OCCASIONAL REPORTS

Centre for Policy Research in Maritime Studies [C-PRiMeS]

NAVIC Concept Notes

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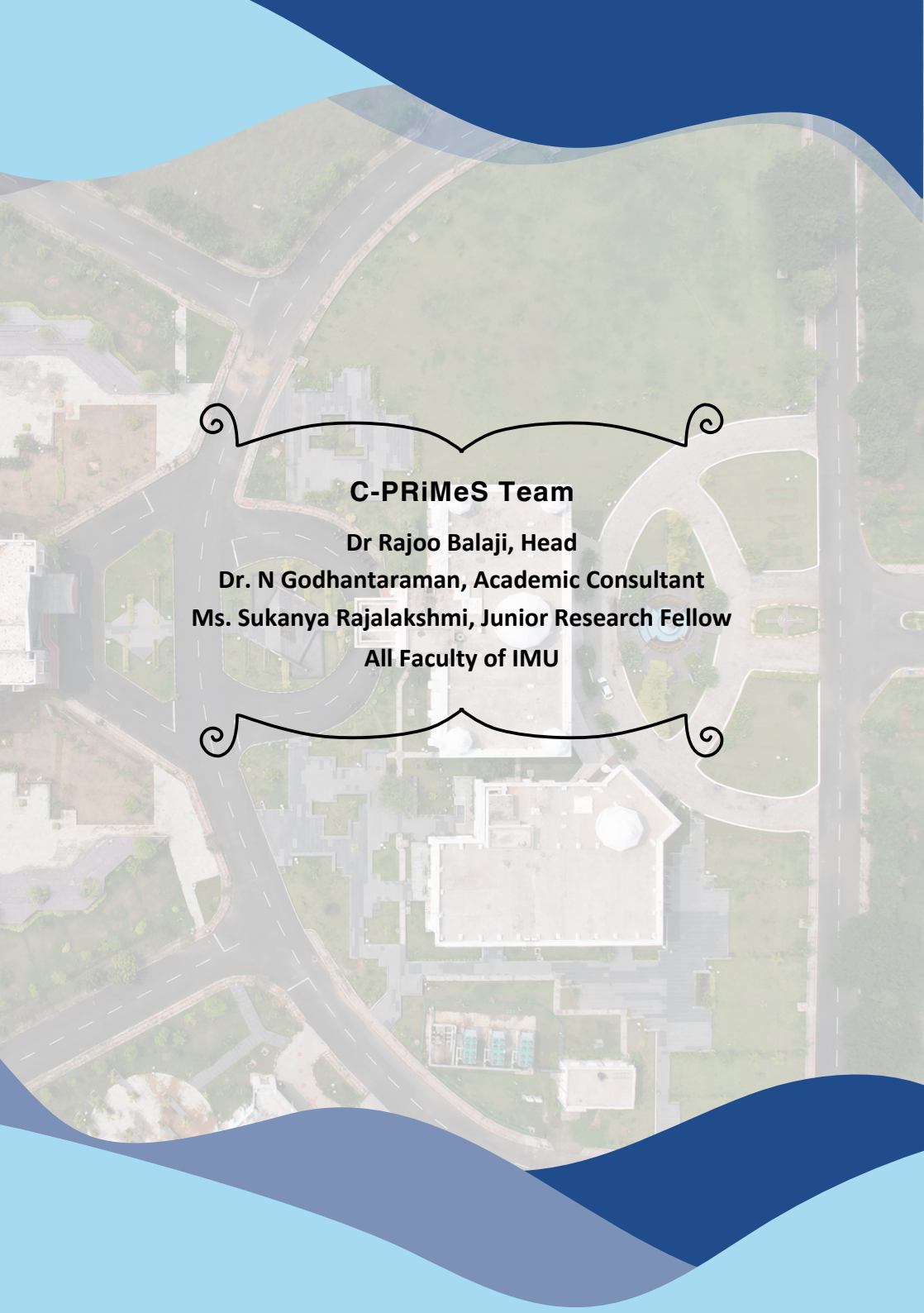

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About this Series

The Ministry of Ports, Shipping, and Waterways (MoPSW) has launched a strategy in which two distinct cells have been formed: Viksit Bharat Sankalp (ViBhaS), which focuses on providing policy direction for the development of a sustainable and prosperous maritime sector, and Neel Arth Vision Implementation Cell (NAVIC), which concentrates on the execution of action plans to operationalise these policies. Both cells operate through their respective functional cells, which encompass all organisations affiliated with the MoPSW.

The Indian Maritime University (IMU) serves as the nodal office for National Categories #9 and #13, with IMU faculty and staff also participating in discussions across all other functional cells. All participating IMU faculty have worked on possible studies which may be undertaken. The proposals are placed broadly as 'Concept Paper', 'Research Paper' and as 'Policy Recommendation'.

C-PRiMeS invites feedback and ideas on these proposals. We also invite stakeholders to support the projects which may be relevant and appeal to their interests. We also invite subject matter experts to be part of our consultant team.

This will be an ongoing series under the Maritime India Vision and Maritime Amrit Kaal Vision.

The centre wishes to thank Dr. Malini V. Shankar, Vice Chancellor, Indian Maritime University, for the support and contribution.

Concept paper, Research paper and Policy recommendation (NAVIC #4)

Capt. Yogesh Shah, Associate Professor, IMU Navi Mumbai Campus

Concept Paper

Integrated Cruise and Ferry Tourism Development: A Sustainable Approach to India's Maritime Vision

Introduction

Cruise and ferry tourism holds significant potential for India, contributing to economic growth, regional connectivity, and sustainable tourism development. With its vast coastline, river systems, and cultural heritage, India can become a global hub for cruise tourism. This concept paper explores strategies to develop integrated cruise circuits, leveraging existing infrastructure, policies, and technology.

