EPH-International Journal of Business & Management Science

GREEN PORT DEVELOPMENT UNDER MAKV 2047-SUSTAINABLE PORT DEVELOPMENT IN LINE WITH NATIONAL MARITIME VISION

Dr. M. Sekar[1], Dr. Thiruppathi KTM[2], Dr. M. N. Mohamed Sadiq[3]

[1]Associate Professor, School of Maritime Management, Indian Maritime University
[2]Faculty, School of Maritime Management, Indian Maritime University
[3]Faculty, School of Maritime Management, Indian Maritime University

Article History
Received : *2026-05-10*
Revised : *2026-07-16*
Accepted : *2026-08-19*
Published : *2026-08-31*

Abstract
India's port industry lies at the heart of the nation's Maritime endeavours. Handling 94% of national trade volumetrically, yet struggling to decarbonize itself, the country's ambition has taken form in the Maritime Amrit Kaal Vision 2047 (MAKV 2047) the long-term successor to the Maritime India Vision (MIV) 2030. In the new vison, sustainability, primarily operationalized through Harit Sagar Green Port Guidelines & its subsidiary such as Green Tug Transition Programme, takes a seat as a structural feature, not merely an attendant variable.
Employing conceptual frameworks drawn from the international port and sustainability literature & document-based analyses using a qualitative approach, this article investigates the degree to which green port initiatives within MAKV 2047 correlate with India's holistic vision of Maritime dominance.
This thesis comprises a focused chapter on literature reviews situated in global discourses on green port instruments, measurement of environmental performance, and port governance. Based on a qualitative, document based, analytic approach, the study addresses the Institutional instruments, Investment Structure and The Enforcement gaps of India's green port transition. It observes progress in setting targets and drafting guidelines but reveals lags in on ground verification, concession-based enforcement tools and its integration with the overall blueprint of the broader Blue Economy. The research then provides recommendations for concrete and measurable green sustainability clause inclusion within existing concessionaire contracts and building up an effective monitoring regime, ahead of the milestones by 2030 and 2047.

Keywords: *Green Port, Maritime India Vision, Harit Sagar Guidelines, Sustainable Port Development, Blue Economy, MAKV 2047*

Vol. 12 Issue 4s (August 2026)
ISSN: 2208-2190 Pages- 93-101
DOI:https://doi.org/10.69980/pdfydy40

1. Introduction

Ports occupy a paradoxical position in the sustainability discourse, they are indispensable engines of trade and economic growth, yet among the more concentrated sources of localised environmental pressure, emissions from cargo-handling equipment and shipping, dredging-related habitat disturbance, water and air pollution, and land-use conflict with adjoining coastal communities. India's maritime sector is no exception. With twelve Major Ports and over two hundred non-major ports handling approximately 95 per cent of the country's trade by volume, the cumulative environmental footprint of port operations is substantial, even as the sector remains central to the government's growth ambitions (Government of India, 2021).

Over the past decade, India's port policy has evolved from an infrastructure-expansion orientation toward one that explicitly foregrounds environmental performance. Maritime India Vision (MIV) 2030, launched in 2021, was the first national roadmap to embed “Green Port Initiatives” as one of its ten strategic themes. This got significantly boosted by the Harit Sagar Green Port Guidelines released by the Ministry of Ports, Shipping and Waterways in 2023 which are further subsumed under the long term goal outlined by the Maritime Amrit Kaal Vision (MAKV) 2047, which spells out more than 300 concrete measures for India to become a premier maritime nation at the 100 year mark (Ministry of Ports, Shipping and Waterways, 2023).Unlike MIV 2030, which treated sustainability as one thematic pillar among ten, MAKV 2047 threads decarbonisation and green infrastructure through nearly every operational domain it addresses - shipbuilding, shipping, inland waterways, and port governance alike. Figure 1 traces this policy evolution.

Figure 1. Evolution of India's Green Port Policy Architecture (2015–2023)

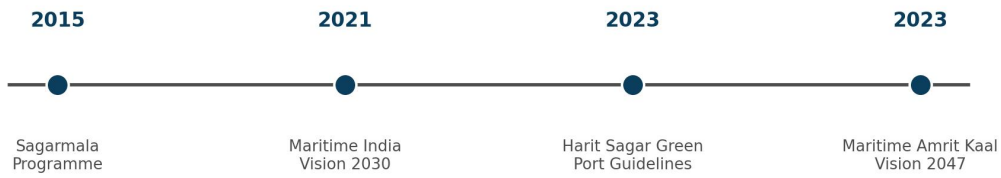


Figure 1. Evolution of India's green port policy architecture, 2015–2023.

