today the public sector (SAIL, RINL and NMDC Steel) makes less than a fifth of India's crude steel.



Fig. 11.6 Tata Steel's Jamshedpur works, India's oldest integrated plant still at work, beside the Subarnarekha.

95 Integrated Steel Plants of India

An **integrated steel plant** carries out every stage at one site: ore and coal handling, coke ovens, sinter and pellet plants, blast furnaces (or DRI), steel melting, casting and rolling. India's integrated plants lie mostly in a belt where iron ore, coking coal, limestone, dolomite, manganese, water and cheap labour come together: the **Chotanagpur–Odisha crescent** across Jharkhand, northern Odisha, eastern Chhattisgarh and western West Bengal (Figs. 11.7 and 11.8). The southern and western plants depend more on ports.

PLANT (STATE)	ORIGIN	IRON ORE	COAL, WATER, POWER	NOTES
PUBLIC SECTOR (SAIL; RINL; NMDC STEEL)				
Bhilai (Chhattisgarh)	USSR; 1959	Dalli–Rajhara; Rowghat being developed	Korba and imported coal; Tandula reservoir	SAIL's largest plant, about 7 Mt; main maker of rails, including long rails; on the Mumbai–Howrah line.
Rourkela (Odisha)	West Germany; 1959	Barsua, Kalta, Taldih (Sundargarh)	Jharia, Talcher, imports; Sankh and South Koel; Hirakud	First public-sector integrated plant; plates and pipes; limestone and dolomite from Birmitrapur.
Durgapur (West Bengal)	UK; 1962	Bolani (Odisha)	Raniganj–Jharia; DVC barrage and power	Wheels and axles for Railways; SAIL's Alloy Steels Plant is beside it.
Bokaro (Jharkhand)	USSR; 1972	Kiriburu–Meghahatuburu	Jharia, Bokaro; DVC	First plant built largely with Indian equipment and design; flat products; expansion to 7.25 Mt approved (2025).
IISCO, Burnpur (West Bengal)	1918; SAIL 2006	Gua, Chiria, Manoharpur	Raniganj; Damodar	Oldest of SAIL's plants; rebuilt 2015; expansion of about 4 Mt approved (2024).
Salem (Tamil Nadu)	1981–82	buys slabs and hot coils	Mettur area	Stainless steel rolling, not an iron-making plant.
Bhadravati (Karnataka)	1923; SAIL 1989	Kemmangundi (Bababudan hills)	Charcoal, then Sharavati hydel	Visvesvaraya Iron and Steel Plant; tiny alloy-steel unit with an uncertain future.
Visakhapatnam (Andhra Pradesh)	RINL; 1992	Bailadila (NMDC), by rail	Imported coking coal via Vizag port	First shore-based plant; 7.3 Mt; Navratna; revival package of ₹11,440 crore (2025).
Nagarnar (Chhattisgarh)	NMDC; 2023	Bailadila, by 135 km slurry pipeline from Bachel	Imported coal; Indravati	3 Mt plant in Bastar district, demerged as NMDC Steel Ltd.
PRIVATE SECTOR				

Jamshedpur (Jharkhand)	Tata; 1907–12	Noamundi, Joda, Katamati, Khondbond	Jharia and West Bokaro captive mines, imports; Subarnarekha, Kharkai	About 11 Mt; Kolkata and Haldia ports about 250 km away.
Kalinganagar and Meramandali (Odisha)	Tata; 2016, 2018	Joda–Barbil belt	Imported coal via Paradip and Dhamra; Brahmani	Kalinganagar raised to 8 Mt with India's largest blast furnace (2024); Meramandali was Bhushan Steel; Neelachal Ispat is next door.
Vijayanagar (Karnataka)	JSW; 1990s	Ballari–Hospet	Imported coal via Mormugao and Krishnapatnam; Tungabhadra	India's largest single-site steel plant; JSW also runs Dolvi (Maharashtra), Salem and Jharsuguda.
Hazira (Gujarat)	Essar; AM/NS 2019	Pellets from Vizag and Paradip pellet plants	Gas and coal; own port	Flat steel; 9 Mt, being raised to 15 Mt.
Angul and Raigarh	Jindal Steel and Power	Captive Odisha mines	Talcher coal gasified (Angul); Raigarh coal DRI	Group capacity 12.6 Mt; also Patratu (Jharkhand).

Capacities are crude steel per year, as reported by the Ministry of Steel and the companies for 2025-26 (rounded).

Integrated Steel Plants of India and Their Raw Materials

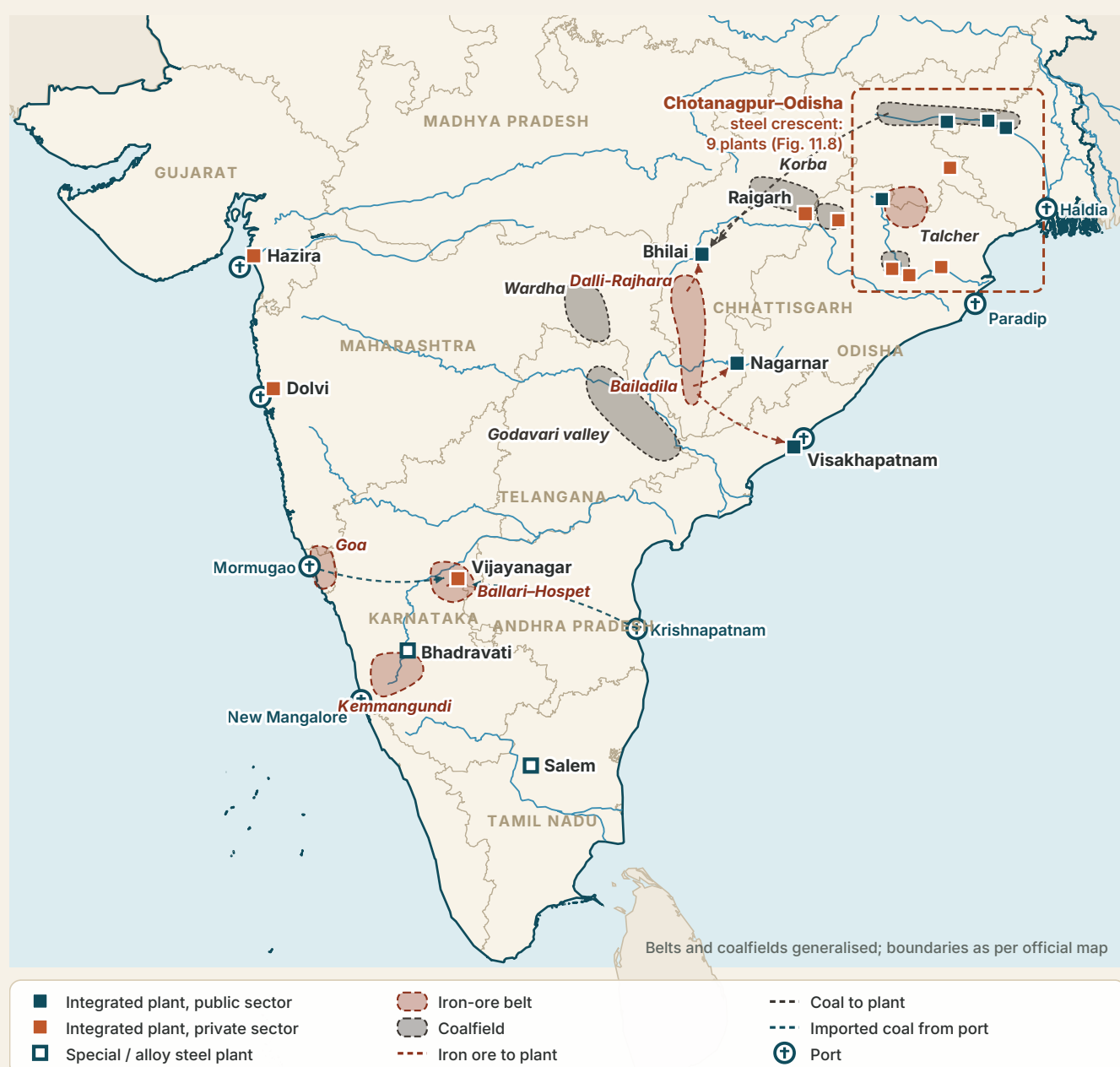


Fig. 11.7 Major integrated and special steel plants, iron-ore belts, coalfields and the ports through which coking coal is imported. Arrows show the main ore, coal and import links. The boxed eastern crescent is enlarged in Fig. 11.8.

Why the crescent?

- **Both raw materials within 100–250 km.** The Noamundi–Joda–Barbil–Kiriburu ore field and the Gondwana coking-coal fields of Jharia, Bokaro and Raniganj face each other across the Chotanagpur plateau; limestone and dolomite come from Birmitrapur and Gangpur, manganese from Keonjhar.
- **Water and power** from the Damodar Valley Corporation reservoirs, the Subarnarekha, Brahmani and Mahanadi, and Hirakud.
- **Rail:** the Howrah–Mumbai trunk line and the mineral lines of South Eastern Railway, with Kolkata–Haldia, Paradip and Dhamra as ports.
- **Market and labour:** the Kolkata industrial region (engineering, wagon and locomotive works at Chittaranjan) and a large workforce.
- **Planning:** the Bhilai, Rourkela and Bokaro decisions deliberately used steel as a growth pole for tribal districts.

The Chotanagpur–Odisha Steel Crescent

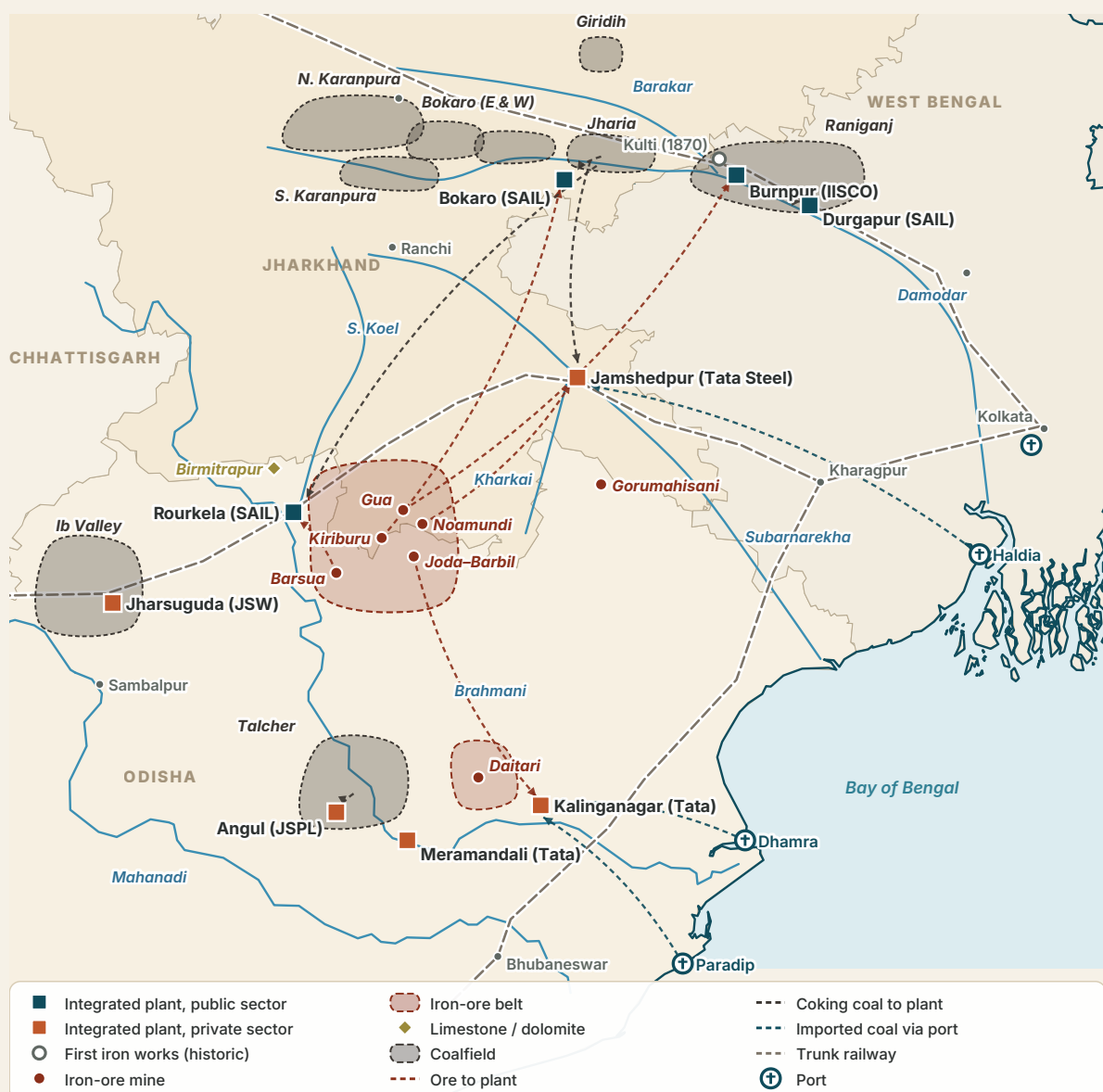


Fig. 11.8 India's densest steel landscape. Coking coal from the Damodar fields (Jharia, Bokaro, Raniganj) and ore from the Singhbhum–Keonjhar–Sundargarh belt move short distances to the plants; newer plants near Angul and Kalinganagar import coal through Paradip and Dhamra. Kulti marks the first coal-fired iron works of the 1870s.

PRELIMS POINTER

Collaborations: **Bhilai and Bokaro** (USSR), **Rourkela** (West Germany), **Durgapur** (UK). **Rourkela** was the first public-sector integrated plant to start; **Bhilai** is SAIL's largest and its rail maker; **Visakhapatnam** is the first shore-based plant; **Salem** makes stainless steel; **Bhadravati** never had local coal (charcoal, then hydel); **Maharashtra Elektros melt** at Chandrapur is SAIL's ferro-alloy unit. Neelachal Ispat Nigam was set up by MMTC with the Odisha government before Tata Steel bought it.

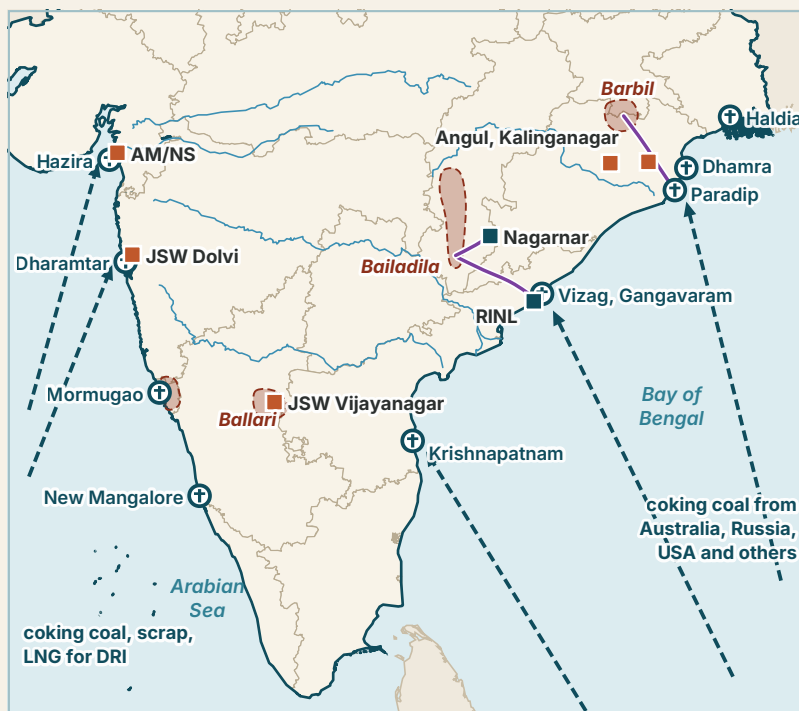
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Coastal Plants and the New Map

Since the 1990s nearly every large new plant in India has been either on the coast or linked to it. The reason is coking coal: India imports most of what it needs (57 million tonnes in 2024-25), mainly from Australia, so a plant beside a port saves a long rail haul of the heaviest input, and can also export. Ore travels the other way, increasingly as **pellets** or as **slurry** pumped through pipelines, which is far cheaper than rail and keeps trucks off forest roads.

