PROJECT DATA

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DELIVERABLE

D 1.1. Initial review of EU/Global Initiatives, Policies & Standards

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REVISION HISTORY

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1.0	31/08/2020	Mireille Tack	Minor adjustments, clarifications, references
2.0	31/03/2022	Karen Van Brussel & Dimitri Laureys	Revisions following feedback from the reviewer. • Clarification role consortium partner • Multi Modal Success factors should not have been in this deliverable (month 3) and are therefore addressed in detail in D1.10 • Justification relevance Artificial Intelligence & Physical Internet

DISCLAIMER

TABLE OF CONTENTS

Executive Summary

Deliverable 1.1 aims to ensure alignment between ePIcenter and other European and Global initiatives and policies. Lessons learned and success stories from previous EC-funded projects and other international research programmes will be reviewed, along with ongoing technology innovations, to ensure that ePIcenter's work is new. More specifically, deliverable 1.1. will summarise the main initiatives, policies and standards impacting international multimodal freight movements, European and Global transport networks, and the use of innovative transport technologies (e.g. electric autonomous vehicles and Hyperloop) as well as visibility and digitalisation international methodologies and tools. This deliverable refers to Task 1.3. under Work Package 1. The work undertaken will continue in the coming months and new results will be reported in the Month 24 : Deliverable 1.7 Final Review of EU/Global Initiatives, Policies & Standards Impacting ePIcenter and Deliverable 1.9 Results of Technology Scan & Relevance to ePIcenter.

The work on this deliverable was coordinated by Port of Antwerp, but involved the entire ePIcenter consortium. Through a number of questionnaires and subsequent in depth interviews with ePIcenter partners, valuable input was received on the different focus areas of this report. The diversity of the consortium, both in terms of expertise as well as geographically, proved to be a real asset. Besides university and research partners, a high number of industry partners and technology partners are represented in the consortium, sharing their vision and the one of their partners.

Sector	Consortium Partner
Industry	AB Inbev
	Autoridad Portuaria Bahía de Algeciras
	Beijing Trans Eurasia International Logistics
	Den Hartogh Logistics B.V.
	DHL
	Duisport
	Einride
	GVZ
	Panasonic Business Support Europe GmbH
	PKP
	Port of Antwerp
	Port Montreal
	Stena Lines
	TTI Algeciras
Technology provider	Freightwaves
	Logit One
	Nxtport
Research & University	Aker Arctic
	ASTAZERO
	BAL
	Bremer Institut fur Produktion und Logistik
	Effective Seaborne Engineering Solutions, S.L.
	Logistik-Initiative Hamburg Management GmbH
	MJC2
	MSP
	TIS PT
	to-be-now-logistics-research-gmbh
	Heriot-Watt University
	HS EL
	Maritime Institute of Gdynia Maritime University
	Shandong University
	Transport and Telecommunication Institute (TSI)
	Univeristé Laval
	Universidad de la Sabana
	Vilnius Gediminas Technical University
	University of Victoria

Additionally, specific partners with top notch expertise in a certain area were responsible for coordinating a specific subtask, ensuring that the redaction of this Initial Report was a shared effort.

This initial deliverable, produced very early in the project, is intended to summarise and collate the initial thoughts of the consortium, to act as a guide to the work needed for the later, more extensive analysis that will go in to the preparation of the final version of this report (D1.7 & D1.9). This deliverable is not intended to be a thorough analysis of EU/Global Initiatives, Policies and Standards (as this would not be possible to achieve in month 3, so soon after the start of the project). Instead it serves as an initial summary for partners about relevant

existing technology, policies, standards and projects that should be considered in more detail in the coming months.

The Initial Report is structured around the following chapters:

- Technology Scan & State-of-the-Art Refresh
  An initial survey was undertaken at the time of submission of the ePIcenter project, but it is important that ePIcenter remains aware of new developments and innovations. Digitalisation, Artificial Intelligence and Physical Internet-related technologies are evolving at a rapid pace. This chapter therefore aims to update the information that was already gathered.
- Policy Review
  This chapter gives a general overview of European and International Transport Policies that affect multimodal logistics operations and related technology solutions. It monitors ongoing work and initiatives by DG TAXUD and DG MOVE and analyses potential impacts on ePIcenter's results. Similarly for the EU's Strategy for Low Emission Mobility, and International programmes such as those of USDOT, Transport Canada's National Trade Corridors Fund and China's Belt & Road Initiative. More recently, the EU Green Deal, Brexit and the Covid 19-crisis are also expected to impact the transport & logistics sector very significantly.
- Ongoing Digitalisation & Visibility Initiatives
  This chapter monitors and reviews developments in other more specific initiatives and projects such as those funded by CEF, SESAR, Shift2Rail. The Single Windows, ITS Action Plan, Intelligent Car Initiative and U-space developments are also very relevant.
- Relevant International Standards & Regulations
  Here we review the regulations and standards applicable to international multimodal containerised and large freight movements to ensure ePIcenter remains compliant. This includes amongst other things the movement of bulk products in "isotainers" and relevant practical/safety constraints relating to dangerous goods and food.
- Lessons Learned from Previous EC-funded & International Projects
  The last chapter reviews the lessons learned from directly related projects (including but not limited to): SYNCHRO-NET, eFreight, eMAR, CORE, SEDNA, EUROSKY, SAFEPOST, the European Hyperloop Development Initiative, ICONET, COREALIS, NOVIMAR, NexTrust, Joules and NIMBLE. It summarises how ePIcenter will build on these success stories. Initiatives such as those supported by USDOT, Canada's Smartway programme and Regulatory Review Roadmap, and the USA's Intelligent Transportation Systems JPO and American AI Initiative are also analysed.

1 Technology Scan & State-of-the-Art Refresh

1.1 Transport planning tools: state-of-the-art

There are many commercial transport planning solutions on the market, and some emerging platforms resulting from research projects, which address scheduling of a single mode (or single terminal/facility), or some degree of multimodality. The ePIcenter algorithms will address new capability that extends beyond the existing available systems, but it is important to note that the use of open standards means that it is intended that other solution providers can integrate their technologies with ePIcenter components if desired.

In general terms the current state-of-the art for commercial planning and scheduling tools is the use of linear programming techniques for solving the optimisation problem. This approach can work for certain cases but is often found to be too slow or too inflexible when modelling complex operations. A multimodal logistics operation is characterised by many possible combinations of modes and services that could be used to achieve a given movement, so finding the best one is challenging, and presents a very large search space. It is important to remember that it is not just the physical connectivity that needs to be established (e.g. via terminal A, port B, port C and finally terminal D), but there could be multiple service providers and services for each leg, each with different schedules, capacity and constraints.

Multimodal logistics optimisation/booking platforms tend to focus on limited geographical areas, or do not include last-mile connections, or are operated by individual logistics providers so are limited in terms of options available. Also of course these platforms do not take into account emerging transport technologies such as hyperloop and autonomous systems, and do not in general reflect the more complex balance of considerations relating to environmental impact, cost and service level.

When asking our consortium about their knowledge of and experiences with transport planning tools, the list of different tools received was impressively long. However, there does not seem to be currently a commercial solution on the market which fully addresses the optimisation problem mentioned above. During the further roll out of the ePIcenter project we will make sure new technologies are taken into account that cover the full end to end flow.

The summary of examples of existing tools is an initial selection based on the input of our consortium partners through a questionnaire in month 1 to 3. This list will be examined in detail in D1.7 and D1.9.

- AnyLogic simulation software v7.1, university edition: a very efficient, highly developed transport and queue simulation tool. There are many positive elements, the agent-based program made in Java, system dynamics, particularly in the optimal program structure and user-friendly GUI, many simulation techniques provided with probabilistic calculations, dashboards for almost every variable of transport element, spreadsheets, various options for transport flow design and organisation, etc.
- Lingo, Lindo, QSB, Excel Module: programs for resolving some fundamental low-scale operational transportation problems
- FlexSim, a 3D Simulation Modelling and Analysis Software, which is very efficient in various transport, manufacturing, material handling and distribution simulation, giving the most probable predictions and transform the exisiting data in accurate simulation model. This software is used for digital twins, advanced process optimization as well as for the complex transport and logistics problems.
- Vehicle booking systems for major ports are becoming more common (e.g. QLES in Antwerp, VBS in Southampton and SBP in Hamburg). These help with reducing congestion around ports, and in some cases relying on a pricing mechanism or similar incentive to encourage use of less busy times of day. Active optimisation through the use of real-time algorithms is less widespread, and not integrated with connected multimodal services.
- Marine Enterprise Suite from Cirrus Logistics which addresses berth scheduling.
- A new idea from DashPort uses historical data of ship journeys to anticipate whether a ship is likely to be on time. This could be relevant to ePIcenter's real-time scheduling innovations.

