TOWARDS A CLIMATE-NEUTRAL, RESILIENT AND INTELLIGENT SYNCHRO-MODAL AUTOMATED TRANSPORT IN 2050

A Common Framework for Multi-modal Data Sharing
Vision and Action Paper

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Executive Summary

In order to reach the ambitions of the European Green Deal, all transport modes need to collaborate to achieve **climate-neutral, resilient and intelligent synchro-modal automated transport in 2050.**

ONE GOAL	CLIMATE-NEUTRAL, RESILIENT, INTELLIGENT, AUTOMATED SYNCHROMODAL TRANSPORT IN 2050		
THREE DOMAINS	**SMART TRANSPORT** (Means of transport, Equipment, Communication, Infrastructure)	**SMART LOGISTICS** (Single Window, Data sharing, Traffic Management)	**SMART ADMIN** (Financial, Technical & Operational)
THREE HORIZONS OF INNOVATION			
DISRUPTIVE	• AUTONOMOUS	• AUTOMATED	• AUTOMATED
NEW	• AUTOMATED	• DIGITALISED	• DIGITALISED
INCREMENTAL	• MANUAL → SUPPORTED	• HUMAN → DIGITISED	• PAPER → DIGITISED
10 GUIDING PRINCIPLES	1. ENSURE A CROSS-MODAL APPROACH 2. INVEST IN BOTH INFOSTRUCTURE AND INFRASTRUCTURE 3. GUARANTEE RESILIENCE, SAFETY AND SECURITY OF THE DATA EXCHANGE 4. MONITOR DATA QUALITY 5. ENSURE TRANSPARANCY	6. ASSURE OPERATIONAL FEASIBILITY 7. CREATE A LEVEL PLAYING FIELD FOR SMALL PLAYERS 8. ENSURE SHARED BENEFITS OF DATA PROVISIONING 9. TECHNOLOGICAL NEUTRALITY 10. THINK GLOBAL	

In order to reach this goal INE, EFIP and De Vlaamse Waterweg propose a **Common Framework for multi-modal data sharing**. The common framework outlines a single goal, a structure (domains and horizons) and the guiding principles to achieve it.

The framework should function as the **guiding instrument for all future digital initiatives related to transport**. Additionally, the framework should bring the transport modes together and accelerate cooperation with other relevant sectors across Europe.

In order to guarantee successful implementation of the Common Framework a multi-modal data sharing **governance ecosystem**, a competent **coordinating body**, sufficient **funding** and coordinated, interrelated **regulatory actions** are necessary.

The next required stage should be to translate the Common Framework into EU policy initiatives such as the creation of the dataspaces, high-value datasets, the revision of the TEN-T regulation, the ITS and RIS directives, as well as the next steps of the eFTI regulation.

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1.   INTRODUCTION

As the European Commission is working on a strategy for sustainable and smart mobility, we envision a common framework for all transport modes that is guiding all digital transport actions by the European Commission. The purpose of this paper is to present such a 'Common Framework for multi-modal data sharing' in order to realise climate-neutral, resilient and intelligent synchro-modal automated transport by 2050. The framework focuses on digitalisation[1], but it is important to know that all initiatives related to digitalisation will only be successful if the underlying infrastructure also evolves or is taken into account[2].

The framework is presented by the European Federation of Inland Ports, Inland Navigation Europe and De Vlaamse Waterweg NV.

The first part of this paper explains the context and aims (2.1 Vision and 2.2 Objectives)followed by the Common Framework for multi-modal data sharing togetherwith its guiding principles (2.3). The second part of this paper describes the key factors for a successful implementation through EU policy initiatives to facilitate implementation across the transport modes (3.1).

This paper is based on the experience of the past twenty years working on digital development and deployment within different European projects and fora.

2.   THE COMMON FRAMEWORK FOR MULTIMODAL DATA SHARING

2.1.   VISION

Transport accounts for a quarter of the EU's greenhouse gas emissions and is growing. To achieve climate neutrality, a 90% reduction in transport emissions is needed by 2050[3]. Road, rail, aviation and waterborne transport will all have to contribute. In order to reach this goal, formulated in the European Green Deal, a comprehensive Strategy for Sustainable and Smart Mobility is in the making.