Key Challenges

- **Infrastructure Gaps**: Limited cruise terminals and underdeveloped ferry hubs
- **Environmental Concerns**: High emissions and insufficient waste management systems
- **Funding Constraints**: Dependence on public funding and limited private sector participation
- **Human Resource Needs**: While India has a strong base of maritime professionals, specialized training for cruise tourism and ferry operations, such as passenger services, on board hospitality, and environmental management, requires further development to meet global standards
- **Policy Gaps**: Lack of comprehensive guidelines for integrated tourism circuits

Objectives

- Develop integrated cruise and ferry circuits connecting ocean, river, and lighthouse tourism
- Promote public-private partnerships to enhance infrastructure and operational capacity
- Encourage sustainable practices to minimize environmental impact

Proposed Approach

- Leverage existing schemes under Maritime Amrit Kaal Vision 2047
- Identify key locations for integrated circuits based on passenger trends
- Use advanced technology for real-time passenger management and emissions monitoring

Expected Outcomes

- Enhanced regional connectivity and economic growth
- Increased private sector investment in cruise and ferry tourism
- Establishment of India as a sustainable cruise tourism destination

Research Paper

Analysing the Economic and Environmental Impacts of Cruise Tourism in India

Abstract

This research examines the economic contributions and environmental impacts of cruise tourism in India. Using data collected by NAVIC #4, the study identifies key trends, challenges, and opportunities to develop sustainable cruise tourism circuits.

Objectives

- Quantify the economic benefits of cruise and ferry tourism
- Analyse the environmental impact of current cruise operations
- Propose actionable strategies to balance growth and sustainability

Methodology

- **Data Collection**: Analyse NAVIC #4 data, including passenger traffic, revenue trends, and environmental metrics
- **Comparative Analysis**: Benchmark India's cruise operations against global best practices
- **Gap Analysis**: Identify gaps in infrastructure, policy, and operational standards
- **Case Studies**: Evaluate successful integrated cruise circuits in other regions

Expected Results

- Comprehensive insights into economic and environmental impacts
- Identification of priority areas for infrastructure and policy improvements
- Recommendations for implementing sustainable cruise tourism practices

Policy Recommendation

Policy Framework for Integrated Cruise Circuits and Sustainable Ferry Operations

Background

India's cruise and ferry tourism sector faces challenges such as limited infrastructure, environmental concerns, and fragmented policies. To address these issues, this policy framework outlines actionable recommendations to promote integrated tourism circuits and sustainable operations.

Key Recommendations

- **Incentivize Private Sector Participation**:
    - Offer tax benefits and subsidies for developing cruise terminals and ferry hubs
    - Encourage public-private partnerships to share risks and benefits

- **Develop Comprehensive Guidelines**:
    - Establish SOPs for integrating ocean, river, and lighthouse tourism
    - Create uniform standards for cruise and ferry operations
- **Promote Sustainable Practices**:
    - Mandate the use of low-emission technologies and renewable energy
    - Implement waste management systems on board cruise and ferry vessels
- **Enhance Skill Development**:
    - Launch training programs for crew and operational staff
    - Align training standards with international guidelines

Conclusion

Implementing these recommendations will enable India to develop a world-class cruise tourism sector, fostering economic growth while ensuring environmental sustainability. By aligning with the Maritime Amrit Kaal Vision 2047, this policy framework supports India's aspirations to become a global leader in sustainable maritime tourism.

Concept paper, Research paper and Policy recommendation (NAVIC Cell No. 10)

Dr. N. Bhanu Prakash, Associate Professor, IMU Visakhapatnam Campus
R. Adm. (Dr.) P. J. Rangachari, (Retd.), Director, IMU Chennai Campus

PPP Projects: A scan of challenges, experiences and opportunities for Major Ports of India.

Background

Public Private Participation (PPP) has proved to be a suitable strategy to revive the performance metrics of publicly owned major ports of India. Around 616 projects involving capital expenditure of around ₹150,695 Crores are at various stages of completion. If implemented with care, the PPP projects are expected to enhance the overall performance of ports in the form of enhanced throughput, better service quality, and optimal asset utilization, improved operational and financial efficiencies that lead to the realization of the targets of Maritime Amrit Kaal Vision 2047 set by the government of India.

However, experience with PPP projects is not free from challenges and constraints for the major ports, resulting in delays in implementation and at times, leading to arbitration. Some PPP projects have had smooth sailing, but there are experiences where projects get stalled due to numerous unwarranted reasons. Issues such as complexities in the project, improper stakeholder consultations, loosely defined responsibilities, delayed legal and regulatory procedures, ill-defined project scope, time and cost overruns, quality expectations, performance monitoring, revenue collection and vague dispute resolution mechanisms are hampering the implementation of these projects.

It is interesting to note that experiences of these challenges in implementing the PPP project are port specific and the port authorities, albeit, with some sacrifice are attempting to resolve them. Oftentimes, these issues are resolved at the port level or taken to arbitration as individual cases and may not be known to outsiders. With the backdrop of the experiences of various major ports, it is proposed to take up a study on the challenges faced by major ports, right from the pre-bid stage to the implementation stage of the PPP projects. A record of such experiences of ports can help other ports to work on the possible improvements from such learnings. This current study aims to identify such experiences and suggest pertinent measures to counter or resolve such impediments in the implementation of PPP projects at the ports.

Objectives

- To identify the list of common challenges faced in various stages of PPP project(s) implementation
- To identify reasons for such disagreements in the interpretation of the provisions of PPP agreements.
- To identify suitable mechanisms that can mitigate such disagreements between/among the stakeholders that can align them to understand the provisions of the PPP contracts

Methodology

The study will be dependent on both primary and secondary data collection. Various documents involved at various stages of PPP contracts will be collected to understand the actual provisions and assess the areas of misinterpretation. From the recorded experiences, a matrix highlighting the type of problem along with the proposed resolution and its impact will be created. Further, data will be collected, through questionnaires, from various stakeholders to assess the disagreements and misinterpretations in the documents prepared in the documents and contracts. A comparison of these experiences will be made to check if there exist any better options. A final guide note highlighting the points that lead to miscommunication and/or disagreements will be prepared along with the refinement in drafting procedures of the contracts. The output is expected to bring clarity and uniformity among the parties and will be the basis for future contracts and negotiations.

Expected outcome

The study is expected to bring out the common issue faced by ports in the implementation of the PPP Projects and propose some pertinent options to improve the clarity and understanding among the stakeholders. This will reduce unwarranted communication gaps and time and cost overruns that happen due to disputes between the concessionaire and the port authority.

Concept paper, Research paper and Policy recommendation (NAVIC #12)

Capt. A. K. Majumder, Associate Professor, IMU Navi Mumbai Campus

Concept Paper

Introduction

The Indian ports & marine sector play a crucial role in expediting trade and economic growth. With its considerable coastline of 7,500 kilometres and over 200 ports (13 major ports), the country's port infrastructure serves as a gateway for approximately 95% of India's trade by volume. The efficiency and competitiveness of the port sectors are often faced with challenges such as unnecessary complicated procedures & rules, outdated processes, and lack of adoption of advanced technologies & inadequate overall infrastructural development of port led industrialization.

