Outcome Document

Introduction

Smart ports and resilient connectivity are key to India's trade and economic progress, as India is aiming to reach at least 10,000 Million Tonnes Per Annum (MPTA) handling capacity, to meet the Viksit Bharat targets.

Ports, shipping lines, and allied agencies generate and collect vast quantities of data from vessel telemetry to container flows, yard operations, and process / systems at the ports.

Despite this data richness, maritime technology adoption remains uneven. Electronic Bill of Lading (eB/L) and digital platforms like MAITRI Virtual Trade Corridor are being deployed to digitalize, secure, and accelerate cross-border trade processes. However, the technology adoption is still in early stages and needs acceleration, particularly in the developing economies.

Further, connecting smart ports with multi-modal infrastructure for both domestic and international connectivity is essential for the growth and resilient supply chain integration for developing economies.

This gap represents both a risk (missed competitiveness, stranded assets, and exclusion from future value chains) and also a unique opportunity. Maritime can become a flagship domain where India demonstrates how emerging technologies and digital transformation like the AI, Blockchain and digital corridors can deliver tangible benefits for India and the Global South -economically, socially, and environmentally.

To discuss and deliberate on the above aspects, a seminar was organised on 23 March 2026 at India Habitat Centre, New Delhi. The agenda of the seminar is given below.

Agenda

Time	Session/Theme
10:30 – 11:00 AM	**Registration and Tea**
11:00 – 11:30 AM	**Inaugural Session**

	Welcome Remarks: Prof. Sachin Kumar Sharma, Director General, RIS, New Delhi **Key Note Address: Shri TK Ramachandran,** Former Secretary, MoPS&W **Special Address: Dr. Seshadri Chari,** Member, Governing Council and General Body, RIS **Vote of Thanks: Dr. Shishir Shrotriya,** CMEC at RIS **Group Photograph**
11:30 AM – 01:00 PM	**Session 1: Role of Resilient Maritime Corridors** • To discuss how connecting Smart Ports with Multi-modal connectivity and resilient international Maritime Corridors is essential for the growth of economies; • To explore how resilient maritime corridors can be big enablers of Supply Chain Resilience; and • To take a stock on the paperless transactions for port and shipping operations. **Chair / Moderator: Dr. Sanjeev Ranjan,** Member, Adjudicatory Board for Major Ports and Former Secretary, MoPS&W **Panelists:** • **Shri Ambrish Bansal,** SVP, Lloyd's Register • **Prof. Dipankar Sinha,** IIFT Kolkata • **Dr. Prabir De,** CMEC, RIS • **Mr. Afaq Hussain,** Director, BRIEF Q&A

01:00 – 02:00 PM	**Lunch**
02:00 – 03:15 PM	**Session 2: Green Ports and Operations** • To examine the role of green technologies in reducing fuel consumption, emissions, and congestion through Route optimization; Berth and yard optimization etc.; • To connect maritime initiatives to India's and IMO's decarbonization pathways and the broader blue economy agenda; • To discuss green / alternate fuel infrastructure opportunities for India, including bunkering; and • To discuss fractional ownership of green assets and ports, and smart provisioning at ports. **Chair / Moderator: Cmde. Sujeet Samaddar, NM (Retd.), Visiting Fellow RIS** **Panelists:** • **Shri Sushil Kumar Singh,** Chairman, DPA • **Cmde. Debesh Lahiri, (Retd.),** Advisor, NCoE GPS, TERI • **Mr. Ankur Malyan,** Rocky Mountain Institute, New Delhi • **Mr. Sudheer Kumar M,** Executive Vice President, VP Jakson Green Limited • **Shri SK Purohit,** Chairman, VoCPA Q&A
03:15 – 03:30 PM	**Tea Break**
03:30 – 04:45 PM	**Session 3: Digital Ports and Digital Corridors** • To consider how technology integration and efficiency in ports and shipping can lower logistics costs for

	Indian MSMEs and exporters, improve reliability of supply chains to and from the Global South; • Discuss models where value generated by automation like MAITRI and e-BL are universally adopted and implemented; and • Highlight pathways for Indian maritime technology companies / startups for smart ports to develop globally competitive solutions, instead of merely consuming foreign technologies. **Chair / Moderator: Dr. Shishir Shrotriya,** CMEC, RIS **Panelists:** • **Shri Surender Ahirwal,** ED, Traffic Commercial, Former Head ULIP • **Mr Manoranjan Gupta,** Chief Product Officer, JM Baxi Group • **Shri Abhay Shukla,** CEO, AITransmute – MAITRI Software • **Shri Lingraj Mahanand,** CEO & Founder, Credore Software Q&A
04:45 – 05:00 PM	**Vote of Thanks and Group Photographs**
05:00 – 05:30 PM	**Post Event Networking and Tea**

Executive Summary

The seminar on “Smart Ports and Resilient Maritime Corridors” convened experts and dignitaries to discuss the rapid changes in global trade architecture, shifting geopolitical fault-lines, and the necessity for ports to evolve into smart, green, and resilient hubs. The core discussions revolved around three pillars: the role of resilient maritime corridors, green ports, and digital ports/corridors.
A central theme was the high logistics cost in international trade, which impacts India's global competitiveness. With 90-95 per cent of international trade occurring via sea routes, maritime and inland infrastructure development, guided by initiatives like PM Gati Shakti, is crucial. The keynote addresses highlighted that becoming green and digital is not merely an option but a compulsion, underscored by current energy security and geopolitical vulnerabilities. The importance of decentralized energy generation and consumption (like solar and hydrogen) at ports was emphasized as a pathway to green sustainability.

Discussions on smart ports stressed the move beyond basic automation to achieving comprehensive connectivity across strategic, physical (multimodal), and technological domains. The need for end-to-end resilient supply chains was advocated, moving the focus from quick turnaround times at the port to seamless service for the end customer, even if it entails a slight increase in cost for guaranteed supply. Challenges include the reluctance towards standardization in a heterogeneous port ecosystem, the need for a national supply chain authority, and accelerating the implementation of digital tools like paperless transactions (e.g., e-Bill of Lading).

Geopolitical events, such as the Red Sea crisis, underscore the urgency of developing alternative, resilient corridors like IMEC, which offer a time-saving option even if not the lowest-cost one. The speakers called for actionable reports, new performance indicators for ports, and reinforced regional cooperation through frameworks like a “regional Gati Shakti” to realize the vision of resilient trade corridors.

Inaugural Session

Prof Sachin Kumar Sharma, Director General, RIS highlighted that logistics cost is a major issue for India's competitiveness in international trade. He stressed that the maritime sector is extremely important, handling 90 to 95 per cent of international trade and introduced three sessions of the seminar, namely, Role of Resilient Maritime Corridor, Green Ports, and Digital Port and Digital Corridor.

Former Secretary MoPS&W, Shri TK Ramachandran emphasized that the current global situation underscores the need to be more green, smart, and connected. He highlighted the recent digital initiatives of the MoPS&W, which includes National Logistics Portal (Marine), EBS systems, E-Samudra, and the Sagar Manthan portal. He said that the next wave will be the AI wave, sitting on top of digital transformation, with implications for strategy and security. He also said that the way forward must take into cognizance of global events, reinforcing the pursuit of green targets (solar, hydrogen, ammonia) and exploring corridors like EMC, INSTC, and IMEC.

Prof. Seshadri Chari, Member, Governing Council, RIS, referred to Alfred Mahan’s sea power theory: "One who rules the sea rules the world." He highlighted the importance of a government's policies in developing sea-power. He also acknowledged the tremendous progress in the last decades due to government facilitation and a strong and resilient private sector. He also pointed out challenges: inadequate focus on shipbuilding, archaic rules for ocean trade, and lack of insurance insulation, without India’s P&I club membership. Prof

Chari, urged for a robust discussion between the private industry and the government to find workable solutions.