Every transport mode will need to commit in order to realise **climate-neutral, resilient and intelligent synchro-modal automated transport for both freight and passenger in 2050**. This consists of the following characteristics:

- **Resilient** means working towards a pandemic-proof system but it goes further in our opinion. It means that the transport system should be able to withstand or recover quickly from difficult conditions or from whatever impact is stressing an object: no matter what happens, the system has to be robust and trustworthy. Digitalisation is a way to withstand a pandemic, climate changes such as drought or flooding, reach cybersecurity, and so on.

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[1]**Digitisation** is the process of converting information from a psysical format into a digital one. When this process is leveraged to improve business processes, it is called **digitalisation**.

[2] In this paper, the terms 'infrastructure' and 'infostructure' are used. **Infrastructure** refers to the physical layer (ports, devices, means of transport,…), while **infostructure** is all about the data-layer (protocols, software,…). Both infrastructure and infostructure need to evolve to make interaction between infrastructure and infostructure possible and realise the Physical Internet. The goal is that the infrastructure can collect the data, that will be used by the infostructure in order to analyse a situation, calculate the optimal solution and in return will send it back to the infrastructure to allow automated transport.

[3]https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf p. 10.

- **Intelligent** means that the system is able to adapt to varying situations and past experience, thus enabling the most efficient transport flow taking into account multiple variables. An intelligent system allows optimisation of traffic management and network decisions based on different sets of data, for instance related to infrastructure, logistics, traffic, meteorology and hydromorphology. Physical objects will be mirrored by digital twins[4] that capture data from different ecosystems, for example by the infrastructure, and use this infostructure to predict the most efficient route, by means of artificial intelligence.
- **Synchro-modality** facilitates the most efficient transport: whenever there is something blocking a smooth flow in one transport mode, it should be possible to switch (manually/automatically) to another mode. Moreover, synchro-modality strengthens the resilience of the entire transport network: whenever something happens within one mode, another mode can take over.

> Single-modal:a journey within one mode – e.g. inland waterways, maritime, railways, roads, hyperloop, air, pipelines,…;
> Multi-modal: a journey that involves multiple modes of transport;
> Synchro-modal: the most efficient way to go from A to B (can be single- or multi-modal). The mode can change along the way.

- **Automated** implies that no human interaction is necessary. Information is collected through various digital objects and is brought together in a Digital Twin. By means of artificial intelligence, data is used in simulation or prediction tools that generate the most optimized solutions (e.g. traffic routes). Those data solutions are in return used to control physical objects. That is why physical objects must be smart in order for automated transport to work.

Intelligent synchro-modal automated transport is an essential enabler to achieve climate-neutrality. Digitalisation is an indispensable tool to make multi-modality less complex, more economically viable and easy-to-use. This is in line with the concept of the Physical Internet (PI), which means that the infrastructure and the carriers are smart and the infostructure is intelligent[5], Provided it is developed in an integrated way across the modes, digitalisation will help to achieve this modal shift goal and reduce the climate footprint. At the same time, digital solutions have to minimise their own.

2.2. OBJECTIVES

In order to achieve the goal of a climate-neutral, resilient and intelligent synchro-modal automated transport system, we have set out the following targets:

- ☑ In the period 2015-2020, we have laid out the fundamentals for Inland Navigation Corridor Management and Inland Port Information Systems in the framework of River Information Services (RIS), while other transport modes have carried out work in their respective field.

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[4]A **digital twin** is digital replica of a living or non-living physical entity. There is interaction between the physical reality and the digital replica: the digital twin receives data collected by the infrastructure, can make simulations or calculations and sends information back to the physical infrastructure).

[5]The Physical Internet refersto the combination of digital transportation networks that are deploying to replace analogue road networks. For a roadmap towards the Physical Internet, see also: http://www.etp-logistics.eu/wp-content/uploads/2020/11/Roadmap-to-Physical-Intenet-Executive-Version_Final.pdf

□ By 2030, all efforts will go to transforming Corridor and Port Management to a synchro-modal transport management system.
□ By 2040, the ambition is to build the 'physical Internet',
□ By 2050 Zero Emission synchro-modal transport should be a reality.