- The Infotrans planning system (Source: www.infotransport.eu/LT) is one of most commonly used planning tools during one of our partners' transport studies. This system assists freight forwarders and hauliers in making essential transportation planning/management solutions, including management of transport orders, consolidation of several trips into one, automatic generation of contracts with hauliers, assurance of connections with maps/monitoring systems, fuel consumption control and analysis, information for customers about the condition of their cargo, and many other functions. However, an important drawback is that Infotrans planning system is mainly focused on the needs of road transport.
- Basically the same can be said about another planning tool, namely Microsoft AutoRoute instrument. In addition, both of the above tools do not contribute or can do little to address the EU's ambitious targets for reducing transport emissions, implementing the European Green Deal (COM(2019) 640 final).
- The Agora platform for collaboration (www.intermodal-terminals.eu) is an instrument that responds better (than the above mentioned planning tools) to the modern challenges of transport. One of the key objectives of the Agora platform for collaboration is to contribute to a more effective intermodal transport in Europe by improving data exchange between terminal network partners and customers through using uniform electronic interfaces, as well as development of a standardised set of key performance indicators (KPIs) along the intermodal supply chain. At the same time, the Agora platform enables raising awareness of the importance of terminals in intermodal supply chains, including awareness of terminal capacity enlargement planning needs and sharing information with all intermodal stakeholders: railway companies, shippers, logistics service providers, infrastructure managers, and of course, with terminal network partners. However, on the other hand, the focus on the activities of intermodal terminals highlights a certain limitation of this tool.
- The GUSEK Liner Programming (Source: http://gusek.sourceforge.net/gmpl.pdf) tool provides optimised choices for solution (on minimising time consumption or cost). The model has already been experimentally tested.
- Other partners have developed their own in-house tools. Positive is that these can be customised completely to the company's needs. A negative element is that the development process itself is a lengthy process due to the complexity and level of detail of the tool.
- Dockflow: a logistics enablement platform, offering a visual control centre to monitor ocean cargo, automated demurrage tracking and set up tailor made notifications.
- Turvo provides a collaborative logistics platform designed for a global supply chain with a focus on truck and ocean transport visibility, execution and integration.
- Project44: Advanced supply chain visibility platform.
- Gravity Supply Chain Solutions: Visibility and execution platform personalised for your customer supply chain network including supplier purchase order management, with a focus on ocean shipments
- Flagship: Import-Export matching, suggestions for higher saving. But based in one port only instead of several ports. Only for container truck transport, not for multimodal transport.
- MTRANS: GPS integrated with planning. But it's not user friendly, moreover the opposite.
- Transkal Adur: Transport Management System for companies to link with their logistics flow
- Transnet: Cargo transport pool for tautliner and container trucks, a bailout platform which doesn't search a win-win result.
- SeaRoutes - professional tool for route and distance calculation and voyage planning of seagoing vessels. It also also allows for CO2 footprint estimation.
- INCONE60 Cargo Flow Model – new tool for routes and distance planning created by Gdynia Maritime University in collaboration with SeaRoutes
- MATSim: Transportation Analysis and Simulation System, Open source framework to implement large scale agent based transport simulations.
- AIMSUN: Traffic modelling software on any scale, including multi modal modelling tool
- PTV VISUM: Traffic Planning software to conduct traffic analyses and forecasts.
- VISSIM: Technology company developing innovative software solutions for the maritime and offshore energy domain like offshore wind, offshore energy, port solutions and maritime awareness.
- Graphhopper Directions API: Routing planner and services in an active open source community.
- 4Flow Vista: Supply chain design and optimisation for mainly manufacturers (automotive).
- Supply Chain Guru: Supply chain management software design and analysis application.
- Terminal Operating Systems: to control the movement and storage of various types of cargo in and around a port terminal.

- SIDRA INTERSECTION: software package used for intersection and network capacity, service and analysis by traffic design.
- NUNAV: collaborative routing technology to reduce traffic jams.
- HANSEBLOC: R&D projects on testing and developing block chain solutions in the logistics context.
- Carrypicker tools: AI to tender and optimise the flow of goods by truck transport.
- Cargonexx: TMS to automate truck dispatching.
- SimEvent and Simulink within Matlab: Modelling and data analysis tool to optimise supply chains for manufacturing and operations.

1.2 Multimodal transport planning tools: state-of-the-art

Multimodal logistics optimisation systems are emerging but do not address all modes in an integrated way, especially when considering new modes and technologies such as Hyperloop and last-mile electric trucks, and how these modes could integrate with conventional ship, rail, barge and truck operations.

Furthermore, existing solutions do not contemplate alternatives such as new Arctic routes, which would have a different profile from existing shipping services in terms of transit time, cost, total GHG emissions and reliability.

Similarly, the New Silk Road connections, while being based on rail (plus truck and short sea shipping in some cases), present new operational features and constraints which are not yet fully modelled by these multimodal planning systems.

It is worth reflecting on the complexity and size of the optimisation problems being addressed in ePIcenter. These problems grow at least exponentially (if not faster) as the number of modes, links, nodes and vehicles/services increases. Even the relatively straightforward “travelling salesman problem” (the prototype logistics optimisation case) is challenging when dealing with more than a few 100s of movements/deliveries – please see for example the explanation available here: https://iopscience.iop.org/article/10.1088/1757-899X/263/4/042085/pdf Computation times of hours, ranging up to years (!) for large problems are reported, depending on the approach used. Clearly this is not suitable for dynamic logistics operations which change every few minutes.

Some examples of known multimodal transport planning tools: (It is an initial list based on the input of our partners through a questionnaire in month 1 to 3. This list will forms a great basis for a critical review in D1.7 and D1.9,)

- AnyLogistix, a tool specialised for multimodal logistics systems and Supply Chain Management, derived from AnyLogic and developed according to the practical needs of stakeholders and supported with transport simulation algorithms.
- PARIS: plans the most appropriate transport mode for deliveries and collections by scheduling transport bookings on available space of rail, barge and coastal feeder services combined with truck transport planning.
- BluJay Solutions TMS: a multimodal transportation tendering platform.
- Logit One, a partner in ePIcenter, has its own multi-modal planning tool that supports solutions for shortcomings in the market today. These being: (i) Not taking the empty container handling into account; (2) Not being truly multi-modal from an operational point of view; (3) Not supporting synchromodality.
- The above mentioned Agora collaboration platform is available for multimodal planning tools.
- Synchro-Net tool (Source: https://www.synchronet.eu/): an applicative software module with the objective to create reliable plans for freight transportation from an origin to one or more destinations (also allowing to plan intermediate stops), considering different transport options and constraints. Moreover, the system enables the final users to monitor different KPIs (Key Performance Indicators, such as distance, time and emissions) and KRIs (Key Risk Indicators such as time and cost reliability, safety and flexibility). One of the strengths of the systems relies on an intuitive and interactive map-based user interface. The simulator provides the final user with a set of possible routes, helping to sort the transport solutions according to different KPIs and KRIs.
- Searates: a tariff search engine that compares all available cargo delivery options.
- Short Sea Simulator (http://simulador.shortsea.es/) by Short Sea Shipping association.

- Logistics Benchmarking tool (developed in FP7 BE LOGIC project): enables users to compare two alternative transport chains on six main criteria: time, cost, flexibility, reliability, quality and sustainability. The combination of these criteria provides the user with a broad overview of the potential effects of a modal change. For the sixth indicator "(environmental) sustainability" the Logistics Benchmarking tool makes use of the website www.ecotransit.org. The tool includes CO2, NOx, Non-Methan Hydro Carbons and particles. Depending on the priorities of the users it can give different weights to each of these pollutants. In order to facilitate the users of the Logistics Benchmarking tool to explore intermodal alternatives, a terminal database was developed, evaluating information on transport times, frequencies and modes used between the terminals (including transport by rail, inland waterways and short sea). Using this terminal database the European Intermodal Route Finder (EIRF) was created. It offers the possibility to print intermodal route reports, providing the user with an overview of intermodal alternatives on a certain origin-destination relation, including information on transit times, frequencies and modes used for each alternative that has been found in the database. The EIRF comprises around 650 activated intermodal terminals (including the modes sea, inland waterways and rail) in EU MS, Norway and Switzerland.
  However, the EIRF is mainly focused on the transport market needs of the so-called "core" European countries (or the old EU MS) dominated by of North-South transportation demand. Meanwhile, with up to the recent time permanent increase of demand for transportation and logistics services in East - West direction, the EIRF (its network) does not fully address the current challenges facing the European transport system.

Also relevant is the current feasibility study funded by the Connecting Europe Facility (CEF) (Source: https://eip.its-platform.eu/activities/activity-3-%E2%80%93-feasibility-study-east-west-corridor-and-first-pilot-implementation). The Study is focused on knowledge development with seamless, continuous and harmonized ITS services which can be created along the EAST-WEST corridor (EWC), running from Ireland, via UK, Benelux, and Poland to the Baltic States and Finland, thus linking the CEF corridors North Sea –Mediterranean and North Sea-Baltic. The newly acquired knowledge is used to improve the planner created by experts of the BE LOGIC project. And this is done in order to create an intermodal route planner for containers on the EAST-WEST corridor. The EWC planner will be improved (compared to the BE LOGIC tool) on a number of aspects: the algorithm, new connections and terminals, new characteristics of terminals, improved website interface, plug–in version at EU EIB website, translation to national languages of active partners. It is expected that a new intermodal planner will increase the visibility of the intermodal transport services on the corridor and will contribute to development of an efficient multimodal transport system (cooperation and interoperability between road, rail, inland waterways and sea transport).

In any case, multimodal logistics is an active research topic. Recent publications and work that will be used to inform the direction of ePIcenter include:

• "Multimodal transport information sharing platform with mixed time window constraints based on big data" - Liqun Ding - Journal of Cloud Computing volume 9, Article number: 11 (2020)

• "Travel Time Prediction in a Multimodal Freight Transport Relation Using Machine Learning Algorithms" - Nikolaos Servos et al, Logistics 2020, 4(1), 1

• "Synchromodal Logistics: An overview of critical success factors, enabling technologies, and open research issues" - Daniele Manerba et al., Transportation Research Part E Logistics and Transportation Review 129:92-110, 2019

• "Multimodal Capacitated Hub Location Problems with Multi-Commodities: An Application in Freight Transport" - Alan Osorio-Mora et al., Journal of Advanced Transportation / 2020

• "Optimizing Multimodal Transportation Routes Considering Container Use" - Dandan Chen et al., Sustainability 2019, 11(19)

• "LITERATURE REVIEW ON SUSTAINABILITY IN MULTIMODAL TRANSPORTATION" - Nergis Özispa et al., Mersin University Journal of Maritime Faculty (MEUJMAF) Vol. 1, Issue 1, pp. 40-47, December 2019

• "Modelling of regional transit multimodal transport accessibility with Petri net simulation" – Kabashkin Igor, Procedia Computer Science, 77, pp. 151-157, 2015.