Session 1: Role of Resilient Maritime Corridors

The first session discussed the Holistic Approach for a "Smart, Resilient and Sustainable [SRS]" maritime corridor. The panelists emphasized on the shift from conventional approach of port-based developments to "Supply Chain based approach". They also proposed to develop a "Governance Model" to implement SRS maritime corridor by establishing a **National Supply Chain Authority** and engagement of corridor-level management organisation in lieu of terminal management operators and the need to upgrade integrated platforms such as the ULIP to integrate stakeholders in real-time mode.

The Session 1 panel also highlighted that the focus should move from just reducing costs to a "value for money" approach, where reliability and speed are equally important; opportunity cost assessments alongside Time Release Studies, especially the losses caused by delays in cargo movement; and ESG adoption, which is a major gap in India's maritime sector, mainly due to the lack of strong regulatory requirements compared to regions like the UK, Europe, and Singapore.

The panel also discussed propositions for developing smart corridors in phased manner, with the stakeholders' survey on gaps in existing platforms such as NLP, ULIP, Terminal Operating Systems and platforms of Customs, PGAs and

multimodal service providers. Digitalisation efforts should focus on real on-ground impact, not just creating platforms or making announcements. Many so-called digital processes still involve manual steps, showing a gap between policy and practice. They recommended recalibrating the existing KPIs and introduce strategically and operationally effective KPIs to assess the maritime corridors' performance. The panelists also recommended to assess maritime stakeholders' digital transformation maturity and SMART Port and Corridor Readiness with tools like a Digital Maturity Index or develop a similar tool and the Integrated SMART Corridor blueprint for implementation in phased manner. The panelist also advocated establishing interoperable, trusted, open standard systems.

There were suggestions for extending smart maritime corridors beyond our borders by defining India's maritime and logistics strategy from a regional perspective, given its position as a major economy of the Global South. The panel discussed the importance on focussing on regional cooperation and regionalised supply chains, and policy decisions to support regional partner countries, especially within BBIN, BIMSTEC, SAARC and the Indian Ocean Region (IORA). They also discussed the need to strengthen regional and sectoral networks across insurance, reinsurance, ports, customs, logistics, and shipping stakeholders and extend India's State-of-Art technologies and models such as PM GATI SHAKTI to the partners. The "MAITRI" initiative was also recommended to be extended to the region and protocols established for accepting eBL and other documents.

At the end, the panel discussed the importance of capacity building for smart maritime corridors and highlighted that think-tanks, academic institutions, and industry bodies can play an important role in building these networks and promoting collaboration. The speakers agreed that a greater focus is needed on capacity building, maritime education, and specialised training since programmes are still limited in India.

Session 2: Green Ports and Operations

Session 2 highlighted that the maritime sector is currently at the threshold of a significant green transition, where the focus is shifting from conceptual discussions to the early stages of large-scale implementation. Ports are increasingly recognized as the linchpins of global decarbonization, particularly as international pressure mounts to address Scope 3 emissions within trade supply chains. Despite lingering uncertainties regarding the International Maritime Organization (IMO) timelines and final regulatory agreements, the imperative for early preparedness is clear. Staying competitive in future trade systems requires a dual approach that interlinks digitalization with sustainable infrastructure. By leveraging real-time monitoring, AI-driven optimization, and IoT, ports can transition from manual processes to predictive systems that significantly reduce anchorage delays and operational emissions through "Just-in-Time" vessel arrivals.

Achieving ambitious net-zero targets by 2050 necessitates a robust global framework, potentially involving carbon pricing and penalties to prevent "pay-to-pollute" outcomes. The transition relies heavily on the availability and affordability of zero or near-zero fuels, such as green methanol and hydrogen. While infrastructure for these fuels is beginning to take shape at strategic bunkering hubs, a massive scaling of electrolyser capacity is required to meet

projected demand. Furthermore, the industry faces a challenge in harmonizing national and international standards to provide the policy certainty needed for long-term investments. This shift is also prompting a re-evaluation of India's maritime identity, moving away from "maritime blindness" toward a strategic mindset that treats the nation’s coastline as a gateway for green energy exports.
Beyond alternative fuels, the modernization of port operations includes the electrification of cargo-handling equipment and the implementation of shore-to-ship power, known as cold ironing. While infrastructure for shore power exists, widespread adoption is currently hindered by a lack of compatible vessels, requiring parallel development across both the port and shipping sectors. Looking further ahead, the prospect of nuclear-powered commercial shipping is emerging as a long-term possibility, demanding early planning for specialized safety zones, decontamination systems, and trained workforces. Such forward-looking initiatives are being complemented by circular economy practices, including waste-to-fuel projects and the generation of carbon credits, which help position ports as carbon-negative entities.

A holistic “clusters and corridors” approach is essential for the economic viability of these green initiatives, linking industrial hubs with global shipping lanes to aggregate demand and reduces investment risks. Financing this transition remains a significant hurdle, necessitating innovative models such as equity participation, structured funding, and even fractional ownership enabled by blockchain. Finally, sustainability in ports must extend to resource management, particularly regarding water usage. Moving away from energy-intensive reverse osmosis toward thermal desalination powered by waste heat allows ports to become "water-positive." By combining advanced technology, strategic financing, and sustainable resource management, the maritime sector can ensure that the development of green ports supports both environmental resilience and social equity.

Session 3: Digital Ports and Digital Corridors

The third session of the lecture series focused on the transformative shift from physical infrastructure development to the creation of intelligent, data-driven maritime corridors. With India targeting a massive 10,000 MTPA port capacity, a significant portion of which must be handled by non-major ports, the discussion centred on the imperative for system-wide integration. It was argued that capacity expansion alone is insufficient; the sector must prioritize reducing logistics costs and building resilience. To achieve this, India must move beyond adopting global models to **develop indigenous digital frameworks** and **automation** as foundational requirements. These frameworks must link seaports seamlessly with riverine and coastal systems, ensuring that the vast amounts of data currently generated are no longer fragmented but used for real-time decision-making.

A pivotal theme discussed for acceleration was the evolution of a **Digital Public Infrastructure (DPI) for ports and logistics**, mirroring the success of India's digital payment systems. This involves the **integration of ULIP and PM Gati Shakti** to combine operational intelligence with GIS-based infrastructure planning. By evolving these platforms, India can transition from being a data provider to a developer of globally competitive, indigenous solutions. The goal

is to move toward **AI-based orchestration of logistics flows**, where "smartness" isn't just about digitalization, but about predictive capabilities that align truck movements, yard capacity, and rail scheduling. This requires a move from port-level competition to corridor-level competition, where the efficiency of the entire multimodal supply chain determines success.

The session also addressed the critical need for **interoperability across platforms** and the adoption of advanced tools like **digital twins**, which should be evolved into predictive decision engines for harbour management and just-in-time arrivals. To scale these innovations, there is a clear need to **strengthen public-private partnerships** and **mandate the adoption of digital platforms** like the Maritime Single Window, especially for non-major ports. Furthermore, the transition to a paperless environment requires the **legal recognition for digital trade documents**, such as electronic Bills of Lading (e-BL). By **aligning with international standards** and **promoting cross-border digital trade corridors** with partners like Singapore and the UAE, India is positioned to lead the Global South in digital trade documentation.

The session discussed the drivers of success of this digital renaissance depend on the human element. Stakeholders emphasized the need to **invest in skills, training, and capacity building** to ensure the workforce can operate these advanced systems. By focusing on **open and interoperable digital platforms**, India can avoid vendor lock-in and foster a transparent, self-organizing maritime ecosystem. This strategic integration of technology, policy, and human capital is essential to fulfilling the Maritime Amrit Kaal Vision 2047, turning India into a global leader in maritime intelligence and resilient supply chains.

