Deliverable 6.2.1: Definition of scenarios for coordination of multimodal traffic management plans, at cross-border and urban/interurban integration

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ABBREVIATIONS

Acronym	**Description**
AI	Artificial Intelligence
API	Application Programming Interface
FENIX	Federated Network of Information eXchange in LogistiX
GA	Grant Agreement
ICT	Information and Communication Technologies
ITS	Intelligent Transportation Systems
JSON	JavaScript Object Notation
LoS	Level of Service
REST	Representational State Transfer
RTTI	Real Time Traffic Information
TM	Traffic Management
TM2.0	Traffic Management 2.0
TMC	Traffic Management Centre
TMS	Traffic Management System
US DOT	United States Department Of Transportation
V2X	Vehicle To Anything
VMS	Variable Message Signs
XML	Extended Mark-up Language

CONTRACTUAL REFERENCES

FENIX stands for "A European **FE**derated **N**etwork of **I**nformation e**X**change in Logistics". FENIX is an action 2018-EU-TM-0077-S under the Grant Agreement number INEA/CEF/TRAN/M2018/1793401 and the project duration is 36 months, effective from 01 April 2019 until 31 March 2022. It is a contract with the Innovation and Networks Executive Agency (INEA) under the powers delegated by the European Commission.

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1. INTRODUCTION

1.1 Purpose of the document

The work performed in task A6.2 aims at implementing measures for the reduction of congestion, increase of safety and improvement of the service offered by the FENIX network. FENIX network aims at integrating logistics operations and good transport with the objective of:

- improving information and data sharing in a cross-domain urban/interurban environment;
- improving cross-border and multimodal cooperation;
- fostering interoperability.

As stated during the FENIX GA, the A6.2 deliverable will be completed in two phases: a first one dedicated to the specification of the TM2.0 services in FENIX and a second phase dedicated to the implementation, deployment and validation. The first phase starts with the identification of scenarios for coordination of multimodal traffic management (TM) plans at cross-border and urban/interurban integration, which will allow the definition of measures to minimise perceived discontinuity in quality of information for traffic management services. It will also allow the identification of needs for data exchange due to envisaged measures for a) tactical (short-term, travel and congestion times etc.) and b) for long-term travel information (events forecast) for each stakeholder. Based on this, in the conclusion of the first phase, the requirements for implementation will be defined and the specification of the solution will be released.

The present document is the first one of the overall process for deliverable A6.2 and contains the analysis of business needs over the supply chain and the identification of scenarios for the coordination of traffic management (TM) plans and measures considering a multi-modal approach, at cross-border and in an urban/interurban environment.

The document starts by introducing the Business needs and the Methodology in Chapter 3, followed by the description of the scenarios along with their challenges for implementation. The documents end with Best Practices in Chapter 4 and Conclusions and next steps.

1.2 Connection to other deliverables

Deliverable A6.2 brings together the work contained within the various deliverables, as shown in the image below. There is also an interconnection with other activities in WP6, as well as with the Pilot Activities in the Port of Trieste, to be developed in WP4. According to the description of Activity 6.2 in the Grant Agreement, the work is focussed on the implementation of the Trieste Pilot. The Trieste Pilot is strongly connected with the work developed within Activity 6.2 and is characterised by all the elements needed for a system implementation, which will allow the service operation of the three identified scenarios in a real environment.

Inputs from other deliverables:

- Business needs from Trieste Pilot description (D2.2.1).

Outputs to other deliverables:

- Challenges to be considered when defining the data model (D6.2.3);
- Challenges to be considered when identifying System requirements (D6.2.4).

