Position paper: Inland waterways classification for South America

Core concepts and initial proposals

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

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Introduction

South America, as of yet, has not been able to take full advantage of its extensive system of naturally navigable waterways and in making them an integrated part of the region's transport network to cater for the ever increasing demand for cargo and human mobility.

Infrastructure limitations are one of the major obstacles for the development of inland navigation in the region and, to a certain extent, they are being addressed in most national and regional transport plans and projects. However, this effort, in most cases, remain isolated, and the potential and role of inland shipping as a "natural resource" in itself, but also for transporting the region's natural resources is, in general, absent as an integral part of the countries transport, mobility and or logistics policies. In this sense the economic and social value of the region's inland waterway system is still underestimated.

A common classification of the inland waterways (rivers, canals and lakes), which currently does not exist in the region, could be instrumental for achieving greater, better and more sustainable use and governance of inland navigation. The experiences of other regions in the world demonstrate that inland waterway classifications, far from being public sector formality or a purely academic exercise, are an essential, powerful and dynamic tool for supporting and implementing inland waterways policies and projects inasmuch as they allow to identify the limitations and the economic potential of navigable waterways in the region and to encourage and monitor the development of their capacity for transport of goods and people.

Against this backdrop and in order to encourage reflection on a potential inland waterways classification for the South American region, this document uses the example of the European system of classification to demonstrate the role of classifications in the inland navigation development. Specifically, it looks at the 1996 European Agreement on Main Inland Waterways of International Importance (AGN Agreement). Signed in 1996 and ratified by 18 European countries, the AGN Agreement continues to be one of the main instruments for inland water transport development in Europe, as demonstrated by the growing number of ratifications by the countries of the region.[1]

This Working Document describes the main elements of the European classification system of navigable waterways (Section I) and existing mechanisms for the monitoring and use of the established network of inland waterways (Section II) and then analyses the role of the classification in the development of inland water transport in Europe (Section III). It goes on to discuss lessons learned and presents a preliminary proposal for the establishment of a regional classification for South America (Section IV). The concluding section addresses the institutional processes and next steps needed to develop a classification of this kind.

Bearing in mind that the process for the elaboration of the South American classification is still at an early stage and several open question still remain, the overall goal of the document is to highlight and illustrate relevant issues, which have to be discussed at national level and among the experts of the South American countries to identify and implement a harmonized scheme of classification on a regional basis.

[1] The most recent ratifications have been by Austria (2010), Ukraine (2010) and Serbia (2014).

1 European classification of navigable inland waterways: origins and principles

Inland waterway classification can be defined as the ordering and organization of the components of river infrastructure according to a set of given criteria. These criteria as well as the extent of divisions or categories within the classification vary depending on the main objective of the classification. In the classification based on the aforementioned AGN Agreement, the main parameter of the classification has been the capacity of a navigable waterway (e.g. stretch of inland waterway or a port) to accommodate a certain volume of cargo ship traffic. There exist other classifications of navigable waterways in Europe whose objective is to guarantee the safety of navigation. For example, in the technical prescriptions for inland vessels, waterways are divided in zones I, II, III and IV based on the size of their waves.[2] However, the classification of navigable waterways based on their economic capacity— the ECMT/UNECE classification— is the most widely known and is the one that is analyzed in depth in this document.

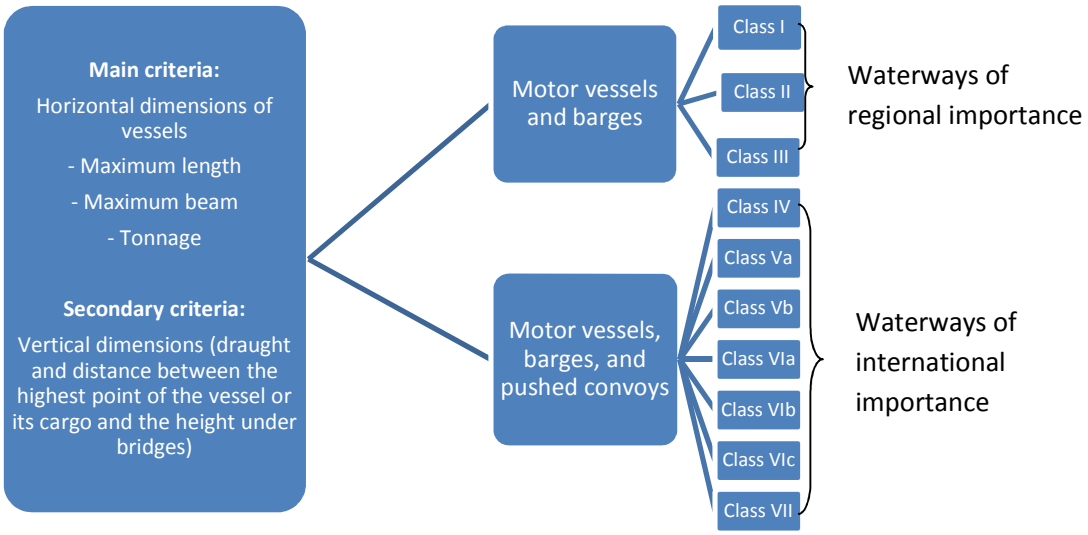
The ECMT/UNECE classification was the product of a joint effort by several organizations active in the development of inland water transport sector in Europe, including the European Conference of Ministers of Transport (ECMT), the World Association for Waterborne Transport Infrastructure (PIANC) and the United Nations Economic Commission for Europe (UNECE). The ECMT was the first to adopt, in 1954, the classification of inland waterways of international importance. The classification was subsequently revised with the support of the PIANC, and updated version of the classification was adopted by resolution of the ECMT in 1992 (ECMT, 1992). Also in 1992, this classification was adopted by resolution of the UNECR Main Working Group on Inland Water Transport (UNECE, 2004), and in 1996 became part of the AGN Agreement.

The ECMT/UNECE classification divides inland waterways into 7 main classes (10 classes and subclasses of waterways altogether), based mainly on their capacity to accommodate vessels (motor vessels and barges) and pushed convoys of certain sizes. The criteria for determining a class are: (a) the horizontal dimensions of the vessels or units (beam and maximum length); and (b) vertical criteria, such as draft and maximum height under bridges.