• "A comprehensive analysis of the planned multimodal public transportation HUB" – Yatskiv Irina and Budilovich Evelina, Transportation research procedia, 24, pp. 50-57, 2017.

1.3 Artificial Intelligence

Artificial intelligence (AI) is a key knowledge field to face operational transformations in majority of contemporary organizational activities. Implicitly, artificial intelligence (the philosophies of machines to think, behave and perform either same or like humans) has knocked the doors of business organizations as an imperative activity. For this reason, AI is a topic of major interest to both academics and practitioners. According to the objective of the project, the main interest is to identify the role that AI plays or can play in logistics operations. Also, these play a key role in real-time information processing and cooperation strategies. In deliverable 1.9 the relevance of this solution to the project will be reviewed more in detail.

Artificial Intelligence (AI), and particularly Machine Learning (ML), can provide solutions in integrated production management (Toorajipour et al., 2021), predict the probable backorder products before actual sales take place (Younis et al., 2021). Also, it can be used in optimization, automation, and human support by handling complex problems (Akbari and Do, 2021; Gupta et al., 2021; Khakpour et al., 2021). Woschank et al. (2020) argue that decision-relevant information would be automatically collected, aggregated, and pre-analysed by AI, ML, and Deep Learning (DL) technologies. Also, Woschank et al. (2020) show that these hybrid decision-making processes outperform purely rational decision-making processes.

According to Gupta et al. (2022), operations research has the ability to identify and provide optimal solutions in a well-defined problem space. Therefore, the challenge lies in providing illustrations that have sufficient expressive power for real-world scenarios and can promise fast and precise solution, and an AI and Operations research integration is promising to overcome these challenges. This integration can be applied to different areas of operations, i.e. routing, scheduling, pricing, process forecasting and control, among others. These fields can be supported with the help of AI techniques ranging from case-based reasoning, fuzzy logic, knowledge-based systems, genetic algorithms, and hybrid techniques (Gupta et al., 2022).

In the reviewed documents we found case studies showing how the implementation of disruptive technologies can improve the decision-making task in: waste management, water supply networks, power plants (Bodkhe et al., 2020), food SC (Ciampi et al., 2020), traffic information analysis in real-time (Bodkhe et al., 2020; Nguyen et al., 2021; Núñez-Merino et al., 2020), route planning and refuelling, pricing negotiations, maintenance times and packages flow optimisation (Bodkhe et al., 2020; Lamba and Singh, 2017; Sanchez-Gonzalez et al., 2019; Talwar et al., 2021); maritime logistics chain optimisation (Fruth and Teuteberg, 2017), truck arrival time prediction, blood SC (Arunachalam et al., 2018), forecasting demand (Nguyen et al., 2021; Rebelo et al., 2021; Riahi et al., 2021), product development (Barbosa et al., 2018), virtual design and simulation of processes (Birkel and Müller, 2021); predictive maintenance, human-expert-driven decision-making and AI-driven decision-making approaches for smart manufacturing processes based on AI and ML (Woschank et al., 2020).

In general, integrating external data lead to real-time enabled response modelling and would provide the necessary data for more holistic and realistic models. In this way, Smart goods, vehicles, and infrastructure are keys enablers. In the proposed framework, decision-making tools are embedded in fleet management, automated guided tasks, warehouse location/management and inventory management.

There are two recent literature reviews which aim to review significant work towards artificial intelligence in the context of logistics operations. Woschank et al. (2020) propose to classify the contributions on the following seven clusters:

- Strategic and tactical process optimization concentrates on the application of AI, ML, and DL methods to optimize strategic and tactical processes on an enterprise or logistics network design level. Based on learning systems for management support, so-called management information systems can be enriched with intelligence, therefore providing not only data, information, and key performance indicators but also preparing and make decisions on a strategic and tactical level. Further progress in such strategic and tactical process optimization will be important for large companies operating in different countries.
- Cyber-physical systems in logistics (CPS) describes opportunities for the development from a conventional logistics system to a Smart Logistics system based on actors and sensors for real-time data analysis and enhanced knowledge management through state-of-the-art learning approaches. CPS can be used to improve the quality of production and logistics processes, which further affects the overall

efficiency of the industrial enterprise. Moreover, CPS will lead to increased connectivity, consistent digitalization, better modelling techniques, more flexibility, and higher versatility and reusability of systems and systems' components.

- Predictive maintenance focuses on the usage of learning approaches in the areas of condition monitoring and predictive maintenance. Thereby, a multitude of studies suggests the application of recent AI approaches for the continuous reporting of machine settings, machine states, and quality parameter settings. Based on real-time data, enhanced knowledge can be used for further predictive analysis regarding a strategic and pro-active plant maintenance strategy for production and logistics processes.
- Hybrid decision support systems describes the improvement of non-automated and therefore human-centred decision-making processes by using learnable support systems. In this context, decision-relevant information will be automatically collected, aggregated, and pre-analysed by AI technologies. In many cases, these hybrid decision-making processes outperform purely rational decision-making processes.
- Production planning and control systems introduces new opportunities for advanced planning and control approaches in the research fields of inventory management, flow shop problems, traditional job shop scheduling problems, production process optimization, and the self-learning abilities of modern production planning and control systems based on the application of AI technologies.
- *Improvement of operational processes in logistics* outlines various possibilities for the enhancement of operational processes in logistics by applying AI technologies. Thereby, swarm robotics can be used to optimize smart warehouses, sound location systems can increase the efficiency of identification and tracking approaches, AI-based algorithms ensure holistic manufacturing fault diagnosis, and ant colony optimization approaches enable the optimization of milk runs in logistics problems.
- *Intelligent transport logistics* analyses the application of AI technologies in intelligent transport systems and intelligent transport processes. In this context, the performance of transport logistics can be increased by applying AI-based methods in combination with state-of-the-art approaches based on the usage of information technology, data communication technology, electronic sensing technology, global positioning technology, geographical information system technology, computer processing technology, and system engineering technology.

In addition, Woschank et al. (2020) present some practical examples that are important to mention:

- DHL research describe their vision of digital twins in logistics. Artificial intelligence has given digital twins and cyber-physical systems a big push in creating new value. Today, all the data DHL has from sensors, historical performance, and inputs about behaviour lends itself to being linked to spatial models and to predict future behaviour by changing different inputs. The data and prediction capabilities of AI make the spatial model come alive
- Presenso is a predictive maintenance software using machine learning and deep learning algorithms to drive precise and continuous failure prediction. With the use of software, logistics companies can achieve operational savings through full predictive maintenance aimed at yield optimization.
- SkyPlanner APS is an advanced planning and scheduling system using AI. The software includes AI that instantly optimizes work order, in which production is most efficiently scheduled. The AI algorithm also considers details that can further enhance production efficiency. For example, in many productions, it is advisable to schedule jobs that use the same materials or tools in succession. AI is also able to more accurately estimate the time it takes to complete the different jobs.
- Swarm Logistics is a deep-tech software technology company specializing in the development of intelligent, autonomous transportation systems. The Auto-Dispatcher of Swarm Logistics is based on a complex algorithm that is constantly improving itself with the use of artificial intelligence. This software was tested in a case study and compared to previous planning. The results of the comparison showed cost savings of 25% and 35% faster delivery for the transportation company.
- Siemens Mobility is testing its ITS Digital Lab applications and services for smarter management of road traffic, fleets such as e-bikes, and intermodal mobility. Connected vehicles sending data in real-time, infrastructure systems transmitting their status to Siemens' internet-of-things platform MindSphere and road users who are connected with their smartphones all produce an immense amount of data. This rich and growing source of data is changing the types of services of mobility that are feasible. Siemens Mobility is working on solutions for a Balanced Intermodal Mobility Ecosystem, which manages

not only the road network but also specific fleets within the network and ultimately the traveller across different modes of transportation.

Some of the most recent literature reviews covering AI in logistic context are:

- Dhamija, P., & Bag, S. (2020). Role of artificial intelligence in operations environment: a review and bibliometric analysis. The TQM Journal, 32(4), 869-896.
- Woschank, M., Rauch, E., & Zsifkovits, H. (2020). A Review of Further Directions for Artificial Intelligence, Machine Learning, and Deep Learning in Smart Logistics. Sustainability, 12(9), 3760.

1.4 Physical Internet

The Physical Internet (PI) is an emerging concept that applies the Digital Internet as a design metaphor for the development of sustainable, interoperable and collaborative freight transport. This concept responds to the urge to develop new logistics and SCM practices that are sustainable in the long run. It is the ultimate target of logistic innovations.

The main PI objective is to transform how physical objects are handled, moved, stored, realized, supplied, and used, aiming towards global logistics efficiency and sustainability. The PI aims to organize the transportation of physical goods in a manner like the way in which data packages are moved on the digital Internet. It can be achieved by sharing resources, such as vehicles and data, and designing transit centres, which enable seamless interoperability. Thus, it is possible to optimize the transportation of goods regarding cost, efficiency and sustainability.

The PI does not directly manipulate physical goods but rather manipulates and manages the shipping containers. For the PI to become full-fledged, numerous elements need to be coordinated, including physical objects, such as PI modular containers (PI-containers or π-containers) or PI transit centres (PI-hubs or π-hubs), and more abstract concepts, such as legislation and business models. Note that, one of the most relevant drivers of the approach is the Physical Internet's system of modular containers. This is what will make the shared network possible.

Due to the notable potential of PI to be a disruptive innovation in the logistics industry and the growing literature, the PI is rapidly gaining relevance in both academic and practitioner circles.

However, when talking about Physical Internet in the framework of the ePIcenter project, it is important not to ignore that fact that there are still serious concerns with the Internet access/connectivity at vast seas. The consortium is aware of this problem and will take this into consideration during the in the work that will be undertaken. The PI concept is supported by big data, standardisation, synchromodality and artificial intelligence, topics that will be further investigated during the project

Academic contributions:
There are literature reviews seeking to increase the understanding and status of the concept by critically examining the research efforts carried out so far by academic and practitioners' initiatives. Based on these reviews, it is possible to get an initial overview of the current state of current knowledge, and some insights of the future research directions and approaches that might be useful to include in the ePIcenter's project tasks.

