Use of ITS technologies for multimodal transport operations – River Information Services (RIS) transport logistics services

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Abstract

Interoperable and interconnected solutions for the next generation of multimodal transport management and information systems are the ultimate objectives of both the European transport logistics operators and of the European Commission. In the field of Inland Navigation River Information Services (RIS) is the corresponding Intelligent Transport System (ITS) primarily addressing administrative services. However, traffic information can also generate benefits for commercial stakeholders of the European transport and logistics sector by improving transport planning and management processes along multimodal transport chains.

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1. Introduction

Europe’s freight transport system has much room for improvement. Congestion, capacity problems and delays affect mobility and economic competitiveness and are detrimental to the environment and quality of life. The EU has committed itself to pursue the goal of shifting transport to less energy-intensive, cleaner and safer transport modes. Inland waterway transport is an obvious choice to play a more prominent role in reaching these targets. Together with rail and short sea shipping, inland waterway transport can contribute to the sustainability of the transport system. In the context of the inland

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navigation market, the European Commission aims at promoting and strengthening the competitive position of inland waterway transport, in particular by enhancing its integration into multimodal supply chains [1].

The European inland waterways offer a 42,000 km congestion-free network connecting cities across European territories and half this network is accessible to 1,000 tonnes vessels and more. The inland waterways form a particularly dense network; this especially in North-West Europe where main waterways are essential to the competitiveness of some major sea ports, providing a seamless network for inland transportation. Small waterways are important for regional transport but also have a feeder function to the main network. Inland waterway transport almost always works in combination with other means of transport. A network of multimodal terminals offers dedicated and/or regular services provide connections to other modes of transport, such as road, rail or maritime traffic [6].

The average modal share (in tonne-kilometers) of Inland Waterway Transport (IWT) within the EU-25 territory accounts about 6%. In regions with major European sea ports IWT holds a significant higher usage, like in the Netherlands, where ca. 44% of all cargo transports are executed on inland waters. An increase in inland navigation can lead to significant transport cost reductions. The availability of low-cost inland waterway transport services proves to be a decisive location factor for European industry. It significantly contributes to the preservation of Europe’s industrial employment [1] [3].

**Nomenclature**

| Acronym | Description |
|---------|-------------|
| ERTMS | European Railway Traffic Management System |
| ETA | Estimated Time of Arrival |
| ICT | Information and Communication Technologies |
| IN | Inland Navigation |
| IT | Information Technology |
| ITS | Intelligent Transport Systems |
| IWT | Inland Waterway Transport |
| RIS | River Information Services |
| RISING | River Information Services for Transport & Logistics (EU project) |
| RISTLS | River Information Services Transport Logistics Services |
| SESAR | Single European Sky ATM Research |
| SSN | SafeSeaNet |
| TAFTSI | Technical Specifications for Interoperability for Telematic Applications for Freight |
| VTS | Vessel Traffic Service |
2. Intelligent Transport Systems for all modes of transport

2.1. Traffic management and information services

Transport is fundamental for every economy and society. Transport enables economic growth and job creation: it must be sustainable in the light of the new challenges we face, like globalization, climate change, energy, EU enlargement and others. The use of Intelligent Transport Systems (ITS) contributes to this objective by providing real-time traffic management offering an increased transparency and efficiency inside mono-modal and along multimodal transport operations. In this manner the efficiency of transport can be increased with information systems, like ITS. This will also concern the deployment of smart systems mostly developed through EU-funded research, such as the air traffic management system of the future (SESAR), the European rail traffic management system (i.e. ERTMS) and rail information systems (i.e. TAF-TSI), maritime surveillance systems (SafeSeaNet et al.), River Information Services (RIS), intelligent transport systems (ITS), and interoperable interconnected solutions for the next generation of multimodal transport management and information systems [4].

2.2. River Information Services

River Information Services (RIS) are the information technology (IT) designed to optimize traffic and transport processes in inland navigation, i.e. to enhance a swift electronic data transfer between water and shore through in-advance and real-time exchange of information. RIS aims at streamlining the exchange of information between waterway operators and users. Since 2005, an EU framework directive provides minimum requirements to enable cross-border compatibility of national systems [8].