- **Visakhapatnam (RINL)**: a deep natural harbour, imported coal, ore from Bailadila by the Kirandul–Kottavalasa line, and an export outlet. Gangavaram port lies next door.
- **Hazira (AM/NS)**: started as a gas-based HBI plant on the Tapi estuary near Surat, using gas from offshore fields and LNG; it now combines DRI with blast furnaces, takes pellets made from slurried Bailadila and Odisha ore, and has its own jetty. It is close to the auto, pipe and engineering markets of western India.
- **Dolvi (JSW)**: on Dharamtar creek near Mumbai, with its own jetty, serving the Mumbai–Pune market.
- **Odisha's coastal belt**: Kalinganagar (Jajpur), Angul–Meramandali and the pellet plants at Paradip sit between the Keonjhar–Sundargarh ore field and the ports of Paradip and Dhamra. Odisha, with the largest ore reserves and mining output, is set to become the country's biggest steel state; new projects announced in 2025–26 by JSW (with JFE and POSCO) and AM/NS are mostly here or on the Andhra coast.

Coastal Steel Plants and Import Routes



WHY THE COAST?

India imports most of its coking coal, so a plant at the water's edge saves a long inland rail haul; ore arrives as slurry or by rail, and steel can leave by sea.

- **RINL Visakhapatnam**
first shore-based plant (1992); ore from Bailadila by rail, coal by sea
 - **AM/NS Hazira**
gas-based DRI + blast furnaces; pellets from its Vizag and Paradip plants
 - **JSW Dolvi**
own jetty at Dharamtar creek on the Konkan coast
 - **Tata Kalinganagar**
Paradip and Dhamra ports 100 km away; Joda ore by rail
 - **JSPL Angul**
coal-gas DRI using Talcher coal
 - **JSW Vijayanagar**
inland, but imports coal via Mormugao and Krishnapatnam
- slurry pipeline (ore)
--- seaborne imports
■ iron-ore belt

Fig. 11.9 Port-based and port-linked plants, with seaborne coal imports and slurry pipelines that carry ore concentrate from Bailadila and Barbil to pellet plants at Visakhapatnam, Nagarnar and Paradip.

WHY STEEL LEFT THE ORE (MAINS 2020)

Five reasons in one line each: **imported coking coal** (port sites); **cheap bulk shipping and slurry pipelines** (raw materials move cheaply, finished steel less so); **scrap and DRI-based electric furnaces** (market sites); **gas** (Hazira, Gulf); **policy and land** (state incentives, SEZs, land at ports). Examples abroad: Japan, Korea, Baoshan, Taranto, IJmuiden; in India: Vizag, Hazira, Dolvi, Kalinganagar, Mandi Gobindgarh.

97

Mini Steel Plants and the Secondary Sector

Beside the large integrated producers stands India's huge **secondary steel sector**: thousands of small and medium units making sponge iron in coal-fired kilns, melting it with scrap in electric arc and induction furnaces, and rolling the steel into bars, wire and sections. The term **mini steel plant** was first used for small electric-furnace units with a capacity of a few lakh tonnes. Induction furnaces alone made 38% of India's crude steel in 2024-25, against 41% from oxygen furnaces and 21% from electric arc furnaces.

Secondary Steel Clusters



THE SECONDARY SECTOR

Thousands of small units make sponge iron, melt it with scrap in induction or arc furnaces, and roll bars and wires. Induction furnaces alone made 38% of India's crude steel in 2024-25.

Punjab: Mandi Gobindgarh, Ludhiana
scrap-based furnaces and re-rolling; the 'steel town' of north India

Chhattisgarh: Raipur, Raigarh
coal-based sponge iron, induction furnaces, TMT bars

Odisha-Jharkhand-West Bengal:
Rourkela, Jharsuguda, Barbil, Girdih, Durgapur: kilns beside ore and coal

Maharashtra: Jalna, Nagpur-Wardha
induction furnaces and rolling mills close to western markets

Karnataka and Tamil Nadu:
Ballari-Koppal sponge iron; Gummidipoondi bar mills near Chennai

Gujarat: Alang
ship-breaking yard, a major source of scrap and re-rollable plate

- Eastern sponge-iron states
- Punjab scrap-melting hub
- ▼ Secondary steel cluster
- Scrap source

Fig. 11.10 Main clusters of sponge-iron, induction-furnace and re-rolling units. The eastern states host kiln-based sponge iron near ore and coal; Punjab, western Uttar Pradesh, Maharashtra and Tamil Nadu melt scrap near markets; Alang supplies ship-breaking scrap.

Merits and problems

- **Merits:** low capital and short gestation; flexible output; can use scrap, sponge iron and local non-coking coal; spread across the country close to buyers, which reduces transport and decentralises industry; much employment; meets local demand for construction steel quickly.
- **Problems:** scarce and costly scrap (India imports some; its domestic scrap pool is small because steel stocks in use are young); high and erratic power tariffs; quality limits of induction furnaces, which cannot refine out phosphorus

and sulphur; coal-based kilns are the dirtiest steel route, with fly ash, dust and CO₂; obsolete technology, small scale and thin finance; exposure to cheap imports.

- **Responses:** the **Steel Scrap Recycling Policy (2019)** and the vehicle scrapping policy (2021) to build registered scrapping centres; Quality Control Orders requiring BIS-certified steel; the National Institute of Secondary Steel Technology at Mandi Gobindgarh for training and certification; energy-efficiency and green-steel support.

08 Production, Consumption and Trade

India's crude steel capacity rose from about 144 million tonnes in 2020-21 to **220.4 million tonnes in 2025-26**, and production reached a record **170.2 million tonnes** in 2025-26, a capacity utilisation of about 77%. In calendar 2025 India made 164.9 Mt (worldsteel), 8.9% of the world total and about a sixth of China's output. Finished steel consumption was 164.4 Mt in 2025-26 and has grown faster than production in most recent years, which explains the swing between exporting and importing.

- **Per capita use:** 115.7 kg of finished steel in 2025-26 (JPC); worldsteel's comparable figure for 2025 is 109 kg against a world average of 209 kg and 562 kg for China (Fig. 11.14). Low use means large headroom for growth.
- **Who uses it:** construction and infrastructure (housing, roads, railways, metros, power and water projects) take well over half, followed by engineering, automobiles, pipes and consumer durables. India has been the world's second largest steel user since 2019.
- **Process mix:** 41% BOF, 21% EAF, 38% induction furnace (2024-25), very different from the world average of about 70% BOF.
- **Sponge iron and pig iron:** sponge iron output rose to 60.5 Mt in 2025-26, about 85% of it coal-based (Fig. 11.12); pig iron output was 8.4 Mt, nine-tenths of it from the private sector.
- **Leading states:** Odisha leads, followed by Chhattisgarh, Jharkhand, Karnataka, Maharashtra, West Bengal and Gujarat; Andhra Pradesh and Tamil Nadu come next.

India's Crude Steel Production and Key Numbers

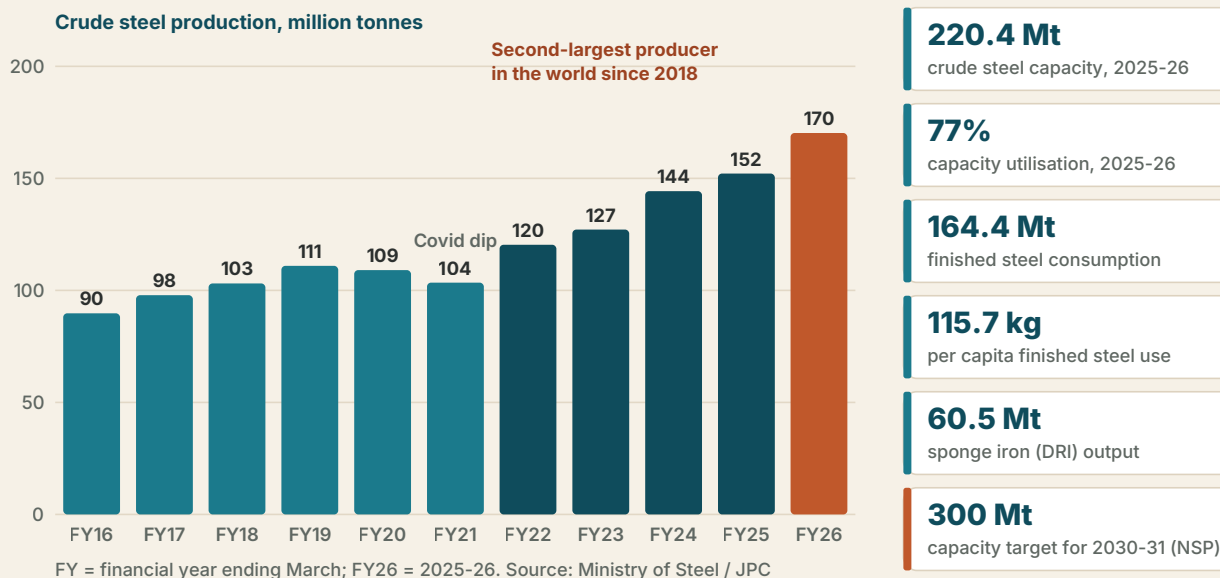
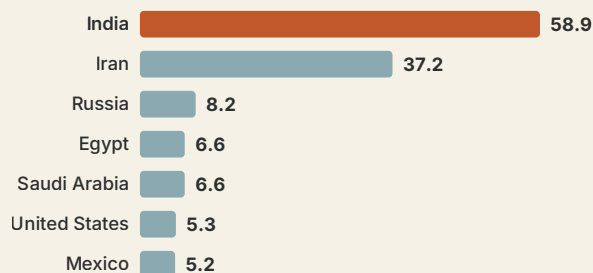


Fig. 11.11 Crude steel production by financial year, with the dip of the Covid year and the record of 2025-26, and the main indicators for 2025-26. Source: Joint Plant Committee, Ministry of Steel.

Direct Reduced Iron: India Leads the World

Direct reduced iron, 2025 (Mt); world 153.0 Mt



India = 38% of world DRI. Source: worldsteel

India's sponge iron output (Mt)

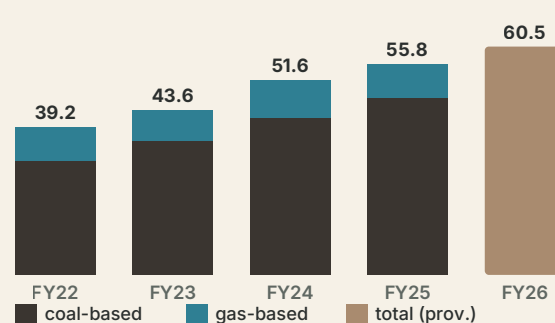


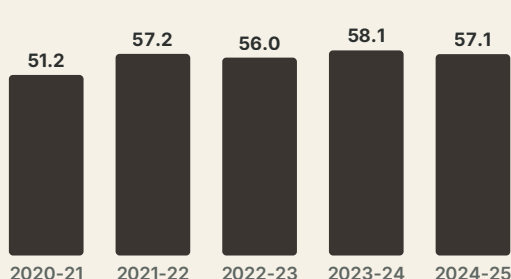
Fig. 11.12 Left: DRI production by country, 2025 (worldsteel). Right: India's sponge iron output by route (JPC; 2025-26 provisional total). Coal-based kilns dominate because India has plenty of non-coking coal but little cheap gas.

Trade

India was a net exporter of finished steel from 2020-21 to 2022-23, a net importer in 2023-24 and 2024-25 as cheap steel, much of it from China, Korea, Japan and Vietnam, flooded Asian markets, and narrowly a net exporter again in 2025-26 (6.6 Mt exported, 6.5 Mt imported) after trade remedies. Exports go mainly to Europe, West Asia and neighbouring countries. On the input side, coking coal is the biggest import bill; India also imports scrap, some ferro-alloys and nickel, and exports iron ore pellets and fines, mostly to China.

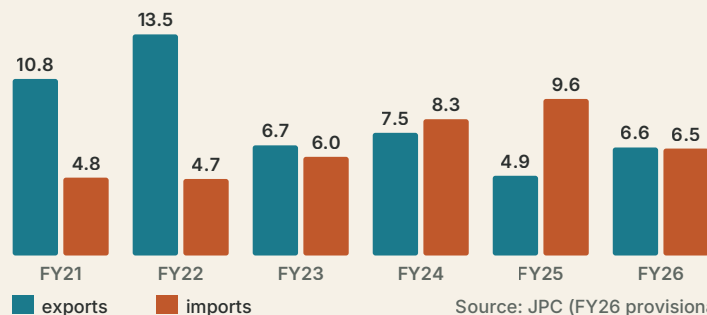
Coking Coal Imports and Steel Trade

India's coking coal imports (Mt)



Mostly from Australia; Russia 7.7 Mt in 2024-25. Source: Ministry of Steel

Finished steel exports and imports (Mt)



Source: JPC (FY26 provisional)

Fig. 11.13 Left: coking coal imports, steady at about 57 Mt a year. Right: finished steel exports and imports, showing the import surge of 2024-25 and the balance restored in 2025-26.

09

Policy: NSP 2017, PLI, Trade Remedies, Green Steel

Steel has been a deregulated sector since 1991-92: prices are market-set and the government acts as facilitator. Its main instruments now are a long-term policy, production incentives, quality standards, trade remedies and the green transition.

National Steel Policy, 2017

TARGET FOR 2030-31	VALUE
Crude steel capacity	300 million tonnes (220.4 Mt reached in 2025-26)
Crude steel production / demand	255 million tonnes
Finished steel demand	230 million tonnes

Per capita finished steel consumption	158 kg
Sponge iron and pig iron	80 Mt and 17 Mt
Coking coal import dependence	to fall from about 85% to about 65% through washed domestic coal

The policy also aims to meet all domestic demand for high-grade automotive, electrical and special steels for strategic uses, to raise safety to global standards, to cut the carbon footprint and to promote research through the Steel Research and Technology Mission of India (SRTMI). The **Domestically Manufactured Iron and Steel Products (DMI&SP) policy** gives preference to Indian steel in government procurement.

Production Linked Incentive for specialty steel

Approved in July 2021 with ₹6,322 crore, the scheme pays incentives on incremental output of five categories of value-added steel: coated and plated steel, high-strength and wear-resistant steel, specialty rails, alloy steel products and wires, and electrical steel. It was reopened as PLI 1.1 (January 2025) and PLI 1.2 (November 2025, adding super alloys, CRGO steel, stainless steel and titanium alloys); round 1.2 alone carries committed investment of about ₹11,900 crore and 8.3 Mt of capacity. Specialty steel output is expected to reach 42 Mt by 2026-27.

