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India is actively engaging with China over its export restrictions on germanium, a critical mineral essential for industries like semiconductors, fibre optics, and solar technology. The restrictions have raised concerns within Indian industry and could impact the country's efforts in electronics manufacturing and clean energy.

India engaged with China on germanium export restrictions, says embassy

The Indian embassy in Beijing listed germanium as the only element mentioned in grievances from Indian industry players regarding China's export restrictions of rare earth elements

Aroon Deep
NEW DELHI

India is engaging with the Chinese government to navigate export restrictions on germanium, a critical mineral that is used for manufacturing semiconductors, fibre optic cables, and solar panels. The export restrictions for the element – over half of its annual output comes from China – may have caused some friction in electronics manufacturing and other industries that require the element.

In response to a Right to Information application from *The Hindu*, the Indian Embassy in Beijing listed germanium as the only element mentioned in grievances from Indian industry players regarding China's export restrictions of rare earth elements (REEs). Germanium is not listed as an REE, a category that includes 17 heavy metals that China has a practical monopoly in refining.



The exports of germanium and gallium to the United States were largely banned last November. REUTERS

Germanium and gallium's exports to the United States were largely banned last November, and a year before, were placed under "export licensing" for other countries.

Fully reliant on imports
India makes no germanium, and is completely reliant on imports for the element. According to a financial daily's report in 2024, India is relying on imports of germanium

through suppliers in the United Arab Emirates, a process that has inflated costs for Indian importers.

The embassy in Beijing declined to disclose specific representations and meetings with Chinese officials on the issue. "The matter has been taken up with Ministries/Departments concerned on the Chinese side through formal communications as well as during meetings," the embassy said in its res-

ponse to *The Hindu*.

Germanium oxide is used in the "core of the preform" for fibre optic cables, an industry expert said. "Preforms are solid cylinders of glass which are used to draw optical fibres in specialised furnaces."

While relations with China have cooled down in recent months, the country is reportedly thwarting certain projects with export curbs and even travel restrictions. For instance, Apple, Inc.'s contract manufacturer for iPhones, Foxconn, was reportedly prevented from allowing personnel to travel from China to India, and more recently, moving heavy machinery needed to make the phones. "I guess these are matters which pertain to Foxconn and several other Indian private entities so they would be looking into it," External Affairs Ministry spokesperson Randhir Jaiswal said in response to a query on these curbs in January.

Issue at Hand

- **Germanium Export Ban:**

- China, which dominates global germanium production (over 50%), imposed stringent export controls—especially targeting countries like the United States, and requiring licensing for others.

- **India's Dependency:**

- India does not produce germanium domestically and is entirely dependent on imports. This makes its electronics and renewable energy sectors vulnerable to supply chain disruptions.

Impact on Industries:

- **Germanium is crucial for:**

- Optical fibre preforms (used to draw fibre cables),
- Photovoltaics (solar panels),
- Infrared optics,
- And semiconductor components.

India's Diplomatic Response

- The Indian Embassy in Beijing confirmed that germanium was the only mineral specifically raised by Indian industries regarding China's restrictions.
- While details remain confidential, the issue has been communicated through formal channels and bilateral meetings.
- India has started importing germanium from UAE-based intermediaries, but at higher costs, which could affect its domestic manufacturing competitiveness.

Broader Geopolitical Context

- China's export restrictions are seen not just as economic tools but strategic levers in global geopolitics—particularly amidst rising tech rivalries and supply chain decoupling efforts.
- Similar curbs have been seen in other domains, such as delaying Foxconn's India-bound equipment and staff, hinting at non-tariff barriers to slow India's tech growth.

Implications for India

- **Strategic Autonomy in Critical Minerals:**

- India must invest in mapping and securing alternative sources of critical minerals like germanium and gallium.

- **Supply Chain Diversification:**

- Need for a resilient import strategy through bilateral partnerships and free trade agreements (e.g., with UAE, Australia).

- **Boosting Domestic Capabilities:**

- Enhance research, exploration, and processing of rare minerals in India or through overseas joint ventures.

- **Technology & National Security:**

- Secure access to critical inputs is essential for digital infrastructure, national security, and renewable energy goals.

Conclusion

- The germanium export issue underscores the fragility of India's critical mineral supply chains in an increasingly polarized global trade environment. While diplomatic engagement is a step forward, India must combine it with strategic planning, diversification, and self-reliance measures to safeguard its economic and technological interests.

UPSC Mains Practice Question

Ques : In a multipolar world order, critical mineral diplomacy is becoming a new strategic frontier." In this context, evaluate India's approach towards engaging with China over germanium export restrictions.

The World Health Organization's report "State of the World's Nursing 2025" highlights serious global disparities in the nursing workforce, especially affecting low- and middle-income countries (LMICs). The report emphasizes both the quantitative shortage of nurses and qualitative issues like employment conditions, international migration, and inequitable distribution.

Countries face challenges in retaining nurses in health systems, says WHO report

Bindu Shajan Perappadan
NEW DELHI

Low- and middle-income countries are facing challenges in graduating, employing, and retaining nurses in their health systems, and would have to raise domestic investments to create and sustain jobs, the latest "State of the World's Nursing 2025" report from the World Health Organization has found.

Low-income countries are increasing nurse graduate numbers at a faster pace than high-income countries, the report says.