Considering chapters of

- MIV-2 E2E Logistics Efficiency & Cost Competitiveness
- MIV-3 Enhance Ease of Doing Business (EoDB) and Operational Efficiency through Technology
- MIV-6 Enhance Cargo and Passenger Movement in Inland Waterways

There is a critical need to leverage automation and technology to enhance the ease of doing business and re-engineer business processes in the sector.

The demand for structured, sustainable, and flexible port operations necessitates the much-needed adoption of automation and advanced technical solutions. However, implementing such solutions requires a prudent & systematic approach customized to the unique challenges, infrastructure, and operational dynamics of each port. This concept paper outlines a framework for developing customized roadmaps to guide the deployment of automation and technical solutions in ports.

Ports are crucial hubs of global trade and logistics, serving as gateways for goods and commodities to move across the world.

For Enhancing Ease of Doing Business and Business Process Re-engineering in the Marine Port Sector in India through Automation and Technology following concepts need to be worked upon

- Digitization to facilitate EXIM trade
- Digital-led Port Operations Enhancement
- Ports Functional Processes Efficiency Improvement
- Digitization in Other Maritime Areas
- Current Challenges & Proposed Solutions
- Expected benefits

Re-engineering business processes and adopting cutting-edge technologies in the port sector is vitally important to enhance its ease of doing business and position itself as a global trade hub. By investing in digital transformation and promoting collaboration among stakeholders, India's ports would achieve

greater efficiency, cost-effectiveness, and sustainability, ultimately contributing to the country's economic growth and global trade ambitions.

Research & study on the following policy roadmaps for Deploying Automation and Technical Solutions in Ports will help achieve the projected goal and necessary action required.

- Challenges faced in Port Automation
- Framework for Customized Roadmap Development
- Phased Implementation Plan
- Workforce Transition and Training
- Establish a Strategic Framework
- Conduct Comprehensive Assessments & global trend
- Develop a Modular Roadmap
- Encourage Technological and Skill Development
- Promote Public-Private Partnerships

Concept paper, Research paper and Policy recommendation (NAVIC #18)

Dr. Lekha Ravi, Assistant Professor, IMU Chennai Campus B. Anjali, Junior Research Fellow, IMU Chennai Campus

[Outlined based on inputs related to NAVIC #18 - (Data Analytics & Knowledge Repository)]

The Transport Research Wing (TRW) of MoPSW which is driving this cell, has compiled data from the various constituents of our Ministry.

AREAS OF STUDIES THAT CAN BE IDENTIFIED FOR RESEARCH INCLUDE:

- Basic Port Statistics
- Indian Shipping Statistics
- Statistics of India's Ship Building and Ship–Ship repairing industry
- Statistics on Inland Water Transport

A Concept paper on Inland waterways in India

Inland Water Transport (IWT) as a Sustainable Mode of Transportation in India: Prospects and Existing Challenges

The global economy's reliance on international trade is significantly supported by maritime transport, with 80% of international cargo transported by sea. India, featuring 12 major ports on its coasts, is upgrading its infrastructure and digitizing operations to improve port efficiency and trade. Inland Waterways Transport (IWT) is crucial, leveraging India's 7,500 km coastline and extensive river network.IWT, an ancient and cost-effective mode of transport, involves moving cargo and passengers via natural channels, offering an environmentally friendly alternative. Despite a total navigable length of 20,275 km, India's IWT usage is only 2% compared to higher rates in the Netherlands, China, and the US. To enhance IWT's role in easing road and rail congestion, the Government of India has invested ₹ 1010.5 crores in 2023-24, aiming to increase IWT's modal share to 5% by 2030, as per the Maritime India Vision 2030. This paper proposes to explore IWT's current status, potential, and challenges.

Methodology: Both primary and secondary data from available statistics on the IWAI site, feasibility reports of the MoPSW on proposed waterways and a stakeholder survey of the existing waterways.

A Research Proposal that can lead to Policy Recommendation

Global maritime trade in terms of ton-miles is estimated to have grown by 4.2% in 2023 (UNCTAD, 2024). In the period 2025–2029, UNCTAD projects that total seaborne trade will grow on average by 2.4% and containerised trade by 2.7%. Sea trade is becoming more integrated with Inland waterways as the concept of the combined transport system develops (Branch, 2007). The total external costs of inland navigation after accounting for all externalities, including accidents, congestion, noise emissions, air pollution and other environmental impacts are seven times lower than that of road transport (Gupta, A Journey through Development of Inland Waterways in India, 2017). Inland waterways provide a viable

alternative to road and rail transport and are very desirable, especially from the perspectives of cost and sustainability (Bangar Raju Totakura, 2022).

The most extensive waterway networks are situated in China, Russia, and Brazil. Nonetheless, the significance of IWT transcends these nations and extends to European countries and the United States. In fact, China is endowed with three significant rivers, the Yangtze, Pearl, and Yellow Rivers, which establish crucial hinterland connections for the distribution of local production and facilitate access to the seaport of Shanghai, on which 4886 million tons of cargo were transported in 2013 (R. Konings, 2016).

Inland waterways in India

India has an estimated 14500 km of navigable inland waterways, including river systems, canals, backwaters, creeks and tidal inlets that can effectively support mechanised crafts. About 5200 km of major rivers and 485 km of canals are suitable for inland transport (Gupta, 2017). The presence of IWT can be found in the Hindu mythology. During the pre-colonial era, under the Mauryan and Gupta Empire, the inland water transportation was significantly developed. As the East India Company started to spread its roots in India, the pattern of trade however was completely changed. After independence in 1947 there were many committees formed by the government with the help of the Central Board of Transport (Ar. Deepali K. Hejib, 2021). The National Transport Policy Committee, headed by B D Pandey, found funding to this sector was grossly inadequate and recommended principles for the declaration of a national waterway and as a result of this, five National Waterways have been declared by the Indian Government (Gupta, 2017). The Inland Waterways Authority of India (IWAI), set up on 27th October 1986 under the Inland Waterways Authority of India Act, 1985, is entrusted with the regulation and development of Inland Waterways for the purpose of inland shipping and navigation (Ministry of Ports S. a., 2022-23)

The Indian Parliament approved a bill in 2016 declaring another 106 waterways as National Waterways across the country making the total navigable waterways in India 111 (Gupta, 2017). Out of the 111 NWs, 24 are currently operational and a total of 133.30 MMT cargo has been handled across the waterways in the year 2023-2024 (Ministry of Port, 2024). Considering the cargo movement along waterways, Maharashtra waterways stand top with cargo movement of 631.49 lakh tonnes in the year 2022-23, followed by Gujarat waterways 276.57 lakh tonnes cargo and then NW-1 (Allahabad-Haldia stretch, Ganga-Bhagirathi-Hooghly river system) with cargo movement of 131. 7 lakh tonnes (Ministry of Ports S. a., 2022-23).