In addition to the division by classes, the ECMT/UNECE classification separates inland waterways into two main categories: classes of regional (Classes I to III) and classes of international importance (Class IV and higher), which meet the technical criteria most suited to regional trade. The class IV vessel, known as the Rhine-Herne Canal vessel, was the standard used for navigable waterways of European importance, and is often referred to as the "Europe boat." (See chart 1). It is important to clarify that the term "regional" in the ECMT classification in the South American context would be equivalent to inland waterways that are important at national level. The term "international" in the ECMT classification in the South American context would be equivalent to inland waterways that are important at international or sub-regional level.

[2] In the UNECE and European Union technical specifications for river-going vessels, navigable waterways are classified as Zone 1 (wave height of up to 2 meters), Zone 2 (wave height of up to 1.2 meters) and Zone 3 (wave height of up to 0.6 meters). See: Resolution No. 61, ECE/TRANS/SC.3/172/Rev.1, EC Directive 2006/87/EC.

Chart 1
Europe: ECMT/UNECE inland waterway classification system



Source: ECLAC Infrastructure Services Unit, on the basis of UNECE Resolution 30, 2016.
Note: The term "regional" in the ECMT classification in the South American context would be equivalent to inland waterways that are important at national level. The term "international" in the ECMT classification in the South American context would be equivalent to inland waterways that are important at international or sub-regional level.

It is also important to note that the classification criteria were based on an analysis of the existing fleet and were adjusted as the characteristics of the fleet evolved. The first ECMT classification of 1954 divided inland waterways into five classes, depending on the dimensions of the five types of vessels that were common in Western Europe at the time. Class I corresponded to the historic Freycinet standard, decreed in France in 1879. The classification sizes of waterways in higher classes focused on the transport on larger canals by tailored vessels like the Dortmund-Ems (class III) and Rhein-Herne (class IV), which also sailed the rivers . When the first pushed convoy navigated the length of the Rhine River, in 1957, followed by the introduction of pusher boats, the ECMT responded by adding Class VI to its classification. Sometime later, however, this classification turned out to be inadequate, and in 1990, a PIANC working group was formed for the specific purpose of to revise it (PIANC, 1990). Additionally, in 1999 PIANC conducted a study on Class Vb navigable waterways, producing the most recent version of the classification adopted by the ECMT and the UNECE, which took into account the rest of the inland waterways in Europe, including the rivers of eastern Europe, which generally accommodate a fleet with slightly smaller dimensions that the rivers of western Europe (PIANC, 1999). In 1996 a PIANC working group reported on a classification for River/Sea vessels, as an extension of the CEMT classes V to VI. As the European fleet kept evolving, the new PIANC WG 179 for revision of the CEMT '92 classification was created in June 2015. The main reason was the lack of provisions for larger motor vessels and coupled units in the current classification system.

As noted in UNECE Resolution 30 (1992), this system of classification fulfills various quality and operational criteria:

- It is illustrative, giving a clear and unequivocal description of existing inland waterways.

- It is forward-looking, specifying the parameters to be complied with when constructing new or modernizing existing inland waterways to achieve a certain classification.
- It contains a class hierarchy, ensuring that a vessel 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.
- It is based on the modular principle with regard to dimensions of vessels.
- It is set up on a long-term basis so as to accommodate future developments in inland water transport technology.
- It is universal in character so that it could be applied over the largest possible territorial range on the European continent.
- It provides for flexibility concerning the draught and bridge clearance values to be determined with due regard to local conditions.

This classification has provided a starting point for identifying the European system of navigable waterways and ports of international importance, while also laying a foundation for planning the future development of the system of national and pan-European inland navigation.

Table 1
CLASSIFICATION OF EUROPEAN INLAND WATERWAYS

Resolution No. 30, adopted by the UNECE Principal Working Party on Inland Water Transport on 12 November 1992)

CLASSIFICATION OF EUROPEAN INLAND WATERWAYS * – CLASSIFICATION DES VOIES NAVIGABLES EUROPEENNES * - КЛАССИФИКАЦИЯ ЕВРОПЕЙСКИХ ВНУТРЕННИХ ВОДНЫХ ПУТЕЙ *

Waterway type Type de voie navigable Тип водных путей	Waterway class Classe de voie navigable Класс водных путей		Motor vessels and barges – type of vessel: general characteristics Automoteurs ou chalands – type de bateau : caractéristiques générales Самоходные суда и баржи – тип судна: общие характеристики					Pushed convoys – type of convey; general characteristics Convois poussés – type de convoi : caractéristiques générales Толкаемые составы – тип состава: общие характеристики					Minimum height under bridges Hauteur minimale sous les ponts Миним. высота под мостами 2/	Symbol on maps Symbole sur les cartes Обозначение на карте
			Designation Dénomination Наименование	Max. length Longueur max. Максим. длина	Max. beam Largeur max. Максим. ширина	Draught Tirant d'eau Осадка	Tonnage Tonnage Тоннаж		Length Longueur Длина	Beam Largeur Ширина	Draught Tirant d'eau Осадка	Tonnage Tonnage Тоннаж		
				L(m)	B (m)	d (m) 7/	T (t)		L (m)	B (m)	D (m) 7/	T (t)	H (m)	
Of regional importance d'intérêt régional Регионального значения	west of Elbe à l'Ouest de l'Elbe к западу от Эльбы	I	Barge – Péniche - Баржа	38.50	5.05	1.80-2.20	250-400						4.00	
		II	Kampine– Campinoise – "Кампин"	50-55	6.60	2.50	400-650						4.00-5.00	
		III	Gustav Koenigs – "Густав Кенигс"	67-80	8.20	2.50	650-1000						4.00-5.00	
	east of Elbe à l'Est de l'Elbe к востоку от Эльбы	I	Gross Finow – "Гросс Финоу"	41	4.70	1.40	180						3.00	
		II	Type BM-500 – Типа БМ-500	57	7.50-9.00	1.60	500-630						3.00	
		III	6/	67-70	8.20-9.00	1.60-2.00	470-700		118-132	8.20-9.00	1.60 - 2.00	1000 – 1200	4.00	
of international importance d'intérêt international Международного значения	IV			80-85	9.50	2.50	1000-1500		85	9.50 5/	2.50 - 2.80	1250 – 1450	5.25/7.00 4/	
	Va			95-110	11.40	2.50-2.80	1500-3000		95 - 110 1/	11.40	2.50 - 4.50	1600 – 3000	5.25 / 7.00 / 9.10 4/	
	Vb								172 - 185 1/	11.40	2.50 - 4.50	3200 – 6000		
	VIa								95 - 110 1/	22.80	2.50 - 4.50	3200 – 6000	7.00/9.10 4/	
	VIb		3/	140.00	15.00				185 - 195 1/	22.80	2.50 - 4.50	6400 – 1200	7.00/9.10 4/	
	VIc								270 - 280 1/ 195 - 200 1/	22.80 33.0-34.20 1/	2.50 - 4.50 2.50 - 4.50	9600 – 1800 9600 - 1800	9.10 4/	
	VII							8/	285	33.0-34.20 1/	2.50 - 4.50	14500 - 27000	9.10 4/	