This shift raises an important analytical question that has received limited scholarly attention: how, precisely, do the green port initiatives embedded within MAKV 2047 align with the broader instruments and institutional logics identified in the international port-sustainability literature, and what does this alignment - or its absence - imply for implementation? This article addresses that gap by first reviewing the relevant international and India-specific literature (Chapter 2), before setting out the study's objectives, scope, and methodology, and undertaking a document-based analysis of MAKV 2047's green port architecture.

2: Literature Review

This chapter synthesises the scholarship most relevant to evaluating green port alignment under MAKV 2047, drawn from two streams: (i) the international academic literature on green and sustainable port management, and (ii) India's national maritime policy documents and blue economy analyses. Together these establish the conceptual and empirical foundation for the analysis that follows.

2.1 Conceptual Foundations: Sustainable Ports, Eco-Ports, and Green Ports

Differences Between 'sustainable', 'eco' and 'green' Port Planning Paradigms However, the naming conventions are not just about terminology, they are illustrative of distinct approaches. Wu et al. (2020) conduct a well-ordered Scopus review and document that the three planning terms are common throughout the maritime space but the approaches focus differently on environmental concerns: sustainable port planning; based upon the "need fulfilment" logic introduced from the Brundtland framework, a sustainable port will fulfil these future "needs" from an environmental sustainability point of view eco-port planning is focusing on eco-certification, like EU's Eco Ports Scheme and, a Greenport planning is explicitly concerning a working with nature' philosophy on ecology conservation. They promote an eco-centric holistic unification among these planning concepts from a supply chain management standpoint. This suggests MAKV 2047 's

Vol. 12 Issue 4s (August 2026)
ISSN: 2208-2190 Pages- 93-101
DOI:https://doi.org/10.69980/pdfydy40

adoption of the green ports agenda is better viewed as within the total logistics chain rather than as self-standing nodes within one node of a broader network. This latter point is strengthened in the work by Wu et al. (2019) which offers sustainable shipping strategic planning methodologies – all of which reinforce how port greening and fleet greening needs to be a closely co-designed transition.

2.2 Institutional Tools for Greening Ports

A substantial body of work by Lam, Notteboom, and collaborators maps the policy instruments available to port authorities. Lam and Notteboom (2014) conducted a comparative review of green management tools used by leading Asian and European ports, identifying regulatory, economic, and voluntary instruments and showing that leading ports typically combine several instrument types rather than relying on any single lever. Notteboom and Lam (2018) developed this further into a typology of "greening" tools embeddable in terminal concession agreements for example, emissions caps or renewable-energy obligations written into lease contracts, enforceable through penalty and incentive pricing, monitoring requirements, market access control, and environmental standard regulation. This typology is directly transferable to how Indian Major Port Authorities could embed Harit Sagar-aligned clauses into future PPP and BOT concessions. Notteboom et al. (2020) empirically examined how four major European ports (Rotterdam, Antwerp, North Sea Port, Zeebrugge) operationalise green supply chain management, finding considerable variation in stakeholder attitudes even within a similar regulatory zone — a caution against assuming uniform adoption across India's twelve Major Ports. Wang and Notteboom (2015) analysed the specific case of port-authority-led LNG bunkering infrastructure development, a theme paralleling India's own green hydrogen and ammonia hub designations at Deendayal, Paradip, and V. O. Chidambaranar Port Authorities under MAKV 2047.

2.3 Environmental Performance Measurement and Evaluation

Puig et al. (2015) benchmarked environmental performance trends across European ports using longitudinal self-diagnosis data, establishing methodological precedent for the kind of composite performance indices increasingly used in green port scholarship. Acciaro et al. (2014) proposed an innovation-oriented framework for environmental sustainability in seaports, arguing that successful greening depends on aligning technological innovation with institutional and stakeholder incentives - a three-way alignment that MAKV 2047's "over 300 actionable initiatives" architecture implicitly assumes but does not always operationalise at the individual-port level. Schipper et al. (2017) compared the ambitions stated in port and port-city sustainability plans against actual achievements, finding a persistent implementation gap. This finding recurs across national contexts and provides an important methodological benchmark for evaluating whether Harit Sagar's 2030 and 2047 carbon-intensity targets are being met in practice rather than only documented in policy.

