ESCAP
Economic and Social Commission for Asia and the Pacific

PIANC
The World Association for Waterborne Transport Infrastructure

WORKING PAPER

ESCAP - PIANC Joint Working Paper on Inland Waterway Transport Development in the Asia-Pacific Region



Acknowledgements

This Working Paper has been jointly prepared by the experts of PIANC INCOM Commission and the staff of the ESCAP Transport Connectivity and Logistics Section under the overall supervision of Ms. Azhar Jaimurzina Ducrest, Chief of the Section.

Special acknowledgement is made to the contributions from Mr. Sooyeob Kim, Mr. Gyu Serb Kim, Mr. Le Minh Nguyen, as well as Mr. Philippe Rigo, Mr. Florian Linde, Mr. Raphaël Wisselmann, Ms. Jasna Muskatirovic, Mr. Filipe Martins, Mr. Otto Koedijk, Mr. Calvin Creech, Mr. Burton Suedel and Mr. Elmar Fuchs.

Disclaimer

The designations employed and the presentation of the material in this working paper do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. Where the designation “country or area” appears, it covers countries, territories, cities or areas. Bibliographical and other references have, wherever possible, been verified. The United Nations bears no responsibility for the availability or functioning of URLs. The opinions, figures and estimates set forth in this publication should not necessarily be considered as reflecting the views or carrying the endorsement of the United Nations. The mention of firm names and commercial products does not imply the endorsement of the United Nations.

For further information on this policy brief, please address your enquiries to:

Director
Transport Division
Economic and Social Commission for Asia and the Pacific (ESCAP)
Email: escap-td@un.org

Table of Contents

Summary 6

I. INTRODUCTION 7

1.1 What is ESCAP? 7

1.2 What is PIANC? 7

1.3 The objectives of the joint paper. 8

II. TOWARDS GREATER INLAND WATER TRANSPORT DEVELOPMENT IN ASIA AND THE PACIFIC: Current Issues and Priority Actions 10

III. SUSTAINABLE AND RESILIENT INLAND WATERWAY INFRASTRUCTURE 14

3.1 Mechanisms to develop Sustainable Waterborne Transport Infrastructure 15

3.2 Resilience 15

IV. DIGITALIZATION STRATEGY FOR INLAND WATERWAY TRANSPORT 18

4.1 (Feasible) Objectives of a Regional Digitalization Strategy 19

V. INLAND WATERWAYS CLASSIFICATION 21

5.1 (Feasible) Objectives of an Inland Waterways Classification in the Asia Pacific region 21

VI. MANAGEMENT OF THE NAVIGABILITY OF NATURAL RIVERS 23

VII. NAVIGATION INFRASTRUCTURE - Structural Guidelines and Standards 24

VIII. GOVERNANCE: International Waterway and River Commissions - Keys to Success 26

IX. CONCLUSION AND PRIORITIZATION FOR INLAND WATERWAY DEVELOPMENT IN THE ASIA-PACIFIC REGION 28

X. REFERENCES 30

10.1 ESCAP References 30

10.2 PIANC References 30

10.3 Other references 32

10.4 References on digitalization 33

10.5 References on IW classification 33

Summary

This Joint Working Paper by the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Association for Waterborne Transport Infrastructure (PIANC) examines the strategic importance of Inland Waterway Transport (IWT) in the Asia-Pacific region and outlines a roadmap for its sustainable development. Despite the region's extensive river systems and growing demand for low-carbon logistics, IWT remains underutilized and lacks a coordinated regional framework comparable to those governing regional highways and railways. The paper underscores IWT's potential to advance the Sustainable Development Goals, particularly in promoting climate action, resilient infrastructure, and inclusive economic growth.

The analysis identifies key challenges, including fragmented governance, infrastructure gaps, inconsistent technical standards, and vulnerability to climate change. To address these, the paper recommends establishing a regional mechanism for IWT development, supported by a common inland waterway classification system and harmonized design standards. It advocates for integrated multimodal networks linking waterways with ports, roads, and rail, and application of sustainability principles—such as "Working with Nature"—to ensure resilience and environmental performance. Digitalization emerges as a critical enabler, with proposals for implementing River Information Services, smart port technologies, and interoperable data platforms to enhance efficiency and safety.

I. INTRODUCTION

This document is a Joint Working Paper of the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Association for Waterborne Transport Infrastructure (PIANC) about the Inland Waterway Transport (IWT) development in the Asia-Pacific Region.

1.1 What is ESCAP?

The Economic and Social Commission for Asia and the Pacific (ESCAP) is the most inclusive intergovernmental platform in the Asia-Pacific region. The Commission promotes cooperation among its 53 member States and 9 associate members in pursuit of solutions to sustainable development challenges. ESCAP is one of the five regional commissions of the United Nations.

The ESCAP secretariat supports inclusive, resilient and sustainable development in the region by generating action-oriented knowledge, and by providing technical assistance and capacity-building services in support of national development objectives, regional agreements and the implementation of the 2030 Agenda for Sustainable Development.

In transport area, ESCAP is currently implementing the Regional Action Programme for Sustainable Transport Development for 2022-2026 (RAP), adopted by the Fourth Asia-Pacific Ministerial Conference on Transport, held in Bangkok and online in 2021. The Regional Action Programme is geared towards three key objectives: Efficient and resilient transport and logistics networks and mobility for economic growth; Environmentally sustainable transport systems and services; and safe and inclusive transport and mobility. As part of the implementation of the Programme, ESCAP secretariat on delivers regular knowledge products and policy tools on decarbonizing multimodal freight operations and promoting environmentally sustainable and resilient logistics services, including inland water transport.

1.2 What is PIANC?

PIANC is the World Association for Waterborne Transport Infrastructure (PIANC) - www.pianc.org

PIANC leads an international network of expertise and knowledge on Waterborne Transport Infrastructure (WTI) providing guidance for sustainable waterborne transport, ports, waterways, and recreational navigation.