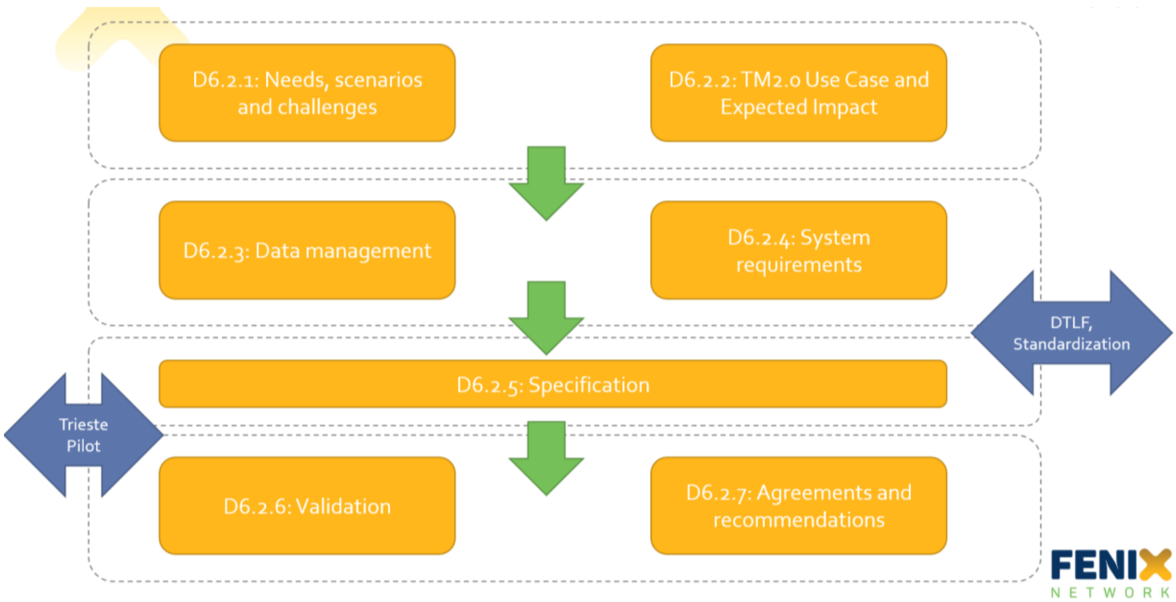

Figure 1 Interaction in Activity A6.2 and with other WPs

1.3 Methodology

The working process applied in this deliverable is explained and illustrated below:

1. A first phase was dedicated to a brief analysis (from literature, with particular focus on the TM2.0 experience) of Traffic Management across L&T corridors, focussing on the business needs of the various stakeholders.
2. The second phase was dedicated to an analysis of Best Practices regarding Traffic Management for urban-interurban, multi-modal and cross-border scenarios.
3. Based on the previous points, a high-level definition of the scenarios occurred in the third phase.
4. Last but not least, challenges regarding the implementation of Traffic Management services along L&T corridors were identified. This will be addressed when defining the Data model (D6.2.3) and System requirements (D6.2.4).

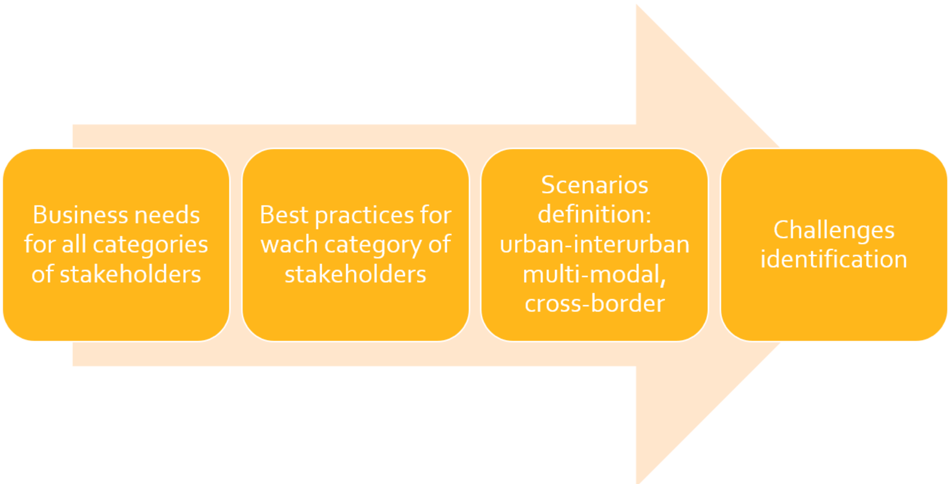

Figure 2 Methodology for D6.2.1

2. EXECUTIVE SUMMARY

Transport networks have become the major lifeline of modern societies, not only ensuring individual well-being, but fostering economic growth through fast and reliable transport activities. The fast growth of freight transport – driven to a large extent by economic decisions – contributes to growth and employment but also causes congestion, accidents, noise, pollution, increased reliance on imported fossil fuels, and energy loss. Infrastructure resources are limited and any disruption in the supply chain (i.e. energy) has necessarily a negative impact on the economy. As a result, fewer units of transport, such as vehicles, wagons and vessels should increase vehicles payloads and more focus should be put on multi-modal transport management. Moreover, there is a need for better integration of the mitigation measures related to increasing traffic to maintain a high-level network efficiency, especially bottlenecks and cross-border sections, and interfaces between short and long-distance networks.

The present document contains the analysis of business needs over the supply chain and the identification of scenarios for coordination of TM plans and measures. In addition, this document considers a multi-modal approach at cross-border and in an urban/interurban environment, as well as the challenges regarding the deployment of ITS solutions, therefore answering the above mentioned needs.

3. SCENARIOS DEFINITION

3.1 Business needs over the supply chain

A supply chain is defined as a set of three or more organisations directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to the final user, and supply chain management has to do with the strategic coordination within each domain but also cross-domain along the value chain for the purposes of improving the performance of the process of a whole.

The speed—or total transit time through the supply chain—will continue to be the necessary success factor, in addition to the minimisation of costs and preservation of service levels. Solutions like “slow streaming”, “night deliveries” or “speed limitations” are already in place in order to support the above mentioned indicators.

Along the supply chain, four categories of needs can be identified:

- The need of measuring, understanding, and responding to the role of intermodality of supply chains in a global marketplace.
- The need to be able respond to changing customer requirements regarding seamless and integrated coordination of freight movement in a flexible way, but still ensuring reliability.
- The need to be aware of current and future operational options and alternatives considering a multi-modal, cross-border, urban/interurban environment.
- The need to define constraints on and coordination of infrastructure capacity, including policy and regulatory issues, as well as better management of existing infrastructure.