2.4 Supply Chain, Governance, and Port–City Interface Dimensions

Sarkis (2003) provided perhaps the earliest of the core strategic frameworks related to green supply chain management more generally and in doing so, set the precedent for many more port-focused strategic frameworks that have come after: this includes the sector-spanning review provided by Davarzani et al. (2015), which positions port greening more in the discourse of the maritime logistics industries reduction of emissions; the examination by Daamen and Vries (2013) of port-city interface governance (where friction exists across space and between port-city authorities can create impediments for environmental management - directly relevant to where Indian ports operate to extend infrastructure, where the sea-side context often means intersecting with coastal management regulations as well as local concerns; and Puig and Darbra (2019), who place ports' global economics in a worldwide context of trade and environmental considerations, explaining that they are both benefit from, and maintenance of, the maritime and coastal milieu within which they exist.

2.5 India's National Maritime Policy Architecture

On the policy the central government (2021) MIV 2030 document establishes 10 theme and 150 initiative medium term road map which includes the initial articulation of the green port ambitions, the MAKV 2047 subsequently builds upon. The Ministry of Ports, Shipping and Waterways (2023, December 3) press release formally launching Maritime Amrit Kaal Vision 2047 specifies the long-term (₹80 lakh crore investment, 300+ initiative) roadmap explicitly targeting carbon-neutral ports, green hydrogen and ammonia hubs, and the Green Tug Transition Programme. The Ministry of Ports, Shipping and Waterways (2023) Harit Sagar Green Port Guidelines operationalise these ambitions into a concrete environmental-performance framework for India's Major Ports, covering energy efficiency, renewable energy adoption, waste and water management, biodiversity conservation, and carbon-intensity reduction targets of 30 per cent by 2030 and 70

Vol. 12 Issue 4s (August 2026)
ISSN: 2208-2190 Pages- 93-101
DOI:https://doi.org/10.69980/pdfydy40

per cent by 2047 - the specific instrument through which MAKV 2047's port-sustainability pillar is implemented.

2.6 Blue Economy and Broader Maritime-Sector Context

Bahl (2026), an occasional paper on the Observer Research Foundation, offers a contemporary account of the interplay between Sagarmala, MIV 2030, and MAKV 2047, and offers a documented record of specific implementation failures – funding gaps, skill deficits and tardy uptake of retrofits and lagging port utilisation of renewable energy (still under ten per cent though the target was under Harit Sagar goals); the present topic needs something that will critically discuss these realities instead of just reiterating policy pronouncements. In her pan-India assessment of the country's blue economy, Sulthana (2025) situates port greening as merely one element along with fish production, coastal tourism, marine renewable energy etc, which necessitated integrated policy. Deep sea and off-shore fishery's deep blue growth strategy document from NITI Aayog (Patel et al., 2025), gives us a picture of an industry specific development strategy assuming the sort of integration across various sectors that MAKV 2047 assumes; here though it is still institutionally spread across various ministries and departments. And to complete the loop, Aalamoush et al. (2021) link sustainability scholarship concerning ports with UN's global sustainable goals (SDG's); thus a frame exists to gauge how the claims that MAKV 2047 conforms to the global target on decarbonisation, specifically linked to the IMO's journey towards net zero along with India's 2070 target, are realistic ones.

2.7 Synthesis of the Literature and Identified Gap

Taken together, this body of work establishes three points relevant to the current study. Second, that MAKV 2047 should be seen as a confluence of conceptual direction (Wu et al., 2020), institutional tool design (Lam & Notteboom, 2014; Notteboom & Lam, 2018) and performance authentication (Puig et al., 2015; Schipper et al., 2017), all of which must be evaluated concurrently and not in isolation. Third, there is a persistent phenomenon across all environments of a disconnect between stated goals and actual accomplishment (Schipper et al., 2017), suggesting that MAKV 2047 should be critiqued only as an institutional goal and not in and of itself, as a sufficient instrument of real sustainability. Third, India-specific articles (Bahl, 2026; Sulthana, 2025) have evaluated provisions under MAKV 2047 mostly independently of this literature on instrumental greening policy and thus an underlying question remains, on which this article answers, how does the MAKV 2047 structure of institutional greesing compare to accepted typologies of such instruments at the international level, and where is the divergence?