Imports: quality orders and the safeguard duty

Steel Quality Control Orders allow only BIS-certified steel to be sold, whether made in India or imported (151 standards notified; 55 suspended in November 2025 for specialty grades and inputs). The **Steel Import Monitoring System** (2019) tracks consignments. Facing a surge of cheap flat steel diverted from markets closed by US tariffs, India imposed a provisional 12% safeguard duty on certain flat steel imports in April 2025, made final in December 2025 for three years at 12%, 11.5% and 11%, alongside anti-dumping duties on items such as Vietnamese hot-rolled steel.

Raw materials and green steel

- **Mission Coking Coal** (with the Ministry of Coal) aims to raise and wash domestic coking coal; supplies are being diversified to Russia (7.7 Mt in 2024-25), the US, Mozambique and others. Captive and merchant ore auctions under the 2015 and 2021 mining law amendments decide future plant sites (Chapter 02).
- **Green Steel Taxonomy** (notified December 2024): steel from a plant emitting less than 2.2 t CO₂-equivalent per tonne of finished steel counts as green, graded **five-star** below 1.6 t, **four-star** 1.6–2.0 t and **three-star** 2.0–2.2 t; the share by which a plant beats 2.2 t is its "greenness" percentage. The National Institute of Secondary Steel Technology certifies, using the measurement rules of India's Carbon Credit Trading Scheme. The thresholds will be reviewed every three years.
- **National Green Hydrogen Mission**: ₹455 crore for steel pilots up to 2029-30; six pilots awarded, including 100% hydrogen DRI in a vertical shaft and hydrogen injection in blast furnaces and gas-based DRI.
- **External pressure**: the EU's Carbon Border Adjustment Mechanism, in its definitive phase from 1 January 2026, charges importers for the embedded carbon of steel, a direct cost for India's coal-heavy exports.

10 Problems and Prospects

Problems

- **Raw-material mismatch.** Indian coking coal is scarce and high in ash (Chapter 05), so most is imported at volatile prices; Indian ore is rich in iron but often high in alumina, which raises slag volume and coke rates and needs beneficiation and pelletising.
- **Capital, land and clearances.** A greenfield plant needs about ₹6,000–7,000 crore per million tonnes, thousands of hectares and forest and environmental clearances; projects such as POSCO's in Odisha (dropped in 2017) and ArcelorMittal's in Jharkhand stalled for years over land and ore linkages.
- **Logistics costs.** Rail freight for ore and coal, congested mineral lines and ports, and long hauls to western and northern markets raise costs above those of Japan, Korea or China.

- **Imports and overcapacity abroad.** China's output of nearly a billion tonnes and record exports (133.6 Mt in 2025), free-trade agreements with Korea, Japan and ASEAN, and diversion of steel shut out of the US and Europe press on Indian prices.
- **Ageing public plants** with old technology and debt (RINL needed a revival package in 2025), **low research spending**, and **quality and safety gaps** in the secondary sector.
- **Environment and health.** Dust, sulphur and nitrogen oxides, carbon monoxide and CO₂ from coke ovens, sinter plants, blast furnaces and kilns; solid wastes (slag, fly ash, sludge); heavy water use; the highest emission intensity among major producers. Slag can be used for cement, road bases and as a soil conditioner.

Prospects

- Demand from infrastructure (Gati Shakti, dedicated freight corridors, metros, housing), autos and renewable energy is set to grow faster than in any other large economy; per capita use is still about half the world average.
- Capacity of about 300 Mt is under way, led by Odisha, Chhattisgarh, Jharkhand, Karnataka and the coasts of Andhra Pradesh and Gujarat; SAIL plans to raise its capacity from about 20 to about 35 Mt by 2030-31.
- Abundant ore, a large DRI base and a fast-growing renewable power sector could make India a low-cost green steel producer if hydrogen and storage become cheap; scrap will grow as the stock of steel in use ages.

11 The World Steel Industry

World crude steel output was **1,849 Mt in 2025**, about 2% lower than in 2024. Asia makes nearly three-quarters of it and **China alone 52%**. China's production peaked at over 1,060 Mt in 2020 and has drifted down since, while India's has risen every year except during Covid. Over seventy years the centre of gravity has moved from the North Atlantic (the US led until the early 1970s, followed by the Soviet Union and Japan) to East and South Asia.

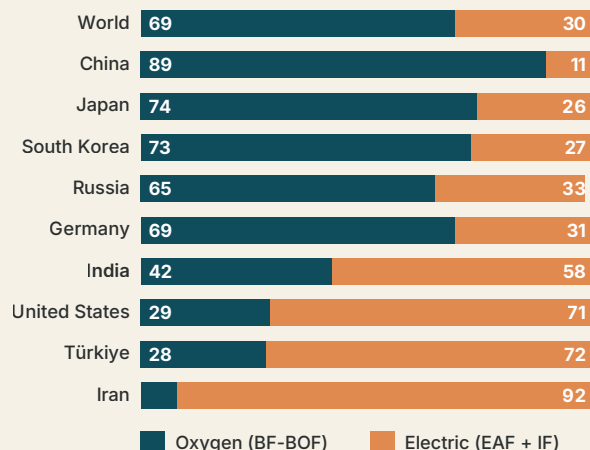
Steel Use per Person and Steel-Making Routes

Steel use per person, 2025 (kg, finished steel)



Source: worldsteel, World Steel in Figures 2026

How crude steel was made, 2025 (% of output)



India by JPC (2024-25): BOF 41%, EAF 21%, induction 38%

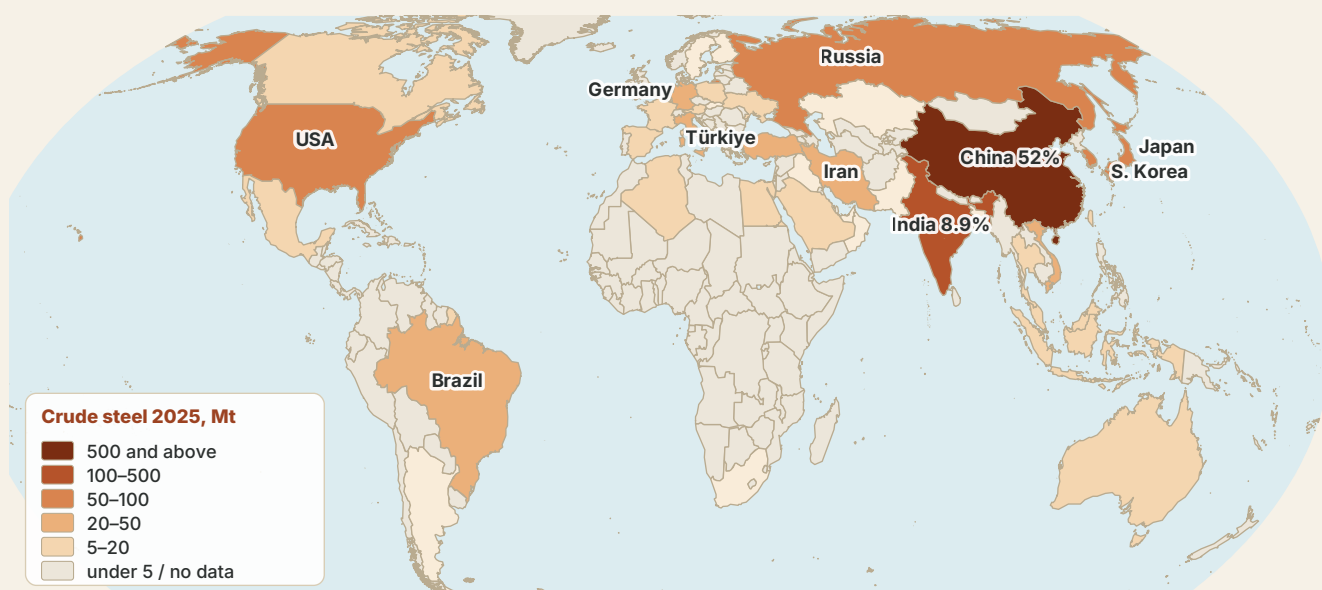
Fig. 11.14 Left: apparent steel use per person, 2025. Right: share of crude steel made by the oxygen route and by electric furnaces. China and Japan rely on blast furnaces; the US, Türkiye and Iran on electric furnaces fed by scrap or DRI; India stands between. Source: worldsteel, World Steel in Figures 2026.

Vietnam is the fastest climber among the leaders. In January–August 2026, global output was slightly lower again, while India's rose by 6%. The biggest companies were China Baowu (124.8 Mt), ArcelorMittal (63.4), Nippon Steel (57.8, now including US Steel, bought in 2025) and Ansteel (57.6); **Tata Steel (10th), JSW Steel (11th) and SAIL (18th)** are India's entries in the world top twenty.

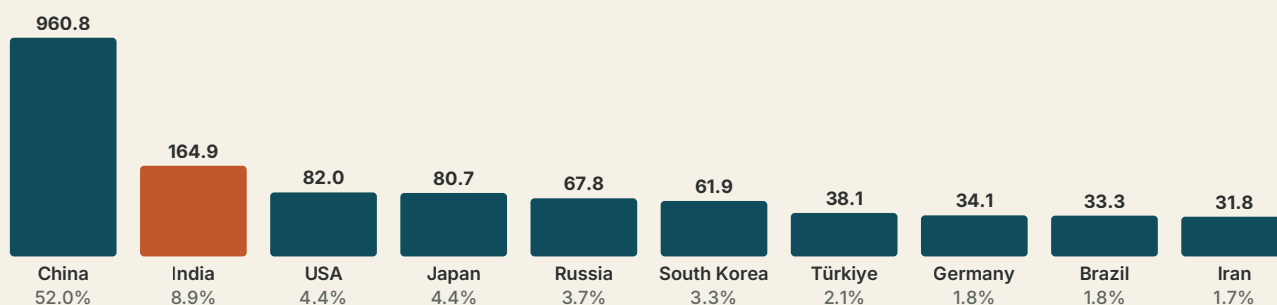
Why the spatial pattern changed (Mains 2014)

- **Shift of demand** to industrialising, urbanising Asia, where most new steel is used.
- **Cheap seaborne raw materials** from Australia and Brazil let resource-poor Japan, Korea and coastal China build huge tidewater plants; old inland coalfield centres lost their edge as local coal and ore ran down.
- **Technology**: the BOF, continuous casting and very large blast furnaces rewarded new greenfield plants; scrap-based mini mills captured much of the US and European market.
- **Costs and policy**: cheaper labour and state support in East Asia, versus high wages, pollution rules and carbon prices in the West; the result was the **Rust Belt** in the US, closures in Britain, Lorraine and the Ruhr, and overcapacity in China.
- **Energy transition**: cheap gas (Gulf, Iran) and, prospectively, cheap renewable hydrogen (Sweden, Australia, Brazil, India) are creating new steel locations.

Crude Steel Production by Country, 2025



Top 10 producers, 2025 (million tonnes of crude steel; share of world total 1,849 Mt)



Bar heights on a square-root scale so smaller producers stay visible. Source: worldsteel, Jan 2026

Fig. 11.15 Countries shaded by crude steel output in 2025, and the ten largest producers with their share of the world total. Source: worldsteel, January 2026.

12 Major Steel Regions of the World

United States

The **Pittsburgh** region grew on Appalachian coking coal, river transport on the Ohio and its tributaries, and local ore; when that ore ran out, the **Mesabi Range** of Minnesota sent ore down the Great Lakes from Duluth through the Soo Locks to new lakeside works at **Gary–Chicago, Cleveland, Detroit, Buffalo and Hamilton** (Canada), while lake boats

carried coal back. Coastal plants at Sparrows Point (Baltimore) used imported ore, and **Birmingham** (Alabama) had ore, coal and limestone side by side. From the 1970s, foreign competition and old open-hearth mills turned the belt into the Rust Belt. Most US steel (about 70%) is now made in scrap-fed EAF mini mills, many in the South (Arkansas, Alabama, Texas).

Four Classic Steel Regions

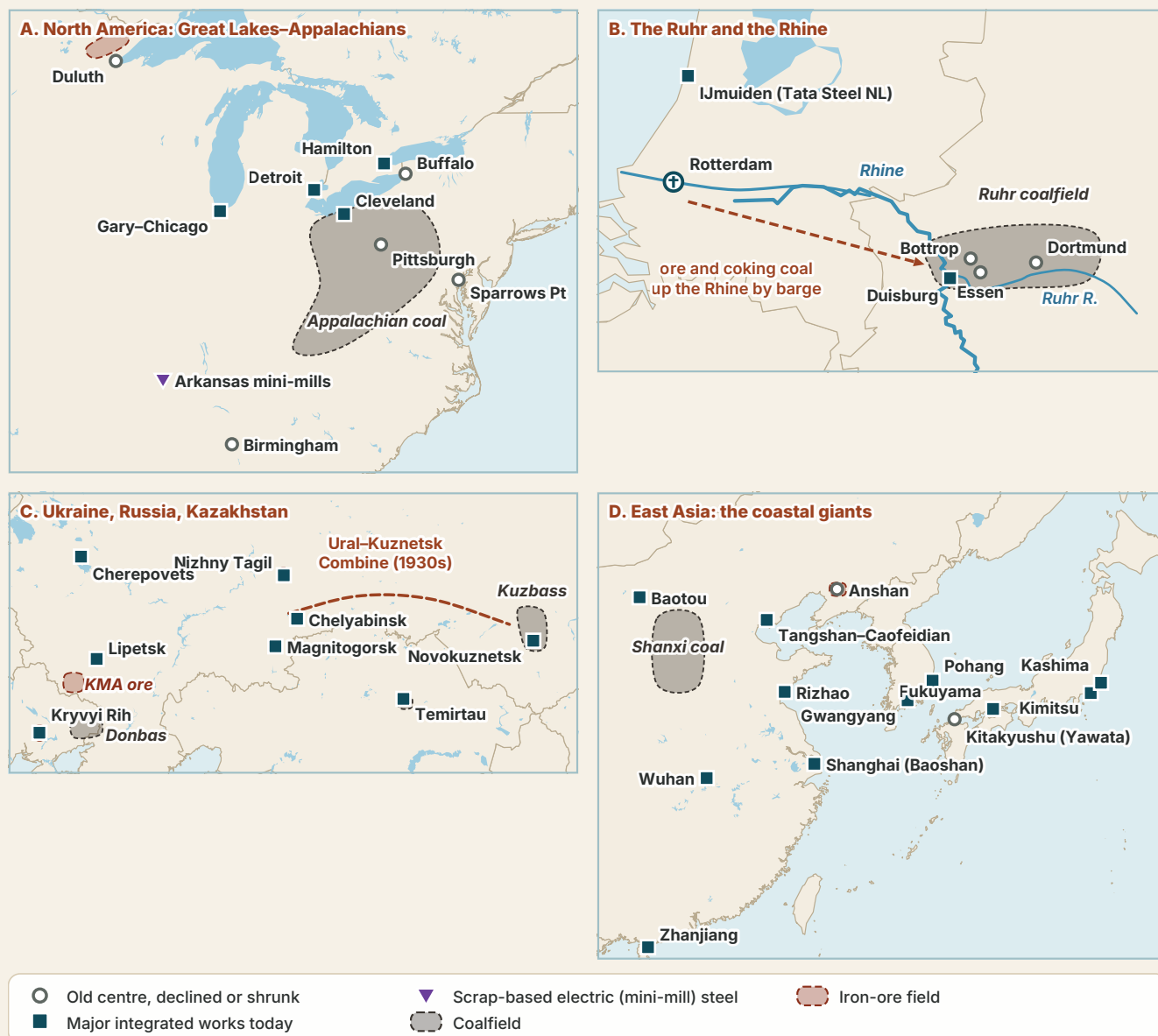


Fig. 11.16 (A) the Great Lakes–Appalachian belt; (B) the Ruhr, fed by Rhine barges from Rotterdam; (C) the Donbas–Kryvyi Rih, Ural and Kuzbass centres; (D) the coastal giants of Japan, Korea and China. Coalfields and ore fields generalised.