Speaker -wise details of the sessions

SESSION 1: Role of Resilient Maritime Corridor

Chair: Dr Sanjeev Ranjan, Member-Adjudicatory Board for Major Ports and Former Secretary, MoPSW

- In today's geopolitical landscape, logistics and supply chains are no longer peripheral but decisive factors shaping outcomes even in conflicts, influencing the trajectory of global tensions.
- Supply chains and port operations, often invisible in normal times, become critically visible during crises, revealing their centrality to economic and strategic stability.
- Repeated disruptions from the COVID-19 pandemic to the Yemen crisis and the Suez Canal blockage the structure reflect the vulnerability of global supply chains. The frequency and scale of such shocks necessitate a fundamental rethinking of how logistics systems, supply chains, and port operations are designed and managed.
- Traditional port performance metrics, centred on operational efficiency such as turnaround time without much focus on their larger role.
- There is now a shift from focusing only on port efficiency to looking at the entire supply chain, where timely delivery and continuity matter more.
- A disruption in even one part of the supply chain can affect entire businesses, showing the need for stronger and more diversified systems.
- The growing demand is for integrated, end-to-end logistics corridors that enable seamless movement from production to final consumption points.
- Ports need to move beyond being just operational hubs and act as service providers ensuring reliable and smooth logistics.
- While cost efficiency remains relevant, resilience and continuity of supply are paramount, given the disproportionately high losses caused by disruptions.
- India's deeper integration into global trade networks, particularly in the context of Amrit Kaal (2047), requires the parallel development of both domestic and international corridors.
- Port performance frameworks must evolve to measure integration with broader supply chain ecosystems, as this will increasingly determine competitiveness.Port performance should also be judged based on how well they are connected with the wider supply chain system.

- Future infrastructure planning must adopt a holistic approach, combining physical infrastructure with digital systems, legal frameworks, and financial mechanisms.
- Many parts of the supply chain still work in silos, which leads to inefficiencies and weakens connectivity initiatives.
- Initiatives such as PM Gati Shakti mark important progress in infrastructure coordination, but their impact must extend beyond physical connectivity.
- The "soft infrastructure" layer digital integration, regulatory alignment, and institutional coordination emerges as equally critical, as reflected in the National Logistics Policy.
- Progress in integration is happening, but it is slow, and delays are becoming harder to manage in today's uncertain environment
- A layered approach is needed: first building physical infrastructure, and then ensuring digital and system-level integration.
- Coordination challenges persist due to the multiplicity of stakeholders, including private sector actors beyond direct government control.
- There is a need for a central body like a National Supply Chain Authority to ensure better coordination and governance. Strong governance either within existing frameworks or through new institutions is essential to align all efforts.
- Overall, the focus should be on building strong, reliable, and secure supply chain corridors to support long-term growth and stability.

KEY RECOMMENDATIONS

Recommendation	**Stakeholders Involved**
Establish a National Supply Chain Authority: Create a central coordinating body to oversee end-to-end logistics and supply chain integration.	• Ministry of Commerce & Industry (DPIIT) • MoPSW (Ministry of Ports, Shipping and Waterways) • PM Gati Shakti NMP
Shift Port Performance Metrics to Supply Chain-Based Indicators: Move beyond turnaround time to include reliability, integration, and continuity metrics.	• Indian Ports Association (IPA) • MoPSW • Major Port Authorities

Strengthen Soft Infrastructure (Digital + Regulatory Integration): Focus equally on digital systems, regulatory alignment, and institutional coordination.	• Indian Ports Association (IPA) • Major Port Authorities • SMFCL • ULIP
Promote End-to-End Logistics Corridors: Develop integrated corridors from production to consumption.	• PM Gati Shakti National Master Plan authorities • MoPSW, Ministry of Railways

Speaker 1: Shri Ambrish Bansal, SVP, Llyod's Register

- Introduced Lloyd's Register as a global professional services organisation with over 265 years of experience. Noted that the organisation's work spans consulting, including **ESG (Environmental, Social, Governance)** and digital advisory, which are closely aligned with current discussions on logistics and supply chains.
- Defined the concept of a **"smart port"** beyond mere automation or technological advancement, emphasising that it is not limited to equipment such as cranes or port infrastructure.
- A smart port can be understood through three key dimensions: strategic connectivity with global trade routes, physical connectivity with multimodal transport, and digital connectivity across systems.
- The real value of a smart port lies in how well it is integrated with the larger ecosystem, including hinterland links, national logistics networks, and global supply chains.
- Improving integration across the logistics ecosystem is especially important for India in the context of geopolitical uncertainties and frequent supply chain disruptions.
- Better connectivity and integration directly support key national goals such as stronger supply chain resilience, lower logistics costs, improved export competitiveness, and energy security.
- Work with the Ministry of Ports, Shipping and Waterways on the National Integrated Shipping Policy represents an important step towards a comprehensive and unified maritime framework.

- The policy builds on earlier initiatives like Sagarmala and aims to bring together ports, shipping, shipbuilding, and recycling under one integrated vision.
- It is structured around key pillars such as green fuels, green shipbuilding, green technology, green financing, and green skilling.
- Among these, capacity building and skilling stand out as the common link that will support all green initiatives in the maritime sector.
- Ongoing work with the Directorate General of Shipping focuses on creating a clear implementation roadmap with short-, medium-, and long-term goals aligned with the Maritime Amrit Kaal Vision 2047.
- There is also active engagement in global green shipping corridor initiatives, including projects in Singapore, with efforts to expand India's participation.
- Digital transformation is another key focus area, with tools like a Digital Maturity Index being developed to assess and improve the digital readiness of ports and maritime stakeholders.
- ESG adoption remains a major gap in India's maritime sector, mainly due to the lack of strong regulatory requirements compared to regions like the UK, Europe, and Singapore.
- However, global expectations around ESG compliance and reporting are increasing, making it important for Indian stakeholders to align with international standards.
- Support is already being provided to stakeholders such as shipyards in developing ESG strategies and reporting systems, showing growing momentum in this area.
- There is also a strong effort to bring global best practices from leading maritime hubs like Norway, the UK, Singapore into the Indian context.
- Overall, greater integration, along with adoption of sustainability and digital practices, will be key to building resilient and future-ready supply chains.

KEY RECOMMENDATIONS

Recommendation	Stakeholders Involved
Develop Fully Integrated Smart Ports (3-layer connectivity: Ensure strategic, physical, and digital connectivity across ports and supply chains.	• MoPSW • Port Authorities • Private Port Operators
Accelerate ESG Adoption in Maritime Sector: Introduce stronger ESG compliance frameworks and reporting standards.	• Indian Ports Association (IPA) • MoPSW
Implement National Integrated Shipping Policy: Operationalise policy across shipping, ports, shipbuilding, and recycling.	• MoPSW • Directorate General of Shipping
Develop Digital Maturity Index for Ports: Benchmark and monitor digital readiness of ports.	• MoPSW • IPA • Private tech partners
Invest in Green Skilling and Capacity Building: Build workforce for green fuels, green shipping, and sustainability.	• Ministry of Skill Development & Entrepreneurship • Maritime Training Institutes • DG Shipping

Speaker 2: **Professor Dipankar Sinha, IIFT Kolkata**

- Logistics maturity should be seen at the level of the entire corridor, not individual organisations, with seamless integration across all stakeholders.
- The first phase of "smart ports" in India focused on digitising operations through systems like the Port Community System (PCS), which improved efficiency but largely remained siloed.
- Even after moving to the National Logistics Portal (NLP), gaps in interoperability and stakeholder integration still continue.
- A truly "smart system" is one where decisions are automated and rule-based, covering processes like berth allocation, gate operations, and contracts.