3: Objectives of the Study

- To examine the institutional architecture through which MAKV 2047 operationalises green port development.
- To analyse India's green port policy instruments within the international port-sustainability literature on institutional greening tools, environmental performance measurement, and port governance.
- To analyse the extent to which green port initiatives under MAKV 2047 are structurally aligned with India's national maritime vision.
- To identify implementation gaps in India's green port transition and propose measures for strengthening the alignment between stated targets and port-level practice.

4: Scope of the Study

The domain of this analysis is limited to a policy-level, conceptually scoped analysis of how the Indian Major port system is embarking on a green port transition given India's policy directions-MAKV 2047, MIV 2030, Harit Sagar Guidelines.2 It is based on a review of secondary sources: national policy documents; government communications and media reports3 and the academic peer-reviewed literature on port sustainability and green port governance.4 However, no attempt at primary empirical measurement ofport emissions or stakeholder surveys was made; this is instead a document-based, comparative-conceptual review foraying into conceptualizing a foundation for further, empirics-basedport-policy research. Geographically, the focus will be on Indian Majorports with a secondary focus on any specific green hydrogen or ammonia hub designations mentioned where relevant. Conceptually and temporally the scope will be from India's Sagarmala initiative(2015)to the recent rollout of MAKV 2047 and subsequent planning-related announcements.

Vol. 12 Issue 4s (August 2026)
ISSN: 2208-2190 Pages- 93-101
DOI:https://doi.org/10.69980/pdfydy40

5: Methodology

The study takes a qualitative, document based analytical design approach. The study reads the core policy texts- MIV 2030 report, MAKV 2047 policy announcement and the Harit Sagar Green Port Guidelines against the sample of twenty peer-reviewed and policy articles on green port management, instrumental instruments of greening, port sustainability performance measurement. (detailed in Chapter 2.) This has been carried out following a qualitative thematic synthesis approach, wherein specific policy provisions were coded against five thematic areas based on evidence in international literature; namely (i) institutional and legal instruments; (ii) instruments based on the concession form; (iii) measuring and auditing the environmental performance; (iv) coordination among stakeholders and mechanisms of governance; and (v) vertical and inter-vertical supply chain linkages.
Figure-3 (Chapter-6) shows how this process will be analysed
This would enable us to evaluate not just MAKV 2047 and what has been declared in terms of ambitious plans, but its correlation with already existing categories for green ports, and gaps in institutional design.

6: Analysis

6.1 MAKV 2047 within the National Maritime Vision Architecture

MAKV 2047 does not stand alone; it is the third layer of a policy architecture that began with the concept first articulated as the Sagarmala Programme (2015) and consolidated in MIV 2030 (2021) in Figure 1 set out the basic logic of port-led development; with modernization and connectivity at its centre. MIV 2030 added a clear strategic theme of sustainability, a 30 per cent cut in carbon emissions per tonne of cargo by 2030. MAKV 2047 continues this further to a 70 per cent reduction by 2047 (in Figure 2) as part of an ₹80 lakh crore investment programme (300+ projects). Read in the light of Alamoush et al. (2021) definition of port sustainability as the use of ports as instruments for the adoption and implementation of sustainable development goals set out in UN SDGs, MAKV 2047 presents a fairly accurate transposition of that normative rationale into a national plan: for it directly relates specific port de-carbonization objectives to both the over-arching Indian net-zero goals in 2070 and the objectives of International Maritime Organization (IMO) dec-carbonisation targets(Bahl,2026).