The ultimate goal is to boost efficiency and potential for new business opportunities. Digitalisation often focuses on eliminating the human factor in terms of eliminating errors or increasing efficiency. We however advocate putting people at centre stage without neglecting the impact the digital transformation on individuals. Digitalisation will help solve current and future labour shortages by the digital upskilling of workforce and creating attractive jobs for old and young in the logistics sector.

2.3. A COMMON FRAMEWORK

In order to realise climate-neutral synchro-modal transport, a common framework covering all modes is required consisting of Domains and Horizons. The Common Framework for multi-modal data sharing sets out the future: what to achieve(goal), how to achieve it (in three domains, over three horizons of innovations) and what to take into account in order to make it work (guiding principles). **The framework should be adhered to in all transport related digital regulatory initiatives.**

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Fig. 1.A Common Frameworkfor multimodal data sharing

2.3.1. Three domains

New trends and technologies need to be implemented in ways that facilitate the evolution towards synchro-modality and prevent modal isolation. These required innovations can be divided into three domains:

- **Smart Transport**: all initiatives to implement new technologies and innovative concepts concerning means of transport (autonomous or automated carriers), communication infrastructure necessary to make automation possible such as remote control,…
- **Smart Logistics**: all initiatives concerning traffic- and transport management, route- and voyage planning, data sharing, digitalised cargo handling.
- **Smart Admin**: all interaction with regulating bodies and governments, especially on financial, technical and safety issues. It implies optimisation and digitalisation of existing processes, especially by applying the reporting-only-once principle.

These three domains are interlocking and reinforce each other. Making infrastructure sufficiently smart so that it can be managed through an intelligent infostructure (software, etc.) while it complies with all necessary norms and standards.

2.3.2. Three Horizons for innovation

To each domain we apply the McKinsey's Three Horizons of Growth-model[6]. This model considers innovation as a continuous process.

- The **incremental horizon** focuses on the short term: the focus is on the core activities and on <u>continuous improvement</u>. It is about monitoring the foundations of the organisation that serve as a basis for further expansion and innovation.
- The **new horizon** focuses on the medium term: it is about developing <u>new technologies</u>. What is formulated as an ambition in the disruptive horizon translates into actions in this horizon.
- The **disruptive horizon** is about creating <u>totally new opportunities</u> that are virtually unthinkable today. The focus is on the long term.

All modes will need to work on those three horizons: this requires focus on continuous improvement of the current operational practices, while working on the foundations of disruptive innovation. The three horizons should also evolve in time – what is disruptive today, might be part of the incremental horizon within ten years.

2.3.3. Ten guiding principles

For every domain and horizon, the following guiding principles need to be taken into account:
1. **A cross-modal approach**: Synchro-modality is only viable if the different modes develop shared definitions, jointly define common standards and common goals. These standards and common rules for the processing of data should enable their utilisation between the modes allowing goods and passengers to move as seamlessly as possible. All this will contribute to sound data management and governance in the Common Framework for multimodal data sharing.
2. **Invest in both, i.e. infostructure and infrastructure**: in order to realise the Physical Internet (PI)[7], work must be done on a physical layer (infrastructure) as well as on the information layer (infostructure). This includes:

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[6]https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/enduring-ideas-the-three-horizons-of-growth#

[7]The Physical Internet refers to the combination of digital transportation networks that are deploying to replace analogue road networks. For a roadmap towards the Physical Internet, see also: http://www.etp-logistics.eu/wp-content/uploads/2020/11/Roadmap-to-Physical-Intenet-Executive-Version_Final.pdf

a. Diversifying and ensuring reliability as far as the connecting infrastructure is concerned. This will be done through investment in fast mobile broadband coverage, multi-modal hubs, efficient automated transshipment, automated and smart infrastructure (remote control), new concepts of carriers (green, small, autonomous, different and new cargos types)and performant communication technologies etc.

b. Reliability and maximum transparency are evenly important for infostructure: the information or data layer consists of technical (standards) and operational performant services (FIS, TIS, TM, ITL, …)[8].