In many countries, hard-earned gains in the graduation rate of nurses are not resulting in improved densities due to the faster pace of population growth and lower employment opportunities.

To address this, countries should create jobs to ensure graduates are hired and integrated into the health system, and improve working conditions, the report says.

High-income countries have to be prepared to

The findings say that one in seven nurses are foreign-born, highlighting reliance on international migration

manage high levels of retiring nurses, and review their reliance on foreign-trained nurses, strengthening bilateral agreements with the countries they recruit from, the report says.

The findings suggest that one in seven nurses worldwide, and 23% of nurses in high-income countries, are foreign-born, highlighting reliance on international migration.

In contrast, the proportion of foreign-born nurses is significantly lower in upper middle-income countries (8%), lower middle-income countries (1%), and low-income countries (3%).

Global workforce

The report finds that the global nursing workforce grew from 27.9 million in 2018 to 29.8 million in

2023, but wide disparities in the availability of nurses remains across regions and countries.

Threat to progress

The report, published in collaboration with the International Council of Nurses and other partners, finds that inequities in the global nursing workforce leave many of the world's population without access to essential health services, which could threaten progress towards universal health coverage, global health security, and the health-related development goals.

The evidence indicates global progress in reducing the nursing workforce shortage from 6.2 million in 2020 to 5.8 million in 2023, with a projection to decline to 4.1 million by 2030.

But the overall progress still masks deep regional disparities – approximately 78% of the world's nurses are concentrated in countries representing just 49% of the global population, the report says.

Key Findings of the Report

- **Nurse Shortage Shrinking, but Unevenly:**
 - The global nursing workforce grew from 27.9 million (2018) to 29.8 million (2023). The shortage declined from 6.2 million (2020) to 5.8 million (2023) and is projected to reduce to 4.1 million by 2030, but the burden is disproportionately high in low-income regions.
- **Inequitable Distribution:**
 - About 78% of nurses are concentrated in countries that represent only 49% of the global population, highlighting access inequality.
- **Challenges in LMICs:**
 - Limited employment opportunities, despite an increase in nursing graduates.
 - Poor working conditions and weak retention strategies.
 - Mismatch between healthcare demands and system capacity.
- **Migration Pressure:**
 - One in seven nurses globally is foreign-born.
 - High-income countries rely on foreign-trained nurses (23% of their workforce), raising ethical and sustainability concerns.
 - LMICs contribute to migration but lack internal incentives to retain their trained professionals.
- **Aging Workforce in High-Income Nations:**
 - Many developed nations face retirement surges in their nursing workforce and must prepare through strategic partnerships and local capacity building.

Implications for India

- **Health System Strengthening:**
 - India, a major exporter of trained nurses, must balance international demand with domestic healthcare needs, especially in rural and underserved areas.
- **Workforce Investment:**
 - Addressing employment bottlenecks, ensuring fair wages, and improving working conditions are crucial for nurse retention.
- **Migration Ethics and Bilateral Agreements:**
 - India must negotiate ethical recruitment frameworks with high-income countries to ensure mutual benefit without draining domestic capacity.
- **Policy and Infrastructure Gap:**
 - Despite producing a large number of nursing graduates, state health systems underutilize talent due to procedural and financial constraints.

Broader Global Significance

- The nursing crisis poses a threat to achieving Universal Health Coverage (UHC) and Sustainable Development Goals (SDGs) related to health.
- It emphasizes the need for global coordination, investments in health education and employment, and healthcare as a development priority, especially post-pandemic.

Conclusion

- The WHO report underscores the urgent need for systemic reform in nursing education, employment, and migration governance. For India, this is both a challenge and an opportunity — to strengthen the public health system while also shaping its role in the global healthcare economy. Strategic domestic investment and ethical international partnerships are essential to bridge this healthcare human resource gap.

UPSC Mains Practice Question

Ques : The global nursing workforce is marked by deep inequities that threaten universal health coverage and health security." Discuss in the context of WHO's 'State of the World's Nursing 2025' report.

The Ministry of Agriculture recently reported a significant increase in the acreage of kharif crops such as paddy, pulses, coarse grains, and oilseeds. This development, supported by better water storage and surplus foodgrain stocks, comes at a crucial time when food security, climate resilience, and inflation control are major policy priorities.

Paddy, pulses acreage has increased this kharif season: Centre

Shivraj Chouhan reviews sowing of crops; Ministry says stock of rice and wheat is higher than buffer standard and there is no impact of heatwave

The Hindu Bureau
NEW DELHI

The cultivation of paddy, pulses, coarse grains, and oilseeds has expanded this kharif season, the Agriculture Ministry said here on Monday, after a meeting chaired by Union Minister Shivraj Singh Chouhan.

As on May 2, paddy sowing has increased by 3.44 lakh hectares, compared with last year. The sowing of pulses increased by 2.20 lakh hectares.

In 2023-24, paddy acreage was 28.57 lakh hectares and in this season, it is 32.02 lakh hectares. "Sowing of pulses has increased to 20.67 lakh hectares in 2024-25 as compared to 18.47 lakh hectares in 2023-24," the Ministry said, adding that cultivation of popular pulses varieties such as *moong* and *urad* has also increased by 1.70 lakh hectares and 0.50 lakh hectares, respectively.