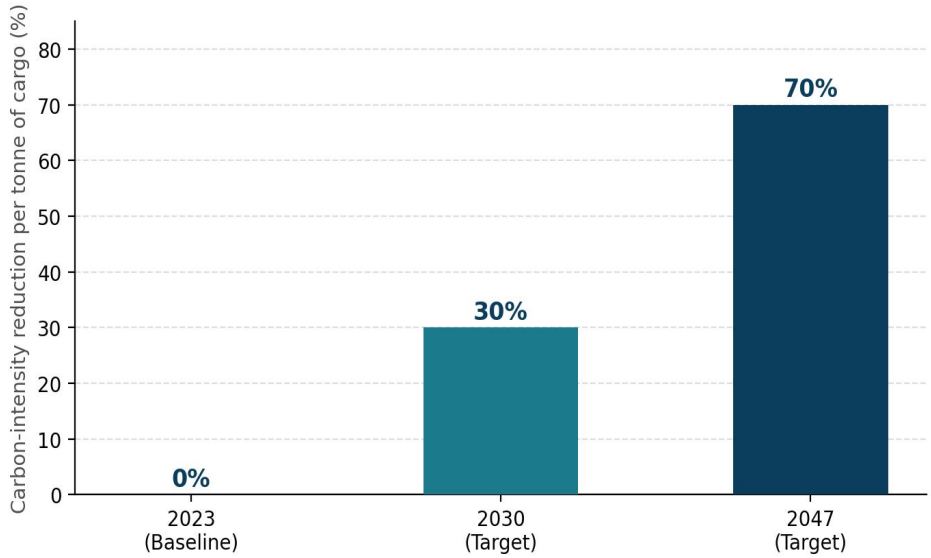


Figure 2. Harit Sagar carbon-intensity reduction trajectory for India's Major Ports (per tonne of cargo, relative to baseline).

The fundamental difference from previous iterations, however, concerns the degree to which green infrastructure is integrated into port strategy as a vehicle for competitive advantage rather than as an add-on for regulatory compliance. A strong illustration of the shift can be seen in the categorisation of Deendayal, Paradip and V.O. Chidambaranar ports as green hydrogen and green ammonia hubs, suggesting these will form an essential part of future bunkering competitiveness given the increasing global shipper demand for green shipping corridors (Bahl, 2026). As such, the MAKV appears to lend support to Acciaro et al. (2014)'s

Vol. 12 Issue 4s (August 2026)
ISSN: 2208-2190 Pages- 93-101
DOI:https://doi.org/10.69980/pdfydy40

claim thatport greening can only thrive where there is complementarity between economic, institutional and environmental factors in innovation.

6.2 The Harit Sagar Guidelines as an Institutional Instrument

The Harit Sagar Green Port Guidelines (2023) are the chief operational device that gives effect to the port-sustainability pillar of MAKV 2047. In the Guidelines, a set of quantifiable areas are defined against which performance, in principle, can be benchmarked - energy efficiency, adoption of renewable energy, water conservation, management of waste and biodiversity, regulation of air quality and noise, and reduction of carbon footprints (Ministry of Ports, Shipping and Waterways, 2023). This bears close resemblance to the ESPO Green Guide and PIANC sustainable-port standards that have conditioned practice in Europe over the last decade (Wu et al., 2020), thus the Indian Guidelines appear well-aligned conceptually with international best-practice, and not simply to be a custom-built Indian response to domestic priorities.

The guidelines, nevertheless, reveal a clear imbalance once assessed alongside the instrument's literature, though. As identified in the seminal work on comparative port policy and environmental regulation (e.g. Lam & Notteboom, 2014; Notteboom & Lam, 2018), a critical distinction between policy instruments may be drawn:voluntary and guidance-based standards versus binding instruments embedded in the concession agreements themselves. Fifteen Binding tools could range from numerical emissions limits to explicit quotas on the installation of renewable energy systems imposed on PPP/BOT contract holders and enforced via penalties and incentives at the transaction level. As stated currently the India's Harit Sagar Guidelines operate on the level of best-practices and benchmarking rather than serving as mandatory instruments at the individual concession contract-holder. India's Major Port Authorities Act 2021 offers legal authority which could ensure the embedment of green clause language within concession and PPP/BOT frameworks but they have not yet been incorporated effectively through public policy materials.

The guidelines offer a wide and ambitiously oriented path to sustainability in India's ports which will be implemented with effective policies designed to embed those recommendations into the practical contract terms of each PPP/BOT project, as this falls into Category (ii) of the analytical framework shown in Figure 3.