By looking more in depth into the main elements involving road transport, the business needs along the supply chain could be summarised as follows:

1. Needs for the network optimisation:
    a. Management needs:
        i. load factor;
        ii. optimisation capacity;
        iii. need for horizontal collaboration.
    b. Data needs:
        i. information on loads;
        ii. information on locations;

iii. information on origins-destinations;
iv. corridors;
v. schedules.

2. Needs at hubs, ports, terminals
   a. Management needs:
      i. process control;
      ii. customs management;
      iii. capacity planning;
      iv. scheduling.
   b. Data needs:
      i. information on loads;
      ii. information on load plans;
      iii. ETA;
      iv. container locations;
      v. customs status.

As outlined in a 2015 report from the US DOT (1), the major components of logistics costs are transport, interest rates (on inventory), and costs of obtaining and operating distribution centres. The performance of road freight transport affects all three of these costs.

Therefore, improved road transport directly reduces the cost of carriage. Reduced congestion decreases transit times, unexpected delay and vehicle operating costs. In addition, there are other logistics costs, including spoilage or other costs associated with perishability that can be significant for some commodities.

Nevertheless, road transport impacts the on-time delivery and, thus, reduces the amount of buffer stock needed. Transport costs also affect the number of distribution centres required. If transport costs fall relative to all cost elements part of a decision (including interest rates), shippers will opt for longer hauls and fewer distribution centres. Fewer distribution centres usually lead to reduced inventory levels. As more stores are served from a given centre, there is some reduction in buffer stock per store. Conversely, when transport costs rise relative to interest rates, there is a tendency towards shorter hauls and more distribution centres. It is important to note that road performance also affects intermodal movements, as global supply chains involving the movement of containers by multiple modes are sensitive to delays anywhere in the supply chain.

The main point to be highlighted is that improved road transport performance for freight movement, through the implementation of efficient Traffic Management schemes, has the potential to increase efficiency all along the supply chain and, thus, increases the efficiency of manufacturers, distributors and retailers, along with an overall improved environmental performance.

Furthermore, another important element for increasing efficiency across the value chain is collaboration. Collaboration is gaining importance in logistics as companies react to intense competition and as the public and government opinion stresses that transport must reduce its effect on the environment. The increasingly tense situation in the transport market forces participants to look for new opportunities and to be more open about alternative concepts. Companies that manage to enter a collaboration ecosystem can reduce costs through efficiency gains both from a vertical point of view as well as from a horizontal one. Collaboration can be the success factor to achieve long-term competitive advantages in the market and, in order to be able to implement and manage these collaboration schemes, interoperability is a mandatory requirement.

3.2 Multi-modality scenario

3.2.1 Context

Intermodal freight transport involves the transport of freight in an intermodal container or vehicle, using multiple modes (e.g., rail, ship, and truck), usually without any handling of the cargo itself when changing modes and with a very low interaction.

Therefore, there is a need to consider the option of integrating multiple modes with the aim of providing a flexible response to the changing supply chain management requirements in global markets and distribution systems. The integration of modes requires a process or systems approach for both execution and information sharing mechanisms over the supply chain. Standardisation of business processes within the execution might be beneficial to achieve a common language along the supply chains. Intermodal transport is based on the concept of integration and moves from a focus on infrastructure components to a holistic focus on the overall movement of goods along the supply chain.

Intermodal freight options have the potential to provide significant community benefits (such as reduced road freight activity and, consequently, a reduced environmental impact) and potential commercial benefits to freight users. In Germany, for instance, the Federal Government has been anticipating since 2019 annual revenues of 7.2 billion euros from the truck toll, so the considerable costs of toll collection have already been deducted. This revenue should be used as support to more sustainable and/or under-used transport modes such as rail, inland water way. However, short haul urban intermodal operations suffer from double handling costs which road transport does not face. Good design of terminal infrastructure, intermodal network integration and governance framework is essential if intermodal operations are to be a significant feature of a port infrastructure.

The following modes of transport along the supply chain (brief description for various modes are provided according to 2) can be identified:

- **Container ships:** container ships are used to transport containers by sea. These vessels are custom-built to hold containers. Some vessels can hold thousands of containers.
- **Railways:** containers are often shipped by rail in container well cars. For example, it is common in North America to transport semi-trailers on railway flatcars or spine cars. Such designs allow trailers to be rolled on from one end, although lifting trailers on and off flatcars by specialised loaders is more common. When carried by rail, containers can be loaded on flatcars or in container well cars. In Europe, stricter railway height restrictions (smaller loading gauge and structure gauge) and overhead electrification prevent containers from being stacked too high. This way, containers are hauled either on standard flatcars or other railroad cars. Taller containers are often carried in well cars (not stacked) on older European railway routes where the loading gauge (especially with the reduced gauge for UK lines) is particularly small.
- **Trucks:** trucking is frequently used to connect the "linehaul" ocean and rail segments of a global intermodal freight movement, as well as to cover local deliveries.
- **Last mile distribution vehicles:** last mile distribution vehicles are being involved for distribution in urban areas.
- **Barges:** a barge is a shoal-draft flat-bottomed boat, built mainly for river and canal transport of bulk goods.
- **Land bridges:** the term land bridge is commonly used in the intermodal freight transport sector. When a containerised ocean freight shipment travels across a large body of land for a significant distance, that portion of the trip is referred to as the "land bridge" and the mode of transport used is rail transport.
- **Planes:** modern, bigger planes usually carry cargo in the containers. Sometimes even the checked luggage is first placed into containers, and then loaded onto the plane.

