



Smart Shipping on Inland Waterways

Terms of Reference

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1. Introduction

When thinking about tomorrow's mobility, one cannot ignore the innovations in the field of autonomous transportation. Autonomous driving and truck platooning are expected to reduce the costs of road transport and to increase its flexibility, while new rail corridors and the next generation of freight trains are expected to lower the technical and organizational barriers for rail freight. It is therefore of paramount importance that technologically innovative initiatives like smart shipping are in the focus of the IWT sector to improve efficiency, safety and sustainability. These improvements will also counter the potentially competitive advantage provided by technological evolutions in the other transport modes. When smart shipping is actually used, this will have an impact. Therefore, we need to establish a framework that allows the deployment of smart shipping in a safe and reliable way.

PIANC is aware that Smart developments in other transport modes have been reaching a mature status (as train and automobile). So, this WG will refer the methodologies implemented in these modes and will focus on smart shipping with a specific interest on the waterborne infrastructure.

1.1 What is meant by smart shipping?

Smart shipping is a widely used term, with several definitions available. In our view, from the perspective of infrastructure providers and traffic managers, smart shipping is broader than just an autonomous vessel. We propose a definition which contains four components:

- Smart Vessel: Smart vessels are vessels that are highly automated and are therefore equipped with automated systems using (external) data to optimize the key functions of the vessel. (Navigation, real-time planning, fuel consumption management, etc.)
- Smart Traffic management and infrastructure: The management of the inland waterways takes into account real-time (external) data coming from ships, infrastructure and third parties. Also the existing operational tasks of bridge/lock operators, traffic planners, vessel traffic service/traffic guidance are expected to change.

- Smart travel and transport: The interaction between ships and third logistic parties are evolved into a smart, smooth and flexible process. This consists of two parts. First is the simplification and international integration of procedures that users of the waterways need to follow. Second, next to smart navigation, smart cargo handling should be developed too.
- Smart Regulation and facilitation: interaction between the ship and third (government) parties for regulation or inspection.

1.2 Why is there the need for establishing a PIANC working group on this topic at this specific moment?

The development of smart vessels and other smart solutions within the inland shipping sector will be of increasing importance in the upcoming years. The technology has reached a point that it can enable vessels to perform more tasks than before. Besides that, smart shipping will lead to a fundamental change in the tasks of the different stakeholders, like skippers and waterway authorities. It may seem early to start the discussions on smart shipping. There aren't any autonomous vessels sailing the inland waterways yet but the first experiences with drones and automated small vessels are executed and commercial use of inland cargo vessels is planned for 2020 by some stakeholders. One thing is sure, there is a lot of development coming our way which will impact the sector. That's the reason why it is a good idea to establish a PIANC working group now. By being at the foreground from the beginning on, the whole sector will be able to give direction to the developments. For example, the current technological evolution needs to include much more than only the automation of the vessels itself. While the concept of smart shipping technology has been researched and undergone a rapid development, research regarding the impact of this developments on the physical infrastructure and on traffic management seem to be receiving less attention. They are, however, as important. Also of great importance is to view the developments of smart shipping as part of the supply chain (e.g. cargo handling at ports).

Infrastructure providers, traffic managers and the IW-transport sector should be pro-active and have to invest in knowledge development and to follow the developments regarding the smart infrastructure and be prepared for what is to come, especially in the context of the current developments regarding smart shipping.

Local based developments are ongoing on this subject. It is the right time to start sharing experience and knowledge with all parties that take part in these developments, and use this experience and knowledge to develop a cross border conceptual framework. The PIANC community is the platform to bring all involved parties (infrastructure providers, traffic managers, fleet owners, skippers, logistic parties, research institutes, system providers, governments, etc.) together.

The PIANC working group will focus on smart shipping at inland waterways and look at the developments from the perspective of infrastructure providers and traffic managers of inland waterways to stimulate and maximize the deployment of smart shipping.

We know Smart Shipping is on the agenda of several other organizations. As far as we know, the focus of these working groups is mainly on maritime and coastal vessels, with the focus on the smart ship itself, and less focus on interaction of the vessels with the infrastructure and the roles and task of the stakeholders. A PIANC working group focusing on the impact of smart shipping on the users, processes and infrastructure of the inland waterways will be of added value.

Sharing knowledge should lead to common understanding of products already available on the market and the current state of developments. Based on results from best practices, the working group can be used to determine which factors are essential to further development of smart shipping, with attention being paid to aspects that are important to waterway managers and authorities (for example: developments should not have a negative impact on safety or sustainability). As a result, it should be possible to determine if there are factors which are important to the development of smart shipping, which are not picked up by individual parties. This could lead to research areas where further research questions can be formulated. As a result, the PIANC community should also consider which roles different parties can have within the development of smart shipping. For example, one can think about which parties could become data suppliers.

