



BULLETIN

FAL

FACILITATION OF TRANSPORT AND TRADE IN LATIN AMERICA AND THE CARIBBEAN

# Inland navigation and a more sustainable use of natural resources: networks, challenges and opportunities for South America

This issue of the *FAL Bulletin* explores a number of challenges and potential opportunities for inland waterway development in South America. The main focus of the discussion is on financing and policy challenges for efforts to develop inland waterways in a way that will allow them to play a key role in a more sustainable transport system in the future.

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The views expressed in this document are those of the authors and do not necessarily reflect the opinions of the organization.

## Introduction

This issue of the *FAL Bulletin* discusses the results of the expert meeting on inland navigation and its potential role in promoting a more sustainable use of natural resources that was held in Rio de Janeiro, Brazil, on 19 October 2016<sup>1</sup> in conjunction with the Ninth International Conference on Coastal and Port Engineering in Developing Countries.

The event represented a joint effort of the World Association for Waterborne Transport Infrastructure (PIANC), the National Waterway Transportation Agency (ANTAQ) and the Economic Commission for Latin America and the Caribbean (ECLAC) and was attended by 90 participants, including government representatives from Argentina, Brazil, Colombia, Paraguay, Peru, the Plurinational State of Bolivia and Uruguay and inland navigation experts from China, Belgium, France, Germany, Netherlands, Japan and the United States of America.

The main objective of the event was to offer decision-makers, national experts and technical advisers an opportunity to share their experiences and exchange views on the challenges and potential opportunities for inland waterway development in South America.



Introduction



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UNITED NATIONS

ECLAC

<sup>1</sup> More detailed information concerning this event and the presentations made at the conference are available at: <http://incomnews.org/index.php/events/12-pianc-eclac-antaq-workshop-copedec-2016>.

The discussions were structured around three main topics:

- Inland waterway infrastructure: identification of the economic potential of national and regional inland waterways.
- Funding schemes for inland waterway development: trends and challenges in public and private investment in inland waterways.
- Policies and governance for inland waterways: the key elements of a national and regional policy on inland waterway development and the associated institutional framework.

Particular attention was devoted to the role that inland waterways can play in promoting a more sustainable use of the region's natural resources.

The main results of these discussions are summarized below. Section II discusses the economic potential of national and regional inland waterways. Section III presents a discussion on funding schemes for inland waterway development, while section IV focuses on policies and governance for inland waterways.

This issue of the *FAL Bulletin* has been prepared as part of the ECLAC work programme on inland navigation and supplements the material presented in two previous (*Inland waterways classification as a tool for public policy and planning: core concepts and proposals for South America (FAL Bulletin Issue No. 346)* and *Connecting South America: river mobility and river navigation systems (FAL Bulletin No. 327)*). It also draws upon the results of the ECLAC International Seminar on River Mobility in Amazonia, held in Quito in May 2016.

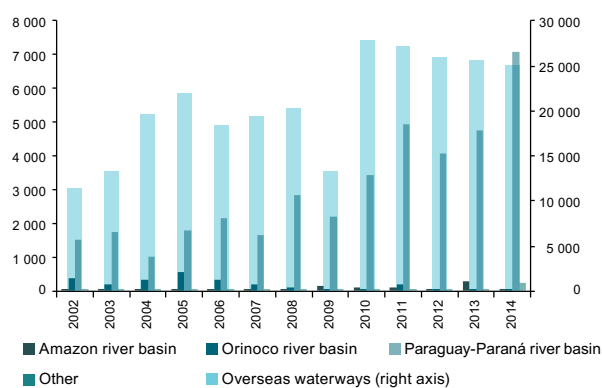
## I. Inland waterway infrastructure in South America: current status and the potential for using the region's natural resources more sustainably

South America has yet to take full advantage of its extensive system of naturally navigable waterways or to integrate them into the region's transport network as a means of building the region's capacity to meet the ever-increasing demand for cargo and human mobility. The modal shares of inland shipping in the region's international transport matrix amount to less than 1% in terms of value and volume (Wilmsmeier and Spengler, 2015). Nevertheless, trends in the role that inland navigation is playing in international transport have been positive over the last decade.