* For footnotes to this table, see UNECE document TRANS/SC.3/131, page 183 - * Pour les notes explicatives de ce tableau, voir le document de la CEE ONU TRANS/SC.3/131, page 185 - * Сноски к настоящей таблице приведены в документе ЕЭК ООН TRANS/SC.3/131, стр. 188

2 From inland waterways classification to identification of the existing and future network of inland navigation in Europe

The AGN Agreement was an initiative that was directly inspired by the concern among UNECE member countries about the state of inland waterway infrastructure in Europe. At the time of its signing, the use of inland waterways and navigation infrastructure was limited by the insufficient length of waterways of international importance, the highly fragmented nature of the European waterway network, the discrepancy between the routes of navigable waterways and cargo flow patterns and the limited reliability of traffic on some sections due to long breaks in navigation periods caused by low water levels, ice obstacles, lack of nighttime navigation, etc. (UNECE, 1996).

Given this context, the main purpose of the AGN Agreement was to promote inland water transport by developing a network of inland waterways with the following characteristics:

- Homogeneous, i.e. suitable for standard vessels, barges and convoys.
- Suitable for economical international transport including the operation of river-seagoing vessels.
- Integrated, allowing for the connection of different river basins by means of connecting canals and incorporating suitable coastal routes.
- Able to accommodate most important cargo flows, this condition being dependent on the sufficient density of the waterway network and on the development of the network in all European countries. (UNECE, ECE/TRANS/243, 2000)

It is important to underscore the essentially co-modal approach of the AGN Agreement, which belongs to the general framework of European agreements on infrastructure, including the European Agreement on Main International Traffic Arteries (AGR) of 1975, the European Agreement on Main International Railway Lines (AGC) of 1985 and the European Agreement on Important International Combined Transport Lines and Related Installations (AGTC) of 1991.[3]

The AGN Agreement established an international legal framework for coordinated planning of the development of the network of navigable waterways and ports of international importance, based on standard operational parameters. The agreement has three main components: first, the establishment of the network of navigable waterways of international importance (category E navigable waterways);[4] second, the commitment to guarantee that category E navigable waterways and ports meet the technical parameters and operational standards indicated in the Agreement;[5] and third, the commitment to ensure that national plans and bilateral or regional agreements allow to complete missing links and reduce bottlenecks in the network.[6]

[3] For more information, see http://www.unece.org/trans/conventn/legalinst.html.
[4] Article 1, paragraph 1.
[5] Article 2, paragraph 1.
[6] Article 2, paragraph 2.

The identification of the network of inland waterways of international importance was based on the following criteria:

- A determination of the minimum technical and operational criteria for navigable waterways and ports in the category E network (based on the ECMT/UNECE classification).
- Identification of category E navigable waterways and missing links between them, and identification of ports in the category E network.
- The numbering system for category E navigable waterways and the associated numbering system for ports.

The annexes to the AGN Agreement defined the technical and operational characteristics for the navigable waterways of category E, setting minimum navigability conditions for the European inland navigation network. Some exceptions to the newly adopted parameters were made for existing waterways, but stricter criteria were set for sections to be developed in the future. In addition, minimum characteristics for established for waterways suitable for combined transport and river-sea navigation (see table 1).

With the adoption of the AGN Agreement, UNECE published the Blue Book (UNECE, 1998), which represented the main mechanism for monitoring implementation of the Agreement and the development of the E waterway network. It contained detailed information on the parameters of the waterways, locks and ports comprising the category E network and also identified waterways suitable for transporting containers. The information included not only the actual values but also the potential values that could be achieved with modernization works. Lastly, the Blue Book contained lists of the limitations on the network in terms of:

- Basic bottlenecks (sections that do not meet the requirements of class IV),
- Strategic bottlenecks (sections that meet the requirements of class IV but need additional work to improve the structure of the network or increase the economic capacity of the waterway), and
- Missing links (sections needed to complete the network).

The AGN Agreement[7], together with the Blue Book[8], has been amended several times to update the list of navigable waterways and ports as Europe's river infrastructure has evolved. In 2012, UNECE built an online database with the information contained in the Blue Book.

[7] For detailed information on the amendments to the AGN Agreement, see http://www.unece.org/trans/main/sc3/sc3depnot.html.

[8] The first edition of the Blue Book was published in 1998, the first revised version in 2006, and the most recent version in 2012.

Table 2

Europe: Technical and operational parameters of the network of category E navigable waterways

	Main technical parameters	Operational parameters
Category E waterways	• Only waterways meeting the basic requirements of class IV and above are part of the E network. • Uniform class, draught and height under bridges should be ensured for the whole waterway or at least for substantial sections thereof. Where possible, the parameters of adjacent waterways should be similar. • Restrictions of draught (less than 2.5 m) and of minimum height under bridges (less than 5.25 m) are accepted only for existing waterways as an exception.[9] • Generally, the highest bridge clearance values should be ensured (5.25 m at a minimum, 7.00 m for waterways connecting seaports with the hinterland and used for container and river-sea traffic and 9.10 m for waterways connected with coastal routes). • Waterways are expected to carry a significant volume of container and ro-ro traffic should meet, at a minimum, the requirements of class Vb. • The minimum draught should be ensured during at least 240 days of the year (or for 60% of the total navigation period). • To be suitable for container transport, the waterway must be able to accommodate vessels with a width of 11.4 m and a length of 110 m with two or three layers of stacked containers, or a pushed convoy of 185 m. • New waterways should meet the requirements of class Vb and ensure a minimum draught of 2.80 m. • Improvements to existing waterways should result in at least class Va services.	1. Navigability should be ensured throughout the navigation period with the exception of: breaks due to severe climatic conditions (for fixed periods that are kept to a minimum), maintenance of locks and waterways (for fixed periods that are kept to a minimum). 2. No breaks will be admissible during low water periods. The minimum draught of 1.20 m should be ensured for the entire navigation period, or for waterways affected by severe climatic conditions, for 60% of the period. 3. Operating hours of locks, movable bridges and other infrastructure should allow for round-the-clock navigation (24 hours/day) on working days and reasonable hours on public holidays and weekends.
Category E ports	• The port should be situated along a category E waterway. • It should be capable of accommodating vessels or pushed convoys used in conformity with its class of waterway. • It should be connected with main roads and railway lines (preferably belonging to the AGR, AGC or AGTC networks). • Its cargo handling capacity should be at least 0.5 million tons per year. • It should offer suitable conditions for the development of a port industrial zone. • It should provide for the handling of standardized containers (with the exception of ports specialized in bulk cargo handling). • All the facilities necessary for usual operations in international traffic should be available. • Reception facilities for the disposal of waste generated on board ships should be available.	