3.2.2 Scenario overview

The multimodal transport is a combination of two or more modes of transport of goods, such as air, road, rail, or sea, also called combined transport. For the purposes of this examination, "combined or multimodal transport" refers to the carriage of passengers or freight, or both, using two or more modes of transport, between at least two transport modes or between two different rail systems, and for temporary storage of freight, such as ports, inland ports, airports and rail-road terminals. “Urban node” is defined as an urban area where the transport infrastructure of the trans-European transport network (such as ports, including passenger terminals, airports, railway stations, logistic platforms and freight terminals located in and around an urban area) is connected with other parts of that infrastructure and with the infrastructure for regional and local traffic.
Goods transported by trucks and vessels in the port area need to benefit from a smooth and efficient intermodal exchange as well a seamless data exchange.
Traffic Management services can provide reliable information at the interchange point across nodes (e.g. precise times of truck arrivals) and can manage operations (e.g. parking zones dynamic management).

3.2.3 Involved stakeholders

Optimising intermodal freight transport across the value chain may involve many users and other stakeholders, relevant for the successful implementation of a solution:

- shipping lines;
- shipping agents;
- freight forwarders;
- logistic operators;
- multi-modal transport operators;
- custom agents;
- terminal operators;
- haulage transport operators;
- rail/river transport operators;
- shippers;
- port authorities;
- maritime authorities and bodies;

- customs and controls;
- air transport operators;
- port authorities;
- maritime authorities and bodies.

3.2.4 The value chain

Figure 3 Example of an intermodal Value Chain

Figure 3 shows the example of an intermodal value chain for "Hinterland to Maritime" transport. The value chain levels, which are relevant for the current scenario, are marked in green.

3.2.5 Underlying trends

Today at EU level high attention is paid towards standardisation of regulations. Governments support innovation and innovative solutions are being deployed in compliance with global guidelines issued by standardisation groups and bodies.

Moreover, the EU transport policy aims at a form of mobility that is sustainable, energy-efficient and respectful of the environment. These goals can be achieved by using multimodal transport, optimally combining various transport modes and therefore minimising potential weaknesses. The European Commission therefore pursues a policy of multimodality by ensuring better integration of the transport modes and establishing interoperability at all levels of the transport system.

3.2.6 TM2.0 enabled solutions

The growth of the freight transport sector stretches the existing infrastructure to its limits, at peak hours or in certain geographical areas. There are already considerable signs of congestion in the European transport system, such as on roads and in harbours. Congestion has a negative impact on the costs and time of transport, which affects the prices and the quality of products, and severally impacts society as a whole. Data exchange should make it possible to better spread the use of infrastructure over time. The goal is to facilitate the growing need for transport without building more transport infrastructure, but by fully using data exchange to enable a more efficient use of the available capacity.

ITS and therefore advanced Traffic Management schemes (e.g. TM2.0) can overcome the limits of the physical infrastructure and provide solutions, based on data exchange, that can support optimal intermodal operations such as:

- improved operations planning within one and between various transport modes;
- detailed tracking of vehicles and goods;
- advanced ETA/ETD;
- intermodal data sharing.

3.3 Cross-border scenario

3.3.1 Context

The increased amount of freight being traded via e-Commerce, as well as a great variety of origins and destinations, makes international transport a fundamental element supporting the European (and global) economy (3). Economic development in some regions of Europe has been the dominant factor behind the growth of international transport in recent years. The (often) considerable trading distances have resulted in increasing demands on the maritime shipping industry and on port activities, as well as in traffic on European roads and borders.

As a result, international transport systems have been under pressure not only to support the additional demands in freight volumes, but also the distance at which this freight and the additional seamless services are being carried together across all countries.

This could not have occurred without considerable technical improvements which allow to transport larger quantities of passengers and especially freight. Few other technical improvements than containerisation have contributed to this environment of growing mobility of freight.

3.3.2 Scenario overview

As a consequence of what is described above, transport, along with its management systems, is often referred to as an enabling factor that is not necessarily the cause of international trade, but is rather a condition without which globalisation could not have occurred. Within this scenario, ITS applied to logistics is one of the main factors impacting the efficiency of international trade.

A common development problem is the inability of international transport infrastructures to support flows, undermining its access to the global market and to the benefits linked to international trade. International trade also requires distribution infrastructures that can support trade between several partners.

Traffic management provides guidance to the European traveller and haulier on the condition of the road network. It detects incidents and emergencies, implements response strategies to ensure safe and efficient use of the road network and optimises the existing infrastructure, including across borders. Incidents can be unforeseeable or planned and through ITS they can be easily monitored and controlled in a cross-border environment: accidents, road works, adverse weather conditions, strikes, demonstrations, major public events, holiday traffic peaks or other capacity overload.