The concept of River Information Services (RIS), constituting one of the most substantial changes in the Inland WT sector during the last decades, is aimed at the harmonized implementation of information services in order to support traffic and transport management in inland navigation, including interfaces to other transport modes. The implementation of RIS will not only improve safety, security and efficiency in inland waterway traffic but enhance the efficiency of transport operations in general. The RIS concept is composed of advanced information services and functionalities which are supported by various technologies including the Internet, satellite positioning systems, electronic chart and display information systems and automatic identification systems [5].

The objectives of RIS are the:

- Enhancement of inland navigation safety in ports and rivers,
- Provision of local and regional traffic information for safety monitoring on tactical as well as strategic level,
- Enhanced the efficiency of inland navigation and an optimization of the resource management of the waterborne transport chain by enabling information exchange between vessels, lock and bridges, terminals and ports,
- Better use of the inland waterways - providing information on the status of fairways,
- Environmental protection - providing traffic and transport information for an efficient calamity abatement process. [8].

River Information Services addressing traffic and safety aspects cover [8]:

- Information on fairways to plan, execute and monitor voyages by boat masters and fleet managers (e.g. water levels, traffic signs, and opening hours of locks). The information systems contain geographical, hydrological and administrative data for this purpose,
- Traffic information services comprises both tactical traffic information (display of the present vessel characteristics and movements on a limited part of the waterway) and strategic traffic
information (display of vessels and their characteristics over a larger geographical area, including forecasts and analyses of future traffic situations),

- Traffic management aims at optimizing the use of the infrastructure as well as facilitating safe navigation. Currently, the VTS centers (vessel traffic service centers) are designed to improve the safety and efficiency of vessel traffic and to protect the environment,

- Calamity abatement services are responsible for registering vessels and their transport data at the beginning of a trip and updating the data during the voyage with the help of a ship reporting system. In case of an accident, the responsible authorities are capable of providing the data immediately to the rescue and emergency teams,

- Information for transport management includes estimated times of arrival (ETA) provided by boat masters and fleet managers based on fairway information making it possible to plan resources for port and terminal processes. Information on cargo and fleet management basically comprises two types of information: information on the vessels and the fleet and detailed information on the cargo transported,

- Statistics and customs services: the RIS improves and facilitates the collection of inland waterway statistical data in the Member States,

- Waterway charges and port dues: the travel data of the ship can be used to automatically calculate the charge and initiate the invoicing procedure.

3. River Information Services for transport logistics services (RIS TLS)

Due to the growing need for seamless information flows and exchanges between stakeholders in the Inland Navigation industry and between the Inland Navigation sector itself and other modes of transport, River Information Services (RIS) become a growing importance in the transport logistics industry too. While RIS traffic-related information address primarily safety aspects for public stakeholders, RIS transport-related information focus mainly on the efficiency for commercial users, like transport logistics companies making use of Inland Waterway Transport.

3.1. RIS Transport Logistics Services (RIS TLS) being developed

In the late 1990s, several countries worked on information systems for inland shipping. As their work was not very coordinated, continuation could have led to the implementation of different technologies in each country. European research, particularly that funded through EU research programmes, has played a very important role in harmonizing the development of RIS across all relevant countries. The policy development went hand in hand with European research. Research, demonstration and implementation activities have contributed to technology, organization and policy, and have helped to clear the obstacles to effective implementations of RIS [8]. Now, RIS is again a subject on research level, but for this time for investigating in different kind of requirements; meaning services for transport and logistics purposes.

RISING (RIS Services for Improving the Integration of Inland Waterway Transports into Intermodal Chains) is a project co-financed by the European Commission within the 7th Framework Programme for Research and Technological Development, which aims at identifying, integrating and further developing information services such as River Information Services (RIS) in order to efficiently support Inland Waterway Transport (IWT) and logistics operations, such as planning, execution and completion process phases. In contrast to other RIS projects, RISING focuses exclusively on the present and future needs of the European transport and logistics sector.

Inland Waterway Transport has become an integral part of the multimodal door-to-door transport chains. As such efficient transport infrastructure and Intelligent Transport Systems (ITS) will play an
important role in this evolving process. For that reason there is the need to exploit existing and identify new River Information Services (RIS) for almost all steps on Inland Waterway Transport-based processes in order to increase efficiency within this mode of transport, but also along multimodal cargo flows.