Source: ECLAC Infrastructure Services Unit, on the basis of the AGN Agreement.

[9] One of the main European Waterways, the Rhine, has, over a large stretch, a restriction of less than 2,5m; but it is a very efficient waterway anyway. In practice, not only the restrictions are of importance, but also to what extent are the parameters over fulfilled. This may warrant a discussion.

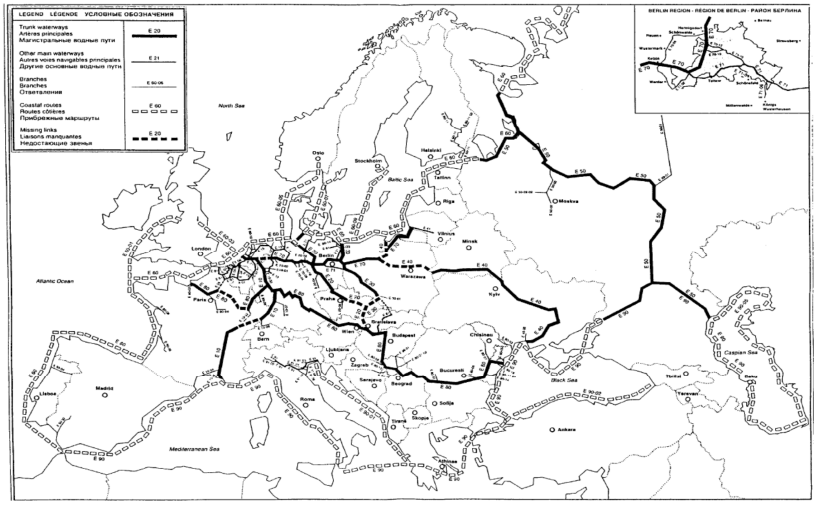
3 Use of the classification in the development of the inland waterway network and pan-European navigation system

The adoption of technical and operational parameters and the classification of inland waterways in Europe, achieved in the AGN Agreement, have brought greater visibility to the existing and potential network for inland navigation in the region. As will be shown in the following paragraphs, the AGN Agreement and the Blue Book have helped to determine the dimensions of the network, to identify missing links and to gauge the potential for developing waterways suitable for economic use. The Agreement has also been useful in determining the degree to which inland waterways have been or could be integrated with sea, road and rail corridors. Lastly, the Agreement has been used to determine the scope of application of certain technical and legal provisions for the transport of merchandise.

In the first place, with the signature of the AGN Agreement and the publication of the first Blue Book, it became possible to identify the full dimensions and main characteristics of the pan-European network of inland waterway navigation adapted for cargo transport purposes. It was determined that in 1997 the full length of the network was 27,711 km, of which some 5,775 km (approximately 21%) had missing links or corresponded to a class inferior to class IV. A schematic map was prepared of the category E network, identifying the main waterways in the region, their connections with coastal routes, and missing links (see map 1).

Map 1

European network of category E waterways, according to the AGN Agreement, 1997

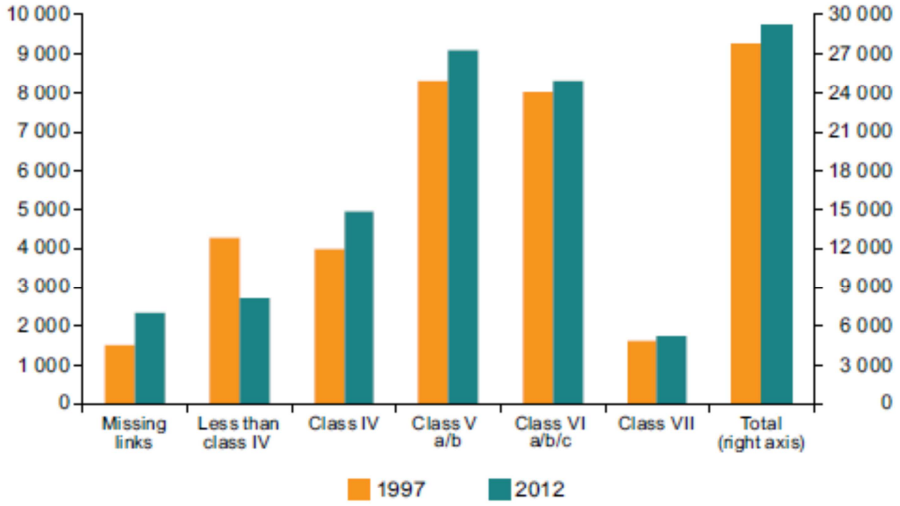


Source: (UNECE, ECE/TRANS/243, 2000).

The update of the AGN Agreement and the Blue Book has made it possible to monitor the development of the category E network over the years, identifying changes in both the overall size and composition of the network. That information reveals that there was a slight increase in the total length of the network in the period 1997-2012 (increase of 5%), a slight increase in waterways in class V (9%), class VI (3.5%) and class VII (8%) and a net decrease in the substandard portion of the network (decrease of 36%). At the same time, new missing links have been added; increasing by 50% in total length, and in 2012 this

group represented 8% of the total network. The number of category E ports in the network continued to grow between 1997 and 2012, from 391 to 439 ports (see figure 1).

Figure 1
Evolution of European network of category E inland waterways, 1997-2012



Source: ECLAC Infrastructure Services Unit, on the basis of data from the 1997 and 2012 editions of the Blue Book.