The PIANC working group (WG) reports of the Inland Navigation Commission (InCom), Maritime Navigation Commission (MarCom), Environmental Commission (EnviCom) and

Recreational Navigation Commission (RecCom) provide relevant and specific information, knowledge base, and guidance for practical use in the navigation sector.

The PIANC WG reports are the core business of PIANC and are a worldwide recognized resource for governments, companies, and industry associations. Many of these reports focus on the Sustainability and Resilience of the waterborne transport infrastructure and give guidance on applying Sustainability in operational practice of the navigation sector (see references).

With his **Strategic Plan 2024-2028**, PIANC is committed to promoting *"the development and improvement of global waterborne navigation infrastructure (WTI) and enhancement of its economic, environmental, and social benefits [and] the innovation and sustainability of waterborne navigation infrastructure by focusing its activities and its own operations on Sustainable Development goals"*.

Through its worldwide network and reputation as an independent knowledge / technical expertise community, PIANC has a fundamental role to play to achieve sustainable navigation infrastructure globally.

1.3 The objectives of the joint paper.

In 2024, ESCAP and PIANC signed a Memorandum of Agreement based on the common understanding of the importance of discussions and cooperation among countries and international organizations to promote sustainability, digitalization and decarbonization in the waterway, maritime and port sectors to achieve a more sustainable transport sector. In this Memorandum, ESCAP and PIANC agreed to jointly promote the implementation of the relevant activities of the RAP and its follow up, particularly in the thematic areas of sustainable maritime and Inland Waterborne connectivity, digitalization and low carbon transport and logistics.

As an expression of this collaboration, the objective of this Working Paper is to identify how the technical expertise, tools and initiative of PIANC could support further development of Inland Waterway Transport (IWT) in the Asia-Pacific region.

Over a brief overview of the current issues in the inland waterway transport development in Asia and the Pacific, this paper identifies several strategic opportunities for collective action, where PIANC expertise can be useful. This covers:

- Sustainable and resilient inland waterway infrastructure (section 3)
- Digitalization strategy for inland waterway transport (section 4)
- Inland waterways classification (section 5)
- Management of the Navigability of Natural Rivers (section 6)

- Navigation infrastructures - Structural Guidelines and Standards (section 7)
- Governance - International Waterways and River Commissions - Keys to Success (section 8).

The paper finishes with the conclusion and a list of priorities for Inland Waterway Development in the Asia-Pacific Region (section 9).

II. TOWARDS GREATER INLAND WATER TRANSPORT DEVELOPMENT IN ASIA AND THE PACIFIC: Current Issues and Priority Actions

In Asia and the Pacific, the development of the regional road, rail and intermodal network is coordinated by intergovernmental transport agreements, which define geographic coverage of the regional transport network and offer flexible technical parameters for its infrastructure. Currently, around 150 thousand km of highways are earmarked by the Governments as part of the Asian Highway Network, 120 thousand km of railways as part of the Trans-Asian Railway Network and 275 dry ports as dry port of international importance.[1]

No similar mechanism exists in Asia and the Pacific to facilitate a coordinated development of Inland Waterway Transport (IWT) infrastructure and policies at the regional level. At the same time, the region is characterized by a rich potential for further IWT development, as it includes major river systems already used for freight transport, including Yangtze River, Pearl River System, Mekong, Ayeyarwad, Chao Phraya, Red River, Ganges–Brahmaputra and Ob and Yenisei. It also includes rivers with emerging or underdeveloped potential, such as Salween, Indus, Fly & Sepik, Kalimantan Rivers and Central Asian river systems.

Many global and regional actors, including WB, ESCAP, ASEAN, and ADB have promoted inland waterway integration through multimodal corridor planning, cross-border transit agreements, and green logistics corridors. Key areas include harmonized regulations, green infrastructure investment, and digital tools for navigation. Bilateral agreements, such as Indo-Bangladesh Protocol on Inland Water Transit and Trade have, also been instrumental in revising inland water transport corridors in Asia.

ESCAP's Regional Action Programme for Sustainable Transport Development prioritizes the role of IWT as a key enabler of sustainable transport development under its transport connectivity and low-carbon mobility pillars. The programme emphasizes IWT's potential to advance the Sustainable Development Goals (SDGs), particularly SDG 9 (Industry, Innovation and Infrastructure), SDG 13 (Climate Action) and SDG 14 (Life under Water).

[1] For more information, please visit: https://www.unescap.org/our-work/transport/regional-land-transport

To support IWT development, ESCAP – in cooperation with relevant actors - has convened several regional events, highlighting national strategies, policy discussions, and case studies. The most recent events include:

- International Conference on Promoting Sustainability of Inland Waterway Transport and Logistics (Chiang Rai, Thailand, 16-18 July 2025) [2]
- International Conference on Sustainable Inland Waterway Transport Development (Zhoushan, China, June 2024) [3]
- Capacity-Building Workshop on Sustainable IWT Development (Bangkok, November 2024) [4]
- International Conference on Promoting Sustainability of IWT and Logistics (Chiang Rai, July 2025) [5]

These events highlighted the current major issues relevant to IWT development. Key rivers like the Yangtze, Mekong, Ganges-Brahmaputra, and Chao Phraya were considered, with case studies highlighting challenges and opportunities in infrastructure, policy, and intermodal integration. Across these events, several recurring policy themes and case study patterns emerge, including:

- The continued need for a holistic integration of inland waterway systems into national and regional logistics frameworks
- New green logistics paradigms, calling for digitalization, decarbonization, and corridor synergies that link rivers with ports and hinterlands
- The key role of the Mekong River basin as a regional best practice case, both in addressing operational challenges and exploring collaborative potential
- The need for knowledge exchange platforms that bring together national governments, regional commissions, universities, and international bodies to build capacity and policy coherence
- Emphasis on long-term strategy formulation, stressing that each member country requires tailored frameworks responsive to its IWT characteristics

---

[2] https://www.unescap.org/events/2025/international-conference-promoting-sustainability-inland-waterway-transport-and

[3] https://www.unescap.org/events/2024/international-conference-sustainable-inland-waterway-transport-development

[4] https://www.unescap.org/events/2024/capacity-building-workshop-sustainable-inland-waterway-transport-development

[5] https://www.unescap.org/events/2025/international-conference-promoting-sustainability-inland-waterway-transport-and

- The impact of technology and institutional innovation, including smart navigation, digital tools, and green infrastructure, as levers for sustainable development.