Fig. 1. RIS Transport Logistics Services along multimodal transport processes [9]
A typical process life cycle in the field of transport logistics starts with transport planning, before the physical transport itself can be executed and finally completed. The EU co-financed project RISING did investigate into these business processes by defining, developing and testing new RIS services supporting primarily the European transport logistics sector:

- **Voyage planning**: RIS information for voyage planning of Inland Waterway Transport (IWT) based operations via data provision on water levels and depth, IWT based berth availability and lock occupation,
- **Fleet management**: RIS information for fleet management – including unpropelled inland vessels – by identifying current position and status of operation,
- **Event management**: RIS information facilitating monitoring (tracking and tracing) of IWT based transport processes as well as value added services such as event management,
- **Port and Terminal management**: RIS information for inland ports and terminals by providing Estimated Time of Arrival (ETA) updates for e.g. transshipment operations, terminal resource management and pre- and post haulages.

### 3.2. Stakeholders and users of RIS Transport Logistics Services (RIS TLS)

In general River Information Services (RIS) support the planning and management of traffic and transport operations. They contribute to a more efficient and safer use of waterways, locks, bridges and terminals by optimising electronic data interchange and logistics operations. It is invaluable for waterway authorities in supporting traffic management tasks and dangerous goods monitoring, and will become of great use for commercial actors. RIS will lead to increased competitiveness and improved safety, and needs to be implemented and further developed in a coordinated way within the trans-European networks [1].

The actors of the European transport logistics sector are also the addressee of RIS Transport Logistics Services (RIS TLS), which can be clustered as following:

- inland navigation companies (i.e. inland vessel operator or fleet operators),
- inland hubs (i.e. inland port and terminal operators),
- logistics companies (i.e. logistics service providers). While inland navigation companies want to optimize their transport route and efficiency and have therefore interest in inland waterway infrastructure information (e.g. water levels, information from the authorities), inland ports want to optimize their transshipment handling and are asking therefore for more precise information services such as Transport and Execution Status services, same as logistics companies who have to manage and steer the entire logistics chain.

Taking the variety of all different stakeholders and their different interests into account also appropriate RIS TLS have to be offered for serving the specific requirement and needs of the European transport logistics operators making use of Inland Waterway Transport. Following, selected examples of RIS TLS will be presented and described [9].
Table 1. RIS Transport Logistics Services being developed (selected examples) [9]

| RIS Transport Logistics Services (RIS TLS) (selected examples) | Inland vessel and fleet operators | Inland ports and terminal operators | Logistics service providers |
|---------------------------------------------------------------|----------------------------------|-------------------------------------|----------------------------|
| RIS Transport and Execution Status Platform                   | X                                | X                                   | X                          |
| RIS Fleet Management Application                              | X                                |                                     | X                          |
| RIS Estimated Time of Arrival calculation service              | X                                | X                                   |                            |
| RIS Ports and Berth Management                                | X                                | X                                   |                            |
| Lock management services for transport and logistics          | X                                |                                     |                            |

RIS Transport and Execution Status Platform: For the cargo owners, or if outsourced the logistics service provider, and port and terminal operators it is of essential interest to follow the cargo all the time along the entire transport, which requires precise and actual information about the relevant inland vessels and unpropelled inland vessels (barges) in order to define the current location and status of the dedicated cargo unit.

RIS Fleet Management Application: Fleet managers and logistics service providers who want to monitor the movement of their vessels. They want to know the exact position and availability of their fleet. The RIS fleet management application supports the needs of fleet operators by providing a so-called Single Window RIS application and further integrating already existing systems and services to the fleet management application, such as existing RIS traffic services and information.

RIS Estimated Time of Arrival calculation service: Actual traffic information is of utmost importance for traffic management and controlling, but can also be used for transport logistics purposes. For instance, with regard to Estimated Time of Arrival (ETA) a shipping company relies to its proper information sources and its generated ETA calculations, which base normally on own algorithms. By using this new RIS Transport Logistics Service (RIS TLS) more precise information can be given to the fleet operators by receiving and considering also available actual traffic information for transport and logistics planning, such as water levels & prognosis, lock status information.

RIS Ports and Berth Management: Within RIS information also port and berth operations can be improved. The system includes port authorities into the RIS information chain as a data user and provider, taking into account their unique position in the transport chain as completely reliable and exhaustive source of all data on transhipped cargo and port operations. For these reasons, it is a valuable addition to RIS information to use the data available in inland ports for all time planning purposes focusing on an individual inland vessel and/ or certain cargo shipments.