Europe

Britain's industry began on coalfields (South Wales, Midlands, Sheffield, Teesside) and later moved to the coast; Port Talbot closed its blast furnaces in 2024 for an electric arc furnace, and British Steel (Scunthorpe) came under state control in 2025 and public ownership in 2026. The **Ruhr**, with Europe's best coking coal and the Rhine, became the continent's steel heart (Duisburg is still Europe's largest steel site); its last hard-coal mine closed in 2018, so ore and coal now come up the Rhine from Rotterdam, and Dortmund's works were dismantled and shipped to China in the early 2000s. **Lorraine** (France–Luxembourg) used minette ore with Ruhr or Saar coke; the Saar, Liège, Silesia, Linz (home of the LD process), IJmuiden and Taranto complete the map. **Sweden** exports Kiruna ore through Narvik and Luleå and makes high-grade steel with hydropower.

Ukraine, Russia and Kazakhstan

The **Donbas** coalfield and **Kryvyi Rih** ore made eastern Ukraine the steel base of the Russian empire and the Soviet Union; war since 2014, and the destruction of Mariupol's Azovstal and Ilyich works in 2022, has cut Ukraine's output to about 7 Mt. Russia's **Ural** plants (Magnitogorsk, Chelyabinsk, Nizhny Tagil) were linked in the 1930s with **Kuzbass** coal 2,000 km away in the **Ural-Kuznetsk Combine**: trains carried coal west and ore east. Other centres are **Lipetsk** on the Kursk Magnetic Anomaly ore, **Cherepovets** (Kola-Karelia ore, Pechora coal) and **Temirtau** in Kazakhstan on Karaganda coal.



Fig. 11.17 The Carrie Furnaces and Hot Metal Bridge on the Monongahela, relics of Pittsburgh's steel age.



Fig. 11.18 A disused blast furnace at Duisburg-Nord, now a landscape park in the Ruhr.



Fig. 11.19 Yawata works, Kitakyushu: Japan's first modern steel works (1901), on the shore of Dokai Bay.

East Asia

Japan has almost no coal or ore, yet briefly led the world in the early 1990s with **tidewater plants** on reclaimed land along the Pacific belt (Kimitsu, Kashima, Fukuyama, Wakayama, Oita), unloading Australian and Brazilian ore and coal straight from giant carriers. **South Korea** copied the model at Pohang (1973) and Gwangyang (POSCO) and Dangjin (Hyundai). **China's** older centres sit on domestic ore and coal: **Anshan** (Liaoning), **Baotou** (Inner Mongolia, using Bayan Obo ore, also the world's largest rare-earth mine), **Wuhan** on the Yangtze, Taiyuan near Shanxi coal and Tangshan in Hebei, the largest steel-making province. Newer giants are coastal: **Baoshan** near Shanghai (from 1985), Caofeidian, Rizhao, Zhanjiang and Fangchenggang, built to use imported ore.

Other regions

Brazil's industry lies in the **Quadrilátero Ferrífero** of Minas Gerais (Ipatinga, Ouro Branco), at Volta Redonda between Rio de Janeiro and São Paulo (1946, the first large plant in Latin America) and at the ore port of Tubarão (Vitória); Minas Gerais still makes pig iron with plantation charcoal. **Iran** (Mobarakeh near Isfahan), the Gulf states and Egypt use gas-based DRI; **Türkiye** melts imported scrap in EAFs along the Marmara and Iskenderun coasts; **Vietnam** (Dung Quat), **Indonesia** and **Mexico** (Monterrey) are rising producers, and **Australia**, the largest ore exporter, makes little steel at Port Kembla and Whyalla.

13 World Trade in Iron Ore and Steel

Iron ore is the largest dry-bulk commodity at sea. In 2024 world ore exports were about 1,740 Mt. **Australia** (Pilbara ports of Port Hedland and Dampier) exported 902 Mt and **Brazil** (Carajás ore through São Luís; Minas Gerais ore through Tubarão) 389 Mt; South Africa (Saldanha Bay), Canada (Sept-Îles), Sweden (Narvik), Ukraine and India (36 Mt) follow. **China imported 1,238 Mt, almost three-quarters of all seaborne ore**, followed by the EU (106 Mt), Japan (96 Mt) and South Korea (70 Mt). Coking coal moves on a similar pattern, from Queensland (Hay Point, Gladstone), the US east coast, Canada, Russia and Mongolia to India, China, Japan, Korea and Europe.

Seaborne Trade in Iron Ore and Coking Coal



Fig. 11.20 Main iron ore flows (arrow width roughly proportional to volume, 2024) and coking coal routes. Exporter and importer totals in million tonnes. Source: worldsteel, World Steel in Figures 2026; routes generalised.

About a quarter of world steel output is traded. **China** exported a record 133.6 Mt in 2025, far ahead of Japan (29.8 Mt) and South Korea (27.9 Mt); the EU and the US are the largest importers. China's surplus, the US Section 232 tariffs (raised to 50% in 2025), EU safeguards and CBAM have made steel trade one of the most protected in the world, and India's safeguard duty (Section 09) is part of that wave.

USING THIS CHAPTER IN MAINS

- **Location factors (GS I):** explain steel as a weight-losing industry and trace its successive pulls: forest, coalfield, ore field, coast, market and scrap (Sections 02–03). Use the Chotanagpur crescent, Bhadravati and Vizag as Indian cases and the Ruhr, Great Lakes, Ural–Kuznetsk and Japan as world cases (Sections 05, 06, 12).
- **Location away from raw materials (2020):** imported coking coal, slurry pipelines and pellets, gas-based DRI, scrap-based EAFs and induction furnaces near markets, port-based SEZs (Sections 06–07).
- **Changing world pattern (2014):** North Atlantic to Asia, inland to coast, integrated to mini mill, and now coal to hydrogen (Sections 11–13).
- **GS III:** NSP 2017 targets, PLI, safeguard duty, coking coal security, CBAM and the green steel taxonomy; the role of steel in infrastructure-led growth (Sections 08–10).



Previous Year Questions

Prelims

2020 Steel slag can be the material for which of the following?

1. Construction of base road
2. Improvement of agricultural soil
3. Production of cement

Select the correct answer using the code given below:

a 1 and 2 only

b 2 and 3 only

c 1 and 3 only

d 1, 2 and 3

Answer: (d). Slag is used as road aggregate, in slag cement and, being lime-rich, as a soil conditioner (Sections 02 and 10).

2014 Which of the following are some important pollutants released by steel industry in India?

1. Oxides of sulphur
2. Oxides of nitrogen
3. Carbon monoxide
4. Carbon dioxide

Select the correct answer using the code given below.

a 1, 3 and 4 only

b 2 and 3 only

c 1 and 4 only

d 1, 2, 3 and 4

Answer: (d). Coke ovens, sinter plants, blast furnaces and kilns emit all four (Section 10).

2009 Consider the following statements:

1. MMTC Limited is India's largest international trading organisation.
2. Neelachal Ispat Nigam Limited has been set up by MMTC jointly with the Government of Orissa.

Which of the statements given above is/are correct?

a 1 only

b 2 only

c Both 1 and 2

d Neither 1 nor 2

Answer: (c). Both were true then; Neelachal Ispat, at Kalinganagar, was sold to Tata Steel in 2022 (Section 04).

2007 With reference to the steel industry in India in recent times, consider the following statements:

1. Vizag Steel Plant (RINL) has been declared a Mini-Ratna.
2. Merger of IISCO with SAIL has been completed.

Which of the statements given above is/are correct?

a 1 only

b 2 only

c Both 1 and 2

d Neither 1 nor 2

Answer: (c). RINL became a Mini-Ratna and later a Navratna; IISCO merged into SAIL in 2006 (Sections 04–05).

2005 Which one of the following statements is NOT correct?

- ☐ a Rourkela Steel Plant, the first integrated steel plant in the Public Sector of India was set up with the Soviet Union collaboration
- ☐ b Salem Steel Plant is a premier producer of stainless steel in India.
- ☐ c Maharashtra Elektrosnelt Ltd. is a subsidiary of the Steel Authority of India Ltd.
- ☐ d Visakhapatnam Steel Plant is a unit of the Rashtriya Ispat Nigam Ltd.

Answer: (a). Rourkela was built with West German collaboration; Bhilai and Bokaro were Soviet-assisted (Section 05).

1998 Consider the following statements:

Coke is one of the materials of the charge added to blast furnace for the production of steel/iron. Its function is to

- I. Act as a reducing agent.
- II. Remove silica associated with the iron ore.
- III. Function as fuel, to supply heat.
- IV. Act as an oxidizing agent.

Of these statements:

- ☐ a I and II are correct
- ☐ b II and IV are correct
- ☒ c I and III are correct
- ☐ d III and IV are correct

Answer: (c). Coke is fuel and reductant; silica is removed by the limestone flux as slag (Section 02).

1998 Match List I with List II and select the correct answer using the codes given below the lists:

List I (Places): I. Jamnagar II. Hospet III. Korba IV. Haldia

List II (Industries): A. Aluminium B. Woollen Textile C. Fertilizers D. Cement E. Iron and Steel

- ☐ a I-D, II-C, III-A, IV-B
- ☒ b I-B, II-E, III-A, IV-C
- ☐ c I-D, II-E, III-B, IV-A
- ☐ d I-B, II-A, III-D, IV-C

Answer: (b). Hospet is the base of the Vijayanagar steel plant on Ballari ore; Korba has BALCO's aluminium smelter (Chapter 12); Haldia has fertiliser and petrochemical plants.

1996 Which one of the following elements is alloyed with iron to produce steel which can resist high temperatures and also have high hardness and abrasion resistance?

- ☐ a Aluminium
- ☐ b Chromium
- ☐ c Nickel
- ☒ d Tungsten

Answer: (d). Tungsten keeps tool (high-speed) steel hard at red heat (Section 01).

1996 Local supply of coal is not available to

- ☐ a TISCO, Jamshedpur
- ☒ b VISL, Bhadravati
- ☐ c HSL, Durgapur
- ☐ d HSL, Bhilai

Answer: (b). Bhadravati has no coal nearby; it used forest charcoal and then hydroelectricity (Sections 03 and 05).

Mains

2020**GS I · 10 MARKS**

Account for the present location of iron and steel industries away from the source of raw material, by giving examples.

Approach: Contrast the old raw-material pull with today's coastal, market and scrap locations; cite imported coking coal, slurry pipelines, gas DRI, mini mills and port plants (Vizag, Hazira, Dolvi, Kalinganagar; Japan, Korea, Baoshan) with Fig. 11.9 as a sketch (Sections 03, 06, 07).

2014**GS I · 10 MARKS**

Account for the change in the spatial pattern of the Iron and Steel industry in the world.

Approach: Show the shift from the US–Europe–USSR coalfield belts to tidewater East Asia and now India, and explain it through demand, seaborne ore, technology, costs and the energy transition (Sections 11–13).

LOTUSARISE IAS

HUMAN & ECONOMIC GEOGRAPHY

PRELIMS · GS PAPER I

19

Ports of India and the World

About 95% of India's foreign trade by volume and about two-thirds by value crosses a quay. A port is where the land economy meets the sea: it needs deep, sheltered water on one side and a rich, well-connected hinterland on the other, and its fortunes rise and fall with both. India's twelve major ports and some two hundred smaller ones handled a record 1,668 million tonnes in 2025-26, yet until 2024 the country had no port deep enough to receive the largest container ships, so most of its transshipment was done in Colombo and Singapore. This chapter explains what makes a good port, how ports are classified, the geography and specialisation of each major and leading private port, the new mega-ports at Vadhavan, Vizhinjam and Galathea Bay, the laws and programmes that govern the sector, India's shipbuilding and ship-breaking industries, its port projects abroad, and the great ports and shipping alliances of the world.

SYLLABUS

PRELIMS

Indian and World Geography: Economic Geography of India and the World (major and non-major ports, their location and specialisation; new ports and places in the news; Sagarmala and maritime laws; Alang; overseas ports such as Chabahar and Sittwe; leading ports of the world)

MAINS · GS PAPER I

Factors responsible for the location of tertiary sector activities in various parts of the world (including India); distribution of key natural resources (coastline and harbours). GS III links: infrastructure (ports), investment models (landlord ports, PPP), logistics and trade, shipbuilding as manufacturing, and maritime and coastal security

CONTENTS

01 Ports, Harbours and Hinterlands

03 India's Port System

05 Major Ports of the East Coast

07 Non-Major and Private Ports

09 Shipping, Shipbuilding and Ship-Breaking

11 Ports of the World

02 Classification of Ports

04 Major Ports of the West Coast

06 New Mega-Ports

08 Laws, Policy and Performance

10 India's Ports Abroad

12 Previous Year Questions

This chapter covers:

- what a port, harbour, hinterland and foreland are, the physical and economic conditions of a good port site, and the classification of ports by location, origin, function and ownership;
- India's coastline and port system, cargo and traffic in 2025-26, and the features, hinterland and specialisation of all twelve major ports and the leading non-major ports, with the new mega-ports at Vadhavan, Vizhinjam and Galathea Bay;
- the constitutional position of ports, the Major Port Authorities Act 2021, the five maritime Acts of 2025, Sagarmala, Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047, port performance and problems;

- Indian shipping, shipbuilding, the Maritime Development Fund and ship-breaking at Alang; India's port projects abroad and China's port network; the world's leading ports, ship sizes and shipping alliances.

Sea routes, canals and chokepoints are in Chapter 17 and inland waterways in Chapter 18; the trade that passes through the ports is the subject of Chapter 20. Coastal landforms are in *Physical Geography*, and the coasts and islands of India in *Indian Physical Geography*.

01 Ports, Harbours and Hinterlands

A **harbour** is a stretch of water sheltered from waves and currents where ships can anchor safely; it may be natural (a bay, estuary or lagoon) or made by building breakwaters. A **port** is the commercial facility built on a harbour: berths, cranes, storage yards, tanks, warehouses, customs and the road, rail and pipeline links that move cargo in and out. Every port has a harbour, but not every harbour has a port, and a well-equipped port can be built where nature offered only an open coast. Since ships carry over four-fifths of world trade by volume, ports are the main gateways of international trade.

Hinterland and foreland

The **hinterland** is the land area that a port serves, the region from which its exports come and to which its imports go. Its size and wealth decide how much cargo the port handles. The **core hinterland** is captive because the port is clearly the cheapest outlet; farther out lies a **competitive hinterland** that rival ports contest. Hinterlands are made by transport as much as by distance: the Western Dedicated Freight Corridor has extended the reach of Jawaharlal Nehru Port deep into north India, and pipelines tie Gujarat's oil ports to refineries in Punjab and Haryana. The **foreland** is the seaward counterpart, the set of overseas ports and regions with which a port trades. Inland container depots (**ICDs**) or **dry ports**, such as Tughlakabad in Delhi, act as extensions of seaports deep in the hinterland, where containers are cleared by customs and sent to the coast by rail.