The following specific regional priority actions for IWT Development in Asia and the Pacific emerged from these recent regional and sub-regional discussions.

1. Promoting greater regional coordination of the sustainable and resilient development of the Inland waterway infrastructure

Asia-Pacific countries could consider developing a regional framework or agreement to promote IWT transport in the Asia-Pacific region, including through setting up an inventory of regionally important IWT routes in terms of transport connectivity, intermodal transport, sustainability and resilience. Main bottlenecks (as low draft, low traffic capacity) could also be identified. This would complement the existing regional initiatives on transport infrastructure networks and, notably, the Inter-governmental Agreements on the Asian Highway Network, on the Trans-Asian Railway Network and on Dry Ports.

2. Strengthening and further developing existing Regional Mechanisms for Inland Waterways Cooperation

It is essential to strengthen a cooperative mechanism for IWT development in the Asia-Pacific region, including the Mekong River Commission (MRC*) or LMC (**), to share best practices, address common issues, and develop a comprehensive integrated basin management plan that reflects the shared interests of basin countries. This could take form of regular dedicated expert working groups that meet regularly to support and discuss regional transport cooperation on IWT and help effectively implement and sustain regional and sub-regional cooperation frameworks.

(*) Mekong River Commission , www.mrcmekong.org

(**) Lancang River in China, www.lmcchina.org/eng/2024-03/19/content_42728557.html

3. Developing Integrated Multimodal Transport Infrastructure and facilitating IWT

This entails investing in infrastructure that improves waterways (selective dredging, removing obstacles), alongside river terminals, logistics hubs, and seamless connections to road and rail networks and prioritizing resilient, adaptive construction and water resource management for rivers and port infrastructure, accounting for climate change and land subsidence. This would also require implementing reforms to digitize port and customs procedures to increase efficiency and transparency, and establish multi-stakeholder platforms involving government, private sector, civil society, and local communities to ensure inclusive decision-making and accountability.

4. Supporting a Digitalization Strategy for IWT in Asia-Pacific

Countries could consider a coordinated digitalization strategy for IWT in the Asia-Pacific region which can act as a key enabler of modern, efficient, and sustainable logistics systems. For instance, the implementation of River Information Services (RIS), digital aids to navigation (AtoN), automated data exchange systems, and smart port technologies could significantly enhance the safety, reliability, and competitiveness of IWT.

5. Helping to finance Sustainable Infrastructure Maintenance and Technology Adoption, Promoting Fleet Modernization and Developing Strategic cooperation and Public-Private Partnerships (PPPs)

Countries could explore different sources of funding, such as subsidies, investment tax incentives and international aids, to support long-term maintenance. They could adopt environmentally friendly dredging technologies and develop technical solutions for navigation aids that withstand water level fluctuations and provide financial incentives like low-interest loans, tax relief, and subsidies to encourage green vessel technologies and green logistics (e.g., low emission carbon fuel-powered ships, electric ships, green logistic solutions).

Countries could support modernization of engines on existing ships and strengthen port facilities' environmental management, waste handling, and emergency response to reduce pollution and accident risks. They would need to proceed cautiously with PPPs and privatization in high-potential areas such as port operations, logistics services, and vessel maintenance, by establishing clear, predictable regulatory frameworks, providing strong oversight and incentives to attract private investment, and incorporating social and environmental safeguards to mitigate potential adverse impacts on communities and the environment.

6. Enhance Human Capacity

The region needs to develop specialized training programs for boat-masters, crew, river pilots, and port operators and to strengthen collaboration with regional logistics companies and international organizations to build skilled human resources.

The following sections will match these regional priority actions with the global expertise and technical knowledge of PIANC experts and consider how specific initiatives could be developed through appropriate regional cooperation initiatives and collaboration between the two organizations and other relevant actors.

III. SUSTAINABLE AND RESILIENT INLAND WATERWAY INFRASTRUCTURE

There is no doubt that all modes of transport shall make their transition towards zero-emission. The urgency is high for the IWT sector to develop measures to realise this transition, both for air pollutant emissions and greenhouse gases.

Possible objectives for the Asia-Pacific Region could be:

- To list the mature technologies suited for Asian-Pacific IW transportation mode, including adequate fleet and vessels.
- To Identify possible low emission carbon fuels and ways to implement them.

The roadmap adopted by the Central commission for the Navigation of the Rhine in 2021 to reduce Greenhouse Gases Emissions and other air pollutants could serve as a blueprint.

For the navigation sector, PIANC strongly supports the purpose of enabling safe navigation while contributing to sustainability. Construction and maintenance of WT infrastructure can be inter-twined into technical designs leading to viable solutions with long-term added value for environmental, economic, and social sustainability.

In this context, sustainability in the navigation sector is about efficiently investing the resources needed to support the desired social, environmental, and economic services for the benefit of current and future generations (IADC 2023).

For the navigation sector, PIANC strongly endeavours its stated mission and purpose of enabling safe navigation while contributing to sustainable economic, environmental and social objectives. Construction and maintenance of the relevant infrastructure can be inter-twined into technical designs leading to viable solutions with long-term added value for sustainability in all aspects.

Providing sustainable water transport infrastructure may include a wide diversity of structures, features, and capabilities for various reasons, e.g. operating a navigational channel, construction of river training structures, construction and operation of ports, creating natural infrastructure, building a new lock or a quay wall, ensuring the link between vessel and infrastructure, expanding a maritime terminal, sediment management, dredging and re-use of dredged material, redeveloping a waterfront, building a marina in a tourist destination, envisioning the waterborne logistics of an offshore energy system, or simply operating a shipping facility.