Following the classification of PI literature themes proposed by Treiblmaier et al. (2020), in the following some insights offered by the authors are presented:

- Modular containers research conceptualizes shared, modular, sustainable, robust, lightweight and scalable PI containers. Using smart tags, including RFID and GPS technologies, PI containers collect and store logistics and SC information, which ensures container identification, integrity, routing, conditioning, traceability and security in interconnected logistics network. Thus, PI containers provide the foundation for sophisticated SCM that is characterized by real-time logistics and SC data flow and analysis. According to this, in this field disruptive technologies as Internet of Things and Big Data might play an important role.
- Vehicle usage optimization research proposes the idea of using shared, fully loaded, energy-efficient PI vehicles with relays, which reduces transportation costs and carbon footprints. Such research attempts to solve the problem of groupage transportation, including consolidation and deconsolidation centres in open-logistics network nodes in which goods are loaded/unloaded in/out of PI containers. As discussed in Section 1.2, in this field there are important challenges to face because of the complexity related to solve large size transportation problems.
- Transit centres research encourages the move from non-standardized proprietary transit centres to modern and open PI transit centres for efficient and effective cargo handling. Using coordination algorithms for matching demand and supply, the mission of PI transit centres is to efficiently and

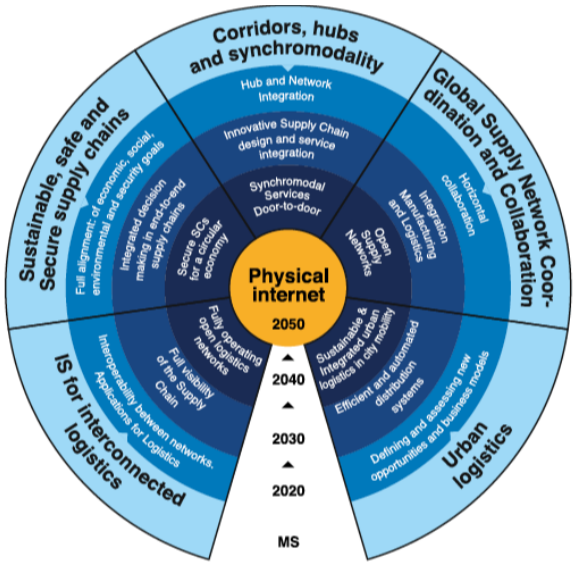
sustainably transfer PI-trailers from one truck to another. This is done specifically for two purposes: (1) to enable PI containers to move from their origin to its destination, facilitating delivery within the delivery time window and (2) to enable trucks to pick-up a PI container that will put the driver closer to the target destination at the end of a workday.

- The seamless, secure and confidential data exchange research defines a set of open, shared and secure protocols for data exchange in PI-enabled open logistics networks, which restrict access to data on goods and information about delivery status. Such research leverages multiple data models, including canonical data and enterprise application integrations, to define a common set of data and information for information exchange and interoperability between participants in open logistics network. In this field, blockchain and cloud computing technologies might play a relevant role.
- Legal framework research aims to synchronize the incompatible legal environments associated with different countries to provide legal security and seamless international transport. This, legal framework is especially useful for synchronizing the legal environment between regions that have relatively disparate legal systems.
- The cooperation models research attempts to redefine the existing practices for revenue sharing among different stakeholders in the new PI-enabled business models, such as PI hub holders and PI movers. This breakthrough in the cooperation practices should facilitate openness among logistics and SC partners.
- Business models: business model research strives to foster innovation in logistics practices and SCs by using the 13 principles of the PI. SC innovation is critical for companies to survive global competition and the PI can be fundamental to this innovation. The PI provides a new paradigm to encourage the development of innovative ideas that are based on PI to directly impact and improve the effectiveness and efficiency of current logistics and supply chain practices both in domestic and in global applications.

Some of the most recent literature reviews covering PI related literature are:

- Treiblmaier, H., Mirkovski, K., Lowry, P. B., & Zacharia, Z. G. (2020). The physical Internet as a new supply chain paradigm: a systematic literature review and a comprehensive framework. The International Journal of Logistics Management, 31(2), 239-289.
- Ambra, T., Caris, A., & Macharis, C. (2019). Towards freight transport system unification: reviewing and combining the advancements in the physical internet and synchromodal transport research. *International Journal of Production Research*, *57*(6), 1606-1623.
- Sternberg, H., & Norrman, A. (2017). The Physical Internet–review, analysis and future research agenda. *International Journal of Physical Distribution & Logistics Management, 47(8), 736-762*.

Working groups:
It is still too early to perform an analysis of the IP adoption process. However, there are groups of people and organizations developing and supporting the vision of the PI. For example, the Alliance for Logistics Innovation through Collaboration in Europe (ALICE) has created a roadmap (see below figure) of how the PI will gradually replace the logistics of today. ePIcenter aims to follow these roadmaps and in fact expects to accelerate progress so that targets are reached ahead of schedule with especially a link in WG1 Sustainable, Safe and Secure Supply Chains and WG2 Corridors, Hubs, Synchromodality (https://www.etp-logistics.eu/)



A second initiative that is worth to be mentioned is the Modular Logistics Units in Shared Co-modal Networks (MODULUSHCA). The objective of MODULUSHCA was to achieve the first genuine contribution to the development of interconnected logistics at the European level, in close coordination with North American partners and the international Physical Internet Initiative. The goal of the project was to enable operating with developed iso-modular logistics units of sizes adequate for real modal and co-modal flows of fast-moving consumer goods (FMCG), providing a basis for an interconnected logistics system for 2030. (https://cordis.europa.eu/project/id/314468/reporting/es)

Some Study/Business cases:
There are some business/study cases from start-ups and literature in line with limited but genuine implementation of the Physical Internet principles:

- Sarraj et al. (2014a) used data representing the flow of goods from the fast-moving consumer goods (FMCG) industry in France to test various transportation protocols and scenarios, concluded that the "PI is very efficient within the FMCG supply networks of two large retailers" (p. 3206) and reported positive effects on greenhouse gas emissions, cost, lead time and travel delivery time. (Sarraj, R., Ballot, E., Pan, S., Hakimi, D. and Montreuil, B. (2014a), "Interconnected logistic networks and protocols: simulation-based efficiency assessment", International Journal of Production Research, Vol. 52 No. 11, pp. 3185-3208.)
- Ballot et al. (2014) reported the findings of an exploration project in Canada in which simulations revealed various positive effects of the PI, including increased fill rates, energy savings, decreased transportation costs and reductions in the total logistics costs.
- *CRCServices (http://www.crc-services.com/en).* A Collaborative Routing Centre (CRC) proposes to route pallets of FMCG products from many suppliers to many retailers. A direct shipment takes place from the warehouse of each supplier to each distribution centre. When it makes sense, several shipments for several retailers are dynamically bundled from a single (or several) manufacturers to the CRC. The CRC, for a fixed per unit transhipment fee, sorts units received and fills trucks towards the retailers. The CRC could operate near the suppliers or near the distribution points or both.

- On the market for stocking companies like Flexe.com or stock-booking.com enable warehouses as a service.
- For transportation with many new marketplaces for shippers Uship.com.
- In cloud-based software solutions mixmove.io/en/

1.5 Hyperloop

Hyperloop is conceived as a magnetically levitated capsule to transport passengers between metropolitan cities at a very high speed. Therefore, its conception is oriented to the transport of passengers. Many companies are currently involved in the design and the production of the pods as well as the vacuum tube. The key challenge lies in creating a test track of a significant length that would be enough to ensure that the prototype pods will reach the desired maximum speed.

Given that prototypes for transport of passengers are under development, there are few contributions related to freight transport or SCM. Werner et al. (2016) estimates the shared value created by constructing a hypothetical Hyperloop to transport cargo along 300 km in Northern Germany. They identified and evaluated eight factors that create shared value: travel speed, operating costs, safety, noise pollution, air pollution, climate effect/carbon footprint, separation effect/property efficiency, and maintenance.

Later, Markvica et al. (2018) focusses on the estimation of the impacts of high-performance transport technologies (Hyperloop technologies, Cargo-Sous-Terrain, freight airships, and drones) on the society, spatial proximity, and the logistics sector while extending the European transportation network accordingly. They perform the estimation by solving a Design Transport Network problem on a small artificial scenario. According to their results, they conclude that the cargo airship is a cheap and versatile technology for the medium range and that the Hyperloop and Cargo-Sous-Terrain, due to their high costs as for now, are only applicable with a large subvention.

Finally, Rajendran and Harper (2020) study the Hyperloop from an operational perspective by developing simulation models. The authors identified the sequence of five events in Hyperloop operations based on the discussion provided by different contributions: Arrival of passengers at the Hub, Hyperloop arrival and unloading, Hyperloop loading and departure, Hyperloop travel, and Arrival at the terminal hub. To study the impact of varying parameters such as the pod capacity, the number of Hyperloop capsules in the system, commuter volume variability and willingness to use Hyperloop rate, the authors perform a sensitivity analysis.

References

- Werner, M., Eißing, K., & Langton, S. (2016). Shared value potential of transporting cargo via Hyperloop. Frontiers in built environment, 2, 17.
- Markvica, K., Hu, B., Prandtstetter, M., Ritzinger, U., Zajicek, J., Berkowitsch, C., ... & Schodl, R. (2018). On the Development of a Sustainable and Fit-for-the-Future Transportation Network. Infrastructures, 3(3), 23.
- Rajendran, S., & Harper, A. (2020). A simulation-based approach to provide insights on Hyperloop network operations. Transportation Research Interdisciplinary Perspectives, 100092.