Inland waterways not only are used for transport between countries of the region that are located along river basins, but also serve as the first leg of international transport

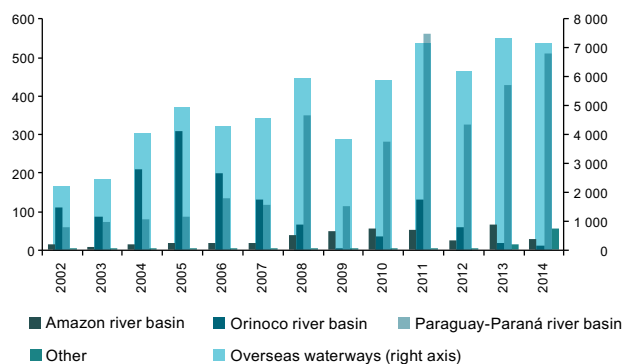
flows with other regions of the world in the case of such goods, for example, as soybean products and aluminium from the Paraguay-Paraná and Orinoco river basins that are destined for Europe, the United States or Asia. In these cases, seagoing vessels are deployed directly from the ports along these river systems. While the value of these exports has more than tripled since 2002, volumes have been declining over the last few years (see figures 1 and 2).

**Figure 1**  
Trends in international inland shipping, by river basin: exports in metric tons, 2002-2014



Source: Economic Commission for Latin America and the Caribbean (ECLAC) and International Transport Database (ITD) (various years).

**Figure 2**  
Trends in international inland shipping, by river basin: exports in millions of United States dollars (at current prices), 2002-2014



Source: Economic Commission for Latin America and the Caribbean (ECLAC) and International Transport Database (ITD).

From a macro perspective, the use of inland waterway systems in the region is limited by various factors, including:

- Incomplete, outdated or absent national and regional standards and regulatory frameworks.
- Lack of common inland waterway classifications in South America as a basis for the standardization of inland navigation protocols at the national and regional levels.

- Lack of standardization of fleet, vessel and control procedures.
- Lack of investment in the construction and maintenance of waterway infrastructure and inland ports.
- Lack of administrative structures and delays in building institutional capacity, especially in terms of human and financial capital.
- Lack of navigational aids, including updated maps, electronic charts, signals and other navigational services.
- Lack of qualified human resources and institutions for capacity-building and the training of highly skilled personnel.

These shortcomings limit the current and future potential of inland navigation. The current situation not only impedes the wider use of this mode of transport, but also interferes with its integration with other modes. They also generate inefficiencies, such as cargo losses, and result in relatively high transport costs at the local, regional and national levels.

One challenge is the lack of information and, in some cases, political visibility of the region's waterways' existing and potential capacity for freight and passenger transport. In this context, the first session of the seminar was devoted to discussing policymaking and planning tools for promoting more analysis and gaining more visibility for the current and potential status of inland waterway infrastructure in South America.

Drawing on the experience of other regions of the world and technical contributions from the PIANC experts, the participants discussed a proposal for the development of a common classification of inland waterways for South America. It was pointed out that the European experience (European Conference of Ministers of Transport (ECMT); also commonly referred to by its French-language acronym: CEMT) has demonstrated that inland waterway classifications, far from being a formality or a purely academic exercise, are an essential, powerful and dynamic tool for supporting and implementing inland waterway policies and projects. Such classifications facilitate the identification of constraints and the economic potentials of navigable waterways. In addition, they pave the way for promoting and monitoring the development of these waterways' capacity for transporting goods and people (Jaimurzina et al., 2016).

The discussions held at the meeting addressed the first proposal for a South American classification, based on the ECLAC/PIANC working document entitled "Inland waterways classification for South America: core concepts and initial proposals". The PIANC reports from Working Groups 9 and 16 and the report entitled "Calibrating the navigable waterways of the Mekong river system

into a classification standard" were also cited as useful background documents (PIANC, 2009).