The development of necessary infrastructure to enable the movement of cargo and passengers on the inland waterways is one of the most important aspects for the promotion of the sector. Currently (2024) WT has a modal share of 2% comparing other modes such as road and rail. Priority development of NW 1 has been undertaken through the Jal Vikas Marg Project (JVMP), which includes Arth Ganga as an integral part. This aims to develop the river Ganges as a commercially sustainable and safe mode of navigation (Ministry of Ports, 2020). The Maritime India Vision 2030 report states that MIV 2030 aims to enhance the cargo and passenger movement in Inland waterways through infrastructure development,

regional connectivity with Bangladesh, Bhutan, Myanmar and Nepal and Policy interventions for the development of the IWT sector. As a part of various developmental activities in this sector, the government has invested 1010.50 Crores in the year 2023-24 (Ministry of Port, 2024).

The peculiar challenges faced by the IWT sector

Asia-Pacific countries possess an extensive system of water bodies that make them naturally equipped to handle water transport. However, certain inhibitors have prevented countries from attaining the advantages of IWTs in Asian contexts (Ashish Trivedi, 2021). A study by Sriraman (2010) identified different impediments to the growth of IWT in India, such as the non-availability of high technology vessels, non-availability of permanent terminals, or lack of intermodal connectivity, and non-availability of cargo near the river-front. The cost of maintenance as well as the building of waterways as compared to roadways has long been recognized as a major challenge for IWT. Lack of government support was also a critical factor.

IWTs are also subject to water level fluctuations caused by floods and/or droughts, which make them less suitable during specific times of the year. Financial support is the factor that decides the capacity of to leverage the potential of IWTs. In India, the flow of water and navigable length are bigger issues that need the government's attention (Ashish Trivedi, 2021). The infrastructure gap and institutional support need to be addressed well to achieve better results in IWT (Praveen and Jegan, 2019). The Environmental Impact of pollution due to diesel driven vessels is another recognized issue (Rangaraj and Raghuram, 2007), however, that is less as compared to other transportation modes.

Wang et al. (2020) suggested that "Sustainable inland waterways should meet the needs of navigation without compromising the health of riverine ecosystems. Barros et al. (2022) defined sustainable IWT as "the one in which freight increase meets lower environmental and economic costs in waterway developing works and operations while being resilient to climate change and promoting social equity (N. Calderón Rivera, 2024).

Research question

Is the Government equipped to address the above challenges so as to make IW a truly sustainable mode of commercial transportation as envisaged in MIV 2030?

The above can be developed as a white paper for policy recommendations.

References

1. Ar.Deepali K. Hejib, M. (2021). Inland Water Transportation in India: Past, Present and Future.
2. Ashish Trivedi, S. K. (2021). Analyzing barriers to inland waterways as a sustainable transportation mode in India: A dematel-ISM based approach. Journal of Cleaner Production.
3. Bangar Raju Totakura, N. N. (2022). Factors Affecting Container Shipping Through Inland. Journal of ETA Maritime Science, 156-167.
4. Branch, A. E. (2007). Elements of Shipping. Oxon: Routledge.
5. ECMT. (2006). Inland Wtaerways and Environmental Protection. EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT.
6. Gupta, A. A. (2017). A Journey through Development of Inland Waterways in India. Archives of Business Research, 38-72.

7. Gupta, A. A. (2017). A Journey through Development of Inland Waterways in India. Archives of Business Research, 38-72.
8. (2016). Inland waterway transport: an overview. European Commission.
9. John Zumerchik, S. L. (2010). Seas and Waterways of the World- An Encyclopedia of History, Uses, and Issues. California: ABC-CLIO, LLC.
10. Ministry of Port, S. a. (2024). 10 years Maritime -Led Prosperity.
11. Ministry of Ports, s. a. (2020). MIV 2030.
12. Ministry of Ports, S. a. (2022-23). STATISTICS OF INLAND WATER TRANSPORT. Government of India.
13. N. Calderón Rivera, I. B. (2024). Sustainable development of inland waterways transport: a review. Journal of Shipping and Trade.
14. Narayan Rangaraj, G. R. (2006). Viability of Inland Water Transport in India.
15. Paul Tae-Woo Lee, Y.-S. C. (2016). Transportation research trends in environmental issues: a literature review of methodologies and key subjects. Int. J. Shipping and Transport Logistics.
16. Praveen S, J. J. (2019). Key issues & challenges for inland water transportation. International Journal for Scientific Research & Development, 653-658.
17. R. Konings, B. W. (2016). Inland waterway transport: an overview. Inland Waterway Transport Challenges and prospects, 1-17.
18. Sriram, D. (n.d.). Long Term Perspectives on IZnland water Transportation in India. Rite Journal.
19. Thi Cam Huyen Nguyen, P. Q. (2019). Environmental pollution issues in inland waterway transportation. World Wide Journal of Multidisciplinary Research and Development, 62-66.
20. Tom van Lier, C. M. (2014). Assessing the environmental impact of inland waterway transport using a life cycle assessment approach: A case of Flanders. Research in Transportation Business & Management, 29-40.
21. UNCTAD. (2024). Review of Maritime Transport. New York: United Nations Punblications.
22. (2022). UNECE Transport Division Database.
23. Vadim Panov, M. G. (2009). Assessing the Risks of Aquatic Species Invasions via European Inland Waterways: From concepts to Environmental Indicators. Integrated Environmental Assessment and Management, 110-126.
24. Yichu Wang, X. C. (2020). Sustainability of global Golden Inland Waterways. Nature Communications.