3.1 Mechanisms to develop Sustainable Waterborne Transport Infrastructure

PIANC´s **Working with Nature (WwN)** philosophy promotes an integrated planning and design process, using the ecosystem's natural processes to produce positive environmental outcomes while also supporting the delivery of navigational project goals. Working with, rather than against, natural processes can result in more cost-effective and sustainable solutions for the construction and maintenance of waterborne transport infrastructure, which is also valid for using natural processes combined with, or even in lieu of, conventional hard infrastructure.

A powerful collection of real-life case studies collected by PIANC shows that WwN is relevant for the navigation sector. WwN is aligned with PIANC's overarching goal to support navigation infrastructure development in a manner that is mutually beneficial to economic, social, and environmental interests. PIANC understands that WwN is essential to achieving sustainable port and navigation development.

The PIANC's "Working-with-Nature", the "Building with Nature - BwN" and the "Engineering With Nature -EWN® " initiatives promote resilient and sustainable development by leveraging ecosystems, natural resources, and nature's energy to achieve navigation projects that benefit both society and the environment.

PIANC´ **Task Group on Climate Change (PTGCC)** addresses climate change mitigation and adaptation issues. PTGCC informs on how navigation may be affected by climate change; advising on where and how adaptation and mitigation actions need to be taken so that the necessary actions and investment can be performed in a proactive way

PIANC reports, such as WG 176 and 178; provide clear indications of how sustainability can be achieved through climate action. For example, such solutions can be achieved by incorporating WwN principles in operational designs.

The **PIANC White Paper** ´Accelerating Sustainability Practices in the Waterborne Transport Infrastructure Sector´ (PIANC, Sept 2025) may be a starting point for further integration of the sustainability and resilience concepts within the PIANC global organization. Dissemination in the international navigation sector will serve as an incentive to integrate and realize sustainability and resilience in planning, realization, and management of waterborne transport infrastructure.

3.2 Resilience

Strongly related to a sustainable inland water transport is Resilience. A resilient waterborne transport infrastructure has the characteristic to largely maintain itself, even towards external

impacts. Ideally a sustainably managed waterborne transport infrastructure is resilient and needs less maintenance works compared to a conventionally trained waterway.

In that respect Resilience refers to:

- the effectiveness and functionality of the waterborne transport infrastructure and its facilities,
- the riverine ecology, which has the capacity to respond to disturbance by resisting damage and recovering,
- the ability of the waterborne transport infrastructure to cope with or to recover from the climate change impact,
- the ability of the waterborne transport infrastructure to serve societal needs and demands (e.g. nutrition, housing, living conditions).

Changes in climate-related parameters and processes can impact different aspects of water transport infrastructure. Changing seasonal precipitation characteristics and/or extreme rainfall events can lead to waterways experiencing more frequent and/or prolonged episodes of extreme high or low flow, in many cases with consequential changes in sediment transport. Such changes can affect the available channel depth. Furthermore, the activities of inland ports and navigation are potentially susceptible to climate change effects including changes in:

- heat and humidity, potentially affecting the operation of mechanical assets, commodities in storage or transport, connecting road and rail infrastructure
- flood frequency and extent impacting assets and operations on the port estate as well as in adjacent areas
- drought or water shortages potentially compromising the structural integrity of embankments or other infrastructure, or impacting water supply
- changes in water chemistry or biology, for example increased native species growth rates requiring new or more frequent vegetation management, or new operational or liability risks associated with any proliferation of invasive non-native species in warmer waters.

Managers of waterborne transport infrastructure owning, designing or evaluating navigation infrastructure should strive to understand and prepare for the possible consequences of projected and modelled climate change alterations of e.g. hydrological parameters relevant for training, maintaining and operating inland waterways.

In many cases this will require action to strengthen both engineered and operational resilience. Understanding how waterborne transport infrastructure and operations may be affected by the full range of potential climate change impacts, and quantifying the associated costs and consequences of inaction, is important to make the business case for investment in strengthened resilience (PIANC-PTGCC, 2024).

Strengthened resilience is not only achieved via physical or structural measures such as raising, strengthening or otherwise modifying assets or incorporating engineered redundancy into design, but also through non-structural, asset or system level measures. The latter include mapping to understand the location of vulnerable assets; preparing contingency plans; identifying climate-related thresholds for action; introducing early warning systems; and otherwise improving adaptive capacity.

For new infrastructure, the further into the future the intended design life of the infrastructure asset, the greater the uncertainty in the climate change projections and the greater the risk that extreme events will challenge the integrity or functioning of infrastructure. To ensure future resilience, those planning new infrastructure should consider the potential climate futures associated with a range of climate change scenarios, and the new infrastructure should ideally be designed to facilitate physical or operational modification as conditions change.

With regards of the objective to make the waterborne transport infrastructure more resilient all along the year, decision makers should consider the issue of the problem of low water in natural rivers (as the Mekong river). But, the origin of low water level is not only due to climate change as the recurrence of low water level is a natural phenomenon, which occurred before the rise of the climate change effects (which makes them more severe). So is it important the responsible authorities consider that issue (yearly occurrence of low water level) in their policy to mitigate these impacts.

Depending on the type of risks identified and the associated uncertainties, changes in operation, management, maintenance or behaviour might be appropriate or cost-effective as a supplement, or alternative, to a structural intervention. Nature-based solutions are a cost-effective option depending on the particular hazards faced. Temporary or mobile components may also play a role in accommodating intermittent impacts associated, for example, with high or low flow conditions. Finally, institutional change, for example in land-use policy, project financing or insurance, might also form part of an overall, long-term solution.

Adaptive management is an important concept. A combination of good data and inbuilt flexibility can help avoid miss-adaptation (i.e. interventions or responses that have negative, often unintended consequences) and deliver resilient solutions. Local monitoring (short- and long- term) is also vital, both to support the implementation of adaptation pathways (a phased approach intended to ensure positive outcomes in the face of uncertainty) and to inform investment decisions as conditions require.