Both layers require investment, that need to be coordinated across transport modes. The design of both infrastructure and infostructure must go hand in hand.

3. **Resilience, safety and security**: in order to accrue stakeholder buy-in, cybersecurity, data privacy and privacy-by-design need to be addressed. A common framework with shared commitments to safeguard resilience, safety and security, is a stronger guarantee for all involved parties.

4. **Data quality and reliability**: in order to make synchro-modality work, we need to assure the quality and reliability of data The data should be complete, accurate, on time, consistent, unique and valid (cf. six dimensions of data quality) and involve sound data management and governance.

5. **Transparency**: as pointed out in the European Strategy for Data, the value of data lies in its use and re-use. Only through clarity and transparency on the rules of data sharing, usage and access can trust be fostered in the digital transition.

6. **Operational feasibility:** initiatives cannot be theoretical or remain at an academic level, they should be realistic and feasible for practical operations.

7. **Level the playing field for small players:** Europe has an SME-economy and counts many small public entities. Nobody should be left behind. The transport of the future should be accessible to all players, not only the large ones.

8. **Shared benefits of data provisioning:** Actors hold the right to decide to share data following the norm of privacy-by-design. Ideally, they are encouraged to provision data. Therefore, it is important that not only the public actor should benefit from the information that is provided by the private actor. Structured data provisioning between public and private actors should be a win-win for all parties involved: in return for sharing its data. For instance, the private actor could gain from new business opportunities, process optimisation and better business insights.

9. **Technological neutrality** a future infrastructure and infostructure needs to support existing and tomorrow's data sharing technologies supporting high-volume modern standardised messages, such as EDIFACT and XML message to emerging publish/subscribe API and blockchain based platform sharing in near real-time milestone events.

10. **Think global:** A clear, common strategy across transport modes is a must in collaboration with partners outside the European Union. Synchro-modal transport does not stop at the boundaries of the European Union. Nor do logistic chains. In order to make the European Union a strong trading party, we need to connect with global partners.

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[8] FIS = Fairway Information Services, TIS = Traffic Information Services, TM = Traffic Management, ITL = Information for Transport Logistics.

3. KEY FACTORS FOR SUCCESSFUL IMPLEMENTATION

Digitalisation takes place in a decentralised landscape with a broad variety of players (transport modes, logistics and mobility, other sectors, public and private entities, global, European and local actors etc.). The Common Framework for Multi-modal Data Sharing, as discussed before, is a tool to facilitate cooperation and coordination amid this diversity.

Against this common framework, definitions, goals, timelines, KPI's etc. can be made explicit for all modes. In the past many legal and project initiatives have been taken in different modes to pave the way for more sustainable transport. The Common Framework for multi-modal data sharing sets out the strategy: what to achieve(goal), how to achieve it (in three domains, over three horizons of innovations) and what to take into account in order to make it work (guiding principles).

Creating coming understanding and buy-in, implementing and deployment, monitoring and steering of the common framework requires sound EU governance including appropriate funding instruments and regulatory actions. As a matter of fact, successful governance guarantees the achievement of objectives.

3.1. GOVERNANCE

In order to implement the common strategy and framework across transport modes, geographical boundaries and industries, national and EU administrations, governance is one of the key success factors.

In line with the Data Governance Act, governance defines **what** roles, functions and processes to **establish a sustainable and trustful ecosystem** for data spaces that allows a data sharing infrastructure and infostructure where everything connects to everything in a decentralized environment, without a central authority.

A "federated" governance must make sure that the relevant guidelines and principles are in place and monitored to ensure that the objectives of a common framework are achieved, protecting the interests of all involved parties and technical neutrality through a common reference architecture.

- The definition of a virtual multi-modal data space leveraging existing standards, technologies and governance models that is necessary to provide a seamless and secure access to multiple data sources, such as for example infrastructure management, trade and logistics, meteorological and hydrological forecasts and central EU databases and repositories.
- The definition of methods and rules for secure data exchange and data sharing that are essential for a trusted business ecosystem that must
    - o accelerate the introduction of smart and innovative transport and logistics services
    - o to ensure and supervise the quality and reliability of data and its management,
    - o to guarantee privacy by design
- Define how solution components must comply through a certification process.