Concept paper, Research paper and Policy recommendation (NAVIC cell #22)

Dr. G. Veera Senthil Kumar, Assistant Professor, IMU Navi Mumbai Campus

Concept Paper

MIV 2030 looks to strengthen the maritime economy, protecting maritime interests and exploring ocean resources. One of the ways to achieve these goals is Deep Sea Mining.

Deep Sea Mining involves the extraction of valuable minerals from the ocean floor, including polymetallic nodules, polymetallic sulphides, and cobalt-rich ferromanganese crusts. Ferromanganese nodules are polymetallic mineral concretions found on the sediment-covered abyssal plains at water depths of approximately 3500 to 6500 m. They contain metals like copper, nickel, cobalt, iron, manganese, and rare earth elements.

Due to their rich mineral content, they are considered valuable for resource extraction, particularly for industries like electronics, battery manufacturing, and renewable energy technologies. India presently has an area of 75,000 square km, located about 1600 km away from her southern tip. Polymetallic nodules resource potential in this site is 380 million tonnes. It is envisaged that 10% of the recovery of that large reserve can meet the energy requirement of India for the next 100 years. It provides a boost to coastal and national economies and the development of the blue economy.

Research Paper

In deep sea mining, exploring Polymetallic manganese nodules is a great challenging task because the availability of the targeted mineral is at a depth of more than 5000 m from the sea level. With the advent of the latest optical technologies, hyperspectral images override the traditional direct invasive methods using trawl or Remotely Operated Vehicles (ROVs) as well as imaging methods using ROVs mounted with still cameras. Hence hyperspectral imaging is a promising spectral imaging method for underwater mineral exploration.

Hyperspectral image spectral unmixing facilitates the detection of polymetallic manganese nodules and their quantification. This research work aims at adopting hyperspectral image analysis for automatic mineral detection using underwater Hyperspectral Images for deep sea mining.

Policy Recommendations

To facilitate sustainable underwater mineral exploration, meeting the goals of MIV 2030,

- Research & Development partnerships between governmental agencies, private enterprises, academic institutions, and international stakeholders to build capacity in deep sea mining technologies are to be promoted
- Skilled manpower to support deep-sea mining activities by fostering education, training, and knowledge development in marine engineering and environmental sciences is to be created

Concept paper, Research paper and Policy recommendation

Dr. Krushna Mohan Pattanaik, Assistant Professor, IMU Kolkata Campus

Disruptions in Humanitarian Logistics: A study on Sample Villages of West Bengal

Abstract

With escalated episodes of natural disasters surrounding the Bay of Bengal, the discourse on the potential results of such activities has taken a front seat. In this context, humanitarian logistics play an imperative role in facilitating timely support to the needy. However, studies addressing challenges to humanitarian logistics are still in their infancy, particularly in the Indian context. It is in this regard, using primary data collected through convenient sampling that the present study attempts to explore the challenges to humanitarian logistics in sampled villages of West Bengal, a state that is prone to cyclones. The study also suggests a way forward towards agile humanitarian logistics practices that would provide timely support.

Linking Organizational Safety and Economics: A Morphological Analysis

Abstract

Safety Economics is the study of achieving optimal level of safety at an optimal cost through timely decision making. The rising trends of risk assessment and the derived knowledge on episodes of potential safety incidents and associated costs in many organizations, however, have not been reflected in research endeavours on safety Economics. This is more so in the case of developing countries where research on safety economics is very limited. It is in this context that this study is an intervention that aims to provide a morphological analysis of existing scientific evidence on the co-evolving of safety and economics from the perspective of micro economics.

Concept paper, Research paper and Policy recommendation

Capt. S. Viswanathan, Associate Professor, IMU Chennai Campus
Capt. Manohar Babu Gajjala, Associate Professor, IMU Chennai Campus

Concept Paper

MIV 2030 is centred on the development of coastal communities. In addition to providing the nation's population with a high-protein diet, marine fishing is a vital industry for coastal communities, supporting their livelihood. The current marine fishing industry faces numerous obstacles, including the dearth of fisheries resources close to the coast, the adoption of deep-sea fishing as a substitute, technological advancements in the sector, a labour shortage, the implementation of sustainable fishing policies, and government support for the blue economy. Engaging qualified and knowledgeable personnel on fishing vessels is essential for the marine fishing sector to overcome these obstacles and meet Sustainable Development Goal 14: Life below water. Thus, it is inevitable that marine fishing needs to become sustainable in the near future. Therefore, it becomes crucial to prepare the coastal communities in accordance with the requirements of the sustainable marine fishing industry.

One of the most significant issues facing the marine fishing sector is the lack of skilled fishermen, which has caused many operational problems on fishing vessels. This might be because younger people are choosing to pursue higher education instead of engaging in marine fishing. As a result, the marine fishing industry's features have come to a standstill. The purpose of this project is to ascertain the qualified manpower needs of the fishing sector, the current scarcity of fishermen for fishing voyages, and offer solutions in order to make marine fishing sustainable.

Data will be collected from the fishermen from Chennai Fishing Harbour and analysed in order to get the answers to the research questions. The research paper will be published in a reputed journal and the recommendation will be brought to the knowledge of the policy makers.

Research paper

Shortage of qualified manpower is one of the biggest challenges faced by the marine fishing industry. Due to this many of the fishing vessels get delayed for fishing voyages besides resulting in poor fishing practices. Further, the younger lot prefers higher studies rather than going to work on board fishing vessels due to their poor income and uncertainty in the marine fishing industry. Additionally, it could be due to the conception among the coastal communities that the marine fishing industry is for uneducated people only. Further, the proposed merchant shipping bills – 2024 part XIII specifies the training and competency level for the fishing vessel personnel in accordance with the Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel 1995. In order to find a solution to the shortage of qualified manpower for the fishing industry, data will be collected from active fishermen at the Chennai fishing harbour. The present manpower will be comprehended through descriptive analysis and the gap from the standard marine fishing industry practice (Proposed Merchant Shipping Bill – 2024)

will be determined. The measures to fill the gap will be suggested to the policymakers from the outcome and recommendation of the studies.

Policy recommendation

The proposed Merchant Shipping Bill 2024 Part XIII deals with the qualified manpower scales for the fishing vessels based on their category and area of operation. References are made to Standards of Training, Certification and Watchkeeping for the Fishing Vessel Personnel (STCW-F) for training and grade of certificate of the fishermen (certificate of competency and certificate of proficiency). The measures to fill the gaps identified through the research will be recommended to the policy makers in line with the proposed Merchant Shipping Bill 2024.