- This level of automation requires all stakeholders to be actively connected and part of a shared digital ecosystem.
- Smart corridor development has two main dimensions: operational (digital systems) and strategic (coordination, governance, and alignment).
- On the operational side, there are still challenges such as delays in developing systems like terminal operating systems (TOS) and uneven adoption across ports.
- There is a need to break port operations into stages like ship arrival, berth allocation, and cargo handling and improve each using data and predictive tools.
- The concept of a digital twin can help simulate operations, predict issues, and ensure smoother cargo movement.
- A wide range of stakeholders need to be integrated, including shipping lines, freight forwarders, port operators, banks, and government agencies.
- Lack of standardisation remains a key barrier, even though global efforts like those by the Digital Container Shipping Association (DCSA) are ongoing.
- Earlier efforts like Electronic Data Interchange (EDI) have seen slow and uneven progress in India.
- Ports differ widely in cargo, infrastructure, and operations, making uniform standardisation difficult.Instead of forcing a “one port, one process” model, the focus should be on enabling interoperability while allowing diversity.
- Technologies like AI can help manage this diversity and enable flexible integration across systems.
- Many parts of the logistics chain- ports, ICDs, CFSs, warehouses, customs, and others still operate in silos.
- Moving towards common standards and API-based integration can help systems connect without needing a single platform.
- There is a need to shift from terminal-level management to corridor-level management, focusing on the entire logistics chain. This can be done through partnerships and coordination among stakeholders, rather than ownership-based models.
- Better efficiency in logistics reduces time and wastage, and also brings indirect environmental benefits.
- The focus should move from just reducing costs to a “value for money” approach, where reliability and speed are equally important.

- Opportunity cost also needs attention, especially the losses caused by delays in cargo movement.
- A phased approach is needed for smart corridors: starting with standardisation, then system implementation, integration, use of AI, and finally addressing governance issues.
- Data-related concerns like ownership, privacy, trust, and security are critical, especially when private players are involved. There are risks around data control and continuity, particularly when stakeholder relationships or contracts change.
- Overall, along with technology, strong governance frameworks for data sharing and security are essential to build reliable and trusted smart corridor ecosystems.

KEY RECOMMENDATIONS

Recommendation	Stakeholder Involved
Move from Port-Level to Corridor-Level Logistics Management: Manage logistics as an integrated corridor rather than isolated ports.	• DPIIT (Logistics Division) • MoPSW • State Governments
Enable API-Based Interoperability Across System: Replace siloed systems with interoperable digital platforms.	• MeitY • NLP (National Logistics Portal) authorities
Adopt Digital Twin & AI-Based Predictive Systems: Use simulation and AI for port and logistics optimization.	• MoPSW • Port Authorities • Tech firms / Startups
Develop Data Governance Framework (Ownership, Privacy, Security): Establish clear rules for data sharing and protection.	• DPIIT • ULIP

Speaker 3: Dr. Prabir De, CMEC, RIS

- India's maritime and logistics strategy needs to be seen from a regional perspective, given its position as a major economy in South Asia.
- Policy decisions should also support regional partner countries, especially within groupings like BIMSTEC and the Indian Ocean region.
- Many current challenges are regional in nature and require shared responses, particularly in times of global disruptions to trade and supply chains.
- There is a lack of a strong, coordinated response from regional organisations such as ASEAN, BIMSTEC, and SAARC, highlighting the need for a common minimum agenda for cooperation.
- Growing global uncertainty is pushing countries to focus more on regional cooperation and regionalised supply chains.
- Maritime logistics faces structural constraints, as shipping routes are less flexible compared to air transport, making long-term planning very important.
- India also faces geographical and infrastructure-related challenges along its coastline, which affect port efficiency and navigation.
- Existing regional trade agreements, while promoting cooperation, often lack proper safeguards to deal with disruptions in trade and supply chains. Such disruptions directly affect trade competitiveness by increasing costs, delaying deliveries, and weakening integration into global value chains.
- Tools like the IMF's global trade monitoring dashboards show how supply chain disruptions are reshaping trade patterns and competitiveness worldwide.
- Broader global trends include rising tariffs and protectionism, fragmentation of global value chains, and a shift towards near-shoring and regionalisation. In this context, resilient maritime corridors are becoming increasingly important.
- There is a need to adopt paperless trade systems, especially electronic documentation like electronic Bills of Lading, to improve efficiency and ease of trade.
- Despite being technologically possible, the use of such systems is still limited in India.
- Regulatory and governance reforms are required, with a push for innovative approaches similar to models like GIFT City.
- Regional cooperation frameworks need to be strengthened, as seen in delays in implementing agreements like BIMSTEC maritime cooperation and finalising SOPs.
- Environmental sustainability must be a key focus, including the adoption of green fuels and decarbonisation in maritime strategies.

- The global shipping sector has issues like alliances and cartel-like behaviour, which can distort markets and negatively impact smaller economies.These market dynamics need more policy attention and awareness.
- There is a need to strengthen regional and sectoral networks across insurance, reinsurance, ports, customs, logistics, and shipping stakeholders.
- Think tanks, academic institutions, and industry bodies can play an important role in building these networks and promoting collaboration.
- There is a clear gap between digitisation (converting documents into digital form) and digitalisation (complete transformation of processes), which needs to be addressed.
- Greater focus is needed on capacity building, maritime education, and specialised training, as such programmes are still limited in India.
- Industry outreach should be expanded to include MSMEs and smaller players, who often lack awareness and access to logistics systems.
- The government needs to play a more proactive and leadership-driven role in shaping maritime and logistics strategies. New regional initiatives and institutions should be developed to strengthen India's leadership in the region.
- National initiatives like PM Gati Shakti can be extended to neighbouring countries such as Bangladesh, Bhutan, and Nepal to create a regional framework.
- Port performance metrics need to be revisited, moving beyond traditional measures to more outcome-based and multi-sectoral indicators.
- There is a need for more advanced analytics and research on port performance, cargo flows, and overall system efficiency to support policymaking. Stronger policy outputs, research, capacity building, and technical knowledge sharing are needed, especially from institutions like RIS and other think tanks.
- This is a crucial moment for India to strengthen regional leadership, build trust, and deepen cooperation with neighbouring countries.
- Overall, building resilient maritime corridors will require a mix of regional cooperation, institutional innovation, digital transformation, and proactive governance.

KEY RECOMMENDATIONS

Recommendation	Stakeholder Involved

Strengthen Regional Maritime Cooperation (BIMSTEC, IOR): Develop common regional logistics and maritime agenda	• Ministry of External Affairs (MEA) • MoPSW • BIMSTEC Secretariat
Promote Paperless Trade (e-Bill of Lading, Digital Docs): Transition from digitisation to full digitalisation.	• DPIIT • DG Shipping • Shipping Companies
Extend PM Gati Shakti to Neighbouring Countries: Build regional logistics integration framework.	• MEA • MoPSW
Develop Maritime Education & Capacity Building Ecosystem: Expand training, research, and skill development.	• Ministry of Education • DG Shipping • RIS, IIFT, Maritime Universities
Invest in Green Skilling and Capacity Building: Build workforce for green fuels, green shipping, and sustainability.	• Ministry of Skill Development& Entrepreneurship • Maritime Training Institutes • DG Shipping
Build Regional Institutional Networks (Insurance, Ports, Logistics: Strengthen collaboration across sectors and countries.	• DPIIT • Ministry of External Affairs • RIS • Port Authorities

Speaker 4: Mr. Afaq Hussain, Director, BRIEF

- Crises like the COVID-19 and recent geopolitical conflicts have pushed countries to focus more on digitalisation and building resilient supply chains. Before COVID-19, there was resistance to paperless trade, but the pandemic forced a shift away from physical documents toward digital systems.

- Disruptions such as the Russia-Ukraine conflict and tensions in West Asia and the Red Sea have led to new thinking on resilient supply chains and alternative trade routes.
- Initiatives like IMEC have emerged in response, aiming to provide alternative connectivity options.
- India has made progress in trade facilitation through measures like pre-arrival clearances, SWIFT, e-Sanchit, and faceless assessment.
- Despite these steps, India is still not fully paperless, with physical documentation continuing alongside digital systems. The continued demand for hard copies in trade processes remains a major concern in today's global environment.
- While around 70-75 per cent of cargo is cleared without human intervention, the remaining 25 per cent still faces delays due to regulatory checks, testing, and certifications. Full digitalisation is important for better integration into global supply chains and improving competitiveness.
- A uniform "one port, one process" approach may not work due to differences in ports, cargo types, and geography.
- Efficiency measurement should go beyond time release studies and include practical indicators like truck turnaround time at port gates.
- Improving gate efficiency through technologies like OCR and RFID can help reduce congestion and delays.
- Indian ports have improved over time, but inefficiencies still remain, especially in infrastructure and operations. Development across ports has been uneven, with more focus traditionally on western ports compared to eastern ones.
- Strengthening ports like Kolkata is important for regional connectivity, especially for landlocked countries like Nepal and Bhutan.
- There is a need for consistent improvement in infrastructure and trade facilitation across all ports. Many digital portals have been created, but there is limited post-implementation review to check how effective they actually are.
- Digitalisation efforts should focus on real on-ground impact, not just creating platforms or making announcements. Many so-called digital processes still involve manual steps, showing a gap between policy and practice.
- Continuous review, flexibility, and stakeholder involvement are important in designing effective digital systems.