Besides traditional actuation channels for collective guidance (such as VMS), TM2.0 can contribute to strategic traffic management with a plan. This is a pre-defined set of temporary measures and procedures in response to a specific situation. Several partners need to be involved and the duration of the initial situation requires substantial co-ordination. The surrounding network has to be considered, not only the affected road section.

According to the European Commission, all major border crossings on the trans-European transport network should have adequate traffic management plans in operation. Equipping critical road sections and accident black spots (e.g. tunnels, bridges, mountain passes, large congested areas) with adequate ITS solutions and services will lead to quick wins in terms of safety and road efficiency. Benefits at European level will derive by addressing issues that serve cross border areas and long-distance traffic.

3.3.3 Involved stakeholders

International trade also requires distribution infrastructures that can support trade between several partners. Therefore, the following categories of stakeholders were identified as supporting freight transport management in a cross-border environment:

- road operators at borders;
- service providers;
- freight forwarders;
- logistic operators;
- custom agents;
- haulage transport operators;
- customs.

3.3.4 The value chain

Figure 4 Example of an cross-border Value Chain

Figure 4 shows an example of a cross-border value chain. The levels of the value chain that are relevant for the current scenario are marked in green.

3.3.5 Underlying trends

Cross border e-commerce is an increasing market which has strong potentials for the postal/courier operators. To help cross-border e-commerce to flourish, the European Commission adopted a proposal for a Regulation of cross-border parcel delivery services in May 2016. The aim of the regulation is, inter alia, to improve interoperability of delivery services between operators, and operators and e-retailers, in order to complete the Single Market for parcel delivery.

Moreover, in relation to road transport and in-vehicle services, the latest European Commission's programs and guidelines focus more and more on the seamless cross-border experience.

3.3.6 TM2.0 enabled solutions

ITS and advanced Traffic Management schemes (e.g. TM2.0) can overcome the limits of the physical infrastructure with regards to solutions that can support optimal cross-border transport management:

- strategic corridor and network management;
- section control;
- incident management;
- speed control;
- cross-border data sharing.

3.4 Urban-interurban scenario

3.4.1 Context

The extraordinary increase within the last decades of the need for interurban and urban passenger and freight transport has deeply impacted the human and natural environment. The increase of urban population and the more frequent and greater movement of goods to the cities have a negative impact on the environment, cause excessive energy consumption, congestion, and accidents. According to the European Commission White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system" (3), the elimination of these negative impacts and the provision of sustainable transport systems require the implementation of innovations and interventions related, among other, to coherent cooperation of the key stakeholders and the development of efficient interfaces between short and long-distance networks.

When discussing freight transport in urban-interurban context there are two main topics to be handled. On one side, the shift from an interurban to an urban environment (and vice-versa) usually implies a strong need for interaction between these environments' roads and traffic systems (5). This is mainly due to increased congestion during peak periods and underlines the necessity of data exchange between urban and interurban traffic centres for the purpose of harmonised driver information and traffic control strategies. On the other side, urban freight transport constitutes a fundamental component in the life of a city. Apart from last-mile transport, freight transport in urban areas involves a vast range of additional processes: handling and storage of goods, inventory management, waste and returns and home delivery. While many of these processes, or parts of them, are undertaken outside of urban areas, they continue to have an impact on urban operations with negative consequences in terms of safety, congestion, air and noise pollution.

3.4.2 Scenario overview

ITS applications are already applied to increase the effectiveness of freight transport, but mainly by private sector road freight operators. The public sector at all levels can contribute to the effective implementation of ITS in urban areas through the widespread implementation of systems that provide real-time data on the status of the road network in an interoperable way. This would allow road freight vehicles to operate in different cities, along and in between the interurban connections without having to use different hardware and software. In this, context TM2.0 applications, EU level associations in the field of ITS and collaboration projects would have a clear role in ensuring that such systems are as quickly as possible and in an interoperable way in interurban/urban areas around Europe.

Data sharing (real time traffic information, traffic management plans, fleet data) facilitating coordinated traffic management strategies between different operators at the connection point between urban and interurban roads are the key elements in this scenario.

3.4.3 Involved stakeholders

The complexity of freight distribution in interurban and especially urban environments, along with the potential conflicts between key stakeholders require a comprehensive approach. The following stakeholders are able to influence and shape city logistics:

- logistic operators;
- residents;
- retailers;

- distributors;
- carriers;
- city operators;
- road operators;
- service providers.

3.4.4 The value chain

Figure 5 Example of an urban-interurban Value Chain

Figure 5 shows an example of an Interurban/urban value chain. The levels of the value chain that are relevant for the current scenario are marked in green.

3.4.5 Underlying trends

Urban logistics management is also one of the focus topics in the European Commission's Urban Mobility Package (6). Indeed, urban logistics is essential for cities to function successfully and make up a significant share of urban traffic. However, logistics is often neglected in urban planning even though it has a high impact on the efficiency of the transport network and on the environment.