In summary flexible and responsive approach can help reduce risks, and deliver appropriate and resilient inland navigation infrastructure.

IV. DIGITALIZATION STRATEGY FOR INLAND WATERWAY TRANSPORT

A coordinated digitalization strategy for IWT in the Asia-Pacific region can act as a key enabler of modern, efficient, and sustainable logistics systems. The implementation of River Information Services (RIS), digital aids to navigation (AtoN), automated data exchange systems, and smart port technologies could significantly enhance the safety, reliability, and competitiveness of IWT.

As seen in Europe's DIWA Masterplan (www.masterplandiwa.eu), digitalization is not merely a technical upgrade—it is a structural transformation of how inland waterways are managed, monitored, and integrated into multimodal transport chains. In particular, RIS should be seen not only as a navigational aid but as the backbone of an integrated information ecosystem. When coupled with digital twins of infrastructure and a secure data sharing platform, RIS becomes a multi-functional layer supporting dynamic lock planning, situational awareness, infrastructure risk monitoring, and integration with other modal systems.

Furthermore, the use of standardized data models and interfaces facilitates real-time collaboration between vessel operators, port authorities, infrastructure managers, and logistics stakeholders. This is further reinforced by the trend towards semantic interoperability frameworks aligned with EU standards such as those emerging from the Digital Transport and Logistics Forum (www.dtlf.eu).

The implementation of data sharing platforms—based on federated architectures—ensures that sensitive or proprietary information can be exchanged with fine-grained control, while supporting the creation of value-added services by both public and private actors. These platforms support a range of functionalities beyond operational coordination, including environmental monitoring, infrastructure asset condition integration, and strategic planning of logistics chains.

Such digital infrastructures also lay the foundation for the development of next-generation logistics integration systems. By linking RIS with inland terminal operations and hinterland transport modes—via interoperable APIs and standardized data services—it becomes possible to orchestrate cargo flows dynamically across different transport modes, improve ETA predictions, and enable real-time decision support. This vision of integration is especially pertinent to Asia-Pacific countries aiming to improve inland waterway connectivity with rail and road networks, and to enhance coordination between authorities, shippers, and logistics service providers.

For Asia-Pacific, such a strategy would support:

- Improved navigation safety and predictability.
- Real-time traffic and waterway condition monitoring.
- Efficient port and terminal management.
- Optimized fleet and cargo operations.
- More resilient and adaptive responses to climate-related disruptions.
- Availability of statistics, useful to develop policies.

4.1 (Feasible) Objectives of a Regional Digitalization Strategy

1. Enable Harmonization and Interoperability

- Develop common technical standards for RIS and digital AtoN, adapted from international best practices (e.g., CESNI, PIANC RIS Guidelines), to ensure cross-border operability and regional integration,
- Support data-sharing protocols and geo-information services to allow seamless exchange of navigation, hydrology, and logistics data among countries, especially in transnational rivers,
- Establish regional coordination bodies (as Mekong River Commission (MRC)) working with ESCAP to monitor and support RIS implementation and interoperability.
- Develop a standard for RIS like the European Standard for River Information Services (ES-RIS) (www.cesni.eu/wp-content/uploads/2024/11/ES-RIS25_signed_en.pdf)

2. Modernize Infrastructure and Services (see PIANC WG 263 and WG 264)

- Promote investment in digital port infrastructure, including Vessel Traffic Management Systems (VTMS), electronic reporting, and real-time cargo tracking,
- Facilitate adoption of autonomous and semi-autonomous vessel technologies, following early examples from China,
- Support deployment of RIS core components such as Fairway Information Services, Notices to Skippers, and Tracking & Tracing systems.

3. Build Capacity and Digital Skills (see PIANC WG 257 and WG 266)

- Create a regional competence framework for IWT professionals focused on digital operations, cybersecurity, and RIS maintenance,

- Encourage public-private partnerships for piloting and scaling innovations across diverse IWT environments, including in landlocked and island nations.
- Create a framework enabling the development of automated navigation or remotely operated vessels (see PIANC WG 262)
- Develop a vision on automation like the one of CCNR (www.ccr-zkr.org/files/documents/cpresse/cp20211117en.pdf)
- Adopt definition of automation levels for inland navigation vessels.
- www.ccr-zkr.org/files/documents/AutomatisationNav/DefinitionAutomatisation_en.pdf)

.

V. INLAND WATERWAYS CLASSIFICATION

This section refers to the PIANC InCom WG 210: Framework for an Inland Waterway Classification in South America, developed by PIANC and the United Nations Economic Commission for Latin America and the Caribbean (ECLAC).

A common inland waterways classification could provide a tool for assessing the status of the existing waterways and their current and potential capacity to integrate into the national and regional logistics chains, helping to implement a more sustainable logistics system. It would help identifying the main and secondary inland waterway network and its missing links as well as to monitor its development and to evaluate to what extent the implemented infrastructure projects enhanced the capacity of the network.

Moreover, it would help decision makers from both public and private parties to invest (more) in inland waterway infrastructure, being the inland waterways and ports, but also the barges, cranes and shipyards.

5.1 (Feasible) Objectives of an Inland Waterways Classification in the Asia Pacific region

First, the classification should make it possible to clearly identify the capacity of existing navigable waterways by:

- Introducing a hierarchy of classes, this guarantees that a vessel or convoy normally operating on waterways of one class could be used on waterways belonging to a higher category without restriction as to the parameters covered by the classification;
- Identifying waterways capable of accommodating the largest cargo and passenger flows (major waterways), contributing to the regional integration of the countries of South East Asia;
- Identifying substandard sections and missing links.

Second, it should be forward-looking in its design, specifying the parameters to be complied with when constructing new or modernizing existing inland waterways with the objective of contributing to the sustainable development of the entire region, that is, to establishing a network that has the following characteristics:

- Based on the regional and global experience with inland waterways classifications;

- As homogeneous as possible but with the flexibility to take into account local conditions;
- Integrated, ensuring the integration of different watersheds via connecting canals, as well as via adequate coastal routes;
- Co-modal, that is, suitable for international transport, which includes synergy with the regional network of the Asian Highways, Trans-Asian Railways and dry ports of international importance, as well as the operation of seagoing vessels;
- Sustainable: Both in terms of a more sustainable use of inland navigation and a sustainability of the class over time.