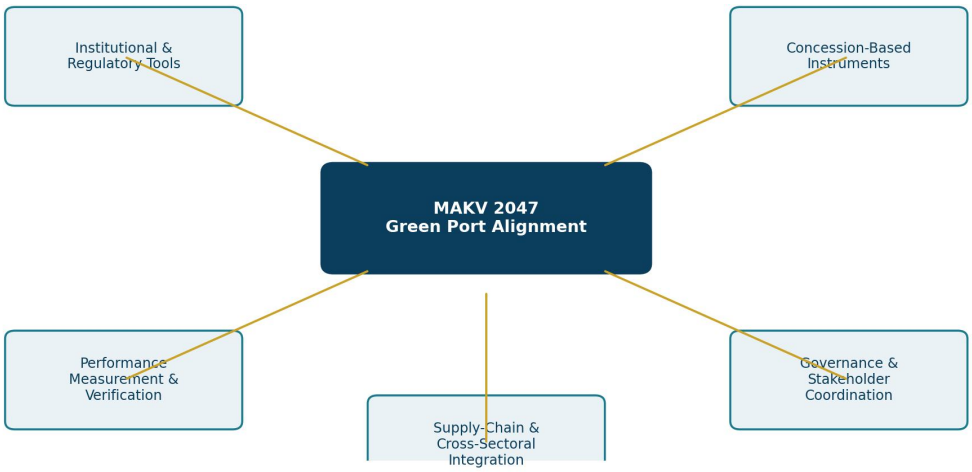


Figure 3. Analytical framework: five thematic categories used to assess green port alignment under MAKV 2047.

6.3 Investment Architecture and Institutional Coordination

MAKV 2047's spending commitment of -8,000 cr (5-15) for ports, shipping, waterways and shipbuilding, are sizeable, and come on any global comparative lens. Separate green budget allocation within MAKV 2047 can be identified in terms of the Green Tug Transition Programme, which envisages to transition harbour tugs to methanol, ammonia or hydrogen by 2040, the Harit Nauka Guidelines, encouraging the transition of inland waterway vessels to clean fuel technology by 2045 (Bahl, 2026), and the in draft National Green Shipping Policy under Directorate General of Shipping, which will enhance the Harit Sagar, ports focused initiatives, by introducing vessel based emissions targets.

From a governance point of view, this architecture typifies, issues of multi-actorco-ordination raised by Daamen and Vries (2013), in their discussion of the interaction betweenport and city; successful transition

Vol. 12 Issue 4s (August 2026)
ISSN: 2208-2190 Pages- 93-101
DOI:https://doi.org/10.69980/pdfydy40

must reflect co-coordination among ports authorities, shipping industry and the state Maritime Boards, regulator bodies and, increasingly communities in the vicinity.

Furthermore, there are additional complexities arising from India's Indian governance management; 12 ports are managed centrally whereas other non-major ports fall under state maritime management, which also requires relevant change of Jurisdiction. This challenge of co-ordination in leading a green transition, also reflects in the implementation of clean energy initiatives at ports (aimed to meet HaritSagar) having an implementation rate far below the set target of 10% and where costs associated with retrofitting can be as high as between 30-50% when comparing green to non-green alternatives, as confirmed by Schippers and et.al.(2017) where a high number of green-port commitments do not match up with actual practices.

6.4 Performance Measurement and the Verification Gap

One of the consistent refrains in the international literature, is the challenge of translating expressed targets into demonstrated outcomes. Puig et al. (2015) shows with respect to their longitudinally studied European ports, that to derive trends, it is necessary to establish multiple year cycles of consistent and standardise self-assessment for environmental benchmarking to actually have meaning. India's Harit Sagar states quantitative target values, "30 percent of carbon intensity Reduction of 70 by 2047" (Figure 2), but by 2020-21 we observed few public port level verification data against these values can readily found or linked to the ports analysed within this review. Whilst the tendency is noted and consistent with the study Schipper et al (2017) that "This type of disconnect between planning, aspiration and the observed reality is structurally rather than a specifically Indian failure on port sustainability," it remains the only truly substantial analytical void this study reveals to date.