Regarding the environmental aspect, some measure are being taken, such as captive fleets, mail delivery vehicles and garbage trucks, which are well-suited for the early introduction of new types of vehicles and alternative fuels. Member States and local authorities are aiming to provide a framework (delivery spaces, access regulations, enforcement etc.) to ensure that there is a positive business case for the private operators to invest in new technologies and solutions.

Moving in that direction, the EU stresses, in the 2011 White Paper as well as in other documents, the significance of using ITS for optimising the last mile distribution, which aims at the complete digitalisation of urban freight mobility.

The efficient interconnection of long distance and last mile transport (interurban-urban), through the implementation of urban nodes (being the starting point or the final destination - first/last mile) for passengers and freight moving on the trans-European transport network, is also one of the priorities of the EU.

3.4.6 TM2.0 enabled solutions

ITS and therefore advanced Traffic Management schemes (e.g. TM2.0) can overcome the limits of the physical infrastructure with regards to urban-interurban freight transport and provide solutions that can support optimal interurban/urban operations, such as:

- improved operations planning;
- detailed tracking of vehicles and goods;
- strategic corridor and network management;
- section control;
- incidents management;
- ramp-metering;
- hard shoulder running;
- speed limits management;
- priority schemes;
- deliveries areas management.

3.5 Challenges in implementing the scenarios

Currently, supply chains are characterised by a low level of collaboration, a scattered approach and a silo approach, by which every stakeholder owns a business. The low level of collaboration is intended as both vertical and horizontal. A weak vertical collaboration is due to the lack of data sharing and collaboration schemes across the various levels of the value chain, while a successful horizontal collaboration could be achieved by more investments in the standardisation of processes and of data structures supporting interoperability at all levels.

The following characteristics of the future models for freight transport will need to face challenges with respect to the value chains:

- Data challenges:
    - Ownership;
    - Access;
    - re-use;
    - trust;
    - confidentiality;
    - privacy;
    - big data management;
    - added value creation;
    - availability of supporting technology;
    - definition of data elements, harmonization, standardisation, etc.
- Information challenges:
    - information sharing;
    - information data structures;
    - standardisation;
    - maintenance of information.
- Intermodal transport (specific):
    - cross-modal information sharing;
    - cross-modal standardised processes;
    - cross-modal interoperability;
    - cross-modal strategies.
- International transport (specific):
    - international policies and regulations;
    - cross-border information sharing;
    - cross-border standardised processes;
    - cross-modal interoperability;
    - cross-modal harmonised strategies.
- Freight transport (specific):
    - policies and regulations;
    - interaction between long distance and urban freight;
    - vehicles/fleets adaptation;
    - harmonisation and interoperability of services.

4. BEST PRACTICES

4.1 CIVITAS PORTIS

Civitas Portis is a Horizion2020 project (7) for sustainable mobility planning, that will test innovative and sustainable urban mobility solutions in five European port cities (Klaipeda, Aberdeen, Antwerp, Trieste and Constanta). The project aims to improve the governance for an enhanced cooperation between cities and ports, create more sustainable and healthier city-port environments, shape more integrated transport infrastructure and mobility systems and improve the efficiency of urban freight transport.

In particular, the following Traffic Management related objectives are set for the Trieste case:

- development of a Transport Information Platform;
- establishment of a Multi-Governance Technical Office;
- promotion of Soft Mobility;
- introduction of a hybrid and innovative public transport system;
- promotion of sustainable mobility to cruising tourist;
- integration of the parking management system;
- control of urban access;
- coordination of freight movements;
- regulation of access to the port area and integration of SUMP (Sustainable Urban Mobility Plan). Since January 1st 2017, the Old Port areas of the Trieste Port, consisting of a 600.000 sqm area in the city centre, have been released from the Free Port status and put under the competence of the Municipality of Trieste. This recent acquisition has totally changed the city’s framework. It is therefore necessary for the city of Trieste to develop a SUMP to ensure that the Old Port areas are fully incorporated into the city’s overall mobility strategy. This requires a total rethinking of urban mobility within the port-city context.

4.2 Port of Hamburg (HPA)

As one of Europe's largest container ports, the Port of Hamburg aims to become a model port for sustainable and forward-looking urban mobility. Due to its special location within a major German city, the challenges for the port traffic management are many and across different modes of traffic. The Port of Hamburg is seeking to gain visibility on/into:

i) the container availability from the container terminal;

ii) the Estimated Time of Arrival of the train;

iii) the availability of parking spaces at the inland terminal;

iv) the Estimated Time of Arrival at the final customer delivery point.

The main challenges are: multimodality, end to end planning management, real time visibility for maritime container flows for the Logistics hubs of Hamburg, Frankfurt, and Trieste, and increased collaboration along the core network corridor.

Re-aligned, multi-modal based supply chain operations can enhance and maintain the competitive performance of the logistics hubs of Hamburg and Frankfurt (incl. Hub2Hub supply chain), increase the hubs' competitiveness, efficiency, reduce its emissions (e.g. CO2) and congestion for the Hamburg / Frankfurt and Trieste metropolitan areas.