There was a general consensus among country representatives and experts as to the direct and indirect benefits of a harmonized classification system. From the policy and planning perspectives, having standardized parameters for waterways, including their structures (locks, bridges etc.), is expected to contribute to:

- The preparation of an overview of the current status of existing waterways that will, in turn, facilitate their integration into overall logistics chains at the national and regional levels.
- The provision of a basis for estimating the impact of new infrastructure investment on infrastructure capacity.
- The development of a system for monitoring and assessing the status of the corresponding infrastructure.
- Facilitated access to financing.
- A more sustainable use of inland waterways if the classification incorporates the appropriate environmental and social standards from the outset.
- A common basis for binational and regional agreements on inland waterway infrastructure and its use.

From both users' and the industry's perspective, such a classification would offer: (a) more reliable information regarding navigation conditions; (b) facilitated and safer inland navigation; (c) more favourable conditions for industry development (i.e.; ship building) and; (d) clear parameters for the analysis of the costs/benefits of constructing new waterways and infrastructure and for maintaining and replacing existing facilities.

At the same time, the participants emphasized several challenges that will have to be met in developing a common classification for South America.

First, because the region's dialogue on a common classification is as yet at such an early stage, agreement still needs to be reached on the key elements of the classification, such as the corresponding goals or objectives (which can differ based on the modes of navigation concerned —freight, passenger, tourism— or include other economic objectives, such as those of ports, the industry, communities, hydropower suppliers, etc.), geographical scope or areas of interest (regions, waterways to be considered), the need for one or more classifications (depending on how waterways or regions can be linked to each other, as well as the relevant fleets), the types of waterways to be considered (rivers, canals, lakes), classification parameters (existing ones or future parameters to be developed, depending on what goals and objectives are identified) and, possibly, the consideration of additional waterway uses (flood control/



protection, water management, irrigation, hydropower, other water-related businesses), etc. The PIANC/ECLAC working document offers preliminary responses to these questions, which now need to be confirmed by the countries concerned.

Second, based on the results of the countries' discussions on these issues, it will be necessary to collect and analyse a certain amount of geographical, economic and social data, including, but not limited to, information on the following:

- The current status of inland waterways, including their hydrological and morphological conditions.
- Existing and future inland waterway fleets and the parameters and technologies being used.
- Data from surveys of commodities, other cargo and passengers carried by the inland navigation system (both current and future, including potential niches).
- Existing technologies, such as River Information Services (RIS), for intermodal connections (the roll-on /roll-off system for the transport of trucks or trailers, short-sea navigation and ports, etc.).
- Transport policies and the current and future demands associated with infrastructure plans in the countries of the region.
- Data from existing studies on the economic potential of inland waterways in the region.

Third, it was emphasized that insufficient consideration had been given to the sustainability dimension of existing classifications in other regions of the world, such as the ECMT/United Nations Economic Commission for Europe (UNECE) classification, and that it would be necessary for the operational and technical parameters of the classification to incorporate conditions and criteria for achieving a more sustainable use of inland navigation, both in terms of the provision of infrastructure and in terms of its use over time.

Finally, it was recognized that the development of a classification requires that the countries of the region take on a proactive role in further developing the methodology and tailoring the classification for its regional application. This also entails the development of monitoring indicators, instruments and systems. In this

context, a dialogue and collaboration between the public and private sectors and academia, as well as with potential donor agencies, is of key importance, as financing for these initiatives and activities will be essential in order to ensure the sustainability of these efforts over time. Since river basins are often transnational in nature, the involvement of regional integration initiatives such as the Union of South American Nations (UNASUR), the South American Infrastructure and Planning Council (COSIPLAN), the Initiative for the Integration of Regional Infrastructure in South America (IIRSA) and the Latin American Integration Association (LAIA/ALADI) is a core element in the process of reaching agreement on all of these issues.

The overall recommendation of the participants in the ANTAQ/ECLAC/PIANC Workshop was to create a special working group, to be chaired by ECLAC and PIANC/INCOM, to focus on the establishment of a regional classification for South America.