Concept paper, Research paper and Policy recommendation

Dr. A. Sankaran, Professor, IMU Chennai campus

Sustainable Cultivation of Microalgae in Ocean Environment for Pollution Remediation and Biomass Production

Abstract

Marine pollution has escalated into a critical global issue, driven by increased plastic waste, nutrient runoff, heavy metals, and other contaminants that threaten ocean ecosystems and human health. Among potential solutions, algae-based bioremediation emerges as a promising approach to reduce marine pollution due to its natural ability to absorb, metabolize, and detoxify various pollutants. This study examines the potential of macro and microalgae species, such as Chlorella, Spirulina, and Ulva, to effectively capture pollutants, including heavy metals, nutrients, and organic toxins, thereby restoring marine water quality. Through processes like bioaccumulation, biotransformation, and biosorption, algae can reduce harmful elements and compounds in the ocean, transforming pollutants into less toxic forms or accumulating them in biomass, which can then be harvested. Additionally, algae sequester significant amounts of carbon dioxide, mitigating the effects of ocean acidification. Field experiments and controlled studies demonstrate that specific algae species can be cultivated strategically near pollution hotspots, such as industrial outfalls and agricultural runoffs, to reduce contaminant levels. The findings suggest that algae-based marine pollution control, combined with sustainable harvesting techniques, offers a viable and environmentally friendly method for ocean clean-up. This study discusses the limitations, scaling potential, and environmental impact of algae-based remediation while providing insights into its integration with existing marine pollution management practices. Algae cultivation in marine settings has the potential to contribute to both cleaner oceans and a reduction in greenhouse gas emissions, underscoring algae's dual role in marine pollution mitigation and climate change adaptation.

Concept paper, Research paper and Policy recommendation

Dr. T. S. Aravind, Faculty, IMU Kochi Campus

Towards a Fully Automated Future: Conceptualizing Automated Ports in India

Introduction

This research proposal outlines a comprehensive strategy for implementing fully automated port systems across India's major ports, aligned with the Maritime Amrit Kaal Vision 2047. The project aims to transform India's maritime infrastructure through advanced automation technologies, supporting the nation's goal to handle 10 billion tonnes of cargo annually by 2047.

As global trade continues to expand, the urgency for efficient and innovative port operations in developing countries becomes increasingly pronounced. India, with its vast coastline of approximately 7,500 kilometres and 12 major and 200 minor ports, handles about 90% of its trade volume through maritime transport. Despite this capability, Indian ports face significant challenges, including congestion, outdated infrastructure, and limited technological integration. A gap analysis reveals that while countries like Singapore and Rotterdam have embraced automation to enhance efficiency and reduce turnaround times, India's ports fall short in adopting similar practices. The implementation of fully automated ports promises to address these issues by integrating advanced technologies like Artificial Intelligence and the Internet of Things, enabling real-time data processing and improved logistical operations. However, significant hurdles remain, including financial investment, workforce adaptation, and regulatory reforms, which must be navigated to realize the vision of automated ports in India.

Overview of the Current State of Ports in India and the Need for Automation

India's ports, while serving as critical nodes in the country's trade network, face significant challenges that necessitate a shift toward automation. Currently, the 12 Major Ports in India handle over 60% of the country's cargo, yet inefficiencies abound, with cargo dwell times averaging 5-7 days compared to global standards of 1-2 days. The gap analysis reveals that while India ranks among the top 20 countries in terms of port capacity, it is hindered by outdated infrastructure and limited technological integration. Moreover, the reliance on manual processes exacerbates delays in cargo processing and contributes to high operational costs. Current port operations have not adapted to the demands instigated by the 4th Industrial Revolution, which emphasizes flexibility and real-time adaptability in production systems (Eymüller et al., 2024). Therefore, implementing automated systems could streamline operations, improve turnaround times, and position India's ports for more competitive participation in the global marketplace (Yue J et al., 2024).

Gap Analysis

The evolution of port automation presents unique challenges and opportunities that necessitate a thorough gap analysis, particularly in the context of India's aspirations for fully automated ports. Preliminary assessments indicate that while global container port throughput reached 802 million TEUs in 2019, India's share remains significantly lower, accounting for only 15% of this volume despite its strategic geographical position. The disparity highlights critical gaps in technology adoption, infrastructure development, and workforce readiness.

For instance, while advanced data-driven methodologies such as GIS and AI can optimize operations, there is a pronounced lack of integration and investment in these technologies within Indian ports. Moreover, the existing workforce often faces skills mismatches, hindering the transition to automated systems. Hence, addressing these gaps not only involves technological upgrades but also an investment in training and policy frameworks to foster a competitive and sustainable port environment.

Identification of Existing Inefficiencies in Indian Ports and Potential Areas for Automation

The operational landscape of Indian ports reveals significant inefficiencies that compromise their effectiveness, with cargo handling times averaging over three days, far exceeding global benchmarks. A gap analysis of the existing infrastructure uncovers obstacles such as antiquated equipment, insufficient digital integration, and inadequate workforce training, which collectively hinder productivity. In fact, a study from the PLATO project highlights that, despite the rapid growth in shipping traffic, port efficiency has stagnated, causing congestion and delay (Acocella et al., 2024). Furthermore, with container throughput growth projected to rise by 6% annually, the demand for automation becomes increasingly critical (Rahmawati A et al., 2024). Identifying these inefficiencies and challenges presents a pivotal opportunity for automation, which could streamline operations, enhance cargo tracking, and ultimately reduce turnaround times. By leveraging technology such as automated guided vehicles and smart data analytics, Indian ports could transform their operational capabilities to meet future demands efficiently.

Challenges in Implementing Fully Automated Ports

The transition to fully automated ports in India presents an array of formidable challenges, compounded by the country's unique socio-economic landscape. Presently, approximately 80% of Indian ports are inadequately equipped for automation, resulting in significant operational inefficiencies. This gap in infrastructure not only hinders potential trade growth but also exacerbates logistical bottlenecks, with cargo handling times averaging 3-4 days compared to the global standard of less than 24 hours. Furthermore, the reliance on manual labour poses an additional hurdle; reports indicate that nearly 60% of port jobs could potentially be displaced by automation. This situation raises critical concerns about workforce retraining and the socio-economic ramifications for affected communities. Additionally, the initial financial outlay for state-of-the-art automated systems can deter investment, particularly in an environment where operational costs must remain competitive. Addressing these challenges requires a multifaceted strategy encompassing technological investment, workforce transition programs, and policy reforms.