VI. MANAGEMENT OF THE NAVIGABILITY OF NATURAL RIVERS

This section refers to the PIANC InCom WG 236: “Sustainable Management of the Navigability of Natural Rivers - Lessons learnt”.

Inland Waterways in the Asia and Pacific region are predominantly based on natural river systems that exhibit high degrees of morphological and hydrological variability. Unlike engineered canals with regulated flows and stabilized channels, natural rivers are living systems—subject to seasonal fluctuations, sediment dynamics, bank erosion, flood pulses, and intricate ecological inter-dependencies. Navigability in such environments is inherently dynamic, and enhancing it demands a carefully calibrated approach that balances navigation efficiency, ecosystem protection, climate resilience, and the well-being of riparian communities.

PIANC WG 236 on Sustainable Management of the Navigability of Natural Rivers directly addresses this challenge by offering a strategic and operational framework for assessing and managing navigability in free-flowing rivers. This WG emphasizes sustainability not as a secondary consideration, but as a core design and management principle, advocating low-impact interventions, adaptive operations, and the co-existence of navigation with natural processes.

The outcomes of WG 236 are particularly relevant for the Asia-Pacific region, where many of the world’s largest and most complex river systems—such as the Mekong, Ayeyarwady, Ganges, Red River, and Yangtze tributaries—remain only partially regulated or entirely free-flowing. These rivers play a dual role as economic corridors and ecological lifelines, and are increasingly under pressure due to navigation expansion, hydropower development, urban encroachment, and climate-induced hydrological shifts.

In the background of accelerated investment in inland waterway development, there is an urgent need for the region to adopt a sustainability-first paradigm when it comes to improving navigability in natural rivers. The WG 236 framework provides a globally tested, but locally adaptable, set of tools and principles that can be used to guide this process.

VII. NAVIGATION INFRASTRUCTURE - Structural Guidelines and Standards

Inland waterways play a significant role in the transport and logistics networks of Asia-Pacific countries, supporting trade, mobility, and regional economic integration. The physical infrastructure enabling inland navigation—locks, dams, weirs, ship lifts, training works, and ports—is foundational for safe, efficient, and resilient waterborne transport. However, despite the vital importance of these waterways, the region lacks a unified set of structural guidelines for designing and maintaining critical navigation infrastructure such as locks, weirs, dams, and ship lifts. The absence of consistent standards limits operational efficiency, safety, and climate resilience.

As seen in Europe, where CEMT classification systems and PIANC's WG reports (e.g., WG201) have been widely adopted, Asia-Pacific's IW systems could greatly benefit from a similar, harmonized approach. Structural guidelines must be tailored to local hydrological conditions while also aligning with global standards to foster cross-border cooperation and sustainable infrastructure development.

1. Challenges and Gaps in the Region's Navigation Infrastructure

Nationally driven standards result in variation in lock dimensions, channel design, sediment management, and flood protection across countries. This inconsistency hinders the integration of national networks into a seamless regional transport system.

2. Best Practices and Lessons

Countries within the Asia and Pacific region have done some practices:

- Standardized lock designs on the Yangtze River, such as Class IV locks, have proven effective in managing large volumes of traffic and varying water conditions.
- The Mekong River Commission (MRC) has worked to standardize navigational channels for cross-border trade, using data from previous projects to influence infrastructure planning and implementation.

3. Recommendations for Structural Guidelines and Standards

Inland waterways in Asia-Pacific are poised for significant growth, but this potential can only be realized through a unified approach to structural design standards and sustainability practices. It is recommended to establish a Regional Task Force to draft "Structural Guidelines

for Inland Navigation Infrastructure in Asia-Pacific" based on PIANC's WG201 and WG236, and adapt it for local conditions.

VIII. GOVERNANCE: International Waterway and River Commissions - Keys to Success

On an efficient international waterway vessels from various countries operate and regularly cross borders. Similarly, water resources should not be managed solely at the national level but rather on a catchment scale whenever possible. These two simple examples illustrate the necessity of an international approach, whether concerning navigable corridors or hydrological basins.

From a water management perspective, upstream/downstream solidarity is essential from quantitative as well as qualitative aspects. This approach enables effective flood control by strategically distributing retention basins and flood zones. It also ensures improved water quality management, preventing upstream pollution from rendering downstream water usage impossible. To achieve this, establishing a shared-access water quality monitoring network would be highly beneficial.

Regarding navigation, several governance models exist, including **River Commissions** —each responsible for a specific corridor. These commissions operate in Europe, Asia, Africa, and South America, with varying roles and levels of authority depending on their mandates. Their effectiveness relies on several key powers:

- **Constituent Power:** Certain commissions have the authority to amend or supplement the founding Treaty without convening a Diplomatic Conference. This flexibility allows them to adapt navigation regimes to evolving circumstances, technologies, and legal or economic necessities.
- **General Decision-Making Power:** The commission deliberates on proposals from Member States concerning the prosperity of the waterway. No aspect of navigation should fall outside its competence, ensuring a holistic approach. It may also establish relations with other institutions as needed.
- **Regulatory Power:** The commission sets and adapts common regulations, ensuring a unified framework for all users. Standardized rules contribute to freedom of navigation and harmonization. If normative power is lacking, the commission may issue recommendations to promote consistency among Member States.
- **Judicial Power:** Some commissions operate their own tribunals, tasked with handling civil disputes (such as damages caused by boatmen) and criminal matters (violations of common regulations). These tribunals typically rule as a second and final instance after national courts.

Possible objectives for the Asia-Pacific Region could be to discuss the relevance of those ideas to regional waterways and to examine their possible added value.