1.6 Autonomous vehicles

Today, with the technological breakthrough in areas such as artificial intelligence (AI), driverless or fully autonomous transportation is a reality on certain transport legs. For road transport, the concept of autonomous cars is being developed and tested by companies like Google and Tesla. For air-based transport, unmanned aerial vehicles (UAVs) or drones are also being introduced for delivery services (Amazon). Given the importance of maritime transport in global trade, the interest in academia on automated marine vessels is also rapidly increasing. Gu et al. (2020) present a survey of the literature on autonomous marine vessels in general. They classify the contributions on the following categories:

- Safety: the topics in this category consists of collision avoidance, cyber security and other safety concerns.
- Navigation Control: about individual and group navigation control problems for unmanned vessels. The topics considered in this category include path or trajectory planning, path tracking or following, manoeuvring, steering, heading and swarm or formation control.
- Design: There search focus here includes the general design of the entire autonomous maritime system and specific sub-systems of the autonomous vessels.
- Projects and Prototypes: The project MUNIN (Maritime Unmanned Navigation through Intelligence in Networks) is a major research project regarding autonomous shipping funded by the European Commissions under its Seventh Framework Programme with intensive multinational and cross-industrial cooperation. Another research project, named Advanced Autonomous Waterborne Applications Initiative (AAWA) and funded by the Finnish Funding Agency for Technology and Innovation, aimed to study the specification and preliminary designs for the next generation of advanced ship solutions.
- Economic Analysis: The economic incentives, and economic analysis or cost-benefit analysis for autonomous vessels implementations.
- Environmental Impact: The literature about emission reduction for the conventional ships is well developed. However, only few articles collected in this survey considered the environmental impact brought by autonomous vessels.
- Law and Regulation: One of the main obstacles for the development of autonomous ships is that the existing maritime laws do not offer a practical legal framework for autonomous vessels to operate in international waters.

According to the results presented by the authors, it is important to highlight that most of the published articles have focused on navigation control and safety issues. Studies regarding other topics, such as transport and logistics, are very limited.

Some recent literature reviews covering Autonomous vehicles in logistics and freight transport are:

- Gu, Y., Goez, J. C., Guajardo, M., & Wallace, S. W. (2020). Autonomous vessels: State of the art and potential opportunities in logistics. International Transactions in Operational Research.
- Sanchez-Gonzalez, P. L., Díaz-Gutiérrez, D., Leo, T. J., & Núñez-Rivas, L. R. (2019). Toward digitalization of maritime transport?. Sensors, 19(4), 926.
- Bălan, C. (2018). The disruptive impact of future advanced ICTs on maritime transport: a systematic review. Supply Chain Management: An International Journal.

1.7 What opportunities and challenges have arisen from the current developments (COVID-19, Brexit, climate change)?

Based on papers published by international freight organizations and insights from the professional press (sources: http://www.linava.lt/naujienos/korona-virusas/; https://www.vz.lt/transportas-logistika; https://www.iru.org) it is possible to form initial observations that during the COVID-19 crisis the first and last mile systems faced the greatest challenges in the logistics supply chain. Also, another common observation highlighted by experts in the deployment of a global production system in China, stockpile policy, and response and shipment security issues.

During the crisis, most consumers experienced delays, loss or non-receipt of cargo and shipments. It would be a mistake to say that delays or disruptions occurred during the stages of global shipments. According to the publicly available information, no significant disruption has been highlighted in global transport. One major change was noticeable: in response to the growing demand for certain goods, conventional rail or waterborne transport was replaced by air transport. There have been airlines that have redesigned passenger cabins to accommodate their cargo, thus adapting to the need for the fast delivery of shipments. Substantial disruptions to parcel delivery occurred during the First and Last Miles stages of the logistics supply chain. This aspect is easily explained as the First and Last Mile subsystem is usually served by local courier companies or local transport companies that have adapted to transport relatively small volumes of freight. Before the crisis, they had optimized their capacity for the volume of freight at that time, but with the closure and the change in the traditional form of trade to the Internet, freight volumes increased significantly and delays or non-processing problems arose. Undoubtedly, the problems of information management and quality control also contributed to the growth of the existing cargo volumes. There is a need to rank orders, control inventory and create conditions to serve a larger number of customer orders. Examples from personal experience can be given when consignments arrive damaged - due to the large volume of cargo, the amount of loading and the proper use of protective materials were not properly controlled and the packaging was torn and damaged. Another problematic aspect observed is the dislocation of global production in China. During the last decades of the twentieth century, with the globalization of business and in response to the cost of labour and the cost of global transportation, global production of products was largely deployed in China. In the event of a crisis, this has led to two major problems: firstly, production has stopped due to the closure of factories, and secondly, the former transport times from China to the EU or the US have become too long. In response to these developments, discussions have begun on the possibility of relocating at least strategically important products to Europe, and in this context, Central and Eastern Europe, with a competitive workforce and past manufacturing experience, has great prospects. It should be noted that part of the production is already being developed closer to the consumer, but its volumes are insufficient and often unable to respond to changing significant fluctuations in demand. In the context of the COVID-19 crisis, an additional new issue was identified in the global logistics business: inventory management policies and applied methodologies. It must be acknowledged that Lean Logistics methodologies that focus on the complete abandonment of inventories or their significant minimization are debatable in this context and can have negative consequences for the operations of companies. Many of the problems would be alleviated if consumer markets accumulated higher-than-normal stocks of strategic products and used them faster than they did during the crisis. Therefore, stock management measures will inevitably be reviewed, which should allow for more development of the warehousing business in consumer markets.

As is known, the project ePIcenter will accelerate progress towards an Enhanced Physical Internet-enabled Global-European Network (“ePIGEN”). i.e. efficient integration of the infrastructure or “hard” TEN-T network with global networks, and seamless integration in the “soft” layer: secure international information flows and digitization, combined with ethical algorithms for environmentally-friendly logistics and seamless freight movements. Artificial Intelligence, digitization, automation and innovations in freight transport and handling technology offer powerful solutions to many important global supply chain issues. However, there is nervousness about AI in the partner community: concerns that important decisions are made by obscure, poorly understood algorithms on remote cloud-based servers, run by billion-dollar businesses who naturally aim to protect their interests. An important objective, therefore, is to address this vital point by developing a highly interactive and

user-friendly technology that can be rapidly deployed. All this means that the purpose of the project and the planned activities in the context of the COVID-19 crisis will only become more relevant and this crisis will both adjust the relevance of the project's goals and give them a clearer content. It has already been mentioned that several problems in the face of the crisis have been caused by poor management of information flows and problems with data processing. These groups of problems can include information availability, forecasting, user information, quality control, transportation process optimization opportunities, management. Therefore, the information and data management tool developed as a result of the project can be further updated. The objectives of the ePIcenter project state that sustainability and quality of life issues have never been more prominent: environmental impact, congestion, health, social equality and the work-life balance must all be considered in future strategies. This provision directly correlates with the challenges of the COVID-19 crisis and other project challenges, as well as crisis management approaches.

During the pandemic, due to limitations in airfreight (e.g. higher costs, limited capacity, local regulations) and sea freight (blank sailings), shippers explored the rail option with the benefit of lower costs than air and a faster transit time than maritime and shifted accordingly. This shift also challenged the current rail connections, infrastructure and capacities due to the unpredicted or planned volume increase. Shippers will with this experience now be able to consider 3 alternatives to connect China and Europe and require to prepare logistics flows (warehouses, etc.) also under consideration of first/last mile solution via truck and rail. Current patterns to use major airports or seaports will be challenged. This project shall define solutions to tackle the new ways and transport flows and shifts also under considerations of infrastructure situations and optimizations (incl. cross-borders situations) and climate targets.

An important lesson learned is to be more agile in the way you work and do business, streamline your flows and re-evaluate your business and purchasing model. This approach is perfectly translated into the approach of the consortium to the ePIcenter project.

Another important trend is that COVID-19 put even more pressure on cost control. Efficiency is key and so it is container stock logistics. Sudden production decrease/increase creates container overflow or demand. Empty stock locally creates heavy congestion at some ports and a huge amount of resources were spent to solve this (vessel space, capital, human work, energy,...).

Consumer behaviour patterns due to the pandemic have changed (e.g. moving into the online shopping channel) thus also patterns of cargo flows within supply chains are changing leading to new challenges and opportunities. This may continue also when this crisis is over. It will generate new challenges and improvement pinpoints in handling and follow-up of individual goods during transportation in order to make transportation more fluent and economic.

Both in B2B as well as B2C environments, behaviour of consumption/procurement and warehousing has significantly changed, e.g. through e-commerce, peaks of demand for specific products/services, supply shortage of products/services etc. These topics will not "go away" but will lead to long term evolutions of supply and transport chains. This leads to one main opportunity & challenge: Only those stakeholders who are capable of change and can react flexibly and ad hoc are future-proof in the long term. In this respect, this is highly relevant for ePIcenter, as resilience in the supply chain will be one of the most important future topics, with increasing importance.

In general, the COVID-19 crisis is widening the horizon in which many stakeholders are thinking. There is a tendency to be open also to more "unusual" or innovative ideas and solutions. This mindset could have a very positive impact on the ePIcenter project.

1.8 Impact of current trends (protectionism, Brexit, COVID-19,…) on stakeholders' position towards the use of innovative technologies

Firstly it should be stressed that the ePIcenter Partners do not expect the current developments to be exceptional, but more part of a "new normal". We live in a VUCA world (Volatility | Uncertainty | Complexity | Ambiguity). Thus, not only due to "recent" trends or economic climate, but permanently, an adaption towards more flexible, more diversified and more resilient logistics processes will be needed. To achieve this, technical support through intelligent IT/logistics optimisation tools is absolutely necessary. Data analytics, AI and others can and must provide support here, (a) to allow/support rapid changes/adaptations at all in the first place (b) to make higher complexities manageable due to diversification; and (c) to identify changes and risks early or at an early stage by means of predictive systems.