Thus, the implementation of the classification of navigable waterways in Europe has allowed for close monitoring of the evolution of the network at national and regional level, which since then has revealed a slight improvement in its condition and persistent challenges in terms of missing links. The generally positive evolution of the regional network of navigable waterways is the product of national and regional efforts to promote river transport and cannot be attributed solely to the AGN Agreement. However, it is true that the monitoring system has made it possible to bring considerably more visibility to the potential for inland waterway transport in the region while also pointing up major weaknesses and thereby facilitating the identification of strategic projects for national and regional infrastructure development plans. For example, the missing links in the network, identified in the Blue Book, have been addressed in several regional planning tools, such as the strategic documents prepared by the PLATINA platform in charge of implementing the first part of the European Union's NAIADES program (PLATINA, 2010).

Another positive outcome of the classification of navigable waterways in Europe was the identification of opportunities for integrating inland water transport with other modes of transport: from sea transport in coastal areas to road or railway transport. From the start, the AGN Agreement and the classification have facilitated links between inland and coastal navigation routes, since both coastal routes and seaports were part of the category E network identified in the AGN Agreement. In addition, the requirement that category E ports should have access to the main road and railway lines (preferably belonging to the AGR, AGC or AGTC networks) also promoted the integration of inland shipping corridors with the main overland road and rail transport corridors. Lastly, one year after the AGN

Agreement was signed, an additional protocol to the European Agreement on Important International Combined Transport Lines and Related Installations was signed, on combined transport on inland waterways. The protocol identifies the parts of the category E network defined in the AGN Agreement that are suitable for regular combined transport services (UNECE, ECE/TRANS/243, 2000).

Finally, it should also be noted that the delimitation of category E waterways has been useful in delimiting the scope of application of some safety and legal requirements concerning inland water transport operations. The example that best illustrates this is the European Agreement Concerning the International Carriage of Dangerous Goods (ADN Agreement) by Inland Waterways of 2000[10]. This agreement governs security regulations for the transport of dangerous goods and is only open to UNECE member countries with inland waterways (excluding coastal routes) that are part of the category E network. However, more importantly, although the agreement allows for the possibility that a contracting party may exempt certain national waterways from the agreement, it does not authorize such exemption in the case of waterways in the category E network. Consequently, a minimum level of safety is guaranteed in the transport of dangerous goods along the main inland waterways of Europe (UNECE, ECE/TRANS/243, 2000). Another more recent example is the Strasbourg Convention on the Limitation of Liability in Inland Navigation of 2012[11], which is the equivalent for inland navigation of the Convention on Limitation of Liability for Maritime Claims (LLMC). The Strasbourg Convention allows the owners of vessels to limit their liability by making predetermined contributions to a special fund set up according to criteria established in the Convention for the purpose of paying damages for harm caused by navigation accidents, with the condition that the owner of the vessel is not personally culpable for the harm in question. As in the case of the ADN Agreement, the Strasbourg Convention does not allow exemptions for waterways that are included in the category E network of the AGN Agreement (CCNR, 2012). In addition to identifying the existing and potential network of navigable waterways in Europe, the AGN Agreement has, therefore, also facilitated the establishment of a set of technical and legal regulations governing the transport of goods along all navigable waterways of international importance in Europe, contributing to a level of regional integration that goes beyond the member countries of the European Union.

The example of ECMT/UNECE classification shows some of the benefits of achieving and maintaining a regional inland waterways classification. It shows that it can be highly instrumental for the development and integration efforts of the region on linked and integrated into the efforts towards a more sustainable use and governance of inland navigation, as well as transport and logistics planning. The classification of an inland waterway as an immediate result defines its economic potential and regulates the use and risks associated to its use. Thus, it provides the users with a solid framework to develop their activities. At the same time the projection of changing the category of an inland waterway (or section of an inland waterway) to a higher category also defines the minimum requirements of that future inland shipping lane. In consequence any planning and investment calculations can be clearly determined as these will need to satisfy the minimum requirements set by the anticipated category.

[10] http://www.unece.org/fileadmin/DAM/trans/danger/publi/adn/agreement_text.pdf
[11] https://www.unece.org/fileadmin/DAM/trans/doc/2012/sc3wp3/ECE-TRANS-SC3-2012-inf04e.pdf

Moreover, in cases where projects can be defined by and checked against specific goals, and the interconnection between different modes in the transport system is becoming more standardized, promoting an integrated transport system, the access to funding from national and international agencies and as well as private sector should result easier, as the parameters are clearly set for all stakeholders.

These benefits were highlighted in another initiative on a common classification of inland waterways, this time in the Lower Mekong River System, which emphasized that the common classification would allow to:

- Make the information available as a guarantee for users that minimum dimensions will be respected;
- Inform the shipping and transport industry, determining IWT competitiveness by laying down maximum vessel sizes, affecting navigation costs;
- Ensure the orderly and efficient control and maintenance of waterways;
- Assist the authorities in planning and policy making by showing the missing links and bottlenecks that should be prioritized.

Finally, in case of the South American countries, a very significant and a even more direct benefit would be a link between waterway classification and international funding of development projects by the international development agencies, such as CAF and IADB. In this sense, the European experience with the development of the Trans-European Transport Network (TEN-T) and related to this the definition of a “Good Navigation Status” is another example, of how the navigation classification and access to financing can be directly linked.

Bearing these potential benefits in mind, the following section discusses the process and steps towards a common South American classification of inland waterways.

4 Towards a classification of inland waterways for South America: preliminary proposals

Navigable rivers form a natural network for communication and trade in South America. The South American system comprises a wide range of navigable rivers, from one of the largest watersheds in the world, the Amazon (Solimões) and the Paraguay-Paraná Rivers, to the smaller, less navigable rivers, which tend to be even more important for local communities and economies as they offer the only means of communication and accessibility in several regions of the continent (Bara Neto, Sánchez and Wilmsmeier, 2006).

In terms of volume, inland navigation is the third most important mode of inland transport for intraregional exports and imports, and the fourth in terms of value. The types of goods that are shipped by river are relatively bulky and low in value. In recent years, there has been an intriguing increase in the participation of inland water transport in international trade flows, by a factor of two in value terms between 2006 and 2012 (Wilmsmeier, 2013). However, in many cases, local and national flows largely exceed international flows (Bara Neto, Sánchez and Wilmsmeier, 2006).