- There has been increased engagement between the government and private sector, which is important for practical solutions.
- IMEC is a multimodal corridor connecting India to Europe through the Middle East, combining sea and land transport.While there are concerns about cost, businesses often prioritise time and reliability over cost. IMEC can offer time savings, making it attractive even if it is more expensive. It is meant to be an alternative route, not a replacement for existing routes like the Suez Canal or the Cape of Good Hope.
- During crises, businesses are willing to bear higher costs to ensure continuity of supply.
- Similar multimodal transport models are already being used in regions like the Middle East.
- Having multiple route options is important to reduce dependence on key chokepoints like the Strait of Hormuz.
- Global logistics players are playing a role in building networked supply chains that improve resilience. Expanding corridors across multiple routes increases capacity, reduces risks, and improves flexibility.
- Overall, logistics decisions are not just about cost, but also about speed, reliability, and resilience, making alternative corridors essential for the future.

KEY RECOMMENDATIONS

Recommendation	Stakeholders Involved
Achieve Full Paperless Trade Implementation: Eliminate parallel physical documentation systems.	• MoPSW • Port Authorities • Private Port Operators
Improve Last-Mile Port Efficiency (Gate Operations): Use OCR, RFID for truck movement and gate automation.	• Indian Ports Association (IPA) • MoPSW
Ensure Balanced Port Development	• MoPSW • State Governments • Sagarmala Programme
Align Trade Facilitation with Ground Reality: Focus on actual	• DPIIT • Ministry of External Affairs

outcomes, not just digital platforms.	

SESSION 2: Green Ports and Operations
Chair/Moderator: Cmde. Sujeet Samaddar, NM (Retd. Visiting Fellow RIS)

- The green transition in maritime and port sectors is still at an early stage, with many technologies being discussed but limited large-scale implementation so far.
- Ports are expected to play a key role in decarbonization, especially as Scope 3 emissions linked to trade and supply chains come under greater global focus.
- While governments have announced net-zero targets and discussions are ongoing under the International Maritime Organization, there is still uncertainty around timelines and final agreements.
- There is a need for early preparedness, even without full global clarity, to stay competitive in future trade systems.
- Digitization and green transition are closely linked, as adopting green technologies also requires development of clean energy and sustainable infrastructure.
- Real-time monitoring and predictive systems can help improve logistics efficiency and reduce emissions.Technologies like predictive maintenance, AI, and IoT are already widely used in sectors like aviation, but their adoption in ports and shipping is still limited.
- There is a need for AI-driven optimization of port operations, using tools like machine learning, computer vision, and intelligent systems.
- Availability of real-time data is essential for better decision-making, especially for tracking vessel movement and managing port activities.
- India already has systems like Vessel Traffic Management Systems (VTMS), but these need to be upgraded into more advanced, data-driven platforms.
- Improving berth and yard planning is important, ensuring ships arrive “just in time” instead of waiting at anchorage, which reduces delays and emissions.Such operational improvements can significantly lower carbon emissions within port ecosystems.
- Alternative fuels are a key part of future maritime decarbonisation, both for ships and port operations.

- Electrification within ports, including cargo handling equipment and internal transport, can further reduce emissions.
- Port operations require large investments, and the green transition will need innovative and transparent financing mechanisms.New financing models, such as equity participation and structured funding frameworks, should be explored to support green investments.
- Concepts like fractional ownership of green assets, possibly enabled through blockchain, can help bring in wider participation.
- Overall, the focus needs to be on combining technology, operations, financing, and sustainability to move towards green ports.

KEY RECOMMENDATIONS

Recommendation	Stakeholders Involved
Upgrade existing Vessel Traffic Management Systems (VTMS) into advanced, data-driven platforms with real-time monitoring and predictive capabilities	• Directorate General of Shipping (DGS) • MoPSW • Port Authorities
Implement AI-driven optimisation of port operations (e.g., predictive maintenance, computer vision, IoT, logistics optimisation)	• Port Authorities • Maritime tech providers
Adopt just-in-time vessel arrival systems to reduce anchorage delays and emissions	• Port Authorities • Shipping lines • Terminal operators
Develop innovative financing models (e.g., equity participation, structured financing, fractional ownership) for green port investments	• MoPSW • Port Authorities • Maritime financiers • Private investors

Speaker 1: Shri Sushil Kumar Singh, Chairman, DPA

- In 2023, the maritime sector generated about 780.5 million tonnes of CO_2 equivalent emissions from fossil fuel use, rising to nearly 1.4 billion tonnes when lifecycle emissions are included.

- The International Maritime Organization 2023 GHG Reduction Strategy sets clear targets: 20 per cent reduction (aiming for 30 per cent) by 2030, 70 per cent (aiming for 80 per cent) by 2040, and net zero by 2050.
- Achieving these targets will require mid-term measures, including a net-zero framework with compliance rules and penalties.
- The framework proposes carbon pricing penalties of around USUS$ 380 per tonne for missing base targets and about USUS$ 100 per tonne for partial compliance gaps.
- It defines "zero or near-zero fuels" as those emitting less than 19 gCO_2e per MJ of energy.The IMO framework is technology-neutral, allowing flexibility in fuel choices, unlike stricter regional systems.
- In comparison, the European Union's RFNBO framework has stricter conditions like additionality of renewable energy, time and location matching, and exclusion of subsidised energy.
- India's green hydrogen certification standards differ from both IMO and EU approaches, creating regulatory differences and uncertainty.
- The IMO framework could generate around US$ 11–12 billion annually through penalties, while the transition requires about US$ 90–95 billion per year, showing a large financing gap.
- Current measures may achieve only about 10 per cent emission reduction by 2030, which is below the target.
- Kandla Port is positioning itself as a green fuel bunkering hub on the Rotterdam-Singapore route, expecting demand from about 200 dual-fuel vessels by 2030.
- Methanol has lower energy density, meaning ships will need more frequent refuelling, making mid-route ports like Kandla strategically important.
- Kandla already handles large volumes of grey methanol and has infrastructure like storage, pipelines, and jetty systems to support green methanol bunkering.
- The port has been assessed by DNV and placed at PRL Level 6, indicating readiness for pilot bunkering operations.
- A key challenge remains the lack of availability of green methanol (e-methanol), despite infrastructure being ready.Efforts are ongoing with MNRE and SECI to develop supply through tenders, targeting around 500 KTPA demand.
- Uncertainty around what qualifies as "green fuel" is affecting investments and demand creation.

- Global estimates suggest 5-10 per cent alternative fuel adoption by 2030, but current ship orders are below this level.
- The scale of transition required is very large, including around 43 million tonnes of green hydrogen for shipping by 2050, with about 70 per cent expected to go into green methanol production.
- This would require about 580 GW of electrolyser capacity, compared to the current global capacity of around 2.5-3 GW.
- Weakening economic measures under IMO, such as lowering penalties, could create a "pay to pollute" situation and reduce incentives for green fuel adoption.
- Allowing alternative compliance options like biofuels could also reduce investments in green hydrogen and methanol infrastructure.
- The green transition faces three major challenges: high costs (affordability), limited supply (availability), and lack of clear global standards (acceptability).
- Clear and stable policies are essential to drive demand, attract investment, and scale up green fuel systems.
- Differences in global, regional, and national regulations could create compliance challenges for shipping companies.
- Long-term commercial contracts, such as 15-year agreements, carry risks if policies or technologies change over time.
- Kandla Port has already taken several steps, including setting up a 1 MW green hydrogen plant and developing a 5 TPD bio-methanol plant. It is also introducing electric cargo handling equipment, linear induction-based cargo systems, and electric tugboats.
- Plans are in place to expand hydrogen capacity further with an additional 5 MW project.
- There are major industry investments at Kandla, including projects targeting 5.6 million tonnes of green ammonia production by 2032.
- The port is collaborating with the Port of Rotterdam for knowledge sharing and development of green fuel corridors.
- Preparations are underway for pilot methanol bunkering, supported by SOPs based on international standards like Singapore's TR 129.
- Kandla is also being developed as a Green Hydrogen Hub under India's National Green Hydrogen Mission.