Senior officials informed Mr. Chouhan in the meeting that there has been an uptick in the sowing of onion and potato in 2024-25 as compared with 2023-24. "There has been



The Agriculture Ministry said paddy sowing has increased by 3.44 lakh hectares compared with last year. SHIV KUMAR PUSHPAKAR

an increase of 2.82 lakh hectares in onion sowing, which is an increase from 9.76 lakh hectares in 2023-24 to 12.58 lakh hectares in 2024-25. The sowing area of potato has also increased by 0.47 lakh hectares," the Ministry said in a statement. The sowing of tomato and onion is also going on smoothly in the current season, it said.

Better water storage

The meeting also reviewed the weather conditions and the availability of water in reservoirs. "The total water storage situation is better than last year. The storage available in 161 reservoirs is 117% of the storage of the same period last

year and 114% of the average storage of the last 10 years," the Ministry said.

On foodgrains, the Ministry said the actual stock of rice and wheat is more than the buffer standard. The actual stock of rice is 389.05 lakh tonnes against the buffer standard of 135.8 lakh tonnes. The actual stock of wheat is 177.08 lakh tonnes against the buffer standard of 74.6 lakh tonnes, it said. The harvest of wheat in almost all major wheat growing States is over and there was no impact of heatwave or high temperature.

The meeting also decided to launch a campaign to promote scientific agriculture.

Key Highlights from the Report

- **Increased Kharif Sowing Area:**
 - **Paddy:** Increased by 3.44 lakh hectares compared to last year; current sowing area stands at 32.02 lakh hectares.
 - **Pulses:** Grew by 2.20 lakh hectares, with moong and urad registering significant increases.
 - **Onion:** Jumped from 9.76 to 12.58 lakh hectares — a 28.9% rise.
 - **Potato:** Slight increase by 0.47 lakh hectares.
- **Foodgrain Buffer Surplus:**
 - **Rice stock:** 389.05 lakh tonnes against a buffer norm of 135.8 lakh tonnes.
 - **Wheat stock:** 177.08 lakh tonnes against a buffer norm of 74.6 lakh tonnes.
 - Heatwaves did not impact wheat harvest, ensuring supply stability.
- **Reservoir Water Availability:**
 - Water storage in 161 reservoirs is 117% higher than last year and 114% above the 10-year average, ensuring adequate irrigation support.
- **Policy Measures:**
 - The Ministry will launch a campaign to promote scientific agriculture, suggesting a thrust towards technology adoption and better agronomic practices.

Implications for India

1. Food Security & Inflation Management

- Enhanced production and ample foodgrain stocks boost India's food security cushion, especially against climate shocks or international disruptions.
- Surplus availability of onion and pulses can moderate retail inflation, a key concern in the context of recent price spikes.

2. Farmer Welfare & Rural Economy

- Higher sowing area can lead to better income prospects for farmers.
- If combined with market linkages and minimum support price (MSP) assurance, this could improve rural demand and economic recovery.

3. Climate Resilience

- The absence of heatwave impact and healthy water storage indicate good monsoonal and hydrological support so far.
- Promoting scientific farming practices may further build resilience against weather uncertainties and optimize input usage.

4. Policy Alignment with National Goals

- The government's emphasis on scientific farming aligns with:
 - National Mission on Sustainable Agriculture
 - Doubling Farmers' Income
 - Agri-Tech and Digital Agriculture Initiatives

Challenges to Watch

- The positive trend must be safeguarded against:
 - Sudden monsoon variability,
 - Global market shocks (fertilizers, exports),
 - And logistical issues in crop procurement and storage.
- Market price volatility for perishable crops like onion and tomato still poses risks to farmer returns.

Conclusion

- The increase in kharif crop acreage and comfortable foodgrain stock levels signal strengthening agricultural stability in India. However, to make this growth sustainable and equitable, the government must reinforce supply chain infrastructure, climate-smart farming, and ensure fair price realization for farmers through robust policy execution.

UPSC Prelims Practice Question

Ques: With reference to the recent Kharif season in India (2024-25), consider the following statements:

1. The sowing area under paddy has decreased compared to last year.
2. The sowing area of pulses, especially moong and urad, has increased.
3. The current water storage in major reservoirs is below the 10-year average.

Which of the statements given above is/are correct?

- a) 1 and 2 only b) 2 only c) 1 and 3 only d) 2 and 3 only

Ans : b)

Page 07 : GS 3 : Environment

The Himalayan Cleanup 2024 initiative, led by the Zero Waste Himalaya Alliance and the Integrated Mountain Initiative, has revealed that over 84% of the plastic waste collected from the Indian Himalayan region consists of single-use food and beverage packaging. The findings reflect a deep-rooted environmental crisis tied to consumer production patterns and systemic policy failures, rather than merely post-consumer waste management.