Project Overview

India's maritime sector stands at a crucial juncture, with the government planning to invest ₹ 80 lakh crore in logistics, infrastructure, and shipping under the Maritime Vision 2047. Currently, only 8.3% of container terminals globally are fully or partially automated, presenting both a challenge and an opportunity for India's port modernization efforts.

Objectives

- Implement fully automated container handling systems across major Indian ports
- Reduce manual intervention in port operations by 80% by 2030
- Increase port efficiency and reduce vessel turnaround time by 50%
- Achieve seamless integration with the Maritime Amrit Kaal Vision 2047
- Enhance port security through automated monitoring systems

Conclusion

The automation of Indian ports represents a crucial step toward achieving the Maritime Amrit Kaal Vision 2047. This project will position India as a leading maritime nation while significantly enhancing port efficiency and capacity. The proposed implementation strategy ensures a systematic transition to automated operations while maintaining operational continuity and managing associated risks effectively.

References

1. Acocella, N., Di Bartolomeo, G., & Hughes Hallett, A. (2024). Port efficiency and automation: Lessons from the PLATO project. Journal of Maritime Logistics, 12(3), 210-228. https://doi.org/10.1016/j.jml.2024.05.002

2. Eymüller, N., Finkenzeller, M., & Klemmt, M. (2024). The 4th Industrial Revolution in Port Operations: Challenges and Innovations. International Journal of Maritime Studies, 18(2), 135-152. https://doi.org/10.1080/ijms.2024.132457

3. Rahmawati, A., Sutanto, A., & Widodo, P. (2024). Container Throughput Growth and the Need for Smart Port Solutions. Asian Journal of Shipping & Logistics, 40(1), 89-102. https://doi.org/10.1016/ajsl.2024.03.007

4. Yue, J., Wang, T., & Chen, L. (2024). Artificial Intelligence in Port Automation: Enhancing Efficiency and Reducing Costs. Transportation Research Part E, 171, 102091. https://doi.org/10.1016/j.tre.2024.102091

5. Rodrigue, J. P., & Notteboom, T. (2023). Port Economics, Management and Policy. Routledge. https://doi.org/10.4324/9781003148506

6. Haralambides, H. E. (2022). Maritime Economics and Logistics in the Age of Digitalization. Springer. https://doi.org/10.1007/978-3-030-91224-7

7. Pallis, A. A., & Ng, A. K. Y. (2023). Global Port Governance: Trends and Future Perspectives. Transportation Journal, 62(4), 305-320. https://doi.org/10.5325/transportationj.62.4.305

8. Heilig, L., & Voß, S. (2022). Digital Twins in Maritime Transport: EnhancingDecision-Making in Smart Ports. Journal of Transport & Supply Chain Management, 26(1), 78-94. https://doi.org/10.4102/jtscm.v26i1.822

Notteboom, T., & Winkelmans, W. (2023). The Impact of Terminal Automation on Port Competitiveness. Maritime Policy & Management, 50(5), 435-458. https://doi.org/10.1080/03088839.2023.1234567

Ghosh, S., & Basu, A. (2023). The Economic Impact of Maritime Automation in Emerging Markets: A Case Study of India. Journal of Emerging Economies, 14(2), 99-118. https://doi.org/10.1108/JEE.2023.0021

Concept paper, Research paper and Policy recommendation

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Environmentally Sustainable Management of Port Operations

The long run sustainability of seaports greatly depends on the initiatives taken up by port authorities to enhance their efficiency. Globally, port authorities have realised the significance of environmental measures in improving port competitiveness and their long term sustainability. Environmental management of the ports, consisting of functional areas such as ship traffic, cargo handling and storage, port expansion and industrial activities, and hinterland connection occupies an important place in contributing to the environmental sustainability of the ports (Jeevan et al., 2022). Ports resorting to optimum transportation channels have the potential to reduce GHG emissions and other environmental damage to achieve competitiveness to attract trade partners and potential investors. In the process, ports adopt green port practices that entail all the environmental measures to improve the efficiency of seaports and also to reduce the negative impact on the seaport ecosystem. It is imperative that there is a need to strike a balance between the environment and the economic benefits of the port developmental initiatives. According to some studies, the relative importance placed on environmental measures has increased the competitiveness of high-performing seaports in Asia and Europe (Lam & Notteboom, 2014).

The concept of 'circular economy model' could be applied to port operations as they need to aim to reduce, reuse, and recycle their resources while involving a number of stakeholders in the channelling of shipping services (de Langen & Sornn-Friese, 2018). The development planning initiatives of the ports incorporate energy conservation, environmental protection and ecological care as vital actions while undertaking various port activities having implications on the environment. Ports, while linking sea trade with land and afterward linking it with the hinterland through trucks or rail lines, are prone to GHG emissions due to congestion and prolonged delays. Similarly, industrial activities carried out in the maritime clusters within the port area also have the potential for negative externalities in and around the port areas. Shipping contributes the most to the air and water pollution in the port. Water pollution arises from ballast water, fuel oil residue, waste disposal from ships, oil spills from ship accidents, wastewater from industrial activities in the port, etc. Similarly, waste dumping from the ships and port areas, waste from cargo operations and administrative buildings, etc., adversely affect the port environment. Port expansion activities and continuous dredging to widen and deepen navigation channels have ecological consequences for wetland areas, resulting in a sparse bird population and poor marine biodiversity.

The green practices followed by the European and Asian ports suggest a number of green port indicators that contribute to the port's competitiveness. These indicators include environmental standards in the operational areas of ports, measured in terms of air, water and noise quality levels, and also in terms of a number of mechanisms adopted by the ports to address the environmental requirements. Environmentally conscious authorities at the ports strive to undertake green operations, indicate a preference towards sustainable equipment, and follow an integrated approach towards resource management.

These initiatives help the ports function as a circular economy by reducing the extraction of resources, enabling the reuse and recycling of retrieved materials, and also replacing non-renewable resources with renewable resources. The port acts as a node of transport and has a major role in ensuring circularity in the port ecosystem by incorporating circularity concepts into the port management. The environmental management system (EMS) prevalent in the ports inculcates the necessity to regularly monitor, measure and evaluate the port performance, conduct audits, and suggest measures to correct the system if there are problems. The port authority plays a role in integrating the activities of all the stakeholders or the port community as it holds a social responsibility too.