7: Interpretation

Combined, the analysis points to a real shift in structural approach in India's marine policy: from an add-on theme for MIV 2030 to a deeply embedded design element of the nation's investment, infrastructure and energy policy agenda. Indeed, in this sense the structure of India's green port policy offers a favourable comparison with standards from port - Sustainability literature: (guideline structures reflect European norms (Wu et al., 2020)and the framing links to the national net-zero regime (Alamoush et al., 2021)).

However, three interpretive tensions are also highlighted in the analysis. First, a structural divide remains between voluntary guidelines and binding concession-level agreements, the former less able to anchor durable transitions (Lam & Notteboom, 2014; Notteboom & Lam, 2018) than the latter, even although India's current policy design has to a large extent done the latter already. Second, the coordination challenge between the central and state jurisdictions and at the port city interface (Daamen & Vries, 2013) is more complex in a federation than in many of the port authority-centred comparisons most found in the literature. Finally, verifying progress against goals remains an issue and relies on an architecture which remains to be built and developed, echoing a phenomenon seen across a spectrum of national green port transition policy frameworks (Schipper et al., 2017), particularly with the level of green investment MAKV 2047 is committed to building.

These tensions do not disqualify the conceptual clarity of MAKV 2047. It rather highlights areas in which the second phase of policy implementation must focus. India's green port transaction, as evidenced, is well developed in commitment setting and investment and relatively much earlier on effective instrument policy development and progress verification. It has yet to make headway on effective binding contract instruments as it could make on effective verification tools that should be developed before the policy investment programme becomes a fact of life on the ground.

7.1 Limitations of the Analysis

Given the document-based nature of this study, there are three obvious limits to the level of confidence that one can place on the conclusions of the study. The first is based on publicly available documents and policy documents, but not the primary data coming from individual ports. Gaps where a check is made for corroboration have to be identified as simply non-verified within the published available data rather than non-verified within the organization itself.

The second is that in Figure 3, there is an analysis based on a common model in the literature which however must be understood in to simplify a more layer situation which the institution instruments, the arrangements of governance and performance measures work with each other not as separate sectors.

And finally, this document is based on MAKV 2047, that is to say, and the period considered is current, so the story will evolve in the next years, after the years described, which means that our analysis on the

Vol. 12 Issue 4s (August 2026)
ISSN: 2208-2190 Pages- 93-101
DOI:https://doi.org/10.69980/pdfydy40

ambition – fulfilment has to be understood as a snapshot for us, and not a complete and lasting success. Those limitations open an interesting avenue for empirical research, a research agenda proposed in Chapter 8 of this text. Nonetheless, after cross referencing India specific documents with a widely accepted literature, these conclusions serve as a reliable structural based reasoning of the facts presented in this analysis. Indeed, this is a well precedented study that has already been use by similar document-based approaches such as the study by Wu et al. (2020) reviewing approaches towards sustainable, eco - and green ports planning and Davarzani et al. (2015), a synthesis that has made use of studies regarding port sustainability in order to provide solid conceptual grounds.
This is the role this document wants to play for the developing literature on green ports in India.

8: Conclusion

In this study, the MAKV 2047-specified green port efforts of India are explored in relation to national maritime strategy, using the context of international literature in port sustainability set out in Chapter 2. An international-grade policy Architecture with clear links between a Harit Sagar guidelines framework (on which other initiatives rely) and a green hydrogen/ammonia hub designation policy supported by a Green Tug Tug Transition Programme, is found to be in place with few internal tensions. Three institutional enhancements, however are identified as needed: the binding of Harit Sagar, currently voluntary at policy level, to port concession contracts/PPP under the MPAA 2021; more closely coordinated centre-state maritime jurisdictions; and a standard public measurement system tested against the 2030 and 2047 targets set by Harit Sagar.
The next step is clear for policy; the transition between ambitions and implementable action is best navigated by integrating specific target measures related to emissions, renewables consumption, and water/waste directly in concessions and PPAs-this has been readily addressed, following international case examples of institutional practice; it is equally clear for the research fraternity with empirical port-level measurement of Harit Sagar, potentially utilising composite index approaches drawn from international experience and practice, an indispensable piece for establishing if our structurally favourable findings have real environmental payoffs.
Whether India will maintain this trajectory towards the 2030 deadline of its Vision for Maritime Growth as well as 2047 (MAKV), will greatly depend upon this progression of policy to practice from green port "architecture to its tangible proof on the ground". These should extend the charting into the hitherto empirically uncharted territory suggested by previous literature studies. A possible tripartite follow-up research agenda would thus include: a case-based comparative study of implementation experience across two or more Port Authorities using a Composite green port performance indicator; an empirical case for analysing whether the binding under relevant concessions/PPAs have been executed in India; and a more detailed case for analysing how diverse stakeholders experience the ongoing process across the federal model.