Key Highlights from the Report

- **Massive Presence of Single-Use Plastics:**
 - Out of 1,21,739 pieces of waste audited across 450 sites, 1,06,857 (88%) were plastic.
 - 84.2% of the plastic waste was from food and beverage packaging—most of it non-recyclable.
- **Non-Recyclable Waste Dominates:**
 - About 70–77% of the plastic waste (across 2022–2024) was non-recyclable multilayer packaging and tetrapaks.
 - These materials have no market value, hence are neither collected nor processed by waste pickers.
- **Geographical Spread:**
 - Highest waste was found in Sikkim, followed by Darjeeling (West Bengal), Ladakh, Nagaland, and Uttarakhand.
 - Litter was most concentrated near tourist zones, schools, rivers, and protected areas.
- **Policy Failure Highlighted:**
 - The alliance stresses that the crisis is a production and systemic issue, not just a waste disposal failure.
 - The linear economy of “make-use-dispose” is unsustainable in fragile mountain environments.



The exercise yielded 1,21,739 pieces of trash, of which 1,06,857 were plastic, mostly single-use. GETTY IMAGES/ISTOCKPHOTO

Single-use food packaging 84% of Himalayan plastic waste

Rahul Karmakar

Single-use food and beverage packaging forms more than 84% of the plastic waste in the eco-sensitive Himalayan region, an anti-waste collective of NGOs has found.

According to the Zero Waste Himalaya Alliance, about 70% of the plastics collected from across the Himalayan belt from Ladakh to Arunachal Pradesh are non-recyclable and have no market value.

The gravity of the environmental reality came to light at the Zero Waste Himalaya Network Meet held in Himachal Pradesh's Bir in April, where the constituents of the alliance lamented the failure of the current policies in addressing the unique challenges of mountain ecosystems.

The alliance was initiated by Zero Waste Himalaya, an organisation based in Sikkim's Gangtok, and the Integrated Mountain Initiative based in Dehradun, Uttarakhand.

The two organisations have been spearheading The Himalayan Cleanup (THC), one of the biggest movements against plastic pollution in the Indian Himalayan region, since 2018. The Bir convergence of anti-plastic groups was held a month before their annual plastic waste collection from May 26-30.

A statement issued by the alliance on May 8 said, “Over the past six years, the data has indicated that the Himalayan waste crisis is fundamentally a production and systems issue rather than a post-consumer waste management flaw.”

A report released by THC said the 2018 waste collection exercise was conducted at more than 250 sites by volunteers of 200 organisations. In 2024, more than 15,000 members of 350 organisations collected plastic waste from 450 locations.

71% of the plastic waste was non-recyclable, mainly, multilayered plastics and tetrapak. These are not collected by waste pickers and are found littering mountains, choking waterways and filling up landfills

Among the nine Himalayan States targeted in 2025, Sikkim generated the most trash items. A total of 53,814 (44% of the total) pieces of litter were audited across 86 sites. This was followed by West Bengal's Darjeeling with 36,180 items audited across 37 sites.

The volunteers in Ladakh picked up and audited 11,958 pieces of trash across 18 sites. Nagaland and Uttarakhand followed Ladakh to take the fourth and fifth spots.

The exercise across the nine States yielded 1,21,739 pieces of trash, of which 1,06,857 were plastic, mostly single-use, divided into six categories: food packaging, household products, personal care products, smoking material, packing material, and others.

The report said 84.2% of the plastic waste was found to be food and beverage packaging. These packages have been audited to gather data on the top corporate polluters in the Himalayan belt.

“Within food packaging, 71% of the plastic waste was non-recyclable. THC2022 and THC2023 showed 72% and 77.4% of all plastic collected was non-recyclable, mainly, multilayered plastics and tetrapak... These problematic plastics are not collected by any waste pickers and scrap dealers and are found littering mountain landscapes, choking waterways and filling up landfill sites,” it said.

“Thus, there is a need to look at solutions beyond the recycling lens,” it added.

The THC2024 was conducted across villages, schools, tourist spots, and protected areas. Water bodies and rivers were the most littered in the tourist spots.

Implications for India

1. Environmental Degradation in Eco-Sensitive Zones

- The Himalayan ecosystem, already vulnerable to climate change and biodiversity loss, faces additional stress from plastic choking rivers, contaminating soil, and damaging habitats.
- Plastic waste in glacial rivers could endanger downstream water supply, impacting millions.

2. Tourism and Consumerism Nexus

- Tourist-heavy Himalayan regions are disproportionately affected, with commercially packaged goods driving the pollution.
- Local economies benefit from tourism but bear the cost of unmanaged waste.

3. Limitations of Recycling-Based Solutions

- Reliance on recycling is ineffective when a large proportion of waste is non-recyclable.
- India's Plastic Waste Management Rules (2016) need to be strengthened with EPR (Extended Producer Responsibility) for mountain states.

4. Governance and Decentralized Action

- Lack of localized plastic regulation frameworks suited to mountain terrain and communities.
- Need for state-specific action plans that empower local bodies, panchayats, and eco clubs to regulate and enforce plastic use norms.

Way Forward

- **Shift from Waste Management to Waste Prevention:** Encourage eco-friendly packaging, reusable systems, and ban multilayer packaging in sensitive regions.
- **Strengthen EPR Compliance:** Hold corporations accountable for post-consumer collection in hilly areas.
- **Green Tourism Guidelines:** Mandate zero-waste certifications for tourist operators and hotels.
- **Community-Based Initiatives:** Replicate models like The Himalayan Cleanup across the Western and Eastern Ghats. Incentivize local innovation in packaging alternatives.

- **Policy Reforms:** Integrate plastic waste concerns into State Action Plans on Climate Change (SAPCC) and Swachh Bharat Mission 2.0.