Hinterland, Foreland and Transshipment

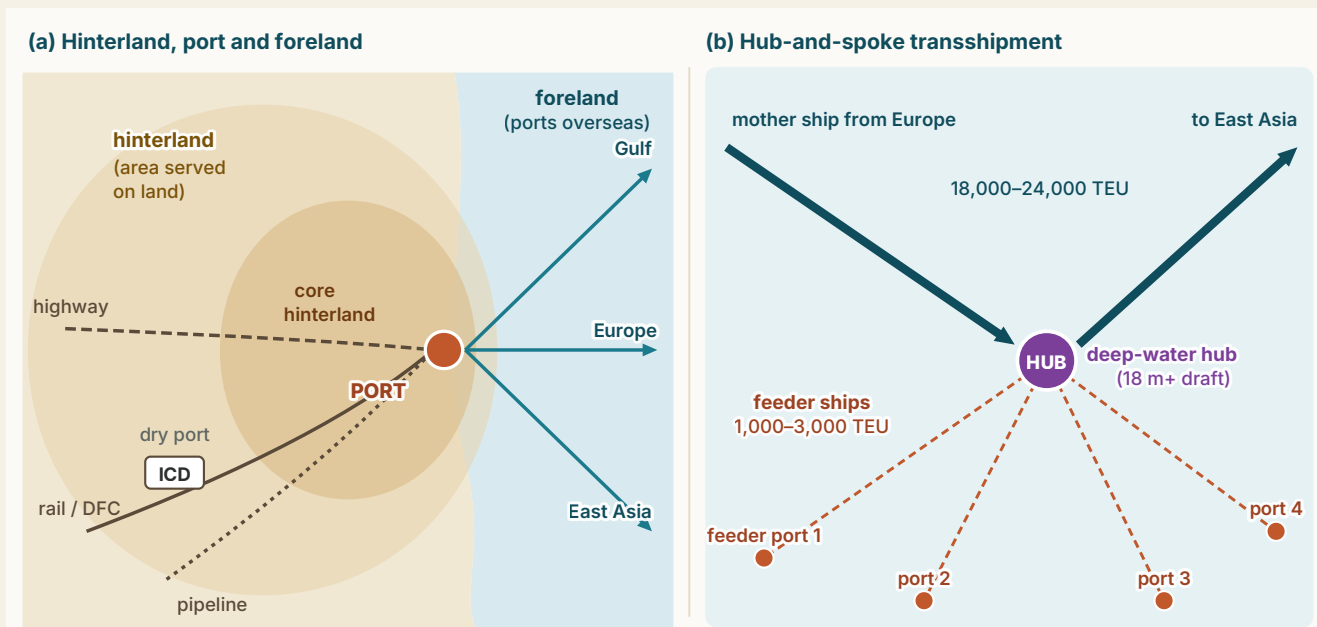


Fig. 19.1 (a) A port links a hinterland on land with a foreland overseas; road, rail, pipelines and dry ports extend its reach. (b) The largest container ships call only at a few deep-water hubs; feeder ships carry boxes between the hub and smaller ports.

What makes a good port site

- **Depth of water.** The **draught** (draft) of a ship is the depth of hull below the waterline. The largest container ships of 18,000–24,000 TEU need 16–17 m of water, laden very large crude carriers need over 20 m and Capesize ore

carriers about 18 m. Ports with a natural depth of 18 m or more close to shore are rare and valuable; others must dredge, or moor tankers at offshore buoys.

- **Shelter** from waves, swell and storms, by a headland, an island, a bay or a breakwater.
- **Low siltation.** Rivers and longshore currents bring sand and mud; deltaic and surf-beaten coasts need constant dredging.
- **Tidal range.** A large range lets deep ships enter only at high tide; such **tidal ports** (Kandla, Kolkata) work by the tide clock, and some old docks are closed by lock gates to hold water (Mumbai's wet docks, Bhavnagar). A large range also suits ship-breaking (Section 09).
- **Flat land behind the quay** for yards, industries and cities; and a **rich hinterland** with good rail, road and pipeline links.
- **Position** close to the main shipping lanes, which makes Singapore, Colombo and now Vizhinjam natural hubs; and **ice-free, cyclone-safe water**.

INDIA CONNECT · TWO COASTS, TWO KINDS OF PORT

The west coast is largely a coast of submergence, with drowned river mouths, creeks and lagoons fed by short west-flowing rivers: Mumbai's harbour, the Zuari estuary at Mormugao and the Kochi backwaters are natural harbours, and the Gulf of Kachchh offers deep water. The monsoon swell, however, shuts small open roadstead ports such as Veraval from June to September. The east coast has a broad continental shelf, big deltas, heavy northward drift of sand, surf and cyclones, so most of its ports had to be built behind breakwaters (Chennai, Paradip, Kamarajar, Tuticorin) or cut into a sheltered lagoon (Visakhapatnam). The west coast handles about 60% of India's port cargo, largely because of Gujarat.

02 Classification of Ports

Ports can be grouped in several overlapping ways. One port may fall in many classes: Kolkata is a riverine, tidal, major and service-cum-landlord port at the same time.

BASIS	TYPES	EXAMPLES AND NOTES
Location	Coastal (sea) ports; riverine or estuarine ports; inland ports on rivers, canals or lakes; out-ports ; offshore terminals	Kolkata is India's only riverine major port, about 200 km up the Hugli; Hamburg (Elbe) and Antwerp (Scheldt) are estuarine; Duisburg on the Rhine is the largest inland port, and Manchester reaches the sea by a ship canal. An out-port is built nearer the sea for ships that cannot reach the parent port: Haldia for Kolkata, Piraeus for Athens, Bremerhaven for Bremen. Single-point moorings at Vadar and Paradip handle crude tankers offshore.
Origin of harbour	Natural or artificial	Natural: Mumbai, Mormugao, Kochi, Sydney, San Francisco Bay (the largest landlocked natural harbour). Artificial: Chennai, Paradip, Kamarajar, V.O. Chidambaram, Colombo, and Jebel Ali, the largest man-made harbour.
Cargo	Bulk (industrial), general (commercial), container , comprehensive	Bulk ports handle ore, coal, grain and oil in shiploads (Port Hedland, Paradip); general-cargo ports handle packaged goods and passengers; most great ports are comprehensive.
Special function	Oil ports ; ports of call ; packet stations ; entrepôts ; transshipment hubs ; naval , fishing and cruise ports	Oil: tanker terminals such as Ras Tanura and Maracaibo, refinery ports such as Abadan, Sikka and Vadar. Ports of call grew as refuelling stops on long routes (Aden, Honolulu, Colombo). Packet stations are paired ferry ports facing each other (Dover–Calais). An entrepôt imports goods to re-export them, often after storage or processing (Singapore, Rotterdam, Hong Kong, Dubai). A transshipment hub moves containers from one ship to another without their touching the hinterland (Singapore, Colombo, Vizhinjam). Naval: Karwar (INS Kadamba), Visakhapatnam, Mumbai, Kochi.
Administration (India)	Major ports (Union) and non-major ports (states)	Major ports are declared by the Centre and run by Port Authorities; non-major ports, also called minor or intermediate ports, are run by State Maritime Boards or directorates (Section 08).

Operating model**Service, tool, landlord and private ports**

In a service port the authority owns everything and handles cargo itself. In a **landlord port** the public authority owns the land, water and basic infrastructure and leases berths to private terminal operators, who bring cranes and run operations under PPP contracts; JNPA was India's first major port to become fully landlord. Mundra and Krishnapatnam are wholly private.

A **free port** or free zone lets goods be stored, processed and re-exported without customs duty: Hamburg's old free port, the Jebel Ali Free Zone and India's **Kandla Free Trade Zone (1965)**, Asia's first export processing zone.

03 India's Port System

India's coastline, recently re-measured by a finer method that follows every inlet, is **11,098 km** long (the older figure was 7,517 km), touching nine coastal states and four Union Territories. Along it are **12 major ports** owned by the Union government and about **217 non-major ports**, of which about 69 report cargo. Maritime transport carries about 95% of India's trade by volume and 68% by value. Harappan Lothal had the world's oldest known dockyard, and Bharuch, Muziris, Arikamedu, Poompuhar and Tamralipti linked India to Rome and South-East Asia in ancient times.

The Ports of India

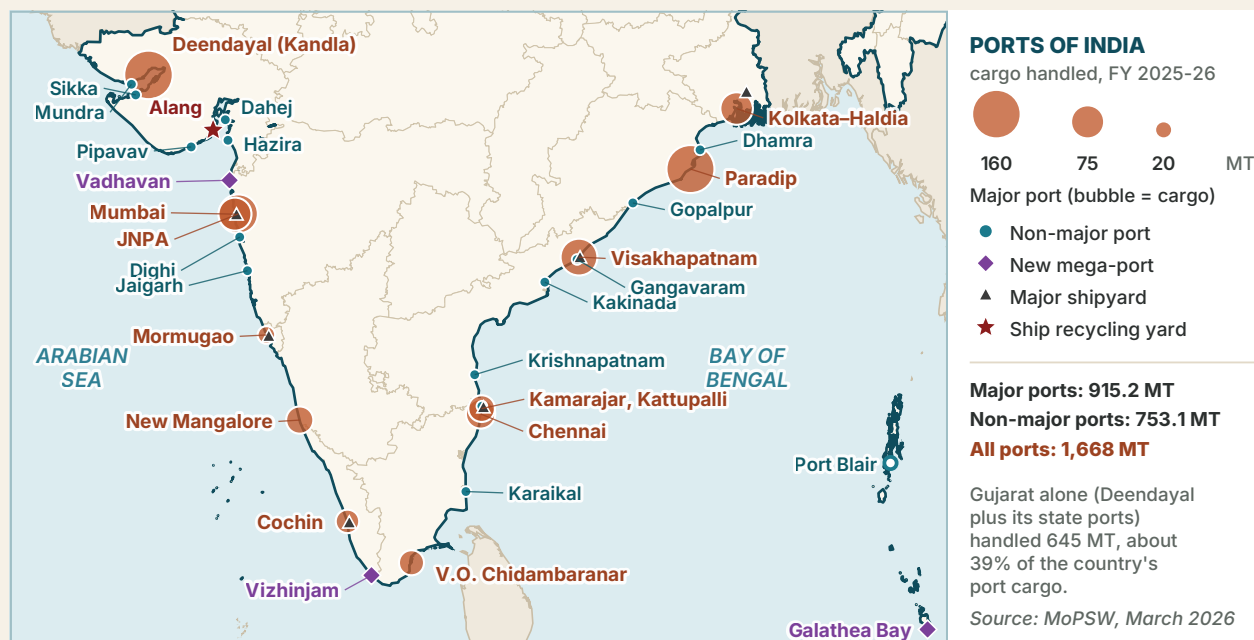


Fig. 19.2 Major ports are shown by bubbles sized to their cargo in 2025-26; leading non-major ports, the new mega-ports, the main shipyards and the Alang ship-recycling yard are also marked. Data: Ministry of Ports, Shipping and Waterways (MoPSW), 2026.

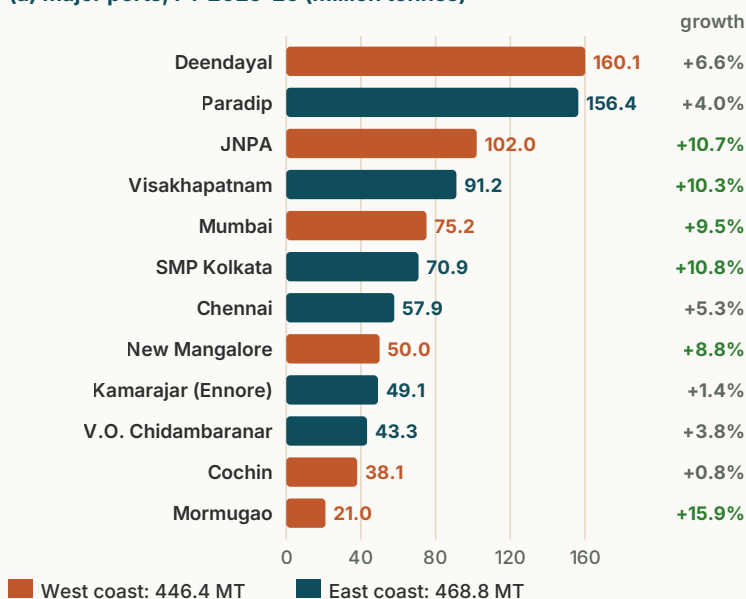
Traffic in 2025-26

- **Major ports** handled a record **915.17 million tonnes (MT)** in 2025-26, 7.06% more than the year before and above the target of 904 MT. **Deendayal (Kandla)** regained first place with 160.11 MT, ahead of **Paradip** (156.45 MT), which had led in 2023-24 and 2024-25; **JNPA** (102.01 MT) was third. Mormugao grew fastest (15.9%), followed by the Kolkata Dock System (14.3%) and JNPA (10.7%).
- **Non-major ports** handled 753.07 MT (+1.44%), so **all Indian ports together handled about 1,668 MT**. Gujarat's state ports alone moved 485 MT, nearly two-thirds of non-major cargo; with Deendayal, Gujarat handles about 39% of all India's port cargo.
- **Commodities at major ports:** petroleum, oil and lubricants (POL) about 30%, containers 23% (14.9 million TEU), coal 21% (up 28% in a year), iron ore 5% and fertilisers 3%. About 23% of major-port cargo is coastal, led by thermal coal shipped from Paradip to power stations in Tamil Nadu and Andhra Pradesh.

- **Capacity** at major ports was about 1,681 million tonnes a year in 2024-25, roughly twice the traffic, but much of it is in old or shallow berths.

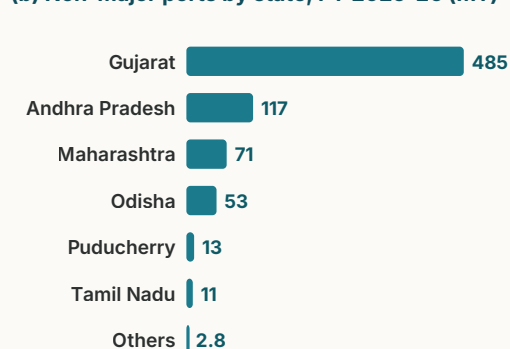
Cargo Handled at Indian Ports, 2025–26

(a) Major ports, FY 2025-26 (million tonnes)



Source: Ministry of Ports, Shipping and Waterways, cargo reports for March 2026 (provisional / advance estimates).

(b) Non-major ports by state, FY 2025-26 (MT)



Major ports: 915.2 MT (+7.1%)

Non-major ports: 753.1 MT (+1.4%)

All ports: 1,668 MT

Coastal cargo: 23% at major ports,
19% at non-major ports

Fig. 19.3 (a) The two leading major ports are a Gujarat oil-and-bulk port and an Odisha coal-and-ore port; containers make JNPA third. (b) Among state ports, Gujarat (Mundra, Sikka, Hazira, Dahej, Pipavav) dwarfs every other state.

84 Major Ports of the West Coast

Deendayal Port, Kandla (Gujarat)

Built on **Kandla creek** at the head of the **Gulf of Kachchh** after Partition took Karachi away from India; declared a major port in 1955 and renamed in 2017. It is a **tidal port** with a large tidal range. Its offshore oil terminal at **Vadinar**, with single-point moorings for very large crude carriers, feeds the Vadinar refinery and the Salaya–Mathura pipeline, so POL dominates its cargo; it also handles fertilisers, salt, timber, edible oil and grain for a vast north-western hinterland (Gujarat, Rajasthan, Punjab, Haryana, Delhi, Himachal and Jammu and Kashmir). The **Tuna Tekra** container terminal is being built off the creek, and the port hosts a green-hydrogen pilot and one of three green-hydrogen hubs.