As an opportunity, note that the objective of the PIANC WG 263 “Key Elements and Best Practices to Improve the Governance of Inland Waterways“, started in May 2025, is to make recommendations for an effective governance of IW and port, based on lessons learnt.

IX. CONCLUSION AND PRIORITIZATION FOR INLAND WATERWAY DEVELOPMENT IN THE ASIA-PACIFIC REGION

ESCAP secretariat and PIANC concur that the following actions would bring a meaningful contribution to promoting IWT development in Asia and the Pacific:

- Sharing knowledge and providing guidance in PIANC approaches and initiatives related to sustainability and resilience, like Working with Nature (WwN), Climate Change WG,
- Providing guidance and training in applying SDGs-based to IW and ports,
- Sharing project experiences related to sustainability,
- Generating collaborative work on regional guidelines supporting IWT development,

Previous cooperation between ECLAC (U.N.) and PIANC (WG 201, 2018) illustrated that enhancing development of IWT in Latin America would require a common inland waterway classification, navigability and technical standards (design guidelines) for inland ports and IW waterways, and the need for each river basin of a centralized commission for navigation (as CCNR, Mekong River Commission), etc.

The sustainable and resilient development of IW transport along rivers, such as the Mekong River, requires a comprehensive strategy centered on physical, economic, political, ecological, and social considerations (see PIANC WG 203 “Sustainable IW - A Guide for Inland Waterway Managers on Social and Environmental Impacts”).

Key recommendations include upgrading navigable stretches through infrastructure investments like selective dredging, navigation channel and port improvements, and establishing a common IW classification system to ensure consistent standards and facilitate planning.

Strengthening regional cooperation is crucial, requiring enhancement of the authority of Mekong River bodies like the MRC through improved legal powers, dispute resolution, and stakeholder communication, while fostering synergy with mechanisms such as the Lancang-Mekong Cooperation to avoid duplication and promote integrated basin management. Additionally, we need establishing a comprehensive cooperation mechanism for IW transport across the entire Asia-Pacific region—including the Mekong River Basin—by sharing best practices, addressing common issues, and developing an overarching, integrated basin management plan that reflects shared interests, with the formation of a dedicated expert

working group to regularly support and facilitate regional transport co-operation and ensure the effective implementation and sustainability of this broader regional framework.

Helping develop resilient multimodal transport networks that connect waterways with road and rail infrastructure, supported by innovative and sustainable financing methods—including environmental technologies and incentives for eco-friendly navigation lines (for goods or passengers) or associated bunkering infrastructures—can improve efficiency and environmental sustainability.

Capacity building through specialized training and transparent governance via digital platforms will ensure inclusive stakeholder participation and reduce corruption. Furthermore, carefully managed public-private partnerships in port operations and logistics, governed by clear regulations and environmental safeguards, can attract private investment and catalyze regional economic growth.

Overall, aligning infrastructural, policy, and institutional efforts across the broader Asia-Pacific region can transform inland waterways into vital economic corridors, promoting sustainable and inclusive development across the entire region.

X. REFERENCES

10.1 ESCAP References

[1] International Conference on Promoting Sustainability of Inland Waterway Transport and Logistics (Chiang Rai, Thailand, 16-18 July 2025)[6]

[2] International Conference on Sustainable Inland Waterway Transport Development (Zhoushan, China, June 2024)[7]

[3] Capacity-Building Workshop on Sustainable IWT Development (Bangkok, November 2024)[8]

[4] International Conference on Promoting Sustainability of IWT and Logistics (Chiang Rai, July 2025)[9]

[5] Standardization of a vessel and waterway classification in the Mekong River Basin, Mekong River Commission (MRC), Report 2023, 72 pages

10.2 PIANC References

[1] PIANC (1990), "Standardization of Inland Waterways", Dimensions: Report of the WG 9 of the Permanent Technical Committee I., PIANC, Brussels, Belgium.

[2] PIANC (1996), "Standardization of Ships and Inland Waterways for Rivers/Sea Navigation": Report of the WG16 of the Permanent Technical Committee I., PIANC, Brussels, Belgium.

[3] PIANC (1999), "Factors involved in standardising the Dimensions of Vb Waterways (canals)": Report of the WG 20 of the Permanent Technical Committee I., PIANC, Brussels, Belgium.

[4] PIANC (2009), "Calibrating the navigable waterways of the Mekong river system into

[6] https://www.unescap.org/events/2025/international-conference-promoting-sustainability-inland-waterway-transport-and

[7] https://www.unescap.org/events/2024/international-conference-sustainable-inland-waterway-transport-development

[8] https://www.unescap.org/events/2024/capacity-building-workshop-sustainable-inland-waterway-transport-development

[9] https://www.unescap.org/events/2025/international-conference-promoting-sustainability-inland-waterway-transport-and