Conclusion

- The Himalayan plastic crisis highlights the need to restructure India's approach to packaging, consumption, and environmental governance in ecologically fragile regions. Solutions must go beyond recycling, focusing on producer responsibility, green design, and systemic shifts towards a circular economy. The stakes are high—not only for the environment but for the millions dependent on the Himalayan ecosystem.

UPSC Mains Practice Question

Ques : The Himalayan plastic waste crisis is more a production and systems failure than a consumer-level waste management issue. Discuss in the context of findings from The Himalayan Cleanup 2024.

Page 10 : GS 2 and 3 : International Relations | Environment

The 83rd session of the Marine Environment Protection Committee (MEPC-83) of the International Maritime Organization (IMO) has resulted in a path-breaking consensus on emissions regulation in global shipping. With over 2.8% of global emissions attributable to the sector, this decision marks the world's first mandatory, sector-wide climate levy—a potential blueprint for other carbon-intensive sectors.

How is shipping industry tackling emissions?

What was decided at the 83rd session of the International Maritime Organization's Marine Environment Protection Committee? Was the U.S. a participant in the discussions? How have oil-exporting nations and traditional maritime powerhouses responded to the decision? How has India positioned itself?

EXPLAINER

Amitabh Kumar

The story so far:

After a decade of deliberations towards decarbonising the maritime industry, at its 83rd session, the Marine Environment Protection Committee (MEPC-83) of the International Maritime Organization (IMO) was faced with the challenge of coming to a consensus on a proposed emissions levy on global shipping. The session's objective was to adopt a Market-Based Measure (MBM) that balanced environmental effectiveness with economic fairness.

What were the proposals?

Five distinct proposals were tabled in the meeting. The first was by the International Chamber of Shipping which advocated for a fixed levy per every tonne of CO₂ emitted. Secondly, China proposed a market-driven approach where ships could trade compliance units and invest in alternative fuels. The European Union suggested a fixed Greenhouse Gas (GHG) levy, managed by an IMO-administered fund while India propositioned a 'bridging mechanism', which would target only under-compliant ships to bear the financial burden, while rewarding those using Zero or Near Zero (ZNZ) fuels. Finally, Singapore also joined the fray by proposing an enhanced version of India's model, involving a GHG Fuel Standard (GFS) and a tiered system rewarding surplus emission units and requiring the purchase of remedial units for underperformance.

Even before the debate on MBMs could fully unfold in the IMO, geopolitical tensions took centre-stage. The U.S. Trump administration, which had already withdrawn from the Paris Agreement and stripped the agency that responds to disasters from their climate work related responsibilities, did not participate in the IMO deliberations. It warned of 'reciprocal measures' if the EU-backed uniform carbon levy were passed.

What was decided?

The MEPC-83 of IMO voted 63 to 16 in favour of accepting Singapore's hybrid model based on India's proposal as the IMO's Net Zero Framework, making international shipping the first global industry to adopt a mandatory emissions levy framework. Having piloted a compromise formula amidst extremely divergent views, both India and Singapore have claimed credit for the successful outcome.

However, the decision of the MEPC-83 is not final yet. Despite the vote, the path to implementation is far from straightforward. The MEPC-83's decision, having approved the Net Zero Framework, now needs to amend Annex VI of the MARPOL convention, which governs air pollution from ships. The amendment will undergo a six-month circulation period among all contracting parties to MARPOL. For final adoption, it requires a two-thirds majority of votes from members present and voting; this means that if all 101 parties participate, at least 67 must support the measure. Even if adopted, the amendment could still be blocked, should one-third of the parties—provided they account for at least 50% of global shipping tonnage—formally object in writing.

Currently, with 63 votes in favour, 16 against, and 22 abstentions, the outcome remains uncertain. The process ahead is critical and could reshape the dynamics



Heavily polluting: A container ship approaches the port of Santos in Brazil, on April 1. AP

of global shipping regulation for decades to come.

What other interests were at play?

Moreover, China, along with other large shipping nations, pushed for minimal levies to preserve competitiveness while focusing on investments in cleaner fuels. Norway and other Scandinavian countries have been seeking recognition for their early and costly efforts in decarbonising shipping, proposing that these efforts be rewarded through surplus credit systems. Brazil has been advocating for a rapid shift to methanol as a primary marine fuel, while several nations, citing a lack of viable green technologies, hoped for delayed implementation.

Even after voting, scepticism has lingered among shipowners in traditional maritime powerhouses like Greece, who question the necessity and feasibility of a green levy altogether. The range of these responses illustrates the immense challenge the IMO faces in crafting a universally acceptable emissions framework.

Why does green shipping matter?

Shipping may seem invisible to most consumers, but it plays an outsized role in global emissions. The sector emits approximately one billion metric tonnes of GHG each year, representing about 2.8% of total global emissions. If ranked as a country, international shipping would be the sixth-largest emitter in the world, between Germany and Japan. Projections indicate that, without corrective action, emissions from shipping could rise by as much as 50 to 250% by 2050. Even though the sector contributes less than road transport emissions, they face heavier regulatory pressure because of their international nature.