References

1. Acciaro, M., Vanelslander, T., Sys, C., Ferrari, C., Roumboutsos, A., Giuliano, G., Lam, J. S. L., & Kapros, S. (2014). Environmental sustainability in seaports: A framework for successful innovation. Maritime Policy & Management, 41(5), 480–500.
2. Alamoush, A. S., Ballini, F., & Ölçer, A. I. (2021). Revisiting port sustainability as a foundation for the implementation of the United Nations Sustainable Development Goals (UN SDGs). Journal of Shipping and Trade, 6(1), 1–40.
3. Bahl, P. K. (2026). Maritime sector development: A gateway to Viksit Bharat (ORF Occasional Paper No. 517). Observer Research Foundation.
4. Daamen, T. A., & Vries, I. (2013). Governing the European port–city interface: Institutional impacts on spatial projects between city and port. Journal of Transport Geography, 27, 4–13.
5. Davarzani, H., Fahimnia, B., Bell, M., & Sarkis, J. (2015). Greening ports and maritime logistics: A review. Transportation Research Part D: Transport and Environment, 48, 473–487.
6. Government of India, Ministry of Ports, Shipping and Waterways. (2021). Maritime India Vision 2030.
7. 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

Vol. 12 Issue 4s (August 2026)

ISSN: 2208-2190 Pages- 93-101

DOI:https://doi.org/10.69980/pdfydy40

8. Ministry of Ports, Shipping and Waterways, Government of India. (2023). “Harit Sagar” – Green port guidelines (Rev. 0).
9. Ministry of Ports, Shipping and Waterways, Government of India. (2023, December 3). Maritime Amrit Kaal Vision 2047. Press Information Bureau.
10. Notteboom, T., & Lam, J. S. L. (2018). The greening of terminal concessions in seaports. Sustainability, 10(9), Article 3318.
11. Notteboom, T., Van der Lugt, L., Van Saase, N., Sel, S., & Neyens, K. (2020). The role of seaports in green supply chain management: Initiatives, attitudes and perspectives in Rotterdam, Antwerp, North Sea Port and Zeebrugge. Sustainability, 12(4), Article 1688.
12. Patel, N., Raj G.H., P., Thapa, N., & Goswami, S. (2025). India's blue economy: Strategy for harnessing deep-sea and offshore fisheries. NITI Aayog.
13. Puig, M., & Darbra, R. M. (2019). The role of ports in a global economy, issues of relevance and environmental initiatives. In C. Sheppard (Ed.), World seas: An environmental evaluation (pp. 593–611). Elsevier.
14. Puig, M., Wooldridge, C., Michail, A., & Darbra, R. M. (2015). Current status and trends of the environmental performance in European ports. Environmental Science & Policy, 48, 57–66.
15. Sarkis, J. (2003). A strategic decision framework for green supply chain management. Journal of Cleaner Production, 11(4), 397–409.
16. Schipper, C. A., Vreugdenhil, H., & de Jong, M. P. C. (2017). A sustainability assessment of ports and port-city plans: Comparing ambitions with achievements. Transportation Research Part D: Transport and Environment, 57, 84–111.
17. Sulthana, N. (2025). Blue economy in India: Unlocking maritime potential for sustainable and inclusive development. International Journal of Research and Innovation in Social Science, 9(14), 1033–1039.
18. Wang, S., & Notteboom, T. (2015). The role of port authorities in the development of LNG bunkering facilities in North European ports. WMU Journal of Maritime Affairs, 14(1), 61–92.
19. Wu, X., Zhang, L., & Luo, M. (2019). Discerning sustainability approaches in shipping. Environment, Development and Sustainability. Advance online publication.
20. Wu, X., Zhang, L., & Yang, H.-C. (2020). Integration of eco-centric views of sustainability in port planning. Sustainability, 12(7), Article 2971.