Mumbai Port (Maharashtra)

India's second-oldest major port and long its main gateway, set in a natural deep-water harbour of about 400 km² sheltered between Mumbai island and the Konkan mainland. Its enclosed wet docks (Prince's, Victoria and Indira) were built to beat the tide. Today it is mainly a liquid-bulk port, with crude and products moving through the Jawahar Dweep oil terminal; it handled a record 75.15 MT in 2025-26. Space for expansion is the city's limit, which is why container traffic moved across the harbour.

Jawaharlal Nehru Port Authority, Nhava Sheva (Maharashtra)

Commissioned in **1989** on the eastern shore of Mumbai harbour off Elephanta island, to relieve Mumbai Port. It is India's **largest public container port** and the first major port to become a **100% landlord port**: five terminals run by DP

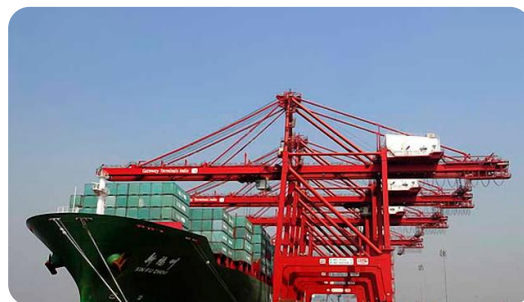


Fig. 19.4 Container terminals at Jawaharlal Nehru Port (Nhava Sheva), India's largest public container port.

World, APM Terminals, PSA and JM Baxi give it 10.4 million TEU of capacity, the PSA-run Bharat Mumbai Container Terminal (4.8 million TEU) being India's largest single terminal. It handled 7.94 million TEU in calendar 2025 and crossed 100 MT of cargo in 2025-26. It is the terminal of the Western Dedicated Freight Corridor and ranked 23rd in the World Bank's Container Port Performance Index 2024, the best in India. Its hinterland spans Maharashtra, Madhya Pradesh, Gujarat, Rajasthan and the National Capital Region.

Mormugao Port (Goa)

A natural harbour at the mouth of the **Zuari**, working since 1885 and a major port since 1963. It was built for **iron ore** from Goa and the Bellary–Hospet belt of Karnataka, and ore still sets its fortunes: it slumped when Goa's mining was halted in 2012 and has recovered as mining resumed, growing faster than any major port in 2025-26. It also imports coal and has a cruise terminal.

New Mangalore Port (Karnataka)

At **Panambur** near the mouth of the Gurupura river, declared the ninth major port in 1974. It once exported Kudremukh ore; now it handles crude for the Mangalore refinery and the Mangaluru strategic oil caverns, LPG, coal, fertilisers, coffee and cashew. It is Karnataka's only major port and runs fully on solar power.

Cochin Port (Kerala)

Developed between 1920 and 1940 on **Willingdon Island**, an island built from dredged spoil in the Kochi backwaters. Lying near the East–West route, it is a natural harbour that serves Kerala and parts of Tamil Nadu and Karnataka, handling POL for the Kochi refinery, containers, fertilisers and an LNG terminal at Puthuvypeen. Its **Vallarpadam International Container Transshipment Terminal** (2011) was India's first transshipment terminal, but its limited depth has seen its transshipment volume halve since Vizhinjam opened. The **Cochin Shipyard**, which built INS Vikrant, stands beside it.

05

Major Ports of the East Coast

Syama Prasad Mookerjee Port, Kolkata (West Bengal)

The oldest operating port and the **only riverine major port**, with twin systems: the **Kolkata Dock System** on the east bank of the Hugli, far upriver, and the **Haldia Dock Complex** on the west bank near the estuary, built as an out-port for larger ships. The Hugli carries heavy silt and its channel shifts with the tides and sandbars, so the port depends on constant dredging and on the extra flow released by the **Farakka barrage**; ships wait for high water and turnaround is the slowest of all major ports. Its hinterland is the whole of eastern India, the north-east and the landlocked neighbours **Nepal and Bhutan**. It handled 70.87 MT in 2025-26 (Haldia 51.86 MT), with coking coal, POL, containers and fertilisers.

Paradip Port (Odisha)

An artificial lagoon port near the mouth of the **Mahanadi**, declared a major port in 1966, the first on the east coast after Independence. It is the gateway of the **mineral belt of Odisha, Jharkhand and Chhattisgarh**: it exports iron ore and pellets, ships thermal coal from Talcher and Ib Valley along the coast, and imports coking coal and crude for the Paradip refinery. It led all major ports in 2023-24 and 2024-25, has the highest berth productivity and the largest coastal cargo, and now takes ships needing 18.5 m of water.

Visakhapatnam Port (Andhra Pradesh)

Opened in 1933, it is India's main **landlocked harbour**: the inner harbour was dug into the land behind a narrow entrance guarded by the **Dolphin's Nose** headland, with an outer harbour added later. The outer harbour takes ships of 200,000 DWT and has the deepest container terminal among major ports. It handles iron ore (once the Bailadila ore for Japan), coal for the Visakhapatnam steel plant and power stations, crude for the refinery and alumina. The Eastern Naval Command and Hindustan Shipyard are here, and the private **Gangavaram** port lies just to the south.

Chennai Port and Kamarajar Port (Tamil Nadu)

Chennai, begun in 1875, is an **artificial harbour** on an open, surf-beaten coast, built behind breakwaters that trap the northward drift of sand. It is a major container port (1.82 million TEU in 2024-25) and a leading port for **car exports**. Twenty-four km to the north, **Kamarajar (Ennore)**, commissioned in 2001 as the 12th major port to bring coal for Tamil Nadu's power stations, is the **only major port run as a company**, now a subsidiary of the Chennai Port Authority; it also handles LNG, cars and containers and is the first Indian port to transship cars.

V.O. Chidambaranar Port, Tuticorin (Tamil Nadu)

The southernmost major port, on the **Gulf of Mannar**, sheltered from storms by Sri Lanka to the south-east; an artificial harbour with breakwaters, opened as a major port in 1974 and renamed in 2011. It handles coal for nearby power stations, containers for the knitwear and engineering clusters of Tiruppur and Coimbatore, salt, limestone and edible oil. It runs a green-hydrogen pilot plant. Tuticorin is also known for the old pearl fishery of the Gulf of Mannar.

MAJOR PORT	MT 2025-26	MAIN HINTERLAND	REMEMBER IT FOR
WEST COAST			
Deendayal (Kandla), Gujarat	160.1	Gujarat, Rajasthan, Punjab, Haryana, Delhi, Himachal, J&K, west UP	Largest by cargo; tidal creek port; Vadinar crude terminal; Asia's first EPZ (1965)
Mumbai, Maharashtra	75.1	Mumbai region, Maharashtra, Gujarat, MP	Largest natural harbour; oldest gateway of the west; wet docks; POL
JNPA (Nhava Sheva), Maharashtra	102.0	Maharashtra, MP, Gujarat, Rajasthan, NCR and north India via the WDFC	Largest public container port; first 100% landlord major port
Mormugao, Goa	21.0	Goa, north Karnataka (Bellary-Hospet), south Maharashtra	Zuari estuary; iron ore; fastest growth in 2025-26
New Mangalore, Karnataka	50.0	Karnataka, north Kerala	Crude for MRPL; LPG; coffee; solar-powered
Cochin, Kerala	38.1	Kerala, south-west Tamil Nadu, south Karnataka	Willingdon Island; Vallarpadam terminal; shipyard
EAST COAST			
SMP Kolkata (KDS + Haldia), West Bengal	70.9	West Bengal, Bihar, Jharkhand, east UP, the north-east, Nepal, Bhutan	Oldest; only riverine major port; heavy dredging
Paradip, Odisha	156.5	Odisha, Jharkhand, Chhattisgarh	Ore and coal; largest coastal cargo; best berth productivity
Visakhapatnam, Andhra Pradesh	91.2	Andhra Pradesh, Telangana, south Chhattisgarh, south Odisha	Landlocked harbour; deepest container terminal of the majors
Kamarajar (Ennore), Tamil Nadu	49.1	North Tamil Nadu	Only corporatised major port; coal, LNG, cars
Chennai, Tamil Nadu	57.9	Tamil Nadu, south Andhra Pradesh, Karnataka	Artificial harbour; cars; containers
V.O. Chidambaranar, Tamil Nadu	43.3	South Tamil Nadu (Tiruppur, Coimbatore, Madurai), south Kerala	Southernmost major port; Gulf of Mannar

The Andaman and Nicobar ports, including Port Blair, are run by a separate Ports Management Board; Galathea Bay was notified as a major port in 2024 (Section 06).

06 New Mega-Ports

Indian ports were built for a world of smaller ships. Few had more than 14–15 m of water, so the largest container ships bypassed India and Indian boxes were carried by feeder ships to **Colombo, Singapore and Port Klang** for transshipment; about three-quarters of India's transshipment cargo was handled abroad, adding cost and delay. Three new ports are meant to change this.

India's New Mega-Ports

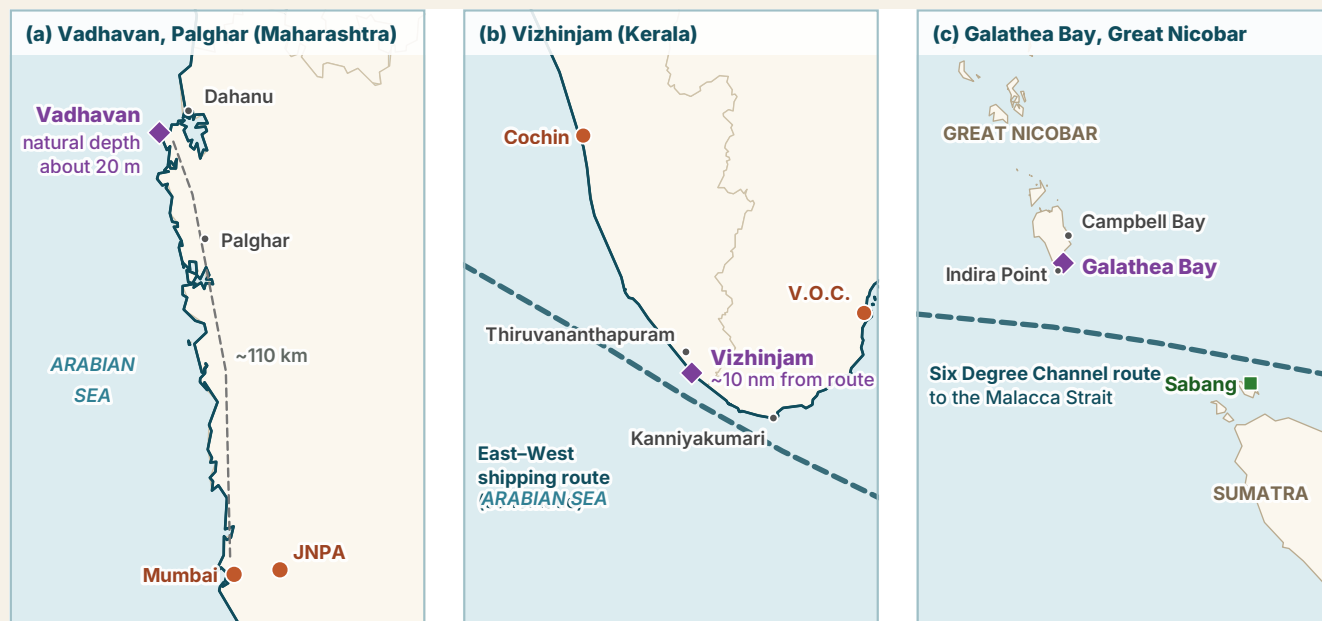


Fig. 19.5 (a) Vadhavan lies on the open coast of Palghar district, about 110 km north of Mumbai. (b) Vizhinjam sits about 10 nautical miles from the East–West shipping lane at the southern tip of the peninsula (route shown schematically). (c) Galathea Bay faces the Six Degree Channel, the western entrance to the Malacca Strait; Indonesia's Sabang lies across it.

Vizhinjam International Seaport (Kerala)

- India's first dedicated deep-water container transshipment port, near Thiruvananthapuram. A natural depth of 18–20 m close to the shore, little littoral drift and a site about 10 nautical miles from the international East–West route make it ideal; it needed little dredging.
- Built by the Kerala government as landlord with Adani Vizhinjam Port under a PPP (design–build–finance–operate–transfer) concession, with central viability-gap funding. Commercial operations began in December 2024 and the Prime Minister dedicated it to the nation on 2 May 2025.
- It handled about 1.3 million TEU in 2025–26, its first full year, the fastest ramp-up of any Indian port, and over 70 ultra-large container vessels have called. Capacity (1.6 million TEU) is being raised to 5.7 million TEU by 2028; in 2026 MSC's terminal arm agreed to take a 49% stake.
- It runs India's first fully indigenous vessel-traffic system, built by IIT Madras.

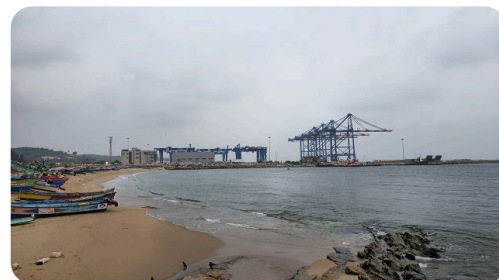


Fig. 19.6 Ship-to-shore cranes at Vizhinjam, seen across the rocky shore south of Thiruvananthapuram.

Vadhavan Port (Maharashtra)

Approved by the Cabinet in **June 2024** as India's **13th major port**, at Vadhavan near Dahanu in Palghar district, at a cost of about ₹76,220 crore; the foundation stone was laid on 30 August 2024. It will be an all-weather, deep-draft greenfield port on reclaimed land with a natural depth of about 20 m, built by Vadhavan Port Project Ltd (JNPA 74%, Maharashtra Maritime Board 26%) on the landlord model. Planned capacity is about 298 MT a year, including 23.2 million TEU of containers, which would place it among the world's ten largest container ports. A breakwater contract was awarded in 2026, and new rail and expressway links will tie it to the Western Dedicated Freight Corridor. Fishing communities and the ecologically fragile status of the Dahanu coast have made it controversial.

Galathea Bay, Great Nicobar

An **International Container Transshipment Port** planned at Galathea Bay on the south-east coast of Great Nicobar, part of the Holistic Development of Great Nicobar Island project that also includes an airport, a township and a power plant. Galathea Bay was **notified as a major port in September 2024**. The site has deep natural water and lies beside

the approach to the **Malacca Strait**, one of the world's busiest lanes. The port is to be built in two stages, reaching about 20 million TEU over 35 years, with the first phase expected around 2028. Critics point to the loss of tropical forest, coral, and nesting beaches of the leatherback turtle, the rights of the **Shompen** and Nicobarese people, and the island's exposure to earthquakes and tsunamis (it subsided in 2004); supporters stress strategic value at the mouth of the Malacca Strait.

Other new ports proposed under Sagarmala include Tajpur (West Bengal), Machilipatnam (Andhra Pradesh), Tadadi (Karnataka) and the Enayam–Colachel site in Tamil Nadu.

07 Non-Major and Private Ports

Non-major ports handle about 45% of India's cargo, up from under 10% in the 1990s, because states invited private developers to build deep, efficient captive and commercial ports. **Gujarat**, which set up India's first State Maritime Board in 1982, leads by far; Andhra Pradesh, Maharashtra and Odisha follow.