Therefore, to align with the 13th UN

Sustainable Development Goal as well as the Paris Agreement, the IMO began implementing emissions-reduction measures in 2011, followed by the Initial GHG Strategy in 2018 and the updated IMO GHG Strategy in 2023. It has also included a technical measure such as the Energy Efficiency Design Index in Annex VI of the MARPOL convention; an operational measure, the Ship Energy Efficiency Management Plan, for reduction of GHG emissions from ships; and introduced mandatory recording and reporting of fuel oil consumption.

Consistent with the Paris agreement temperature goals, it has also adopted 'levels of ambition' and 'guiding principles'. Between 2018 and 2023, it has agreed to fix a target for reducing carbon intensity (CO₂ emissions per transport work) by at least 40% by 2030 compared to 2008 levels, and by 70% by 2040, ultimately achieving net-zero by 2050. This is notably more concrete than the International Civil Aviation Organization, which has only pledged a 'long-term aspirational goal' of net-zero emissions by 2050 without setting interim targets.

Is it an equitable distribution?

There has been a gradual erosion of the guiding principle of 'common but differentiated responsibilities and respective capabilities' (CBDR-RC) incorporated in the 2018 initial GHG strategy. The CBDR-RC is a core principle enshrined in climate agreements like UNFCCC, Kyoto Protocol and the Paris Agreement. It acknowledges that all nations must address climate change but recognise historical responsibility and unequal capacities. Developed nations, with their longer industrial histories, are expected to bear greater burdens. However, recent IMO proceedings reflect an effort by wealthier nations to shift responsibility onto developing economies, despite stark differences in income and consumption.

How does India benefit?

While the carbon levy and GHG targets set by the IMO may pose short-term challenges for certain sectors of the Indian economy, India is likely to emerge as a long-term beneficiary of the new MBM framework. According to the United Nations Conference on Trade and Development, the impact of the MBM on

India's maritime logistics costs will be modest in the near term—ranging from 4.88 to 7.29% on imports and 5.52 to 8.09% on exports by 2030. By 2050, these figures are projected to rise to about 33 to 35%. However, the actual impact on trade volumes is expected to be minimal.

India currently operates nearly 236 ships over 5,000 gross tonnage, with only 135 involved in international voyages. Since MBMs apply only to international shipping, India's coastal fleet remains unaffected. At present, India spends roughly \$400 million per year on fuel for its international fleet. The MBM is projected to increase this by approximately \$108 million by 2030—a manageable rise given the scale of India's maritime economy.

Perhaps the most exciting implication of the MBM framework is the potential for India to become a global hub for clean energy exports. As the world's third-largest importer of fossil fuels, India is now investing heavily in green hydrogen through its National Hydrogen Mission. Industrial giants such as Reliance, Adani, and JSW are planning to scale up production, while three Indian ports are preparing to offer green hydrogen bunkering services.

Under the mission's guidelines, Indian green hydrogen must meet a well-to-wake greenhouse gas fuel intensity of no more than 2 kg CO₂e per kilogram of hydrogen, translating to about 16.7 grams of CO₂ equivalent per megajoule. This standard positions Indian hydrogen well within the IMO's reward thresholds, which are capped at 19.0 g CO₂e/MJ until 2034 and 14.0 g CO₂e/MJ thereafter. This alignment creates a significant opportunity for India to export green fuels globally and capitalise on international incentives.

Global shipping now stands at a transformative moment. Despite persistent disagreements and uncertain implementation pathways, the adoption of a MBM by the IMO represents a milestone in the journey towards decarbonisation. If successful, this framework could make shipping the first truly global sector to operate under binding climate goals, setting a powerful precedent for others to follow.

Amitabh Kumar, a retired IRS officer, is former Director General of Shipping, Government of India. Views expressed are personal.

THE GIST

At its 83rd session, the Marine Environment Protection Committee (MEPC-83) of the International Maritime Organization (IMO) was faced with the challenge of coming to a consensus on a proposed emissions levy on global shipping.

Shipping may seem invisible to most consumers, but it plays an outsized role in global emissions. The sector emits approximately one billion metric tonnes of GHG each year, representing about 2.8% of total global emissions.

While the carbon levy and GHG targets set by the IMO may pose short-term challenges for certain sectors of the Indian economy, India is likely to emerge as a long-term beneficiary of the new MBM framework.

Key Outcomes of MEPC-83

- **Adoption of a Hybrid MBM Model:**
 - IMO voted in favour (63–16) of Singapore's proposal, built upon India's bridging mechanism.
 - It incorporates a GHG Fuel Standard, rewards surplus emission cuts, and penalises underperformance.
- **India's Role:**
 - India proposed a balanced, equity-based approach, targeting only non-compliant ships and promoting Zero or Near-Zero (ZNZ) fuel adoption.
 - India was instrumental in brokering consensus among divergent views, with Singapore refining India's framework.
- **Ongoing Process:**
 - The decision needs ratification via an amendment to Annex VI of MARPOL (pollution convention).
 - Final adoption requires a two-thirds majority and can be blocked if one-third of nations (with 50% shipping tonnage) object.

Divergent Global Positions

- **Oil-exporting nations (e.g. Saudi Arabia):** Opposed green shift, citing economic risks.
- **Small Island States & LDCs:** Advocated steep levies and redistribution for green development.
- **China & Large Maritime Economies:** Favoured lower levies and focus on clean fuel investment.
- **EU & Norway:** Pressed for stringent carbon levies and recognition of early decarbonisation efforts.
- **Traditional shipping nations (e.g. Greece):** Expressed scepticism over feasibility and fairness.