The preliminary terms of reference for this working group would include:

- Provide a forum for initial technical meetings among South American experts, to be joined by international experts, on a future inland waterway classification for South America.
- Collect data on inland waterways, inland fleets, traffic volumes and other relevant factors for the development of technical and operational parameters that can be harmonized at the regional level.
- Based on the initial proposals made in this working paper, formulate an advanced draft outline of the technical and operational parameters that would be used for the classification and present the preliminary results to (selected) countries of the region.
- Develop a proposal concerning a regional mechanism for the classification's implementation and maintenance and for its further development.

## II. Funding schemes for inland waterway development

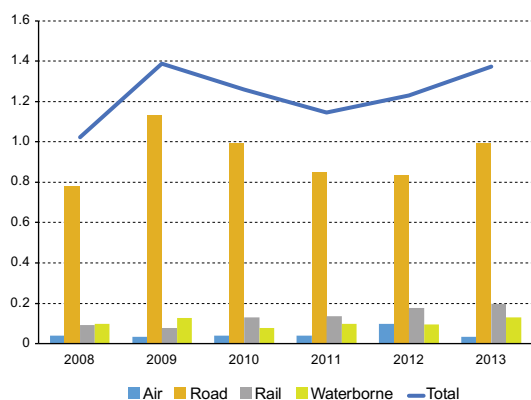
It is generally accepted that South America suffers from a shortfall in transport infrastructure investment. While the investment gap is significant from an overall perspective, it is even more pronounced when viewed from a modal perspective. Although inland waterways are repeatedly referred to as a solution and contribution towards a more sustainable transport system, the reality in terms of investment in this mode tells a different story.

The figures given below show not only that current levels of investment in inland waterways are low, but also that there is a wide investment gap between this and other



modes of transport. In the period between 2008 and 2013, on average, investment in waterborne transport did not exceed 10% of total annual investment in transport infrastructure. In some countries in the region, the relevant government agencies do not even have specific budgets for inland infrastructure and inland port development.

**Figure 3**  
Investment in transport infrastructure, by mode, as a percentage of GDP, 2008-2013



**Source:** Economic Commission for Latin America and the Caribbean, Infrastructure Services Unit, based on data from Economic Infrastructure Investment Data in Latin America and the Caribbean (INFRALATAM).

**Note:** Includes private and public investment. The following countries are included: Bolivia (Plurinational State of), Brazil, Chile, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru and Uruguay.

Infrastructure investments are needed to facilitate economic growth that can in turn provide the necessary fiscal cushion for government expenditure and debt. However, actual analyses of fiscal multipliers of government infrastructure investments are, as a rule, not included in current feasibility studies. If they were, it is likely that the story that they would tell would be discouraging, as the catalytic effects of value-adding industrial investment is the only genuine source of such a fiscal cushion. These industrial investments are not under the control of the government, however, and are rather volatile in the presence of changes in locational competitiveness.

Viewed against this backdrop, the seminar offered a valuable overview of various funding schemes for inland waterway development that are in place in Europe and in some countries of the region.

The case of the Rhone River was presented as an example of long-term concessions and the contribution that they can make to the local economy. The concession-holder for the Rhone River is a land developer that is called upon to perform three important functions for the community: (a) producing hydroelectricity; (b) developing navigation; and (c) facilitating irrigation for agricultural use. This global concession has been in operation for 75 years and

started with the commissioning of the first dam in 1948. The concession-holder is a listed company on the stock market with a balance of public and private shareholders. It works under a redistributive model that enables it to share its added value among the State, the public authorities of the Rhone River Valley, the neighbouring population, the shareholders and the company's employees.

Between 1936 and 1986, 19 multipurpose development schemes and the Port of Lyon were financed by the State based on loan guarantees. The loans were repaid out of the revenues achieved using hydropower resources. At present, hydroelectricity is the main source of revenues (3,005 MW of installed capacity). The Compagnie Nationale du Rhône (CNR) redistributes part of the value that is created to the State (via a hydropower fee of 24% of net electricity sales) and to community development via what are known as "missions of general interest" (five-year plans in place since 2004). At the same time, the use of locks and passages is free of charge.