This being said, the trend towards supply chain optimisations is not new, but might have gotten a lot more attention in recent times, which make it clear that this is no longer a nice to have, but will become a must have in the future. A possible consequence of this might be stronger segmentation in the market. On the one hand there are those parties that see innovation and digitization as their USPs. On the other hand those that remain very traditional and lack the willingness and/or possibility to invest in their soft infrastructure. The recent trends, esp. COVID-19, might accelerate the widening of the gap between these two segments.

The ePIcenter project however chooses to approach these developments positively. Logistic processes are going to be more technologically supported thanks to investments in digitalisation and development of ICT which can lead to the more efficient market positioning of the modern logistics companies, especially those who participate in related R&D projects. Through ePIcenter's open partner community approach and focus on interoperability and transferability of solutions however, the clear ambition is also to see those companies who might be more traditional or lack the resources, gain from the work done under this project.

(Geo)political changes have forced shippers to reconsider the routes they use for their freight, but we believe that this could be greatly enhanced by the use of algorithms, which can search for thousands or millions of possible routes. Similarly, congestion in major terminals is often the consequence of major global disruptions, and we believe that queue reduction algorithms could be used to a much greater extent to mitigate the impact.

Also, stakeholders need to consider that their partners may be affected by COVID-19 and will need to recover for a certain amount of time not being able to do their tasks. Therefore, innovative technologies are needed, helping the stakeholders to handle the additional load in the same time periods. Companies have no or little experience in pandemic situations and are just acting according to their specific contingency plans while dealing with the restrictions or limitations issued by the governments. Efficient and cost-effective technologies which can handle decision making in situations like this, are going to help enterprises overcome the obstacles.

There is apart from transportation modes limitations and changes of routings, a strong demand to revise supply chains and shipments flows under aspects of transport routing availability, market changes, cost optimisation and lead time requirements. New solutions, new routings (e.g. using the New Silk Road by Rail instead of Air or Ocean) require new supply chain designs and optimization of processes.

The impact of the current economic climate might also not be felt in the same way everywhere. For example, shipping through the Northern Sea Route. i.e. cargo shipping from Asia to Europe and visa versa, according to some partners in the consortium is not that much affected since trade relations between Europe, Russia, China and rest of Asia are currently relatively good. The unstable political situation in the far-east as well as other spots along the southern sea route from Asia to Europe may even generate more traffic through NSR. Also the trend of diminishing ice at the NSR makes utilization of this route more attractive.

But in general, it is our feeling that there will likely be a greater need to ensure voyage efficiency and ensure profit margins are healthy under increasing financial pressures that will undoubtedly result from the like of Brexit /COVID-19. We also expect that in a future where climate change will be at the forefront of most decision making that optimising measures to ensure 'green' or environmental targets are met through the use of technology, will

be something all stakeholders will grow to realise and support. The crisis will accelerate the need for ePIcenter type of solutions.

2 Policy Review

2.1 Introduction

In case of a project as ambitious and broad in scope as ePIcenter, a great variety of policy initiatives, both existing as forthcoming, is relevant. While making sure all activities in the framework of ePIcenter comply with relevant European legislation, ePIcenter has the specific ambition to test various innovative concepts that can make a clear contribution to the EU's current policy agenda and even to inspire and influence the policy agenda of the future.

Moreover, since the time of submission of the ePIcenter application, a number of developments have greatly impacted and will continue to impact the sector of transport and logistics. Therefore, during the entire project's lifetime, the consortium will continuously monitor the impact of the COVID 19-crisis, Brexit, rising protectionism and trade disputes on its work. The diversity of our consortium and ambition to form a strong stakeholder community early on in the project will allow us to monitor their impact from very different angles.

2.2 Overview of relevant policy initiatives (EU)

1. **The European Green Deal** (COM (2019) 640 final)

Transport accounts for quarter of the EU's greenhouse gas emissions, and still growing. To achieve climate neutrality, a 90 % reduction in transport emissions is needed by 2050. All transport modes will have to contribute to this reduction.

Multimodal transport needs a strong boost. As a matter of priority, a substantial part (about 75 %) of inland freight carried today by road should shift onto rail and inland waterways, as well as onto short-sea shipping.

Automated and connected multimodal mobility will play an increasing role, together with smart traffic management systems enabled by digitalisation. The Commission foresees to develop smart systems for traffic management and „Mobility as a Service" solutions through its funding instruments, such as the Connected Europe Facility.

The Commission will also review the TEN-T Regulation to accelerate the deployment of zero and low-emission vehicles.

2. **Commissioner Valean's Speech**: "EU strategy for mobility and transport: measures needed by 2030 and beyond", European Parliament, 03.02.2020

Commissioner Valean emphasized that a real market for green, digital solutions is emerging, and she expressed a strong hope that the EU would be a global leader in the areas – from blockchain and digital mapping and tracking, to connected and automated vehicles, trains, planes, and vessels. Also, she expressed the intention to secure EU's position at a global level. For this it is necessary to take investment in research and innovations very seriously, and we need to work closely with industry.

3. **Europe on the MOVE** (Sustainable Mobility for Europe: safe, connected, and clean) COM (2018) 293 final

Technological change is touching all parts of society and the economy and transforming the lives of EU citizens, Transport is no exception to this trend. New technologies are radically changing the mobility landscape. They are disrupting conventional transport business models and industries, bringing new opportunities in the form of new

players, but also challenges. The labour market and the required skills are quickly evolving, and the EU must remain competitive in the face of intense global competition.

The EU has already begun to prepare the ground, for example with the adoption of strategies on cooperative intelligent transport systems, as well as on future 5G communications technology. The EU is also well-advanced on data protection rules that frame the digital single market.

However, more needs to be done. Technology is moving fast and there is a strong need for a coordinated approach and setting priorities for funding research, demonstration and deployment activities at European and national levels in order to make the most of the ongoing and future programmes, to maximize the concerted efforts of public and private investment, and to fully exploit synergies between connectivity and automation.

This Third Mobility Package also includes two proposals aimed at establishing a fully digital and harmonized environment for exchanges between transport operators and authorities. The proposed Regulations on a European Maritime Single Window Environment and on Electronic Freight Transport Information complement each other and will allow electronic and simplified exchanges between business and authorities along the transport routes from point of entry in the ports of the EU to the goods final destination (COM (2018) 278 and COM (2018) 279). These two proposals will cut red tape and facilitate digital information flows for logistic operations, providing better connections between different transport modes, thus contributing to multimodal solutions. See also https://www.europarl.europa.eu/legislative-train/api/stages/report/current/theme/resilient-energy-union-with-a-climate-change-policy/file/electronic-freight-transport-information

The problems occur in subsequent official procedures due to multiple entries of the same data in several diverse applications where errors often occur during repeated data input. Data is still duplicated using paper and electronic means (inputting the same data in different systems). It is therefore necessary to develop a Port Community System (PCS) which represents a neutral platform for electronic data exchange between all stakeholders of the port process. By harmonizing Maritime National Single Windows and Port Community Systems, the ultimate goal would have been achieved, which is the elimination of data duplication in a way that once entered data is visible to all stakeholders of the seaport system, resulting in more efficient and more effective business processes.

Infrastructure is an indispensable tool for deployment of clean, safe, digital and connected solutions in the transport system. The TEN-T network is Europe's transport infrastructure backbone. It has a strong influence on the mobility patterns for freight and passengers by setting common requirements, generating quality infrastructure projects and innovations. To this end, this Third Mobility Package includes a proposal for a Regulation aiming at facilitating the implementation of the TEN-T core network and promoting multimodality.

4. **On the road to automated mobility**: An EU strategy of the future. COM (2018) 283 final

Among the current challenges that face EU transport is the need to strengthen the links between vehicles and traffic management, between public and privately owned data, between collective and individual transport and between all transport service providers and modes.

It is also essential to find the right balance between sharing public and private data, enabling fair and effective competition for innovative solutions, and data protection. This is particularly important in the development of global transport chains and transport corridors.

The EC will follow an integrated approach between automation and connectivity in vehicles. When vehicles become increasingly connected and automated, they will be able to coordinate their manoeuvres using active infrastructure support and enabling truly smart traffic management for the smoothest and safest traffic flows.

The EC has already taken actions to promote the deployment of connectivity enabled infrastructure and services in the support of automated vehicles with the adoption of strategies for 5th generation of communication

networks (5G). Support from CEF is very important to digitize transport infrastructure in promotion of automation.

Other macro-regions (e.g. United States, China) are already adopting strategies for automated vehicles and attracting investment in this field. It is therefore very important that as many countries as possible could accept the model being developed by the EU, also the experience gained in this area.

Finally, EU data protection rules are increasingly recognized at international level as setting out some of the highest standards of data protection in the world and are shaping the digital revolution.

5. **A European strategy on Cooperative Intelligent Transport Systems**, a milestone towards cooperative, connected and automated mobility.COM (2016) 766 final

Digital technologies are one, if not the strongest, driver and enabler of transformation processes which makes transport safer, more efficient and sustainable. Cooperation, connectivity and automation are not only complementary technologies, they reinforce each other and will over time merge completely.

Several Member States have started C-ITS deployment activities under real life conditions through strategic alliances such as the EU cooperative corridor linking Rotterdam to Frankfurt and Vienna or the Amsterdam Group.

This Communication presents an EU strategy for the coordinated deployment of C-ITS to avoid a fragmented internal market in the field of C-ITS and create synergies between different initiatives. It addresses the most critical issues, including cyber-security and data protection (both particularly important for public acceptance) and interoperability and recommends action at different levels. A digital transport system requires thinking in horizontal layers, cutting across different transport modes and industries, rather than in vertical silos.