Green Port Performance Indicators

The port performance indicators can be seen in terms of environmental quality (air, water, and noise pollution levels), energy consumption levels (use of electricity power at berth and terminals, use of renewable resources), waste handling (solid waste management, sewage treatment, treatment and handling of hazardous wastes), habitat quality and greenery (ecological preservation, wetland and marine habitat preservation), proactive measures undertaken by the ports (environmental training and awareness to all the stakeholders, environmental auditing, instructions to the ships to reduce speed in the port area, facilities for cold ironing, differential pricing strategies to ships that adopt green measures, clean trucks at ports, terminals switching to electric RTGs and other equipment, use of alternative energy sources at terminals, wastewater treatment, disposal of solid waste and recycling, the green measures adopted in administrative and other buildings, and publicised on the official port website, etc.,).

Research Questions

The present study aims to examine the green initiatives adopted in Indian ports by mapping the green port indicators prevalent in the port. This could be measured in terms of a set of parameters to assess the air and water quality levels at the port. Moreover, the proactive mechanisms adopted by the ports at the berth and followed within the port premises to transport goods to the hinterland may be brought under the purview of the study.

Secondly, the study will explicate the initiatives undertaken by the port authorities to adopt an integrated green management mechanism within the port. The strategies and initiatives adopted by the port authority through pricing strategies, access regulation, and integrated management initiatives are the focus of this study.

Thirdly, based on the review and assessment of the existing practices, policy recommendations will be proposed to improve the environmental measures taken by a port in India to bring it to par with European or some of the best-performing Asian ports.

Methodology of the Study

The proposed study may be carried out in a select port showing an interest in improving its competitiveness by adopting sustainable environmental management practices. The study will undertake a systematic survey of the environmental initiatives undertaken by the port and try to assess their impact by measuring the air, water, and noise pollution levels at the port. This may be measured at frequent intervals to see the relative changes in these levels at different periods.

With respect to all the other parameters, wherever possible, primarily, the prevalence and the extent of implementation of the measures can be assessed. Since most of the ports in developing countries are at the nascent stage of implementing these mechanisms, the perception of the stakeholders, basically the policymakers about their readiness to adopt such measures may be studied. Based on the data collected, both primary and secondary, a green port index (GPI) specific to a port could be developed to understand where the port stands in its path towards an environmental management system.

The data collection includes interviews with the port authorities, documenting environmental measures adopted by the port, collection and analysis of data regarding pollution and its mitigation, and so on.

Proposed Policy Recommendations

Based on the challenges faced by the ports in the implementation of green practices, the study may put forth recommendations to expedite the greening process. Since such in-depth studies have not been done in the Indian context, the proposed study can add value to the port operations in India.

Clustering of port activities can bring in ecologies of scale, where the output or the by-products of one industry could be channelled to others as inputs, without incurring any additional investment costs. This is an important area that has the potential and has not yet been implemented in India.

References

1. de Langen, P., & Sornn-Friese, H. (2018). Ports and the Circular Economy. In Green Ports: Inland and Seaside Sustainable Transportation Strategies (pp. 85–108). Elsevier. https://doi.org/10.1016/B978-0-12-814054-3.00005-0
2. Jeevan, J., Mohd Salleh, N. H., Abdul Karim, N. H., & Cullinane, K. (2022). An environmental management system in seaports: evidence from Malaysia. Maritime Policy and Management, 00(00), 1–18. https://doi.org/10.1080/03088839.2022.2047814
3. Lam, J. S. L., & Notteboom, T. (2014). The Greening of Ports: A Comparison of Port Management Tools Used by Leading Ports in Asia and Europe. Transport Reviews, 34(2), 169–189. https://doi.org/10.1080/01441647.2014.891162

About C-PRiMeS

The Centre for Policy Research in Maritime Studies (C-PRiMeS) was established to meet the growing needs on policy development for India's maritime sector. With a coastline of 7,516 kilometres, more than 1,300 islands, and an Exclusive Economic Zone (EEZ) covering over two million square kilometers, India's growth is dependent on maritime sector. With over 90% of its trade passing through the Ports and vibrant ancillary industries of shipbuilding, fishing, offshore oil and gas, and deep seabed mining, India is poised to become a maritime might in the coming times.

Inaugurated on November 4, 2022, by Shri Sarbananda Sonowal, Minister of Ports, Shipping, and Waterways, C-PRiMeS is designed to support the realization of India's maritime vision outlined in Maritime India Vision 2030 (MIV-2030) and Maritime Amrit Kaal Vision 2047 (MAKV-2047).

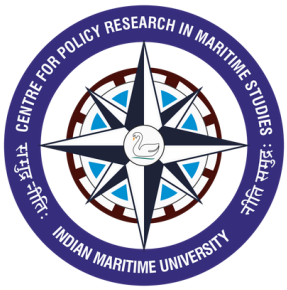
The Centre's core mission is to provide unbiased, data-driven insights that empower policymakers to make informed decisions for the maritime sector's sustainable growth.

C-PRiMeS has several strategic objectives, such as consolidating maritime data for better policy analysis, promoting studies and research across various maritime disciplines, and establishing itself as a premier think tank in India. The Centre actively seeks collaborations with industry, academia, and government bodies to support maritime research, training, and funding opportunities.

C-PRiMeS Maritime Research Verticals include:

- Maritime Health: Focusing on health concerns related to maritime activities
- Special Focus on Pollution: Addressing issues of marine pollution and its mitigation
- Maritime Biodiversity: Exploring the preservation of marine ecosystems
- Maritime Domain Awareness and Maritime Security: Enhancing security and surveillance in maritime spaces
- Ocean Science: Researching ocean dynamics and marine life
- Maritime Conflicts: Analyzing maritime territorial disputes and conflicts
- Global Maritime Interactions: Understanding international collaborations and tensions in maritime affairs
- Maritime Heritage: Preserving and promoting the cultural significance of maritime history
- Blue Economy: Promoting sustainable economic growth through marine resources
- Ocean Governance: Focusing on global, regional, and national governance of oceans
- Maritime Legislations/Maritime Law: Studying maritime laws and their impact on governance

Through these research verticals, C-PRiMeS aims to advance India's maritime policy and contribute to global maritime knowledge and the trade.



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