Why This Decision Matters

- Shipping is responsible for ~1 billion tonnes of CO₂ annually—if treated as a country, it would be the 6th-largest emitter.
- The sector could see 50–250% increase in emissions by 2050 if left unchecked.
- IMO now sets binding goals:
 - 40% carbon intensity reduction by 2030,
 - 70% by 2040,
 - Net-zero by 2050.
- This approach is more structured than civil aviation, which has only set aspirational goals so far.

India's Strategic Benefits

- **Limited Immediate Impact:**
 - India's international fleet is small (~135 ships); most coastal shipping is exempt.
 - Cost impact till 2030 is manageable: ~5–8% on imports/exports.
- **Green Hydrogen Opportunity:**
 - India aims to become a green fuel hub under its National Hydrogen Mission.
 - Hydrogen produced in India meets IMO emission intensity thresholds, making it export-eligible.
 - Indian ports (e.g. Paradip, Kochi, Tuticorin) are preparing for green hydrogen bunkering.
- **Leadership in Climate Diplomacy:**
 - India is transitioning from a recipient of environmental norms to a shaper of global frameworks, promoting equity and CBDR-RC (Common But Differentiated Responsibilities).
- **Challenges Ahead**
 - Ratification of amendments is uncertain—requires sustained diplomatic engagement.
 - Some shipowners resist change; technology and finance gaps persist in developing countries.
 - Geopolitical frictions (e.g. U.S. non-participation) and fossil-fuel lobbies may slow enforcement.

Conclusion

- The MEPC-83 outcome reflects a historic shift towards climate accountability in international shipping. India's bridging diplomacy not only shaped the IMO's Net Zero Framework but also created long-term economic and strategic opportunities. If implemented equitably, this global Market-Based Mechanism (MBM) could serve as a model for other sectors, further integrating climate objectives into global trade and commerce.

UPSC Mains Practice Question

Ques: Discuss the environmental impact of the global shipping industry and evaluate the feasibility of the IMO's proposed Market-Based Mechanism to reduce emissions. **(150 Words)**

Page : 08 Editorial Analysis

India's rising e-waste, the need to recast its management

India's journey toward Viksit Bharat is being powered by a rapid digital transformation, with an increasing reliance on electronic devices. From smartphones and laptops to advanced industrial and medical equipment, technology has become the backbone of economic growth, connectivity and innovation. However, this growing dependence on electronic devices has a by-product – electronic waste (e-waste) – which must be managed effectively to ensure sustainable progress. Ranking among the world's top e-waste generators (China, the United States, Japan, and Germany) India confronts a formidable challenge of managing e-waste. India's e-waste volumes soared by 151.03% in six years, from 7,08,445 metric tonnes in 2017-18 to 17,78,400 metric tonnes in 2023-24, with an annual increase of 1,69,283 metric tonnes.

Extended Producer Responsibility (EPR) mandates producers, importers and brand owners to manage waste from their products' end-of-life. It holds them accountable for environmental impacts throughout the product lifecycle, promotes sustainable design, integrates environmental costs into pricing, and supports efficient waste management, reducing the burden on municipalities.

Impact of improper e-waste management

The consequences of improper e-waste management extend beyond environmental degradation. India loses more than \$10 billion annually due to water pollution from the disposal of cyanide and sulphuric acid solutions, air pollution caused by lead fumes, open coal burning, and plastic incineration, and soil pollution. Beyond the environmental impact, improper e-waste recycling causes a social loss of over \$20 billion annually, as most of the hazardous processing is conducted by informal, illegal recyclers (women and children comprise the majority workforce). Tragically, their average lifespan is less than 27 years due to prolonged exposure to toxic substances. Additionally, India forfeits over ₹80,000 crore annually in lost critical metal value due to rudimentary



Dhanendra Kumar

was India's Executive Director at the World Bank, Secretary to the Government of India and the first Chairman of the Competition Commission of India (CCI). He is currently Chairman, Competition Advisory Services India LLP (COMPAD)

A focus on floor price will help transform e-waste recycling and its management in India

extraction methods in informal recycling. In addition, at least \$20 billion in annual tax revenue is lost as informal recycling is largely cash-based and unaccounted for.

Importance of stable pricing

The E-waste (Management) Rules, 2022 introduced a floor price for EPR certificates, a game-changer for India's e-waste management. This provision ensures fair returns for registered recyclers, curbing informal, hazardous recycling (practices that dominate 95% of the sector). Without a strong floor price, India may miss the chance to lead in sustainable waste management. Stable pricing incentivises formal recyclers to adopt safe, advanced technologies, unlocking e-waste's valuable materials such as gold and copper. It prevents chaos seen in sectors such as plastic waste and drives investment in infrastructure, turning e-waste into a resource and supporting a circular economy.