Lock management services for transport and logistics: Actual and forecast information about traffic conditions are vital for all modes of transport. Regarding Inland Navigation also locks are part of the infrastructure, which influence the Inland Waterway Transport significantly. Actual traffic data are quite important for both the lock operators themselves and also for inland waterway and logistics users passing through these locks along their transport routes. In this manner, the provision of availability and status information of locks generated value added for the stakeholders from the transport and logistics sectors.
3.3. RIS Transport Logistics Services fostering eFreight

According to current European policy framework strategies information technology (IT) should be widely deployed to simplify administrative procedures for providing cargo tracking and tracing and optimizing schedules and traffic flows. The creation of an appropriate multimodal transport framework would allow the tracing of goods in real time, ensure intermodal liability and promote clean freight transport. The roll-out of systems such as RIS (River Information Services), ERTMS (European Rail Traffic Management System), TAF (Telematic Applications for rail Freight) and VTMIS (Vessel Traffic Management and Information Systems) bears witness to the progress made in other transport modes. In road transport, however, the deployment of Intelligent Transport Systems (ITS) in helping to better manage infrastructure. A cohesive deployment strategy for ITS could contribute significantly to material change in the logistics chain [4] [2].

The concept of the "Internet for cargo", known also under the term “eFreight”, denotes the vision of paperless freight transport processes where an electronic flow of information is linked to the physical flow of goods. e-Freight relates also to developments which are expected to lead in the future to “Intelligent Cargo”, meaning that goods will become self-context and location-aware as well as connected to a wide range of information services thus automating further the transportation management process [7].

![Diagram of Internet for the Cargo using ITS for optimizing transport logistics flows](image)

Fig. 2. Internet for the cargo using ITS for optimizing transport logistics flows

Today all traffic infrastructures are establishing their proper Intelligent Transport System (ITS) for their dedicated traffic networks. While inland navigation is implementing River Information Services (RIS) along European waterways, other traffic sectors are doing similar. Having in mind that these implementation processes have not been concluded yet. The interoperability of traffic ITS will contribute to the provision of seamless and efficient information flows across all modes of transport.

- For logistics planning activities actual and future (= prognosis) information about traffic conditions are essential to determine transport route and volumes. For instance, a multimodal logistics operator would need to have information about the road traffic at certain sections,
existing bottlenecks, actual accidents, working hours and capacities of planned transshipment hubs, inland water levels, lock status information and other information.

- For logistics management a seamless visibility of the multimodal processes is important. For instance, a multimodal logistics operator would need to have information about the current position and Estimated Time of Arrival (ETA) of its ordered vehicles (i.e. truck, inland vessel, maritime vessel, rail wagons) in order to follow its transported cargo.

In order to make cargo more intelligent and to establish a so-called “Internet for the cargo” all available Information and Communication Technologies (ICT) have to be used and integrated, covering both intelligent services from the public traffic sector such as Intelligent Transport Systems (ITS) and transport logistics applications (i.e. route planning software, tracking and tracing) from the commercial sectors. Regarding ITS, this means that all traffic sectors should offer their available ITS services and information, where needed for planning and managing comprehensive multimodal transport chains.

4. Conclusions

Interoperable and interconnected solutions for the next generation of multimodal transport management and information systems are the ultimate objective of both the European transport logistics operators and of the European Commission’s policies (e.g. White Paper, Europe 2020). In the field of Inland Navigation River Information Services (RIS) is the corresponding Intelligent Transport System (ITS), which primarily addresses administrative services (e.g. safety) for the responsible authorities of the inland waterways. But these traffic and transport information system can also provide benefits private entities, like stakeholders of the European transport logistics sector. In this manner, the assistance and support is not limited to public-driven obligations, which means that available ITS information and the related messages can be also used by commercial operators, such as logistics and multimodal enterprises in order to optimize their strategic and/ or operational business processes.

Therefore, new RIS services focusing on transport logistics (RIS Transport Logistics Service - RIS TLS) are currently under development or in pilot implementations. For instance, to support transport planning processes (i.e. water level services, inland navigation and lock status information and statistics) or transport execution processes with traffic information services (i.e. positioning based services, event management services, specific services for inland ports/ terminals). All these RIS TLS will support the integration of Inland Waterway Transport into multimodal transport logistics chains for achieving reliable, transparent, cost-efficient and environmentally-friendly transport flows in Europe. Intelligent Transport Systems, like RIS in the field of European Inland Navigation, will foster to the interoperability between the different modes of transport and their corresponding information systems and services.
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