ECLAC studies (Bara Neto, Sánchez and Wilmsmeier, 2006; Wilmsmeier, 2013) have documented the failure to tap the natural potential of river navigation in South America, in both economic and social terms, especially in regions where: (a) geography hinders the development of terrestrial infrastructure; and (b) river transport is the natural mode of transport for mass production. In these regions, governments should recognize that navigable rivers, as main arteries of transport, complement and in certain cases replace the roads and should thus receive treatment and attention on par with other modes of transport.

The European classification shows the practical impact and various uses of inland waterways classification not only for infrastructure development but for defining the basis regulatory framework (security provisions and delimitation of liability) for inland navigation in the region. In this sense, it is a powerful and dynamic tool for advancing public policies for the development of inland water transport. This type of tool could support and strengthen the various national and regional initiatives to promote river transport in South America. It could also support the establishment and application of standardized criteria in terms of the technical and operational characteristics of navigable waterways in the region.

At the same time, it must be acknowledged that there are limitations involved in transferring the European system of classification of navigable waterways to other regions in the world. Essentially, the technical criteria used in the ECMT/UNECE classification do not transfer, as such, to the case of South America. Using the horizontal dimensions of vessels as the main criteria came about because the European network primarily consists of channelized rivers and canals that do not typically experience major fluctuations in water level. Meanwhile, South America mostly has natural rivers with water levels that are in constant flux, so vertical parameters, especially draught, should have a more prominent role in any classification. Analyzing this issue in 1990, the PIANC experts have concluded that given the differences in the characteristics of navigable waterways and in the composition of river fleets in Europe, Asia, Africa and South America, it would be hard to establish a worldwide classification of navigable waterways, and the best hope would be to decide on some elements in common to enable comparisons and assessments across regions (PIANC, 1990).

Despite the limitations on any direct transfer of the European example to the South American continent, the experience of the former is an important point of reference for deciding on the basic elements of a regional classification of navigable waterways. Therefore, as a preliminary proposal for a South American classification, this Working Document proposes the following three basic elements:

- The objectives and requirements in terms of quality for the classification,
- The technical criteria for the classification, and
- The operational criteria for the classification, and monitoring mechanisms.

The issue of the institutional process and framework for adoption of the classification will be addressed in the section on conclusions in this Working Document.

(a) Objectives and quality criteria for the classification of inland waterways in South America

A South American classification of navigable inland waterways should achieve a double objective: to determine the actual capacity of the regional network of navigable waterways and to note/monitor its potential development.

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 America;
- 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:

- 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 the operation of sea-going vessels and the integration with other modes of inland transport.
- Sustainable: Both in terms of a more sustainable use of inland navigation and a sustainability of the class over time.

This last element was not highlighted in the ECMT/UNECE classification and the South American classification can establish a strong link between sustainable waterway development and classification. It is very important that this link is well understood on all levels of decision preparation, making and execution in order to class the waterways sustainable not only in terms of ecological aspects but also in terms of ensuring that the class can be maintained over time.

In terms of its general quality, the classification should be:

- Based on the specific conditions of navigable waterways in South America and the existing and future fleet of the region's countries.
- Able to be applied to the widest possible area of South America;
- Able to adapt to future developments in the technology of inland navigation.
- Able to incorporate waterways of diverse characteristics, given the important social and economic function of some sections at the local level.
- Sufficiently dynamic and flexible to accommodate the diversity of navigation conditions related to hydrography and climate.

As a final outcome of the classification, two basic components, similar to that of the UNECE/CEMT classification, are proposed: *division into categories*, based on economic importance, and *division into classes*, based on more detailed navigability conditions.

At the same time, given the importance of river navigation for local development in many countries of the region, it would be useful to have three and not two main categories, adding a special category for waterways of local importance. The introduction of the category of navigable rivers of local importance recognizes a very important component of South American inland navigation —the river transport of people and the transit of traditional and artisanal traffic and small craft. This was not part of the original ECMT/UNECE classification. However, in 2004, UNECE Resolution 31 was amended to incorporate three additional classes (RA, RB, RC and RD) based on the general dimensions of vessels for recreational navigation (UNECE, 2004). In the case of South America the local dimension of inland shipping is of significant social and economic importance, especially in regions where the provision of land infrastructure is complicated by geography. In these regions navigable rivers are the only transport routes and fulfill the role of highways and roads providing basic accessibility.

Accordingly, **the following basic structure for the classification** is proposed:

1) Division into **three main categories**:

   a) Navigable waterways of local importance: waterways where the transport of goods or people is significant for local development;

   b) Major waterways of national importance: waterways where the transport of goods or people is significant for national development;

   c) Major waterways of regional importance: waterways that meet minimum technical and operational criteria for international traffic, the equivalent of network of category E inland waterways created in Europe.

2) **Subdivision into classes based on technical parameters,** harmonized at the regional level.

Confirming the objectives, the quality requirements and the expected results of the classification should be a first step in developing a South American classification of navigable waterways, prior to which the technical and operational criteria cannot be properly selected.

(b) Technical criteria for the classification

Although the technical criteria from the pan-European classification cannot be directly transferred to South America, the ECMT/UNECE example suggests an inventory of possible classification criteria, as well as the influence of some economic factors, such as the characteristics of the existing and potential fleet in the region and its technological evolution. Consequently, the selection of criteria for a South American classification should emerge from an analysis of various specific elements, including the current state of navigable waterways and hydrographic conditions (especially draught), existing river vessels and vessels being built, technologies in use (ro-ro systems, etc.), the interconnections with maritime and coastal routes and with seaports, transport policies and demand and the social function of some navigable waterways in terms of accessibility.

Although determining the exact criteria will be a medium-term process, involving technical discussions between the South American experts, it is possible to anticipate **a certain direction in the selection of technical criteria**, based on the recommendations of international experts and the national classification experiences of some countries in the region, such as Brazil.

Box 1

The existing classification in Brazil divides the country's main rivers into four classes based on minimum depth. There is also a classification of major waterways divided into five groups based on gabarits (dimensions of river-going vessels), proposed in the 1989 National Plan for Navigable Inland Waterways. A new classification is presently being considered that combines the two elements.