**Table 1**  
Key figures on the Rhône concession, France

1. Installed capacity	2. 3 005 MW
3. Average annual output	4. 14 400 GWh
5. Net turnover (2015)	6. 650 M€
7. Total contribution to State (2015)	8. 283 M€
9. Contribution to community development	10. 32 M€/yr
11. Specific concession expenses (2015)	12. 184 M€
13. Share of navigation of the above	14. ~13%

**Source:** Compagnie Nationale du Rhône (CNR), 2016.

The concept and principles exemplified by the Rhone River case are being replicated in the Mekong River basin in Laos, where a series of hydropower river projects are being undertaken by different developers under a build-own-operate-transfer (BOOT) scheme. The resources acquired from the use of hydropower are then to be used to build a lock. The resulting reservoirs will progressively extend the length of the navigable sections of the Mekong. The application of lessons learned from the Rhone River case in the Mekong River basin underscores the potential and need for coordinating different operators in different phases of the project life cycle (design, maintenance, operation).

To attract private investment and fiscally sustainable public financing for inland navigation infrastructure, it is important to consider the multidimensional and logistics aspects of waterway transport. A public-private partnership (PPP) approach should incorporate socioeconomic impacts and the associated added values in order to ensure a satisfactory level of fiscal returns. This will involve the introduction of a new regulatory and contractual network along with business models that

will enable the various stakeholders to work together to develop local potential in a way that will take account of the different environmental and social issues involved.

By way of example, in Argentina, the toll paid by infrastructure users over the last 21 years has been a feasible tool for financing inland waterway concessions and has made it possible for the infrastructure to be properly maintained, despite national economic problems. The usual types of concessions and PPP models now in use are not universally applicable, however, as they require at least minimally mature demand markets.

Conventional public funding systems, including the use of loans, remain a solution only in particular situations and need to be reviewed further for the case of South America.

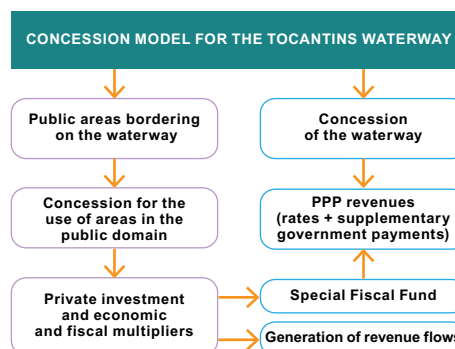
One of the participants, Joaquim Aragão, gave a presentation on the case of Brazil as an example of challenges and possible solutions for inland waterway financing. For decades now, the Brazilian economy has been grappling with the problems caused by the obsolescence and incompleteness of its infrastructure network. High logistic costs hurt the competitiveness of Brazilian exports. As the wave of high world market values for the commodities that represent a major part of its exports has passed, the fiscal leeway for funding infrastructure has dwindled. Consequently, concessions and partnerships with the private sector have been chosen as the main solution. On the other hand, there is a specific feature of Brazilian geography that must be dealt with: infrastructure investment is needed in long stretches that run through areas with high future growth potential, but where the logistics market is still not mature enough to attract private investment. The assumption of market risk in such projects by the government will usher the risks of fiscal unsustainability through the back door.

This approach has been tested on the Tocantins Waterway with respect to its economic and fiscal multiplier effects (see diagram 1). Its intended purpose is to cope with the challenges discussed above, and it is designed to achieve the following aims:

- To assure systemic efficiency and overcome the fragmentation of different ventures by bundling together different public and private projects related to infrastructure, industry and public services into an integrated, geographically based programme;
- To assure the fiscal sustainability of the various public investments and expenditures by screening the economic and fiscal multiplier effects of the investments (both public and private) that are included in the programme;
- To contract a private development company to organize clusters and chains with a view to

subsequently achieving economic performance targets in such areas as the number of contracts with local small and medium-sized enterprises (SMEs), job creation, the level of traffic generated and fiscal multiplier effects. This company will be entitled to use a strategically located public area and to open a bank or another type of financial institution to serve the project's needs.