- Overall, there is an urgent need for harmonised global standards and clear policy direction to avoid fragmentation and ensure the success of green transition investments.

KEY RECOMMENDATIONS

Recommendation:	**Stakeholder Involved**
Ensure harmonisation of global, regional, and national green fuel standards to reduce regulatory uncertainty	• International Maritime Organization (IMO) • DGS • MoPSW
Maintain strong carbon pricing and penalty mechanisms to avoid "pay-to-pollute" outcomes	• IMO • Member States
Scale up green methanol production ecosystems aligned with port bunkering demand (e.g., Kandla ~500 KTPA)	• MoPSW • Port Authorities • SECI • Industry players
Ensure policy certainty and stable long-term frameworks to support investments in green fuels	• IMO • MoPSW • DGS

Speaker 2: Cmde. Debesh Lahiri, (Retd.), Advisor, NCoE GPS, TERI

- The maritime sector is only now gaining due importance in India after years of neglect, often described as "maritime blindness," despite strong historical roots since the arrival of Vasco da Gama.
- There is a clear shift in India's thinking, with growing recognition of the importance of oceans, especially as over 80 per cent of global trade moves by sea.
- This shift is reflected in remarks by Rajnath Singh, who described India's transition from being seen as a "landlocked country with seashores" to an "island nation with some land borders."
- Work is ongoing through institutions like the National Centre of Excellence for Green Ports & Shipping and the draft National Green Shipping Policy,

being developed in consultation with stakeholders and the Directorate General of Shipping, and expected to be finalized soon.

- Green ports are defined as those that integrate sustainability into operations, infrastructure, and governance, aiming to reduce emissions, improve resource efficiency, protect ecosystems, and support communities.
- These efforts are aligned with global decarbonization goals and national frameworks like the Harit Sagar Guidelines. Key targets for green port development include increasing green cover to 20 per cent by 2030 and 33 per cent by 2047.
- Electrification of port equipment is another priority, with targets of 50 per cent by 2030 and 90 per cent by 2047, along with ensuring future equipment is electric or compatible with green fuels.
- There is also a push to transition port vessels and crafts to cleaner fuels.
- Fuel and energy transition goals include green ammonia bunkering at major ports by 2035 and LNG bunkering hubs at all ports by 2030.
- Renewable energy usage is targeted to reach 60 per cent by 2030 and 90 per cent by 2047.
- Resource efficiency measures include reducing freshwater use per cargo unit, increasing wastewater reuse, and promoting energy-efficient systems like LEDs and star-rated equipment.
- A key challenge is shore-to-ship power supply (cold ironing), where infrastructure exists but adoption is low due to lack of compatible vessels, requiring parallel development on both sides.
- Waste management and broader sustainability practices are also important parts of green port development.
- The idea of nuclear-powered shipping was introduced as a future possibility, with nuclear energy considered a clean option already used in naval vessels and some civilian ships.
- Preparing ports for nuclear-powered vessels will require harmonized global standards, particularly under the International Maritime Organization.
- Strong regulatory, legal, and safety frameworks will be essential for such a transition.
- Key challenges include emergency preparedness and ensuring continuous power supply for reactor cooling even after shutdown.
- Ports will need dedicated infrastructure zones, decontamination systems, and trained personnel to handle nuclear vessels.

- Early planning over the next 5-8 years is important to avoid delays when nuclear shipping becomes commercially viable.
- Overall, India is moving from maritime neglect to a more strategic approach, with green ports requiring coordinated efforts across policy, technology, and infrastructure.
- Preparing for future developments, including nuclear shipping, is essential for maintaining competitiveness and sustainability.

KEY RECOMMENDATIONS

Recommendations	Stakeholders Involved
Enable shore-to-ship power (cold ironing) through parallel development of port infrastructure and vessel compatibility	• Port Authorities • Shipping lines • DGS
Initiate early planning for nuclear-powered shipping infrastructure (next 5–8 years)	• IMO • DGS • MoPSW • Port Authorities
Build dedicated infrastructure, safety systems, and trained workforce for handling nuclear-powered vessels	• Port Authorities • DGS

Speaker 3: Shri Susanta Kumar Purohit, Chairman, VOC Port Authority

- V. O. Chidambaranar Port benefits from natural protection due to its proximity to Sri Lanka, resulting in lower cyclone exposure, year-round operability, minimal dredging requirements, and reduced operational risk.
- The port demonstrates strong operational efficiency, with an operating ratio of around 30 per cent, capability to handle specialised cargo such as windmill blades up to 90 metres, and strong multimodal connectivity through highways and nearby airports.
- Cargo handling stands at approximately 40 million tonnes with consistent growth, alongside ongoing development as a transshipment hub and a green hydrogen hub under national initiatives.

- Renewable energy meets 100 per cent of current power demand through wind and solar sources, with additional capacity under development that positions the port towards achieving carbon-negative status.
- A green fuel ecosystem is being developed through small-scale green hydrogen production, planned green methanol facilities, and early-stage bunkering infrastructure aligned with future demand.
- Infrastructure expansion includes new berths, outer harbour development, and offshore wind projects, supported by large-scale investments to position the port as a hub for offshore wind energy.
- Decarbonisation measures include electrification, renewable-based shore-to-ship power systems, plastic-free operations, green building certifications, and deployment of digital tools such as digital twins and AI for operational efficiency.
- Circular economy initiatives include waste-to-green methanol projects, carbon credit generation through registered projects, and potential revenue streams from carbon markets.
- Green mobility within the port ecosystem is being advanced through collaboration with Tata Motors for hydrogen-powered transport and decarbonised internal logistics systems.
- Green fuels are central to achieving net-zero shipping, with the port positioning itself as a major bunkering hub and targeting demand of around 1 million metric tonnes.
- India's transition presents an opportunity to shift from energy import dependence to becoming a green energy exporter, with global disruptions reinforcing the urgency of accelerating green transition in ports and shipping.

KEY RECOMMENDATIONS

Recommendations	Stakeholders Involved
Scale renewable energy integration (towards 100 per cent and beyond carbon neutrality) in port operations	• Port Authorities
Establish green bunkering ecosystems (methanol/hydrogen) targeting large-scale demand (~1 MTPA)	• Port Authorities • Shipping lines

Promote circular economy projects (e.g., waste-to-methanol, carbon credit generation) within ports	• Port Authorities; Industry

Speaker 4: Mr. Ankur Malyan, Rocky Mountain Institute, New Delhi

- The Rocky Mountain Institute presented as a global organization working in India across EVs, buildings, power, and green hydrogen, including early collaboration with NITI Aayog on India's hydrogen mission.
- Green hydrogen seen as moving from hype to reality, with recent global market corrections leading to more practical and realistic adoption.
- India's advantage highlighted in terms of renewable energy resources and strategic maritime location, making it attractive for global partners, especially Europe, in the context of energy security concerns.
- The role of ports underlined as key facilitators in the green transition due to proximity to industrial clusters, existing infrastructure like storage and pipelines, land availability, and experience in handling energy cargo.
- The importance of scale emphasized for cost reduction, with large volumes (around 1 million tonnes) seen as necessary for project viability.
- The "clusters and corridors" approach presented, where ports act as industrial hubs connected through global corridors linking Indian supply with demand centres in Europe and East Asia.
- Domestic demand in sectors like fertilisers, refineries, and steel noted as price-sensitive, with early growth likely to depend on export markets willing to pay a premium.
- The significance of international corridors such as the Rotterdam–Singapore route highlighted, with Indian ports like VOC seen as potential bunkering and export hubs.
- Green fuels acknowledged as currently expensive, but likely to become competitive with policy support and global frameworks.