(a) **Classification based on minimum depth**

Class	Minimum depth	Guaranteed
A	more than 2.10 m	90% of the time
B	between 1.30 m and 2.10 m	90% of the time
C	between 0.80 m and 1.30 m	90% of the time
D	less than 0.80 m	Only during high-water periods

(b) **Classification based on gabarits (National Plan for Navigable Inland Waterways, 1989)**

Gabarit	Length (m)	Beam (m)	Draught (m)	Mast (m)	Comments
I					Maritime and coastal navigation
II	210	32	2,5	15	
III	160	16	2	10	
IV	110	11	1.5	7	
V					Waterways, restricted or of local importance

Classification of navigable waterways in Brazil

Source: DNIT, 2016.

Essentially, the depth or draught criterion should carry significant importance in the final classification inasmuch as it is one of the most important limitations for navigation at present. The draught limitation was also an important issue for the European inland navigation. For instance, on the river Rhine (the most highly used waterway in Europe), the depth varies from 2.80 m to 4.00 m and more. Before departure, shippers make inquiries about the current water level and load their vessel subsequently. The UNECE/ECMT '92 Classification specifies that the class of a waterway is determined by the horizontal dimensions of the vessels or pushed units, especially by their beam, but the draught of an inland waterway must also be specified with reference to local conditions. Thus, the draught of the vessel (although indicative) is taken as parameter. Of course, the depth of the waterway should be larger than the draught of the vessel as it needs water below the keel (in canal situations 30 – 40% of the draught), for which the waterway authority takes care.

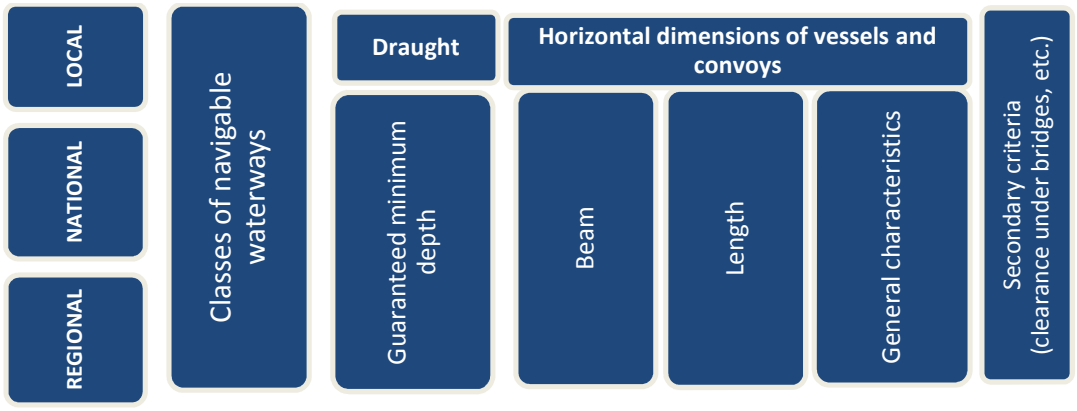
An important variable to confirm in this regard, beyond the values for each specific class, will be the duration of the minimum time for which the indicated depth is guaranteed (90% of the time, as in the

case of the Brazilian classification, 240 days or 60% of the navigation period as in the AGN Agreement or other options).

This criterion should be supplemented by the criteria related to the horizontal dimensions of the fleet in order to determine the final class of the waterway. The selection of these criteria will require an analysis and a typology of the fleets of river-going vessels in the countries of South America, in order to determine the dimensions of vessels and convoys actually deployed in the region.

Thus, the proposal is to combine the draught criteria, based on the minimum depths guaranteed for a certain amount of the navigation period, with the criteria related to the horizontal dimensions (length and beam) of typical vessels in the South American fleet. The approach is summarized in chart 2**.**

Chart 2
Technical criteria for the South American classification of navigable waterways

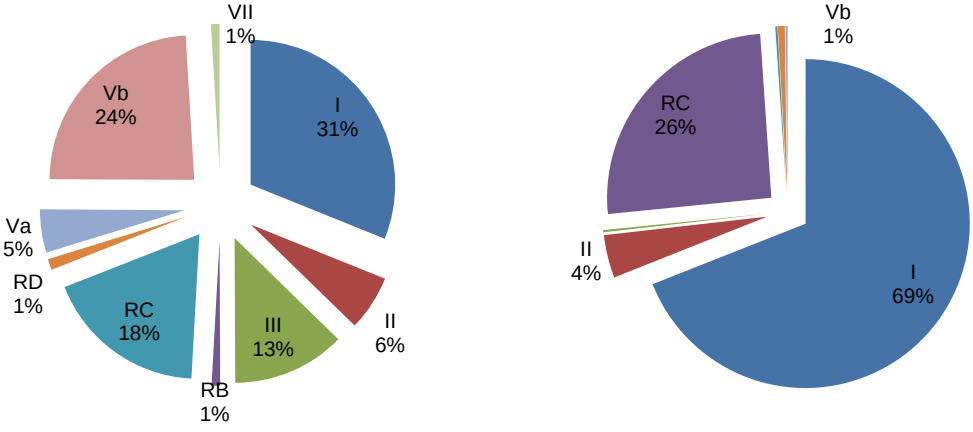


Source: ECLAC Infrastructure Services Unit, 2016.

For the subsequent selection of the horizontal and vertical dimensions of the fleet, it might be possible to use some elements of the European classification to achieve a certain degree of correspondence between the two classification systems. In order to enhance this correspondence, it could be considered to keep vessels with the same dimensions in the same class and indicate the differences in draught in another way, either by using multiple values for draught (like the CEMT ’92 classification) or using subclasses. However, use of that classification is likely to be very limited given that the available data on the river-going fleets in the region’s countries suggest a heavy concentration of the current fleet in classes RA, I, II, III and IV (see box 2).

Box 2

Classification using UNECE typology to inland shipping vessels in South America, 2016



Class	Length (m)	Beam (m)	Draught (m)	Capacity (T)
RA	5.5	2	0.50	
RB	9.5	3	1.00	
RC	15	4	1.50	
RD	15	4	2.10	
I	35	5	1.40	400
II	50	7.5	2.00	650
III	80	9	2.50	1000
IV	85	9.5	2.50	1500
Va	110	11.5	2.80	3000
Vb	185	11.4	4.50	6000
VIa	110	11.4	4.50	6000
VIc	280	34.2	4.50	18000
VII	285	34.2	10.00	27000
Vlb	140	15	3.90	12000

Source: ECLAC Infrastructure Services Unit, on the basis of data from SIGMAP (Ecuador) and ANTAQ (Brazil), 2016. UNECE classification adjusted to local context, data does not include convoys.