**Diagram 1**  
Concession model for the Tocantins waterway, 2008-2013



Source: National Waterway Transportation Agency (ANTAQ), 2016.

In this example, the contracting procedure should be preceded by a general transportation and spatial planning process and by an economic and commercial infrastructure consolidation programme in which the corresponding responsibilities of the private and public stakeholders are defined. Provision should also be made for the conclusion of a conventional PPP agreement with an infrastructure construction company and an exploratory enterprise (e.g. an airport, a port, a railway or a waterway), along with a procurement procedure for the selection of a private development company. The contract should then be awarded to the bidder who offers the most contracts that provide for the participation of local SMEs and local job creation, provided that the set targets for overall fiscal-multiplier and traffic-generation effects are assured.

Based on these case studies, together with the outcomes of the discussions on the main issues related to funding inland waterway infrastructure, the participants in the session put forward the following recommendations:

- To attract private investment and fiscally sustainable public financing for inland navigation infrastructure, it is important to consider the multidimensional and logistics aspects involved in waterway transport.
- A public-private partnership (PPP) approach should take into account the socioeconomic impacts and their added values in order to ensure a suitable level of fiscal returns. This will call for new regulatory and contractual networks and for business models that will work together in developing local and regional

potential while taking into consideration the different environmental and social issues involved.

- The current concessions and PPP models are not universally applicable, as they require at least minimally mature demand markets. Otherwise, government payments and guarantees designed to make projects attractive to private investors may usher in fiscal erosion through the back door.
- In some countries, the rates paid by infrastructure users have been a suitable and feasible tool for financing the operation of concessional inland waterways and have made the infrastructure's proper maintenance feasible, despite national economic problems. For these countries, the ways in which rates have been deployed have been shown to be quite sustainable and are expected to continue to be sustainable in the future as well.
- Support for conventional public funding systems, which includes the use of loans, remains a sound approach in particular situations.

### III. Towards national policies and a regional dialogue on inland waterway development

The last session of the seminar was devoted to the role of national and regional policies in promoting inland navigation.

The participating country representatives and experts emphasized the crucial role of inland navigation in advancing towards the goals of sustainable development and physical, economic and social integration.

More specifically, inland shipping can offer:

- Greater security, as services are delivered along waterways with low traffic density that are not in the vicinity of human settlements, and the accident level is therefore lower than it is for other modes of transport

- Lower economic costs. Inland shipping carriage can be from 30% to 60% less costly than road or railway transport.
- High levels of energy efficiency. In the case of the majority of bulk services, inland shipping consumes from three to six times less energy than road transport and up to two times less than railway transport.
- Lower emissions. The CO<sub>2</sub> emissions of inland shipping are lower than they are for other modes of transport. However, in the case of other emissions, such as particulate matter (PM) and sulphur oxides (SO<sub>x</sub>), the advantages of inland shipping are limited or non-existent because the regulation of road transport emissions has advanced more rapidly than the regulation of emissions in the case of inland shipping operations has. By way of example, Euro VI trucks do have a better performance than inland shipping vessels per ton-km for PM and SO<sub>x</sub> emissions.
- Lower noise emissions. Inland shipping performs better in terms of noise pollution, although port and terminal areas may be an exception.
- Lower infrastructure costs than other modes of transport are found in some cases, but this depends on geographic and climatic conditions and the natural navigability of the inland waterways concerned. In the case of Latin America, the natural geography favours the use of inland waterways; depending on the waterway in question, from 20% to 100% of the available capacity is not being used.

Thus, inland navigation has untapped potential, not only for its traditional markets (such as the transportation of bulk commodity cargo or recreational or local passenger transport), but also for other possible new niche markets. The environmental effects of developing this system are not negligible, but their scale can be controlled more easily and, often, at a more reasonable cost than those deriving from other transport options, particularly road transport. Its social impact is or can be very important, especially

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