Back in 2010, the Hamburg Port Authority (HPA) had already installed measuring points at the most important traffic intersections in the port area. Induction strips and detectors precisely measure traffic volume, vehicle type and speed. The Port Road Management Center collects all system data on the current traffic situation of routes in the port. The IT-based data system uses cutting-edge technologies to deliver rapid, reliable information. Yet, all this is only the beginning of a comprehensive traffic management system in the port to cover all three modes of transport: road, rail and waterway.

Sensors permit the collection and the evaluation of data regarding the traffic situation, as well as parking space availability and bridge closure times. The data is also passed on to drivers and other users using DIVA (DIVA - Dynamic Information Panels on Traffic in the Port of Hamburg) information panels in the port or via SPL.

Similar systems are also in place for rail and waterway traffic. The notifications generated can, where needed, provide aid in planning runs or show possible alternatives, e.g. with an alternative route or a parking space where waiting time can be spent. As such the TMC uses DATEX II and their next steps is to integrate this into DIVA.

4.3 MedTIS

MedTIS (8) is a deployment project with the objective to implement Road Safety Solutions, Traffic Management Services and Traveller Information Services on the TEN-T Mediterranean Corridor.

MedTIS takes on board TEN-T priorities and European Commission's policy objectives to deliver high-level Travel Time Services and enhanced Traveller Information services, including road user awareness to European travellers.

Along the 8.000 km Corridor, MedTIS Action involves four EU Member States: France, Italy, Spain and Portugal. Twenty-seven road operators from these four countries are in charge of the onsite deployments of services and systems.

MedTIS supports the following objectives:

- Improving the interoperability, continuity and seamless mobility in the EU, with particular attention to cross border sections - on which deployment activities will enable the enforcement of cross-border Traffic Management Plans - and urban-interurban interfaces.
- Improving road safety on strategic sections (i.e. tunnels) including cross-border interfaces.
- Improving the harmonisation of services across Europe from the end-user perspective.
- Improving the operational excellence and cost-efficiency from a road operator / traffic manager perspective.
- Providing better traffic management to maintain a high-level network efficiency, especially bottlenecks and cross-border sections.
- Maintaining the high level of safety on the considered network regarding the traffic increase (namely Heavy Good Vehicle).

4.4 URSA MAJOR

URSA MAJOR 2 (9) is an initiative focussing on freight traffic on the TEN-T road network in a corridor linking North-Sea ports with the Ruhr / Rhine area and metropolitan areas in Southern Germany, Northern Italy and the Mediterranean, across the freight sensitive Alps crossings in Austria and Switzerland.

UM2 members are the relevant road operators from Germany, Italy and the Netherlands. Switzerland and Austria road operators are included in their capacity as transit countries.

The UM2 corridor represents one of the major TEN-T road axes in Europe. With a total network length of 8 700 km it has an average traffic load (average daily traffic – ADT) of 56 000 vehicles of which, on an ordinary working day, 22% (12 300) are vehicles transporting goods.

According to projections produced for the German motorway scheme, the freight traffic volume is expected to grow by 55 % between 2007 and 2025. In total, approximately 27 Billion ton kilometres are transported over the corridor.

Improving services for international freight traffic along the mentioned corridors is the main European Added Value of UM2. International freight between EU Member States is one of the main pillars for a Single Europe.

ITS deployments covered by UM2 address at least one of the following topics:

- Enhancement of truck parking services;
- Support for truck navigation services;
- Remove bottlenecks and congestion;
- Safety improvements for freight transport on the TENT-T road.

4.5 URSA MAJOR NEO

The URSA MAJOR NEO (9) project enables the deployment of ITS services to improve freight traffic on the TEN-T road network along the CEF RHINE-ALPS and SCANMED core corridors, linking the North Sea ports, the Rhine region and the Ruhr, the metropolitan areas of southern Germany and northern Italy with the Mediterranean ports up to Sicily. Project partners come from Germany, Italy and the Netherlands.

The Port of Trieste- interfaces:

• DATEX II2 file for traffic congestions on the Autovie Venete S.p.A. motorway;

• proprietary format for arrivals/departures of trucks on Interport of Trieste;

• proprietary format for arrivals/departures of trucks on Trieste Port;

• proprietary format for arrivals/departures of trucks on the ICT system of Samer Seaports & Terminal.

DATEX II offers useful information for the traffic management plan. The cities have to integrate the standard protocol. Autovie Venete S.p.A. uses DATEX II, while the Port of Trieste plans to implement it and the Comune di Trieste is interested in adopting it.

4.6 CROCODILE

Within CROCODILE project (10) public authorities, road administrations and traffic information service providers from 13 European Member States are committed to set up and operate a data exchange infrastructure based on DATEX II.

That infrastructure is used to exchange data and information between all involved stakeholders, including private partners, with the goal to provide harmonised cross-border traveller information services along the whole corridor.

A specific focus within CROCODILE is on safety-related and truck parking information services.

The CROCODILE corridor project succeeds the previous projects EasyWay and EasyWay 2.

CROCODILE involves the Central and Eastern European (CEE) countries to ensure data exchange and service provision along three main road corridors:

- Baltic – Adriatic;
- Rhine – Danube;
- Orient-East-Med.