The focus can no longer be on the infrastructure layer alone (roads, vehicles). Digital technologies also build on data layers which contain both static data such as digital maps or traffic regulations and dynamic data such as real time traffic information. These data are then used to develop a layer of innovative services and applications, which are made available over a layer of networks.

An integrated transport system relies on the interoperability of its components. That means that the systems need to be able to interact with each other, across borders and transport modes, at all levels: infrastructure, data, services, applications and networks. While standardisation activities are necessary, they alone are not sufficient to ensure interoperability.

6. Trans-European Transport Network (TEN-T)

REGULATION (EU) No 1315/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU

The trans-European transport network (TEN-T) shall stengthen the social, economic and territorial cohesion of the EU and contribute to the creation of a single European transport area which is efficient and sustainable, increases the benefits for its users and supports inclusive growth.
Regulation (EU) No 135/2013 contributes to the attainment of the major EU objectives, as set out in the Europe 2020 Strategy and Commission White Paper (2011), such as allowing the seamless, safe and sustainable mobility of persons and goods, ensuring accesibility and connectivity for all regions of the EU, and contributing to further economic growth and competitiveness in a global perspective.
The document empasizes that the TEN-T network should be developed through the creation of new transport infrastructure, through the rehabilitation and upgrading of existing infrastructure and through measures promoting its resource-efficient use. In specific cases, due to the absence of regular maintenance in the past, rehabilitation of rail infrastructure is necessary.

At the same time, the TEN-T network should be developed through a dual-layer structure consisting of a comprehensive network and a core network based on a common and transparent methodology, those two layers being the highest level of infrastructure planning within the Union.
The core network should be identified and appropriate measures should be taken for its development by 2030 as a priority within the framework provided by the comprehensive network. The core network should constitute the backbone of the development of a sustainable multimodal transport network and should stimulate the development of the entire comprehensive network. It should enable Union action to concentrate on those components of the trans-European transport network with the highest European added value, in particular cross-border sections, missing links, multimodal connecting points and major bottlenecks serving the objective, set out in the White Paper, of reducing greenhouse gas emissions from transport by 60 % below 1990 levels to be achieved by 2050.
In order to establish the core network in a coordinated and timely manner, thereby making it possible to maximise the network benefits, Member States concerned are obliged to ensure that appropriate measures are taken to finalise projects of common interest by 2030. With respect to the comprehensive network, Member States should make all possible efforts to complete it, complying with the relevant provisions of the guidelines, by 2050.
Thanks to its large scale, the trans-European transport network should create the basis for the large-scale deployment of new technologies and innovation. These, for example, can help to enhance the overall efficiency of the European transport sector and reduce its carbon footprint. This will contribute towards the objectives of the Europe 2020 Strategy and the White Paper's target of a 60 % cut in greenhouse gas emissions by 2050 (compared to 1990 levels), and at the same time contribute to the objective of increasing fuel security for the Union. In order to achieve those objectives, the availability of alternative clean fuels should be improved throughout the trans-European transport network.
The trans-European transport network must ensure efficient multi-modality in order to allow better and more sustainable modal choices to be made for passengers and freight and in order to enable large volumes to be consolidated for transfers over long distances. This will make multimodality economically more attractive for passengers, users and freight forwarders.
In order to achieve modal integration across the network, adequate planning of the trans-European transport network is required. This also entails the implementation of specific requirements throughout the network in terms of infrastructure, telematic applications, equipment and services. It is therefore necessary to ensure adequate and concerted deployment of such requirements across Europe for each transport mode and for their interconnection across the trans-European transport network and beyond, in order to obtain the benefits of the network effect and to make efficient long-range trans-European transport operations possible.

Very important also in the framework of the ePIcenter project, the TEN-T policy is currently undergoing a revision. In order to achieve smart, sustainable and inclusive growth, to stimulate job creation and to respect the long term decarbonisation commitments, the Union needs an up-to-date multimodal high-performance infrastructure to help connect and integrate the Union and its regions, including remote, outermost, insular, peripheral, mountainous and sparsely populated ones, in transport, digital and energy sectors. Those connections should help to improve the free movements of persons, goods, capital and services. The trans-European networks should facilitate cross-border connections, foster greater economic, social and territorial cohesion and contribute to a more competitive and sustainable social market economy and combating climate change. In the revision, a far reaching alignment of the TEN-T network principles with those of the Green Deal is expected.

7. **Connecting Europe Facility (CEF),** REGULATION (EU) No 1316/2013

An important objective of the Connecting Europe Facility (Programme) is to deliver increased synergies and complementarity between the transport, energy and digital sectors. Enabling digital communication to be accessed as an integral part of common interest in the field of energy and transport.
Actions contributing to projects of common interest in the area of digital connectivity infrastructure shall deploy the best available and suited technology for the specific project, which proposes the best balance between state-of–the art technologies in terms of data flow capacity, transmission security, network resilience and cost

efficiency, and should be prioritised by way of work programmes taking into account criteria set out in this Regulation.
Among other issues, the General Secretariat of the Council document 7207/1/19 states, that in order to favour an integrated development of innovative cycle, it is necessary to ensure complementarity between the innovative solutions developed in the context of the Union Research and innovation framework and the innovative solutions deployed with support from the Connected Europe Facility. The exchange of information and data between Horizon Europe and the Connecting Europe Facility will be facilitated, for example by highlighting technologies from Horizon Europe with a high market readiness that could be further deployed through the CEF.
This important provision applies directly to the ePIcenter project. Because we have an ambitious goal to create a new logistics concept and tools (with the possibility to adopt them in the different areas) that allow end users to benefit from technology without massive investment in hardware or infrastructure. Also, these tools will promote a high level of collaboration between different stakeholders. Together it would be rational to include Macro-regional programmes in addition to the CEF and Horizon Programme for the exchange information on innovations. At joint events promotion of innovations could be organised.
At the same time ePIcenter will also to contribute to the implementation of the specific objectives in the transport sector, including development of efficient, interconnected and multimodal networks and tools, promotion of smart, interoperable, sustainable, inclusive, accessible, safe and secure mobility.

8. Transport White Paper (2011), Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system

In 2011, the EC adopted a roadmap of 40 initiatives in order to create a competitive transport system that will increase mobility, remove major barriers in key areas and fuel growth and employment. At the same time, the proposal aims to dramatically reduce EU's dependence on imported oil and cut carbon emissions in transport by 60% by 2050, with 50% shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport.

The Transport White Paper (2011) is a strategic document that has served and continues to guide the development of the EU transport sector. Building on the previous experience and lessons learned, this document (Roadmap) takes a global look at the developments in the transport sector, at its future challenges and at the policy initiatives that need to be considered. A very ambitious goal has been set here, namely that the Eastern and Western parts of Europe must be united to fully reflect the transport needs of almost the entire European continent and the EU 500 million citizens.

In pursuing this ambitious goal, the Roadmap sets out guidelines for how to create a Single European Transport Area by eliminating all residual barriers between modes and national systems, easing the process of integration and facilitating the emergence of multinational and multimodal operators. A Single European Transport Area facilitates to ease the movements of citizens and freight, reduces costs and enhances the sustainability of European transport. A higher degree of convergence and enforcement of social, safety, security and environmental rules, minimum service standards and users rights were focused in this document also.

The importance of transport research and innovation is also emphasised in the White Paper. The document states that technological innovation allows achievement of faster and cheaper transition to a more efficient and sustainable European transport system by acting on three main factors: vehicle efficiency through new engines, materials, and design; cleaner energy use through new fuels and propulsion systems; better use of network and safer and more secure operations through information and communication systems.

Transport research and innovation policy should increasingly support in a coherent way the development of key technologies needed to develop the EU transport systen into a modern, efficient and user- friendly system. To be more effective, technological research needs to be complemented with systems of multiple actors and large demonstration projects to encourage market take-up.

Transport is fundamentaly international. Because of this a lot of actions declared in the White Paper are linked to challenges related to the development of transport beyond the EU borders. Transport is therefore included in all EU Trade negotiations aiming to promote the EU's role as a standard setter in the transport field, including extension of the EU transport and infrastructure policy to the immediate neighbours, and the preparation of mobility continuity plans to deliver closer market integration.

9. EU's Vision Zero policy (https://ec.europa.eu/transport/sites/transport/files/legislation/swd20190283-roadsafety-vision-zero.pdf)

This vision will be supported by innovations in freight transport that reduce the pressure and weight of traffic on busy roads. A switch to greener modes also means less long-distance driving for truck drivers, which has obvious safety benefits.

10. Public Procurement of Innovation for the public sector

Public Procurement of Innovation is the EC supported policy for enablement of wide diffusion of innovative solutions on the market. PPI provides a large enough demand to industry to invest in commercialisation in order to bring new and innovative solutions to the market with the adequate quality and price appropriate for wide market deployment. By this, the public sector can modernize public services with better value for money solutions and provides growth opportunities for companies. Public Procurement of Innovative solutions (PPI) happens when the public sector uses its purchasing power to act as early adopter of innovative solutions which are not yet available on large scale commercial basis. The European Structural and Investment Funds (ESIF) are financially supporting individual procurers to prepare and undertake PPIs and are able to support them also to participate in Horizon 2020 funded PPIs.

11. EU's connectivity strategy

The EU's response to China's "New Silk Roads" initiative. Its official goal is to strengthen cooperation between the two continents. It is important that the EU agrees on a vision to handle the New Silk Road initiative launched by China and guide based on European infrastructure the volumes flows and build the necessary networks, terminals to cope with the new connections coming in via East (CIS countries).

12. Initiatives on Artificial Intelligence. Artificial Intelligence for Europe {SWD(2018) 137 final}

The communication states that the Artificial Intelligence (AI) research community, as well as innovative entrepreneurs and deep-tech start-ups (founded on scientific discovery or engineering), have a strong industry producing more than a quarter of the world's industrial and professional service robots (e.g. for precision farming, security, health, logistics), and leading in manufacturing, healthcare, transport and space technologies – all of which increasingly rely on AI. Europe also plays an important role in the development and exploitation of platforms providing services to companies and organisations (business-to-business), applications to progress towards the "intelligent enterprise" and e-government (Source: https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe).