- Demand uncertainty identified as the biggest challenge, with a mismatch between long-term supply expectations and short-term buyer preferences slowing progress.
- The need for demand aggregation highlighted to pool demand, reduce risks, and support price discovery.
- Ongoing efforts noted in building industry coalitions involving producers, shipping companies, traders, and buyers to operationalise green shipping corridors.
- The transition framed as dependent more on coordination than technology, requiring stakeholder alignment, policy support, demand aggregation, and viable market structures.

KEY RECOMMENDATIONS

Recommendation	**Stakeholder Involved**
Adopt a "clusters and corridors" approach, linking ports with industrial hubs and global green shipping corridors	• MoPSW • Port Authorities • IPA
Enable demand aggregation mechanisms to reduce risk and support price discovery for green fuels	• Industry coalitions • Port Authorities • Traders
Build multi-stakeholder coalitions (producers, shippers, buyers) to operationalise green corridors	• Shipping lines • Port Authorities
Focus on export-oriented green fuel markets initially, where buyers are willing to pay a premium	• Port Authorities • Exporters • Trade bodies

Speaker 5: Mr. Sudheer Kumar M, Executive Vice President VP Jakson Green Limited

- The discussion shifted to water management in green ports, linked to World Water Day, highlighting its importance for overall port sustainability.
- High water demand at ports noted for vessel operations, refuelling, onboard use, maintenance, firefighting, and nearby townships, along with large volumes of wastewater from sewage, industrial activity, and grey water.

- Increasing dependence on seawater desalination highlighted, along with challenges such as brine discharge, pollution risks, and impacts on marine ecosystems.
- Key issues identified in water management, including high desalination costs, energy intensity, chemical usage, waste disposal (especially membranes), and rising water stress in port regions.
- Many ports located in water-stressed areas, with additional industrial and urban demand likely to worsen local shortages, making it important that ports do not add pressure on surrounding communities.
- Conventional reverse osmosis (RO) systems critiqued for high energy consumption, heavy chemical use, membrane disposal challenges, and high operational costs due to frequent replacement and need for skilled manpower.
- Thermal desalination (multi-effect distillation) presented as a cleaner alternative, especially when combined with renewable energy or waste heat, producing high-purity water with lower chemical use and reduced environmental impact.
- Opportunities highlighted for using waste heat from industries, diesel generators (especially in island ports), and green hydrogen production processes to power desalination systems.
- Cost comparison noted with thermal systems having higher initial investment but lower operating costs over time due to use of low-cost or free heat and reduced maintenance.
- Flexibility of such systems highlighted, as they can treat multiple sources including seawater and wastewater, enabling circular water use within ports.
- A "water-positive" approach suggested, focusing on reducing freshwater use, increasing recycling and reuse, and potentially supplying water back to surrounding communities.
- Sustainable water management highlighted as essential for green ports, not only for environmental reasons but also for social equity, resilience, and ensuring port development does not increase water stress.

KEY RECOMMENDATIONS

Recommendation	Stakeholders Involved
Shift toward thermal desalination systems (MED) using waste heat/renewables instead of conventional RO in ports	• Port Authorities • Industrial operators

Integrate waste heat recovery (industry, DG sets, hydrogen plants) into desalination systems	• Port Authorities • Industrial clusters
Develop circular water systems (reuse of wastewater, multi-source treatment) within ports	• Port Authorities
Adopt a "water-positive" approach, reducing freshwater use and potentially supplying surplus water to surrounding communities	• Port Authorities • Local authorities

SESSION 3: Digital Ports and Digital Corridors

Chair/Moderator: Dr. Shishir Shrotriya, CMEC, RIS

- India's target of achieving 10,000 MTPA port capacity places significant responsibility on non-major ports, which are expected to contribute nearly 7,000 MTPA. This makes coordination, efficiency, and system-wide integration central to future maritime growth.
- Capacity expansion alone is insufficient. Equal emphasis is required on reducing logistics costs, improving resilience, and strengthening operational efficiency across the maritime ecosystem.
- Ports and logistics systems today generate vast amounts of data through terminals, sensors, and infrastructure. However, much of this data remains fragmented and underutilized, limiting its contribution to productivity and decision-making.
- There is a growing need to move beyond adopting global models and instead develop indigenous digital frameworks suited to India's scale and complexity. International examples, including large-scale automated ports, demonstrate the level of integration and efficiency required, particularly in linking seaports with riverine and coastal systems.
- Automation emerges as a foundational requirement. Without it, meaningful data utilization, system-wide integration, and efficiency gains remain constrained.
- Digital tools such as electronic Bills of Lading (e-BL) and virtual trade corridors like MAITRI represent critical enablers for improving trade facilitation, reducing transaction time, and enhancing transparency.

- Digitalization must align with intermodal and multimodal connectivity, ensuring seamless integration across road, rail, coastal shipping, and inland waterways.
- The idea of a Digital Public Infrastructure (DPI) for ports and logistics is gaining relevance, enabling integrated data sharing and real-time decision-making across stakeholders, similar to developments in digital payments.
- Public–private partnerships remain essential for scaling digital transformation, particularly through the participation of startups, MSMEs, and technology providers.
- Digital transformation also requires investments in skills and capacity building, ensuring that the workforce is equipped to manage and operate advanced systems.
- National initiatives such as PM Gati Shakti can achieve their full potential only when supported by strong digital integration and data-driven coordination.
- Overall, India's maritime growth is increasingly dependent on automation, data integration, multimodal connectivity, and collaborative governance, requiring a strategic and integrated approach to digital transformation.

KEY RECOMMEDATIONS

Recommendation	**Institutions Involved**
Develop a Digital Public Infrastructure (DPI) for ports and logistics to enable seamless data sharing and real-time coordination across stakeholders	• Ministry of Ports, Shipping and Waterways (MoPSW) • Ministry of Electronics & IT (MeitY) • ULIP • CMEC
Align digital systems with multimodal connectivity frameworks (road, rail, waterways, coastal shipping)	• PM Gati Shakti (DPIIT) • Ministry of Railways • IWAI • MoPSW
Strengthen public–private partnerships (PPP) to drive digital innovation and scaling	• MoPSW • State Maritime Boards
Invest in skills, training, and capacity building for digital transformation	• MoPSW • DGS

	• Skill India Mission • Maritime Training Institute • CMEC

Speaker 1: Dr. Surender Kumar Ahirwar, Executive Director, Traffic Commercial, Ministry of Railways

- Global disruptions (geopolitical, economic, and strategic) are now a recurring feature, reinforcing the need for resilient and integrated logistics systems. Despite progress, a gap remains between current capabilities and future requirements, particularly in achieving fully integrated supply chains.
- "Smartness" in ports extends beyond digitalization to include automation, which translates digital systems into tangible efficiency and resilience gains.
- Two key digital initiatives are shaping India's logistics ecosystem:
    - Unified Logistics Interface Platform (ULIP): A data integration platform using APIs to connect stakeholders and services
    - PM Gati Shakti National Master Plan (NMP): A GIS-based infrastructure planning platform with extensive data layers
- ULIP represents a shift from information aggregation to real-time system integration, enabling services such as tracking, compliance, and transport planning. It has evolved into a large-scale digital gateway integrating multiple ministries, systems, and private sector participants.
- The platform is designed to support private innovation, allowing applications to build on authenticated government data. Future integration of AI is expected to enable predictive analytics and intelligent decision-making.
- In contrast, PM Gati Shakti serves as a GIS-based infrastructure planning platform, integrating extensive data layers across ministries and states. It enables coordinated planning based on comprehensive geospatial data, improving efficiency and long-term outcomes.
- The integration of ULIP and PM Gati Shakti presents the possibility of a unified ecosystem combining operational and infrastructure intelligence.
- India has already developed a rich logistics data ecosystem. However, there is a risk of remaining a data provider while global players leverage this data to build advanced digital solutions.
- This creates both a challenge and an opportunity for domestic technology players to develop indigenous, globally competitive systems.