Participating Member States include Austria, Cyprus, Czech Republic, Germany, Greece, Hungary, Italy, Poland, Romania and Slovenia, as well as Bulgaria, Croatia and Slovakia in the status of associated Member States.

CROCODILE directly contributed to Commission Delegated Regulation (EU) No. 886/2013 of 15 May 2013 with regard to data and procedures for provision, where possible, of road safety-related minimum universal traffic information free of charge to users, as well as to the Commission Delegated Regulation(EU) No 885/2013 of 15 May 2013 with regard to the provision of information services for safe and secure parking places for trucks and commercial vehicles, both supplementing Directive 2010/40/EUof the European Parliament and of the Council.

Based on the EasyWay Deployment Guidelines (especially on DTX-DG01 - DATEX II) CROCODILE will mainly focus on the implementation of DATEX II notes for data availability and exchange as mentioned delegated regulations.

Additional data collection infrastructure, which is relevant for road-safety and truck-parking information services, has been deployed on specific road sections along the CROCODILE corridor to collect the data needed to detect events or identify conditions and to ensure data availability.

To ensure access to data, CROCODILE Member States and partners set up access points in accordance to the above-mentioned delegated regulations.

4.7 Fer-Net Project

Fer-Net project was founded by the Italian Region Friuli Venezia Giulia within the framework of the POR FESR financing framework 2014-2020 and has been executed by the business network Info.era S.r.l. and Interporto di Trieste S.p.A.

The project has followed the recent trends that are evolving the concept of port, extending its perimeter also to dry-port areas. Fer-Net aimed at increasing a new paradigm of port extension that will link the Interporto di Trieste and the Trieste port, while maintaining their respective operational tasks to better manage the international road traffic originating in continental Europe with final destination Turkey, via the Trieste port.

The objective was to consider the dry-port as an extension of the port, transferring the trucking gate in / gate out process from the Trieste gates to the Interporto di Trieste gates, thanks to new immaterial infrastructures, enabling a better management of the road traffic flows along the motorway connecting the dry-port and the port, thus as the trucks are already / still in the port area.

Such an objective was pursued by realising an immaterial infrastructure enabling interoperability between the local Port Community System and the Interporto di Trieste gate access control system. Secondly, the data quality and reliability issues were targeted, mostly concerning truck license plate recognition via OCR technology. In order to analyse and solve these problems, a partnership was signed between Info.era and the University of Trieste, on the following research and development activities:

- The study of algorithms for the automatic association of the plates read by cameras provided by OCR technology, which enables to find and certify an identification methodology even in conditions of unprecise characters and numbers conditions. This aspect is the essential in order to provide the port of Trieste, and therefore to the Customs, as well as to the terminal operator concerned, information on all vehicles that are boarded on ships;
- The study of vehicle travel times from some strategic points from the highway A4 to the Interporto di Trieste dry-port;

- The study of the environmental impact in terms of CO_2 reduction and fuel savings due to the optimization of the routes that could result from the construction of the controlled corridor.

Such a project served to carry out research, technological and process innovation preparatory to the development of a controlled corridor between port and dry-port which resulted in a better management of the international multimodal traffic insisting on the Trieste logistics areas.

5. CONCLUSION AND NEXT STEPS

The present work contains the analysis of business needs over the supply chain (mainly clustered in four categories and mainly focussed on data availability at all levels) and the identification of scenarios for coordination of traffic management (TM) plans and measures enabled by the TM2.0 paradigm. This tasks is carried out considering a multi-modal environment, at cross-border and in an urban/interurban environment. Based on the context and underlying trends across the value chains, relevant stakeholders and potential TM2.0 based solutions/features have been identified for each scenario:

Multi-modal scenario	Cross-border scenario	Urban-interurban scenario
• Improved operations planning within one and between various transport modes. • Detailed tracking of vehicles and goods. • Advanced ETA/ETD. • Intermodal data sharing.	• Strategic corridor and network management. • Section control. • Incident management. • Speed control. • Cross-border data sharing.	• Improved operations planning. • Detailed tracking of vehicles and goods. • Strategic corridor and network management. • Section control. • Incidents management. • Ramp-metering. • Hard shoulder running • Speed limits management. • Priority schemes. • Deliveries areas management.

These high-level suggestions of features will be used as a basis for Deliverable 6.2.2, focussed on the application of TM2.0 in FENIX.

This document intends to provide a high-level description of existing open issues and relative best practices that addressed the identified topics but still did not manage to completely fill in the gaps. As the current lack of interoperable and interconnected data sharing in the supply and logistics chain represents a barrier to the improvement of the European transport and logistics, efforts to improve this are still necessary – representing as such the main challenge of the FENIX project.

This is why general and specific challenges have been identified, as a basis for the requirements definition that will follow in further activities in Task A6.2 (i.e. with regards to the Data Model in D6.2.3 and the overall System requirements in D6.2.4). At the end of the document , a list of best practices related to initiatives connected to inter-modality, cross-border transport and logistics management in urban-interurban environments has been included.

6. REFERENCES

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