PORT	STATE	FEATURES
Mundra	Gujarat (Gulf of Kachchh)	Run by Adani Ports (APSEZ); India's largest commercial port and the first to handle 200 MT in a year (2024-25); largest coal-import terminal; deep-draft, all-weather; port-based SEZ; 25th in the CPPI 2024; western node of the proposed India–Middle East–Europe corridor
Sikka and Vadinar	Gujarat (Jamnagar)	Crude and products terminals of the Jamnagar refinery complex, the world's largest, and the Vadinar refinery
Pipavav	Gujarat (Saurashtra)	India's first private-sector port; containers and bulk; run by APM Terminals
Dahej and Hazira	Gujarat (Gulf of Khambhat)	Dahej, at the Narmada estuary, has India's largest LNG terminal and serves the chemicals region of Bharuch; Hazira near Surat has LNG, steel, container and bulk terminals
Jaigarh, Dighi	Maharashtra	Deep-water captive and commercial ports of the Konkan coast
Krishnapatnam	Andhra Pradesh (Nellore)	Opened in 2008 as the country's largest private port; coal, iron ore, containers
Gangavaram, Kakinada	Andhra Pradesh	Gangavaram, next to Visakhapatnam, is among India's deepest ports (about 21 m); Kakinada is sheltered by Hope Island and serves the Krishna–Godavari gas region
Dhamra, Gopalpur	Odisha	Dhamra (deep draft, coal and ore, LNG terminal) lies close to Bhitarkanika and the Gahirmatha turtle beaches; Gopalpur serves south Odisha
Kattupalli, Karaikal	Tamil Nadu; Puducherry	Kattupalli combines a container port with L&T's shipyard; Karaikal handles coal and bulk

Adani Ports (APSEZ) alone handled over 500 MT in 2025-26 across 19 ports and terminals in India and abroad and about 45% of India's container traffic, a concentration that worries competition analysts.

08 Laws, Policy and Performance

Who governs ports

- **Constitution.** Ports declared by Parliament to be **major ports** are in the **Union List (Entry 27)**; **other ports** are in the **Concurrent List (Entry 31)**, so states run them through State Maritime Boards or port directorates. Shipping and navigation on the high seas are Union subjects.
- **Ministry.** The Ministry of Shipping was renamed the **Ministry of Ports, Shipping and Waterways** in 2020.
- **Major Port Authorities Act, 2021** (in force 3 November 2021) replaced the Major Port Trusts Act, 1963. Port Trusts became **Port Authorities** with smaller, professional boards that can fix tariffs and sign PPP deals themselves; the Tariff Authority for Major Ports was wound up and an Adjudicatory Board for Major Ports (set up in 2025) settles disputes. It does not apply to Kamarajar, which is a company.

The maritime Acts of 2025

In 2025 Parliament replaced five colonial-era or dated shipping laws:

ACT (2025)	REPLACES	KEY FEATURES
Indian Ports Act	Indian Ports Act, 1908	Gives statutory status to the Maritime State Development Council for Centre–state coordination; defines the roles of State Maritime Boards and port officers; transparent tariffs; dispute-resolution committees; safety, pollution and disaster standards for all ports
Merchant Shipping Act	Merchant Shipping Act, 1958	Cuts sections from 560 to 325; turns the Directorate General of Shipping into the Directorate General of Maritime Administration ; brings in IMO conventions, the ISPS Code for port and ship security and the Maritime Labour Convention; wider ownership rules to grow the Indian flag
Coastal Shipping Act	coastal parts of the 1958 Act	No licence needed for Indian-flag ships in coastal trade; licences for foreign ships given strategically; a National Coastal Shipping Strategic Plan and national database; integrates coastal and inland waterways
Bills of Lading Act	Indian Bills of Lading Act, 1856	Clarifies the rights of holders of a bill of lading, the document of title to cargo
Carriage of Goods by Sea Act	Act of 1925	Restates the Hague–Visby rules on carriers' liability in simple language

Sagarmala and the long-term visions

Sagarmala, approved in March 2015 with a National Perspective Plan in 2016, is the flagship programme for **port-led development**: to cut logistics costs for exports and domestic cargo by using the coast and waterways, and to locate industry near ports. It has **five pillars**: port modernisation and new ports; port connectivity; port-led industrialisation (14 Coastal Economic Zones such as Kachchh, Suryapur, Dakshin Kanara, Kalinga and Gaud); coastal community development; and coastal shipping and inland water transport. By early 2026 it listed 839 projects worth about ₹5.8 lakh crore to 2035, of which 288 worth ₹1.45 lakh crore were complete. Its finance arm, the **Sagarmala Finance Corporation**, became India's first maritime non-banking finance company and began lending in 2025-26.

- **Maritime India Vision 2030** (2021): about 150 initiatives across ten themes, from world-class ports and shipbuilding to cruise tourism and green shipping.
- **Maritime Amrit Kaal Vision 2047** (2023): about 300 initiatives and some ₹80 lakh crore of investment, aiming to handle about 10 billion tonnes of cargo a year and make India one of the **top five shipbuilding nations by 2047**.
- **PM Gati Shakti** National Master Plan coordinates rail, road and port projects; a Comprehensive Port Connectivity Plan targets last-mile links.
- **Green ports**: the Harit Sagar guidelines (2023), a Green Tug Transition Programme, shore power, and green-hydrogen hubs at **Deendayal, Paradip and V.O. Chidambaranar**.
- India Maritime Week (Mumbai, October 2025) saw 522 MoUs worth about ₹12 lakh crore.

Performance and problems

Average ship turnaround at major ports fell to about 49 hours in 2025-26 from about 53 hours four years earlier, but varies from 27 hours at JNPA to 81 hours at Kolkata; Singapore takes less than a day. Seven Indian ports were in the World Bank's top 100 container ports in 2024 (JNPA 23rd, Mundra 25th). The persistent problems are:

- **Shallow draught** at most ports and heavy dredging costs on the east coast and the Hugli;
- **poor hinterland links** and a road-heavy modal mix, which keep logistics costs high;
- **transshipment** done abroad, now being tackled by Vizhinjam and Galathea;
- congestion, slow clearances, under-used old berths alongside overcrowded new ones, and a split between Union and state regulation;
- pollution from coal and ore dust, oil spills and ballast water, and the loss of mangroves and fishing grounds;

- **security:** after the 2008 Mumbai attacks a three-tier coastal security system (Navy, Coast Guard, coastal police) was set up; the ISPS Code applies at all ports handling foreign ships, and a dedicated **Bureau of Port Security** is being created on the lines of the aviation security bureau.

09 Shipping, Shipbuilding and Ship-Breaking

Shipping

India owns only a small fleet for a country of its trade; most of its cargo moves in foreign ships and India pays large freight bills abroad. The **Shipping Corporation of India**, with 58 ships, holds about a quarter of Indian tonnage. India is, however, a leading supplier of seafarers (about 3.1 lakh employed). To grow the Indian flag, large ships owned and flagged in India have been given infrastructure status for cheaper long-term finance, and a Bharat Maritime Insurance Pool is being created to insure Indian ships at home.

Shipbuilding

China, South Korea and Japan build over 90% of the world's ships by tonnage; India's share is under 1%. Shipbuilding is a classic assembly industry that needs a sheltered waterfront with deep water, dry docks, steel and engines, a large skilled workforce and patient finance. The main yards are **Cochin Shipyard** (the largest public yard; INS Vikrant), **Mazagon Dock** (Mumbai; submarines and warships), **Garden Reach** (Kolkata), **Hindustan Shipyard** (Visakhapatnam), **Goa Shipyard** (Vasco) and private yards such as L&T at Kattupalli and the large dry dock at Pipavav.

In **September 2025** the Cabinet approved a ₹69,725-crore maritime package:

- **Shipbuilding Financial Assistance Scheme** (₹24,736 crore to 2036): aid per ship built in India, a shipbreaking credit note, and a National Shipbuilding Mission;
- **Shipbuilding Development Scheme** (₹19,989 crore): greenfield shipbuilding clusters with full capital support through Centre–state SPVs, 25% support for brownfield expansion, an India Ship Technology Centre and credit-risk cover;
- **Maritime Development Fund** (₹25,000 crore, announced in the 2025-26 Budget): a ₹20,000-crore Maritime Investment Fund with 49% government equity, and a ₹5,000-crore Interest Incentivisation Fund that lowers interest on shipbuilding loans by up to 3%.

The aim is about 4.5 million gross tonnes of shipbuilding capacity a year by 2047.

Ship-breaking at Alang

About 98% of India's ship recycling takes place at **Alang–Sosiya** in Bhavnagar district, on a 10 km stretch of the western shore of the **Gulf of Khambhat**. The site suits the **beaching method**: the gulf's very high spring tides carry a ship far up a gently sloping, firm mudflat, and when the tide falls it is stranded on dry land for cutting. Cheap labour, a large market for re-rollable steel and second-hand fittings, and Gujarat's re-rolling mills complete the advantage. Alang yields about 3.5 MT of steel a year, and India, Bangladesh (Chattogram) and Pakistan (Gadani) together dismantle most of the world's retired ocean tonnage; Turkey's Aliağa is the main yard outside South Asia.

The industry has been criticised for accidents and for exposing workers and the shore to asbestos, oil and heavy metals; the Supreme Court's 2006 refusal to let the French carrier *Clemenceau* in made it world news. India acceded to the **Hong Kong International Convention** for safe and environmentally sound ship recycling in 2019 and passed the **Recycling of Ships Act, 2019**; the Convention came into force worldwide in **June 2025**. About 100 Alang plots now meet its standards, and capacity is to double from 4.5 to 9 MT of light displacement tonnage by 2028.



Fig. 19.7 A tanker beached for dismantling at Alang on the Gulf of Khambhat; its steel will be re-rolled in Gujarat's mills.

India's Ports Abroad

Ports abroad give India access to landlocked regions, a foothold on key sea lanes and an answer to China's growing chain of port investments around the Indian Ocean, often called the "string of pearls".

India's Overseas Port Projects and China's Port Network

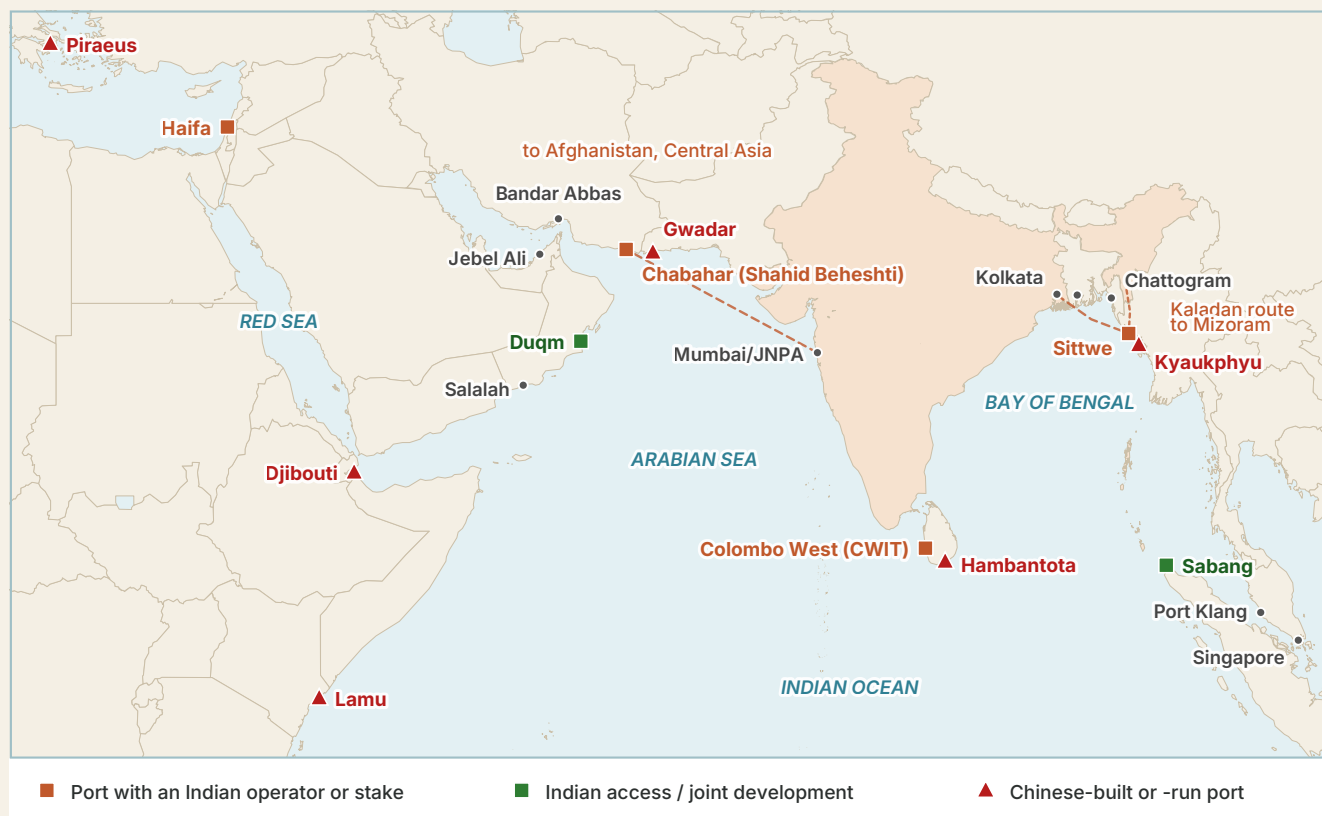


Fig. 19.8 India operates or holds stakes in ports in Iran, Myanmar, Sri Lanka and Israel and has access arrangements in Oman and Indonesia; China has built or runs ports from Piraeus and Djibouti to Gwadar, Hambantota and Kyaukphyu. Dashed lines show the Chabahar and Kaladan links.

- **Chabahar (Iran).** On the Gulf of Oman, outside the Strait of Hormuz and about 170 km west of Gwadar. India Ports Global Ltd has run the **Shahid Beheshti** terminal since 2018 and signed a 10-year contract in May 2024. It is India's route to Afghanistan and Central Asia that bypasses Pakistan, and a link to the International North–South Transport Corridor (Chapter 17); container traffic rose to about 85,500 TEU in 2024–25. The US sanctions waiver for the project was withdrawn in 2025, extended briefly and lapsed in April 2026, and India has said it will make no further financial commitment, leaving the project's future uncertain.
- **Sittwe (Myanmar).** At the mouth of the Kaladan river in Rakhine state, built by India under the **Kaladan Multi-Modal Transit Transport Project**: ships from Kolkata to Sittwe, river barges to Paletwa and a road to Mizoram, bypassing the Siliguri corridor. The port opened in 2023 and India Ports Global has operated it since April 2024, though the road section is stalled by conflict in Myanmar.
- **Colombo West International Terminal (Sri Lanka).** A deep-water container terminal built and run by Adani Ports with John Keells and the Sri Lanka Ports Authority on a 35-year build–operate–transfer basis; it opened in 2025, next to the Chinese-run Colombo International Container Terminal.
- **Haifa (Israel).** Bought by Adani Ports with Israel's Gadot group in 2023; a Mediterranean anchor of the proposed India–Middle East–Europe Economic Corridor.
- **Sabang (Indonesia).** A deep-water port on Weh island at the northern tip of Sumatra, at the mouth of the Malacca Strait and close to Great Nicobar; India and Indonesia agreed in 2018 to develop it and in July 2026 announced a partnership for its integrated development.