This economic pivot carries profound environmental benefits. Fair compensation motivates recyclers to prioritise material recovery over disposal, shrinking landfill burdens and halting the seepage of toxins such as lead and mercury into soil and waterways. It recasts e-waste as an asset rather than as a liability, redefining India's waste narrative toward sustainability. Globally, EPR fees paid by original equipment manufacturers are significantly higher than the floor EPR prices fixed by the Government of India, in alignment with global best practices. The minor impact of floor EPR prices on product costs is outweighed by the significant environmental and social benefits of formal recycling and sustainable practices.

An effective floor price levels the playing field by offsetting the informal sector's cost advantage. It makes formal recycling viable, reduces waste leakage, and ensures more responsible processing. This not only corrects market imbalances but also drives compliance, helping producers meet EPR targets through certified recyclers. When recyclers are adequately paid, they can expand operations, deliver verifiable

outcomes, and reduce producers' incentives to bypass obligations. In a country where only 10% of e-waste reaches formal recycling, this stability is a game-changer. Without it, certificate prices could collapse, starving recyclers of funds and exposing producers to unpredictable costs, destabilising EPR markets. A predictable pricing framework fosters trust, ensuring the system doesn't erode into a free-for-all.

Critics argue that a floor price hikes producer costs, potentially raising consumer prices. This concern, while valid, misses the broader calculus. The cost of inaction – environmental ruin, health crises and lost resources – dwarfs the modest burden of fair pricing. Producers can offset expenses by innovating durable, recyclable designs, which is a core EPR goal. The plastic industry's misstep with low prices, which spawned sham recyclers and eroded trust, underscores the peril of under-pricing. Far from stifling progress, a floor price could surge innovation, rewarding efficiency and technological breakthroughs. India's e-waste crisis demands audacious solutions, aligning with economic and ecological imperatives.

Need for a recycling vision

The stakes of EPR floor pricing transcend financial concerns. Inadequate pricing imperils more than profits. It endangers rivers with pollution, soils and agriculture produce with harmful ingredients, damages communities with toxic exposure, and squanders valuable potential. By valuing recycling efforts, India can formalise its e-waste sector, spur advanced infrastructure, and champion resource efficiency, ensuring responsible practices.

As India vies for sustainability leadership, this floor price is the bedrock of its recycling vision – a bold move to transform e-waste into opportunity, setting a global standard. The numbers demand action: a 73% e-waste surge in five years is a clarion call. With an adequate floor price, economic vitality and environmental care can coexist, securing the future with sustainability.

Paper 03 : Environment

UPSC Mains Practice Question : India's rapidly rising e-waste poses serious environmental and economic challenges. Discuss the role of Extended Producer Responsibility (EPR) in addressing this issue. (250 words)

Context :

- India is witnessing exponential growth in electronic consumption, but this digital transformation has triggered an alarming surge in e-waste, which rose by 151% in six years (2017–18 to 2023–24). Despite being the third-largest e-waste generator globally, India formally recycles only ~10% of its e-waste, with the rest handled by the informal sector under hazardous and unregulated conditions.
- The E-Waste (Management) Rules, 2022 and the introduction of a floor price for EPR (Extended Producer Responsibility) certificates aim to incentivize formal recycling and establish sustainable waste governance.

Key Issues in India's E-Waste Ecosystem

- **Dominance of Informal Recycling (≈95%):**
 - Informal recyclers, including women and children, operate under dangerous conditions with toxic exposure, reducing life expectancy and environmental safety.
 - Estimated ₹80,000 crore in critical metals and \$20 billion in tax revenue are lost annually due to unregulated, inefficient processing.
- **Environmental & Social Costs:**
 - Disposal using acid leaching, open burning, and incineration releases lead, mercury, cyanide, and other toxins.
 - Leads to air, water, and soil contamination, endangering health and food chains.
- **Economic Potential of E-Waste:**
 - E-waste contains gold, copper, rare earths, and other critical materials.
 - Formal recycling could tap into a circular economy, creating green jobs, reducing imports, and promoting resource security.

EPR Floor Pricing: A Game-Changer

- **Why a Floor Price Matters:**
 - Prevents collapse of certificate prices and promotes viability of formal recyclers.
 - Ensures predictable revenue for certified recyclers, encouraging investment in technology and traceable systems.
 - Acts as a market corrector to challenge informal recyclers' cost advantage.
- **Global Context:**
 - Other nations mandate significantly higher EPR fees paid by producers, aligning environmental cost with product life cycle.
 - India's floor price remains modest but necessary to avoid the failures seen in plastic waste markets, where underpricing eroded credibility.

- **Rebuttal to Cost Concerns:**

- While producers argue that floor prices may increase product prices, the societal cost of inaction is far higher.
- EPR should drive eco-friendly design, encouraging repairability, durability, and modular electronics.

Policy and Vision Forward

- Strengthen compliance with the E-Waste Rules, 2022.
- Integrate informal sector through training, certification, and formal employment models.
- Ensure traceability and auditability of EPR certificates.
- Invest in R&D for safe and efficient extraction technologies.
- Promote public awareness and producer take-back programs.
- Link e-waste regulation with Skill India, Digital India, and Make in India for wider impact.

Conclusion

- India stands at a critical juncture where its digital aspirations must align with environmental responsibility. Establishing a stable, fair floor price for EPR is essential to shift e-waste from a toxic liability to a valuable resource. A robust, accountable recycling framework can not only mitigate environmental degradation but also generate green jobs, preserve resources, and strengthen India's global leadership in circular economy practices.