a classification standard", PIANC, Brussels, Belgium.
[5] PIANC (2011), Working with Nature - Position Paper, October 2008, Revised January 2011, PIANC, Brussels, Belgium.
[6] PIANC RecCom WG 12 (2002). Recreational Navigation and Nature, PIANC, Brussels, Belgium.
[7] PIANC EnviCom WG 6 (2003). Guidelines for Sustainable Inland Waterways and Navigation, PIANC, Brussels, Belgium.
[8] PIANC EnviCom WG 10 (2006). Environmental Risk Assessment of Dredging and Disposal Operations, PIANC, Brussels, Belgium.
[9] PIANC InCom WG 99 (2008). Considerations to reduce environmental impacts of vessels, PIANC, Brussels, Belgium.
[10] PIANC InCom WG 127 (2013). Fish Passage, PIANC, Brussels, Belgium.
[11] PIANC EnviCom WG 136 (2013). Sustainable Maritime Navigation, PIANC, Brussels, Belgium.
[12] PIANC EnviCom WG 150 (2014). Sustainable Ports: A Guide for Port Authorities. PIANC, Brussels, Belgium.
[13] PIANC MarCom WG 158 (2014). Master-plans for the Development of Existing Ports, PIANC, Brussels, Belgium.
[14] PIANC InCom WG 139 (2016). Values of Inland Waterways, PIANC, Brussels, Belgium.
[15] PIANC MarCom WG 161 (2018). Interaction Between Offshore Wind Farms and Maritime Navigation, PIANC, Brussels, Belgium.
[16] PIANC EnviCom WG 176 (2018). Guide for Applying Working with Nature to Navigation Infrastructure Projects, PIANC, Brussels, Belgium.
[17] PIANC InCom WG 201 (2018), Framework for an Inland Waterway Classification in South America, PIANC, Brussels, Belgium.
[18] PIANC InCom WG 125/III (2019) RIS Related Definitions, PIANC, Brussels, Belgium.PIANC InCom WG 141 (2019), Design guidelines for inland waterway dimensions
[19] PIANC MarCom WG 159 (2019). Renewable and Energy Efficiency for Maritime Ports, PIANC, Brussels, Belgium.
[20] PIANC MarCom WG 185 (2019). Ports on Greenfield Sites – Guidelines for Site Selection and Master Planning, PIANC, Brussels, Belgium.
[21] PIANC EnviCom WG 188 (2019). Carbon Management for Port and Navigation Infrastructure, PIANC, Brussels, Belgium.
[22] PIANC EnviCom WG 178 (2020). Climate Change Adaptation Planning for Ports and Inland Waterways, PIANC, Brussels, Belgium.
[23] PIANC InCom WG 210 (2022) , Smart shipping in IW PIANC, Brussels, Belgium.
[24] PIANC RecCom WG 148 (2023). Guidelines for Sustainable Recreational Navigation Infrastructure: A Guide for Applying Working with Nature to Recreational Navigation Infrastructure Projects, PIANC, Brussels, Belgium.

[25] PIANC InCom WG 203 (2023). Sustainable Inland Waterways: A Guide for Inland Waterway Managers on Social and Environmental Impacts, PIANC, Brussels, Belgium.
[26] PIANC InCom WG 234 (2023). Infrastructure for the Decarbonisation of Inland Waterway Transport, PIANC, Brussels, Belgium.
[27] PIANC InCom WG 246 (2023) Guidelines and Recommendations for RIS, PIANC, Brussels, Belgium.
[28] PIANC InCom WG 236 (2024). Sustainable Management of the Navigability of Natural Rivers,
[29] PIANC- PTGCC 2024: Climate Change Costs to Ports and Waterways: Scoping the Business Case Assessment for Investment in Adaptation. Permanent Task Group for Climate Change PTGCC. Technical Note 2.
[30] PIANC White Paper (Sept 2025) - Accelerating PIANC Sustainability Practices in the Waterborne Transport Infrastructure. China, June 2024)[10]

PIANC other WGs (in progress)

[31] PIANC WG 249, "Adaptation of Inland Waterways Infrastructure for Climate Change Impacts", started in 2024,
[32] PIANC WG 257, "Digital Twins for Operation and Monitoring of Inland Waterways and Infrastructure", started in 2024,
[33] PIANC WG 258, "Design of Flexible Loading and Unloading Facilities for IW Natural Rivers", started in 2025,
[34] PIANC WG 262, "Remote Operated IW Navigation", started in 2025,
[35] PIANC WG 263, "Key Elements and Best Practices to Improve the Governance of Inland Waterways", started in 2025,
[36] PIANC WG 264, "Innovative Digitalisation Approaches for Managing Hydraulic Structures of Inland Waterways", started in 2025,
[37] PIANC WG 266, "Capacity Augmentation and Structural Expansion of Existing IW Facilities", started in 2025.

10.3 Other references

[1] PIANC WG 249, "Adaptation of Inland Waterways Infrastructure for Climate Change Impacts", started in 2024,
[2] PIANC WG 257, "Digital Twins for Operation and Monitoring of Inland Waterways and Infrastructure", started in 2024,
[3] PIANC WG 258, "Design of Flexible Loading and Unloading Facilities for IW Natural

[10] https://www.unescap.org/events/2024/international-conference-sustainable-inland-waterway-transport-development

Rivers", started in 2025,
[4] PIANC WG 262, "Remote Operated IW Navigation", started in 2025,
[5] PIANC WG 263, "Key Elements and Best Practices to Improve the Governance of Inland Waterways", started in 2025,
[6] PIANC WG 264, "Innovative Digitalisation Approaches for Managing Hydraulic Structures of Inland Waterways", started in 2025,
[7] PIANC WG 266, "Capacity Augmentation and Structural Expansion of Existing IW Facilities", started in 2025.

10.4 References on digitalization

[1] DIWA Masterplan : https://www.masterplandiwa.eu/
[2] EU Inland Water Transport Digitalisation Vision: https://transport.ec.europa.eu/document/download/14b2195a-d175-49d9-a0dd-6662232b1370_en?filename=IWT_Digitalisation_Vision.pdf&prefLang=pt
[3] FEDeRATED Masterplan: https://www.federatedplatforms.eu/images/Library/Activity2/MILESTONE_14_FEDeRATED_Masterplan_29022024.pdf
[4] www.risdefinitions.org
[5] PIANC RIS Guidelines, InCom RIS WG 246 - 2023 – Guidelines and Recommendations for RIS
[6] PIANC RIS Definition, InCom WG125/III 2019 – RIS Related Definitions
[7] PIANC Smart shipping in IW – InCom WG 210- 2022
[8] CCNR Definition on level of automation (2022) https://www.ccr-zkr.org/files/documents/AutomatisationNav/DefinitionAutomatisation_en.pdf

10.5 References on IW classification

[1] Framework for an inland waterway classification in South America. WG 210 PIANC, 2020.
[2] Standardization of a vessel and waterway classification in the Mekong River Basin, Mekong River Commission, 2023.
[3] Technical classification of inland waterways for Vietnam, 2009

Economic and Social Commission for Asia and the Pacific (ESCAP)

Transport Division

Follow us:


unescap


unitednationsescap


united-nations-escap


unescap.org