- **Duqm (Oman).** Under a 2018 arrangement the Indian Navy can use Duqm on the Arabian Sea for logistics and dry docking, extending its reach towards the Gulf of Aden.
- **Bangladesh** allows Indian goods to transit through **Chattogram and Mongla** to the north-east.

China's ports include **Gwadar** (Pakistan, the sea end of the China–Pakistan Economic Corridor, run by a Chinese company), **Hambantota** (Sri Lanka, leased to China Merchants Port for 99 years in 2017 after Sri Lanka could not repay its loans), **Kyaukphyu** (Myanmar, start of the oil and gas pipelines to Yunnan), **Djibouti** (China's first overseas military base, 2017), **Piraeus** (majority-owned by COSCO) and Lamu in Kenya.

11 Ports of the World

World container throughput passed **1 billion TEU in 2025**. The balance of port traffic has shifted decisively to Asia: China alone has eight of the fifteen busiest container ports, a result of its export manufacturing, coastal city clusters and huge investments in deep-water terminals.

The World's Busiest Container Ports

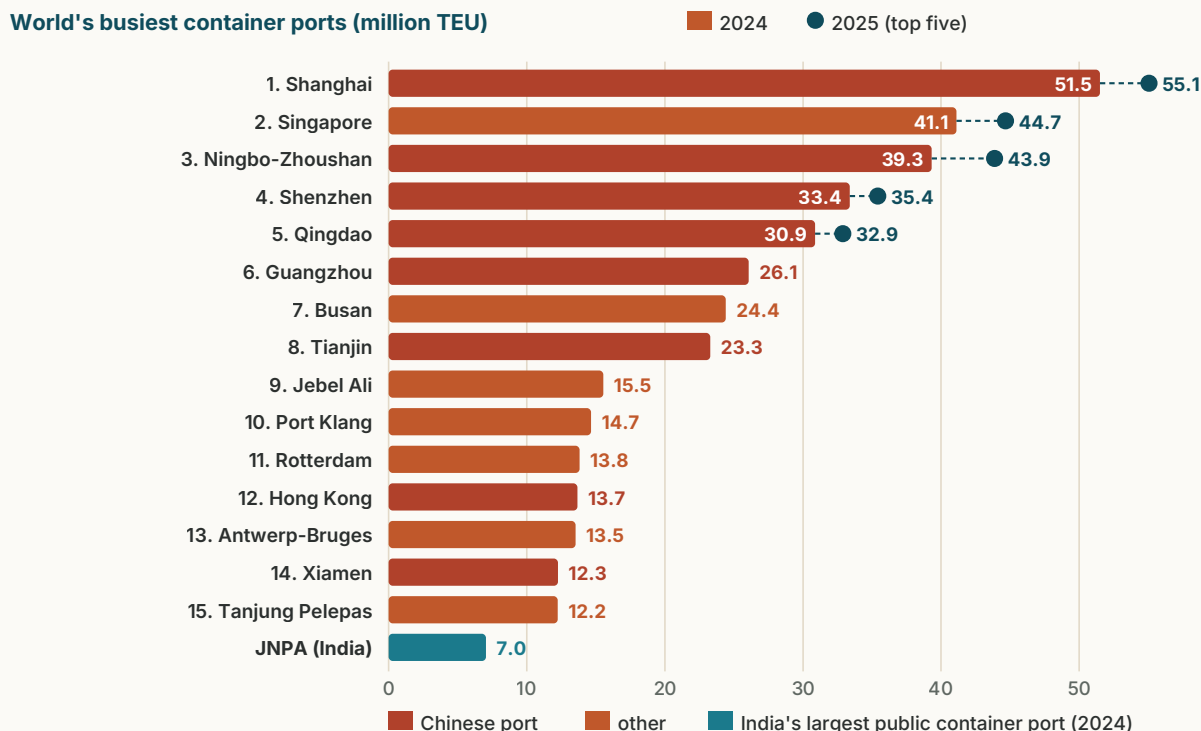


Fig. 19.9 The fifteen busiest container ports of 2024 crowd the coasts of China and the Strait of Malacca; Jebel Ali, Rotterdam and Antwerp-Bruges are the only ones outside East and South-East Asia. Other ports named in the text are marked in teal.

REGION	LEADING PORTS AND WHAT TO REMEMBER
East Asia	Shanghai (the Yangshan deep-water port is built on offshore islands joined to the mainland by the 32.5-km Donghai Bridge), Ningbo-Zhoushan (largest by tonnage: ore, crude, coal), Shenzhen, Qingdao, Guangzhou, Tianjin, Hong Kong (declining entrepôt), Busan (Korea's transshipment hub), Kaohsiung, Tokyo–Yokohama
South-East Asia	Singapore , the world's largest transshipment hub at the southern end of the Malacca Strait, now moving to the automated Tuas mega-port; Port Klang and Tanjung Pelepas (Malaysia); Laem Chabang (Thailand); Cai Mep (Viet Nam)
South Asia	Colombo , South Asia's leading hub, much of whose traffic is Indian cargo; Chattogram; Karachi; Mundra and JNPA
West Asia	Jebel Ali (Dubai; largest man-made harbour, free zone, the region's top port); Khalifa (Abu Dhabi); Salalah (Oman); Jeddah; Ras Tanura, one of the world's largest crude-export terminals
Europe	Rotterdam (Europe's largest port, on the Rhine–Meuse delta, with Europoort and the reclaimed Maasvlakte terminals), Antwerp-Bruges (merged in 2022), Hamburg (on the Elbe), Bremerhaven, Le Havre, Felixstowe; Piraeus, Valencia, Algeciras and Gioia Tauro in the Mediterranean
Africa	Tanger Med (Morocco, on the Strait of Gibraltar; Africa's busiest container port), Port Said, Durban (busiest south of the Sahara), Mombasa, Djibouti, Lagos–Lekki

Americas	Los Angeles–Long Beach (San Pedro Bay; North America's largest complex), New York–New Jersey, Savannah, Houston (energy, via its ship channel), Vancouver; Santos (Latin America's busiest; coffee and soy), Colón and Balboa at the ends of the Panama Canal; Maracaibo (Venezuela's oil port)
Oceania	Port Hedland (the world's largest bulk-export port, for Pilbara iron ore), Dampier, Newcastle (coal), Melbourne (Australia's busiest container port)

Container Throughput of the Leading Ports



Sources: Lloyd's List One Hundred Ports 2025 (2024); DynaLiners, 2026 (2025); MoPSW Annual Report 2025-26 (JNPA).

Fig. 19.10 Shanghai has been the busiest container port since 2010 and handled 55.1 million TEU in 2025. Ningbo-Zhoushan, the busiest port in the world by tonnage (about 1.43 billion tonnes in 2025), overtook Singapore for second place in container traffic in the first half of 2026.



Fig. 19.11 The automated Yangshan deep-water terminals of Shanghai, the world's busiest container port.



Fig. 19.12 Pasir Panjang terminal, Singapore, the world's leading transshipment hub.

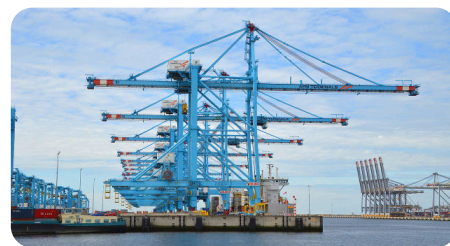


Fig. 19.13 A container terminal on the reclaimed Maasvlakte at Rotterdam, Europe's largest port.

Ships and shipping alliances

SHIP CLASS	SIZE AND THE LIMIT THAT DEFINES IT
Panamax	Largest ship that fitted the old Panama Canal locks (beam about 32 m; about 5,000 TEU or 65,000–80,000 DWT)
Neo-Panamax	Fits the larger locks opened in 2016 (beam about 51 m; up to about 14,000 TEU)
Suezmax, Aframax	Tankers: the largest that can pass the Suez Canal laden (about 150,000–160,000 DWT); Aframax medium tankers (80,000–120,000 DWT)
Capesize, VLCC	Bulk carriers too large for Panama or Suez that round the Cape (150,000–400,000 DWT); very large crude carriers of 200,000–320,000 DWT
Ultra-large container vessel	18,000–24,000+ TEU, about 400 m long, drawing 16–17 m: the ships that only deep hubs can receive

Container lines share ships and routes through **alliances**. Since 2025 there are three: the **Gemini Cooperation** (Maersk and Hapag-Lloyd), the **Premier Alliance** (ONE, HMM and Yang Ming) and the **Ocean Alliance** (CMA CGM, COSCO with OOCL, and Evergreen); **MSC**, the largest line, now sails alone after the 2M partnership with Maersk ended in January 2025. Alliances decide which ports their big ships call at, which is why Indian ports compete fiercely for their services.

IN THE NEWS · CHOKEPOINTS AND PORTS

Attacks on shipping in the Red Sea since 2023 and the closures of the Strait of Hormuz during the West Asian war of 2026 sent ships around the Cape, cut traffic at Gulf hubs such as Jebel Ali and disrupted India's crude, LPG and container flows. Such shocks strengthen the case for Indian transshipment hubs, strategic oil reserves and diversified ports (see Chapter 17 for the chokepoints).

USING THIS CHAPTER IN MAINS

- **Location of a port (GS I):** explain site (depth, shelter, siltation, tides, backup land) and situation (hinterland, foreland, sea lanes); contrast the natural harbours of the west coast with the artificial and lagoon harbours of the east (Sections 01, 03); draw Fig. 19.1.
- **Why India needs transshipment hubs:** shallow ports, feeder costs, revenue lost to Colombo and Singapore; Vizhinjam's natural depth and position, Galathea and Vadhavan; strategic angle of the Malacca approach (Section 06, Fig. 19.5).
- **Port-led development and logistics (GS III):** Sagarmala pillars, Coastal Economic Zones, Gati Shakti, landlord model and PPP, the 2025 Acts; issues of draught, turnaround, hinterland links and the environment (Section 08).
- **Shipbuilding and ship-breaking as industries:** location factors of Alang (tides, mudflat, steel demand) and of shipyards; the 2025 package; the Hong Kong Convention (Section 09).
- **Geopolitics of ports:** Chabahar, Sittwe, Colombo, Sabang and Duqm against Gwadar, Hambantota and Kyaukphyu; maritime security of sea trade (Sections 08, 10).



Previous Year Questions

Prelims

2026

In what way(s) does the Vizhinjam International Seaport represent a structural shift in India's maritime trade and logistics policy?

1. By functioning exclusively as a domestic cargo hub to reduce reliance on coastal shipping and eliminate the need for foreign collaborations.
2. By focusing primarily on passenger cruise tourism and heritage shipping to increase Kerala's profile as a maritime heritage destination.
3. By leveraging its natural deep draft and strategic location to reduce dependence on foreign trans-shipment ports, enhance revenue retention, and reposition India in regional maritime trade.

Select the answer using the code given below:

a 1 only

b 1 and 2

c 2 and 3

d 3 only

Answer: (d). Vizhinjam is an international container transshipment hub that depends on global lines and feeder links; its 18–20 m natural depth near the East–West lane lets it win back cargo transshipped at Colombo and Singapore (Section 06).

2026

Consider the following statements with reference to the Sagarmala Programme of the Government of India :

- I. The Sagarmala Programme seeks to achieve port-led economic growth through cost-effective and sustainable coastal infrastructure.
- II. The success of the Sagarmala Programme is reflected in significant growth in coastal and inland waterway shipping, along with improved global port rankings.
- III. Sagarmala 2.0 aims to position India as a global maritime innovation hub aligned with Atmanirbhar Bharat and Viksit Bharat 2047 visions.

Which of the following relationships among the above statements is/are correct?

1. Statement II validates the effectiveness of the strategies envisioned in statement I.
2. Statement III extends the objectives of statement I by embedding them into a future-oriented innovation framework.
3. Statement I contradicts statement III by focusing only on traditional infrastructure instead of modern innovation.

Select the answer using the code given below :

a 1 only

b 1 and 2

c 2 and 3

d 3 only

Answer: (b). Statement I is Sagarmala's aim of port-led growth; the growth of coastal and waterway cargo and better port rankings bear it out, and the next phase builds on it with innovation and shipbuilding, so the phases complement rather than contradict each other (Section 08).

2023

Consider the following pairs:

Port : Well known as

1. Kamarajar Port : First major port in India registered as a company
2. Mundra Port : Largest privately owned port in India
3. Visakhapatnam Port : Largest container port in India

How many of the above pairs are correctly matched?

a Only one pair

b Only two pairs

c All three pairs

d None of the pairs

Answer: (b). Kamarajar is the only major port run as a company and Mundra the largest private port; the largest container ports are Mundra and JNPA, not Visakhapatnam (Sections 04, 05, 07).

2017

What is the importance of developing Chabahar Port by India?

a India's trade with African countries will enormously increase.

b India's relations with oil producing Arab countries will be strengthened.

c India will not depend on Pakistan for access to Afghanistan and Central Asia.

d Pakistan will facilitate and protect the installation of a gas pipeline between Iraq and India.

Answer: (c). Chabahar, on Iran's Gulf of Oman coast, opens a sea–land route to Afghanistan and Central Asia that avoids Pakistan (Section 10).

2016

Recently, which of the following States has explored the possibility of constructing an artificial inland port to be connected to sea by a long navigational channel?

a Andhra Pradesh

b Chhattisgarh

c Karnataka

d Rajasthan

Answer: (d). Landlocked Rajasthan studied an inland port near Jalore, linked to the Gulf of Kachchh by a long channel across the Rann; an inland port reaches the sea through a river or canal (Section 02).

2009

In India, the ports are categorized as major and non-major ports. Which one of the following is a non-major port?

a Kochi (Cochin)

b Dahej

c Paradip

d New Mangalore

Answer: (b). Dahej, on the Narmada estuary in Gujarat, is a state (Gujarat Maritime Board) port with India's largest LNG terminal; the others are major ports (Sections 04, 07).

2009

In which one of the following States has India's largest private sector sea port been commissioned recently?

a Andhra Pradesh

b Karnataka

c Kerala

d Tamil Nadu

Answer: (a). Krishnapatnam port in Nellore district opened in 2008 as the country's largest private port; Mundra holds that title today (Section 07).

1999

Which one of the following port cities in Venezuela has been developed as an oil port?

a Caracas

b Maracaibo

c Maracay

d Carupano

Answer: (b). Maracaibo, at the outlet of oil-rich Lake Maracaibo, is Venezuela's oil port; Caracas and Maracay are inland cities (Sections 02, 11).

Mains

2025

GS III · 15 MARKS

Why is maritime security vital to protect India's sea trade? Discuss maritime and coastal security challenges and the way forward.

Approach: Start with the scale of sea trade (95% by volume, 1,668 MT through ports in 2025-26) and its dependence on chokepoints and a few ports; list threats: piracy, terrorism via the sea (2008), smuggling, Red Sea and Hormuz disruptions, cyber attacks on ports, and Chinese ports in the region; end with the coastal security grid, ISPS Code and the Bureau of Port Security, new Acts, transshipment hubs and overseas ports (Sections 06, 08, 10).

2022

GS III · 10 MARKS

What are the maritime security challenges in India? Discuss the organisational, technical and procedural initiatives taken to improve the maritime security.

Approach: Challenges: a long, indented coast with many minor ports and fishing harbours, infiltration and smuggling, piracy, threats to offshore and port installations; initiatives: the three-tier coastal security system, coastal radar chain, vessel tracking, ISPS Code at ports, the port security bureau and the 2025 maritime laws (Section 08).

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Part III · Transport, Communication and Trade

World routes, pipelines, corridors and cables; roads, railways, waterways and airports of India; ports of India and the world; international trade

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