To ensure how many different actors work together towards shared goals, a European installed **coordinating governance body** is necessary to ensure that a basic data sharing infrastructure and infostructure facilitates climate-neutral and synchro-modal transport in cooperation with the global playing field. The coordinating governance body should do this in the following way:

- to follow up on the execution of the different action plans across modes and across member states by providing tools that provide insights for all parties involved (e.g. as an overview of all initiatives, projected on a timeline),
- to evaluate the level of progress of the different initiatives,
- to adjust action plans in order to stay on track,
- to link with the institutions that provide the legal framework in order to give evidence-based input for evaluations of regulatory initiatives,
- to communicate with all involved stakeholders to strengthen trust and to create a support base for the mental changes and investments that will be needed to attain the ambitions of the smart and sustainable transport strategy.

By monitoring and steering all actions, the coordinating governance body will:

- **create more transparency**: a clear overview of what different consortia, projects and initiatives address and how they interact.
- **raise efficiency** when all current and planned initiatives financed by the EU are checked according to the Common Framework for multi-modal data sharing and projected on a timeline, it would ensure that new projects build upon the outcome of prior projects (e.g. as is the case with RIS-COMEX), exploit synergies and fill the gaps.
- **increase added value:** efforts across modes, industries and authorities will be **beneficial** for every individual mode as well as for the entire transport sector to understand how difficulties that are being solved in one mode, might help unravel problems in another mode towards achieving synchro-modality.

3.2. FUNDING

To realize synchro-modal transport through deployment of interoperable, harmonized and cross-border infrastructure, the necessary funding under all relevant EU programs is a key success factor to stimulate Member States to participate in sustainable cross-border implementations, covered by a European installed governance.

Under Horizon Europe, funding should support new and disruptive innovation as a continuous process while aiming for market transfer. Next, deployment should be supported under the Recovery and Resilience Facility and the Connecting Europe Facility leaving appropriate room for synergies Transport, Digital and Energy where appropriate.

3.3. REGULATORY ACTIONS

Legislative frameworks ensure stability in a rapidly evolving world. The legislative process takes time and cannot always keep up with the pace of the digital evolution. Therefore, it should become more

agile, flexible and adapted to the digital world we live in. To allow innovation, we would need regulatory trial environments, including:

- living labs allowing temporary exemptions to foster experience building;
- translation of lessons learnt into regulation;
- more flexible and regular revision of regulation;
- fast-track certification covering appropriate safety requirements to enable swift commercialisation of industrial innovation.

The common framework provides a strong multi-modal approach to frame and support fast progressing developments.

The common framework, will only be successful if all new regulatory actions within that domain are assessed against the objectives and principles stated above.. This should especially concern, but not be limited to, the upcoming Revision of the TEN-T Guidelines Regulation and the Combined Transport Directive. These legislations are foundational for the European transport network, and should contribute towards realizing multimodal digital transport. As a result, all regulatory actions taken by the EU will be aligned with each other and with the Common Framework for multi-modal data sharing.

4.   CONCLUDING SUMMARY

In order to reach the ambitions of the Green Deal, all transport modes should work on achieving **climate-neutral, resilient and intelligent synchro-modal automated transport in 2050.**

In order to reach synchro-modality a **Common Framework for multi-modal digitalisation** is a necessary instrument. The common framework formulates a shared goal, structures the way in which the objective can be achieved and points out the necessary prerequisites. When further explored it should help to align operational goals, definitions, standards, KPI's, timelines, etc. It should bring modes together and accelerate cooperation with other relevant sectors across borders.

In order to guarantee a smooth implementation of the Common Framework a multi-modal data sharing, a competent **coordinating body**, sufficient **funding** and coordinated, interrelated **regulatory actions** are necessary.

The next step we will elaborate, is how this translates to EU policy initiatives such as the creation of the dataspaces, high-value data-sets, the revision of the TEN-T regulation, the ITS and RIS directives, as well as the next steps of the eFTI regulation.