In this sense, a very important step in developing a classification will be to prepare a typology based on all the river-going fleets present in South American countries and based on this determining the most representative categories. A useful reference in this regard is the work on the calibration of the navigable waterways on the lower Mekong river, which combined the analysis of the characteristics of the waterway and to the "normal" size of vessel or integrated push or tow barge in order to calibrate the navigable waterways in Cambodia and Viet Nam into a classification standard.

(c) Operational criteria for the classification and monitoring mechanisms

Although a discussion of the technical criteria for the classes requires a specific analysis of the situation in South America, in the case of the operational criteria for navigable waterways, an initial proposal can already be prepared. Table 2 presents a preliminary list of the operational criteria that should be guaranteed for waterways in the region. Unlike the AGN Agreement, the plan in this case is to specify

minimum criteria for all waterways in the region with the strictest operational requirements on the sections of national and regional importance.

Table 3

Proposed operational criteria for navigable waterways in South America

Operational requirements	Local	National	Regional
1. Navigability ensured throughout the navigation period with the exception of: • Breaks due to severe climatic conditions resulting in low water discharge or other impediments to navigation (for fixed periods that are kept to a minimum). • Maintenance of locks and waterways (for fixed periods that are kept to a minimum).	Recommended	Required	Required
2. No breaks will be admissible during low water periods. Minimum draught ensured for the entire navigation period, or for waterways affected by severe climatic conditions, for 60% of the period.	Recommended	Required	Required
3. Navigation 24 hours/day on working days and reasonable hours on public holidays and weekends.	Recommended	Required	Required
4. Intermodal connections: with seaports and railway, airport and road corridors.	Recommended	Required	Required
5. Regular navigation services.	Recommended	Recommended	Required
6. Harmonized signage and signals.	Recommended	Required	Required
7. Navigation maps and river information system.	Recommended	Recommended	Required

Source: ECLAC Infrastructure Services Unit, 2016.

Based on the pan-European experience, the proposal is also to supplement the classification as such with a factual repository of information on the current state of waterways in the region, that is, the Blue Book equivalent for South America. This repository should contain the technical and operational parameters for waterways of national and regional importance along with a list of missing links and bottlenecks and should be updated on a regular basis. Table 3 below presents a preliminary example of the information that the inventory could contain.

Table 4

Navigation conditions for the El Coca – Peruvian border section of the Napo River

				Technical parameters				Operational parameters		Observations	Special periods
ID	**Section**	**Classification**	**Length (km)**	**Draught (m)**	**Height (bridges)**	**Beam (m)**	**Length (m)**	**Operating hours**	**Type of vessel**		**High water**
SA-XX-01	El Coca - Puerto Providencia	TBD	60	1	No restrictions	10	40	between 06:00 and 18:30, 365 days/year	Vessels or pushed convoys		
SA-XX-02	Puerto Providencia – Peruvian border	X (convoy) throughout the year except indicated places	150	1.2	No restrictions	12	Pusher boat plus barge (50 m)	between 06:00 and 18:30, 365 days/year	Vessels or pushed convoys (convoy: pusher boat plus barge)	Critical points with requirements for continuous verification of draught due to branching of navigation channel	Navigation possible up to 2.2 m of draught under certain climate conditions. Not guaranteed, and dependent on approval of departure and/or arrival by authorities.

Source: ECLAC Infrastructure Services Unit.

5 Conclusions: Institutional framework and next steps

This Working Document proposes the elements needed to initiate a discussion on a South American classification of navigable inland waterways. However, developing, adopting and maintaining a classification of inland waterways is a long and continuous process that must be built in to national and regional policymaking for inland navigation and requires an adequate institutional framework from the start.

This institutional framework must allow for technical work to be carried out in close collaboration with decision makers in order to define the overall objectives of the classification and ensure that it is properly applied, maintained and used in investment decisions (on infrastructure and navigable waterways), in order to strengthen the efforts currently being made by the various countries in the region to formulate specific policies on inland navigation (Ecuador), master plans (Colombia), bilateral agreements (Brazil and Ecuador) and regulatory frameworks (Paraguay).

Beyond national efforts, the classification process must be incorporated into the framework of integration initiatives. An analysis of the European experience begs the question as to whether it is really necessary to formalize the classification system as a legal instrument, such as the AGN Agreement, given the political and legal costs involved in signing and maintaining an international agreement. One possible alternative is to fit the classification into an existing regional integration framework that could adopt it and take responsibility for update and monitoring mechanisms. As part of activities to monitor the development of the network, in addition to looking at purely technical parameters, a review of investment pattern in waterways infrastructure and fleets should be part of a more comprehensive analysis of the situation.

Therefore, ECLAC, as the regional commission of the United Nations working on sustainable development and regional integration, with a long track record of analytical and field work in maritime and land transport and economic infrastructure issues, and PIANC, a leading global association on development and maintenance of ports, waterways and coastal areas, propose to create a working group that facilitates the regional effort to develop, adopt and maintain a South American classification of navigable inland waterways.

The preliminary terms of reference of this Working Group would include:

- Provide a forum for initial technical meetings between South American experts, including also international experts, on the future inland waterways classification for South America;
- Collect information and data on inland waterways characteristics, inland fleet, intensity of traffic and other relevant factors for the elaboration of technical and operation parameters, harmonized at the regional level;
- Based on the initial proposals of this working paper, formulate an advanced draft of the technical and operation parameters for the classification and present the preliminary results of such classification for the (selected) countries of the region;
- Elaborate a proposal on the regional mechanism for classification implementation and maintenance.

To have meaningful results, this initiative will require:

- The active participation of the region's countries in preparing the methodology and applying the classification, as well as developing the various monitoring instruments, such as the inventory of waterways proposed above.
- Close collaboration with regional and global industry, given their experience with harmonizing parameters for river infrastructure and fleets and for insight in the potential cargo for IWT.
- Support from the regional integration mechanisms: Given its nature and active portfolio of inland waterways infrastructure projects, the most appropriate forum might be the UNASUR/COSIPLAN/IIRSA initiative, which seeks to improve interconnection and transit between the countries of South America.

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