Furthermore, smart shipping is an excellent subject to try to broaden the PIANC network with research institutions, ship owners and others involved in the smart shipping field.

2. The expected impact of smart shipping

Developments on smart vessels and smart shipping are widespread and diffused. Therefore, the possible impact of smart shipping on for example safety, sustainability and competitiveness of the sector are still under discussion. Nevertheless, some recent studies on the general impact of smart shipping (see Annex A) show that smart shipping has a potential positive influence on the efficiency, safety, sustainability and competitiveness of inland shipping. Although these effects are strongly depending on for example the level of automation that is reached.

3. Task of the working group

3.1. Scope

This WG will focus on inland waterway transport.

Related to the definition given in this document, this WG will focus on:

- Smart traffic: specifically focusing on the developments which interact with infrastructure or influence the role of the waterway manager related to infrastructure and traffic management. By following these developments, it becomes possible to have a discussion within the sector about the roles each stakeholder could take within the development of smart vessels, for example related to data provision.
- Smart regulations and facilitation: the related regulations concerning smart traffic and vessels will be analyzed. The WG will review the various regulations that exist, and identify "severe constraints" that may act against the implementation of Smart (autonomous) navigation. WG should refer to the initiatives with "Testing areas" where Smart vessels can be used and are allowed (See annex)

Thereby looking at the developments from the perspective of the infrastructure providers and traffic managers considering the view of the logistic sector and the individual skipper. Developments in other transport modes, like road, coastal and maritime transport will be used to learn from.

This working group will build upon the knowledge and experiences that are gained in earlier working group on for example RIS and E-navigation. The results from the working group could be input for other working groups within Incom.

3.2. Tasks

The main task of this working group is to come to common understanding of smart shipping, its possibilities, and its influence on tasks of the waterway authority like lock operation and vessel traffic management and roles.

The approach used by the members of the workgroup will consist of several steps:

1. Set up of a detailed work program, further detailing of scope, task and responsibilities, planning and deliverables and milestones, considered the work fulfilled by existing PIANC working groups and other international initiatives.
2. Inventory of existing developments, pilots, projects, communities and research. A first brief overview of known initiatives is given in appendix A.
3. Desk Research and Study, during which team members collect, analyze and consolidate the current available information through literature research and best practices (including communities).
4. Based on the results of step 1 an overall agreement on the following topics will be made
 - a. common understanding of terms and definitions
 - b. first conclusions on for example benefits, legal issues, roles and tasks, information needs, no regret solutions, ...
 - c. identification of (research) gaps/questions
5. Proposals for a follow-up, also considering the need of this working group and in case it is decided to go on in what way the working group should continue. This could be setting up a permanent working group, a new working group or leaving additional work to other players or organizations. These proposals are based on the results of this working group.

3.3 Suggested final products

Proposed results:

1. A report on the conclusions of the desk research;
2. An overview of terms and definitions;
3. An overview of the first conclusions;
4. An overview of the identified research gaps;
5. An overview of the relevant scenarios including agreed research questions for the next phase. (and if applicable indication of other working groups which should deal with the questions.)

4. Recommended Members

International cooperation is required to support smart shipping development and implementation.

Recommended members are experts from the IW transport sector, infrastructure providers, traffic managers of inland waterways, research institutes, universities, consultants and other international organizations that have i.a. technical expertise on Inland Waterways such as CCNR. Experience is needed on the following topics:

- Inland Waterways transport sector;
- infrastructure management;
- traffic management;
- logistics;
- information technology (the use of computers to store, retrieve, transmit and manipulate data, or information);
- operational technology (the application of computers to monitor or alter the physical state of a system, navigation support systems);
- emerging technologies (Internet of Things, Artificial Intelligence and Big Data)

- sensor technology;
- telecommunication (developments, capacity, reliability, availability, ...).

There is a risk that not all the desired experts are able to contribute to this working group. Although several countries have already build up a broad coalition of parties working together on this topic, arties within these coalitions are expected to be easier convinced of the added value of a contribution to this working group.

If this is not the case, stakeholders can be contacted via already existing national or international already existing platforms and communities. In this way, there input can be used without actively contributing to the working group.

5. Relevance for Countries in Transition

As stated before, smart shipping is a new development on Inland waters. There aren't any autonomous vessel sailing these waterways yet, so all countries seems to be in transition. A lot of developments are coming our way. To come to a common understanding of smart shipping, to share experiences within countries and to discuss the possible impact on the infrastructure and traffic management tasks is of interest of all countries in transition.

6. Working with Nature

The WG will raise the potential impacts of Smart Technologies on the environment, safety and specifically on the sustainability of the proposed development (with links to the 17 SDG EU targets).