- Effective utilization of accessible logistics data can significantly enhance resilience, efficiency, and long-term competitiveness.

KEY RECOMMENDATIONS

Recommendation	Stakeholders Involved
Integrate ULIP and PM Gati Shakti for a unified logistics ecosystem	• DPIIT • Ministry of Railways
Enable AI integration in logistics platforms for predictive analytics and decision-making	• MeitY • DPIIT
Encourage domestic development of digital logistics solutions (avoid being only a data provider)	• DPIIT • MeitY
Promote effective utilisation of logistics data to enhance efficiency and resilience	• Port Authorities • All logistics ministries

Speaker 2: Mr. Manoranjan Gupta, Chief Product Officer, Portal, JM Baxi Group

- The evolution of maritime digital systems reflects a transition from port-level platforms to broader trade ecosystems. Early systems such as the Port Community System (PCS) laid the foundation for digitalization, which later expanded into the National Logistics Portal and international implementations.
- Maritime digitalization requires a combination of technological capability and domain expertise. Systems must integrate diverse stakeholders, including importers, exporters, regulators, and service providers, highlighting the importance of collaboration and ecosystem-wide participation.
- Early EDI-based systems enabled standardized communication, forming the basis for interoperability. However, smart ports extend beyond technology, encompassing data analytics, IoT, blockchain, and digital documentation systems such as electronic bills of lading.
- Emerging initiatives such as MAITRI and IMEC demonstrate real-time system interaction, improving coordination across the maritime ecosystem. Despite progress, adoption remains uneven, with non-major ports lagging

behind. Mandating digital platforms such as the Maritime Single Window and National Logistics Portal is seen as necessary for scaling.

- Policy support plays a critical role in ensuring adoption, as demonstrated by regulatory backing for certain platforms. However, technology alone is insufficient without supporting infrastructure, stakeholder participation, and complementary systems.
- Digital twin technology offers significant potential through simulation, predictive analysis, and improved planning. Applications such as harbour management systems and just-in-Time vessel arrival can reduce congestion, improve turnaround time, and lower emissions.
- Smart ports are conceptualised as self-organising ecosystems requiring transparency, scalability, and high system availability. Reliability and accessibility are essential for sustained effectiveness.
- While progress has been made toward paperless processes, challenges persist. Open and interoperable platforms are necessary to avoid vendor lock-in and encourage innovation.
- Successful implementation requires balancing technical architecture with operational understanding. Initial resistance to new systems is expected, but long-term value drives eventual acceptance.
- Collaboration across government, private sector, and stakeholders remains central to the development of smart ports.

KEY RECOMMENDATIONS

Recommendation	**Stakeholders Involved**
Mandate adoption of digital platforms (e.g., Maritime Single Window, NLP), especially for non-major ports	• MoPSW • IPA • State Maritime Boards
Ensure open and interoperable digital platforms to avoid vendor lock-in	• MeitY • MoPSW • NIC
Promote adoption of digital twin technologies for port operations and planning	• MoPSW • Port Authorities

Strengthen policy and regulatory support to ensure adoption of digital systems	• MoPSW • IPA
Enhance collaboration across government, private sector, and stakeholders	• MoPSW • IPA • Shipping lines • Terminal Operators • Logistics Firms

Speaker 3: Shri Abhay Shukla, CEO, AI Transmute - MAITRI Software

- India's maritime sector is at a transition point, moving from physical infrastructure development toward intelligent, data-driven corridors. While digitalisation has advanced, the next phase requires coordinated intelligence across the logistics value chain.
- A critical distinction emerges between automation and intelligence. Existing systems often improve efficiency through automation but lack predictive and decision-making capabilities. The future lies in interconnected systems enabling real-time and data-driven decisions.
- Interoperability across platforms is essential, allowing port systems, logistics platforms, and national data layers to function cohesively. Developments such as MAITRI demonstrate the potential of interoperability engines to integrate disparate databases without altering underlying systems.
- AI-driven integration has already reduced data processing time, highlighting the scalability of such solutions. However, persistent inefficiencies, such as gate congestion, continue due to lack of coordination across systems.
- Optimizing logistics flows requires aligning truck movements, yard capacity, and rail scheduling through AI-based orchestration. This, in turn, depends on end-to-end visibility across the supply chain.
- While initiatives such as PM Gati Shakti and digital twins represent progress, many implementations remain limited to visualization rather than actionable intelligence. The evolution of digital twins into decision engines is necessary for predictive and prescriptive capabilities.
- Global benchmarks indicate a shift from port-level competition to corridor-level competition, where integrated logistics performance determines

competitiveness. Corridor intelligence requires seamless multimodal integration, real-time visibility, and synchronized planning.

- Many technological solutions are already available and deployable, suggesting that the primary challenge lies in implementation and scaling. Reducing inefficiencies also contributes to sustainability by lowering emissions.
- The development of a national corridor intelligence layer can integrate data and decision-making across the logistics ecosystem. With its data capabilities and technological potential, India is positioned to emerge as a global leader in maritime intelligence systems.

KEY RECOMMENDATIONS

Recommendation	**Stakeholders Involved**
Develop a national corridor intelligence layer integrating data and decision-making across logistics	• DPIIT • MoPSW • NIC
Ensure interoperability across platforms without altering underlying systems	• MEITY • NIC
Move toward AI-based orchestration of logistics flows with end-to-end visibility	• MoPSW • Ministry of Railways • Port Authorities
Evolve digital twins into predictive and prescriptive decision engines	• MoPSW • Tech providers
Focus on implementation and scaling of existing technological solutions	• MoPSW • Industry

Speaker 4: Shri Lingraj Mahanand, CEO & Founder, Credore Software

- Digital transformation in cross-border trade is centred on enabling secure, legally valid exchange of documents such as electronic bills of lading. Despite

recognised benefits, global adoption remains low, with limited digitisation and even lower acceptance of negotiable digital instruments.

- The challenge is global rather than country-specific, with two primary barriers: interoperability across platforms and legal admissibility of digital documents. Trade processes involve multiple stakeholders operating on different systems, complicating seamless data exchange.
- Legal recognition remains critical, particularly for financial institutions dealing with negotiable instruments. Addressing these concerns requires adherence to international standards and robust regulatory frameworks.
- Interoperable digital infrastructure enables document exchange across platforms without requiring uniform systems. Recognition by international insurance and regulatory bodies strengthens trust and facilitates adoption.
- Demonstrations through proof-of-concept transactions show significant efficiency gains, reducing processes that traditionally take weeks to a matter of hours. These systems also enable secure ownership transfer and independent verification.
- Digital financial instruments, such as promissory notes, are gaining acceptance in certain jurisdictions, enabling faster trade financing and shorter cash cycles. Regulatory collaboration, including partnerships with countries like Singapore, plays a key role in advancing these frameworks.
- Ongoing efforts to digitize trade corridors - such as India–Singapore and India–UAE, highlight the potential for scaling these solutions. As digital bills of lading remain at a nascent stage globally, there is a significant opportunity for leadership.
- India is well-positioned to play a leading role in digital trade documentation, particularly within the Global South, by developing interoperable, legally robust, and scalable systems for cross-border trade.

KEY RECOMMENDATIONS

Recommendation	**Stakeholders Involved**
Establish legal recognition for digital trade documents (e.g., electronic Bills of Lading)	• DGS • Shipping Companies
Build interoperable systems for cross-platform digital document exchange	• MeitY • MoPSW

Align with international standards to enable trust and adoption of digital trade instruments	• MoPSW • International regulatory bodies (IMO) • DGS
Promote cross-border digital trade corridors (e.g., India-Singapore, India-UAE)	• Ministry of Commerce • MoPSW
Expand adoption of digital financial instruments to improve trade financing efficiency	• DPIIT