Without such efforts, the EU risks losing out on the opportunities offered by AI, facing a brain-drain and being a consumer of solutions developed elsewhere. The EU should therefore strengthen its status as a research powerhouse while bringing more innovation to the market. A vast majority of European companies – whether large or small – should also adopt AI technologies.

Alongside this Communication, the Commission has put forward a set of initiatives to grow the European data space. These are:

- an updated Directive on public sector information, e.g. traffic, meteorological, economic and financial data or business registers;
- guidance on sharing private sector data in the economy (including industrial data);
- an updated Recommendation on access to and preservation of scientific information; and
- a Communication on the digital transformation of health and care, including sharing of genomic and other health data sets.

The Commission calls on companies to recognise the importance of non-personal data reuse, including for AI training purposes.

A new support centre for data sharing will provide public authorities and companies with legal and technical support when trying to access data from public sector bodies and companies. The Commission will continue to study how more data can be made available.

13. 5G for Europe: An Action Plan (SWD (2016) 306 final)

The communication states that twenty-four years after the successful introduction of the 2G (GSM) mobile networks in Europe, another revolution is in sight with a new generation of network technologies, known as 5G, opening prospects for the new digital economy and business models. 5G is not fully standardised yet but its key specifications and technological building blocks are already being developed and tested. 5G is seen as a game-changer, enabling industrial transformations through wireless broadband services provided at gigabit speeds, the support of new types of applications connecting devices and objects (the Internet of Things), and versatility by way of software virtualisation allowing innovative business models across multiple sectors (e.g. transport, health, manufacturing, logistics, energy, media and entertainment). While these transformations have already started on the basis of existing networks, they will need 5G if they are to reach their full potential in the coming years.

The proposed European Electronic Communications Code will support the deployment and take-up of 5G networks, notably as regards assignment of radio spectrum, investment incentives and favourable framework conditions, while the recently adopted rules on open Internet provide legal certainty as regards the deployment of 5G applications. This communication complements and leverages this new regulatory framework through a set of targeted actions. These draw on multiple consultations, events with stakeholders, a targeted survey, several studies, industry consultations, and early results from the 5G-PPP. It presents an action plan for timely and coordinated deployment of 5G networks in Europe through a partnership between the Commission, Member States and industry.

Following the provisions of the Communication, Member States will adopt appropriate legislation in their countries, setting out guidelines for the development of 5G communications, funding mechanisms and areas of use. It must be noted that the development of 5G connectivity would have a direct impact on the transport and logistics sector. Most 5G development projects are related to transport and logistics infrastructure - existing and under development. 5G measures are envisaged in densely populated areas, transport corridors and other important logistics infrastructure. The development of 5G is expected to have a direct impact on the leap forward in communication technologies, facilitate the operation of information systems, and stimulate the development of artificial intelligence tools in transport and logistics.

However, the development of 5G has several barriers that are related to technology and the resistance of a part of the society and the existence of relevant conspiracy theories. Since 2018, there have been discussions about the security of Chinese-made 5G equipment and the possibility of taking other actions that could compromise the security of the countries using Chinese-made 5G equipment. These provisions are particularly emphasized by the United States. The situation can be illustrated by the following quote: “For years, the Shenzhen-based company has dominated the mobile infrastructure market, outselling rivals Nokia and Ericsson by offering cheaper alternatives. But U.S. concerns that Huawei equipment could be used by Beijing for espionage has gained traction: officials in the UK and France are purging their own networks of Chinese-made kit. A similar reaction

elsewhere will seriously dent a business that generated nearly $43 billion in revenue for Huawei last year, roughly a third of the company's total." Source: https://www.reuters.com/article/us-huawei-tech-5g-security-breakingviews/breakingviews-chinas-huawei-holds-a-5g-trump-card-idUSKCN24S09Y

As already mentioned, certain theories are being disseminated in society that claim the harmful effects of 5G on humans. So as Britain's carriers lined up to launch their 5G networks in summer 2019, they were expecting some resistance. Fears over the health effects of mobile telephony are widespread, ranging from fairly limited concerns about potential long-term risks of living or growing up in close proximity to masts, to claims of full-blown "electromagnetic sensitivity", which supposedly manifests as a plethora of symptoms from headaches to immunodeficiencies. Source: https://www.theguardian.com/technology/2019/jul/26/how-baseless-fears-over-5g-rollout-created-a-health-scare

14. Integration of the Western Balkans into the European Union

Having in mind all the benefits of being the part of one of the largest economic and political unions such as the EU, and being a significant part of European land and history, it is natural to expect that Western Balkan countries strive towards political and economic integration with the rest of Europe. One of the most important parts of the process of accession of the Western Balkans to the European Union is the economic integration. It can be stated that several economic issues and criteria are crucial ones when acceding to the Union, especially in the light of the market fluctuations, development disequilibrium, financial and economic crisis and its aftermath causing some socio-demographic changes and political problems. Particularly, the smallest country of Western Balkans, Montenegro, has started the negotiations for accessing the EU in 2012 and in the past eight years opened and discussed most of the negotiation chapters in the process of integration. According to the relevant analytics, it is stated that in the transportation sector and trans-European networks, Montenegro still has to put efforts in order to close this part of negotiations, beside significant resources that have been invested in infrastructural and transport connections (highway for connection of the southern and northern part, regional roads etc). Montenegro as a state candidate for membership in EU, obtains the financial support within the Instrument for Pre-Accession Assistance (IPA) funds and participates as a member in various development programmes with realization of the EU projects in the consortium together with other EU members. In that sense, Montenegro is dedicated to actively deploy a good potential for further development of its available resources and full economic valorisation of geographic, strategic and transportation advantages.
Also, the other important aspect of the economic integration of the region is the energy security on the Western Balkans. It means ensuring energy sufficiency enough to meet the demand, achieving ecological sustainability and creation of preconditions for increasing of energy supplies. The development of energy capacity of the region able to satisfy the growing demand, is a major challenge and a key element in the process of integrating into the European Energy System.

The ongoing "Berlin Process" is an important initiative aimed at stepping up regional cooperation in the Western Balkans and aiding the integration of these countries into the European Union. It was launched on August 28, 2014, by German Chancellor Angela Merkel. The Berlin Process has many goals which are outlined in the Final Declaration by the German Chair: "To make additional real progress in the reform process, in resolving outstanding bilateral and internal issues, and in achieving reconciliation within and between the societies in the region", and to enhance "regional economic cooperation and lay the foundations for sustainable growth".

The Berlin Process is implemented with support of the EC, IFIs, and the EU Member States involved in the Process – Austria, Croatia, France, Germany, Italy, Slovenia and the United Kingdom. The most important agenda of the Process is the Connectivity Agenda (CA) that refers to linking the people (social dimension), economies (economic dimension) and states (political dimension) of the region. Within this agenda, the Berlin Process has thus far yielded initiatives and projects in the fields of transport and infrastructure, economic connectivity, youth cooperation and cooperation among businesses and among the civil societies of the Western Balkans. CA in the Western Balkans is one of the pillars of the Berlin Process. From its beginning in 2014, CA has been linked to connecting physical infrastructure and energy systems" within the region and of the region with the EU. The Connectivity Agenda - will enhance the connectivity between the Western Balkans countries as well as with the EU network, with the facilitation provided by the EC. In the 2018 Enlargement Strategy, increasing connectivity in transport and energy is part of one of the six Flagship Initiatives. Since 2014 CA has resulted in an increase of

EU funding and support for the economic integration within the region and of the region with the EU. By end of 2019, CA consisted of 39 projects, for an investment value of €3.2 billion, including a grant value of €880 million, the remaining being loans. In this context, the transport sector has received funding for 32 projects out of 39, becoming the most important one. But the strategic objectives and guidelines for the development of the Western Balkan transport system include not just the transport development of the region but also economic and social development.

Also, one of the possible initiatives that could be developed in the area of Western Balkans, regarding the maritime transport infrastructure and being connected by the Adriatic sea with southern EU states such as Italy and Greece, these countries can successfully integrate as a part of general EU transportation policy and strategy for connection of maritime and land transportation, known as the Motorways of the Sea (MoS).

15. EU consolidation after the Brexit

The post-BREXIT situation will unfortunately directly affect the EU's fundamental values: the free movement of persons and goods and services. It has been mentioned repeatedly that new problems will arise concerning customs procedures, free trade, customs duties, taxes, permits and certificates. Knowing that the UK was a significant trading partner of the EU member states the build-up of new commercial relations will be crucial, and both parties might have to look for alternative supply and consumer markets.

Admittedly, the BREXIT process has been protracted over time, with many uncertainties and further affected by the COVID-19 pandemic. This report does not yet fully harmonize all issues, not only on free trade but also on the use of transport infrastructure, such as the future of the Eurotunnel.

According to The Guardian: the EU wants the UK to drop its opposition to a role for the European court of justice in British affairs to ensure trains keep running between France and the UK after Brexit is implemented. The European Commission has asked the European Parliament and the European Council to officially mandate France to urgently negotiate a new bilateral deal with the UK giving the ECJ the powers to resolve future disputes between the two countries as “union law would no longer apply to the part of the channel fixed link under the jurisdiction of the United Kingdom”, after Brexit. Unless there is an overarching deal with one body responsible for legal disputes regarding the entire 30-mile (50km) tunnel there will be chaos, insiders say. Source: https://www.theguardian.com/politics/2020/jul/30/brexit-european-court-row-puts-eurotunnel-operations-at-risk

In response to the current uncertainties and the dynamics of the situation, it can be said that the issue of EU consolidation after BREXIT is just beginning to be discussed. It can be predicted that in the future issues related to the redistribution of markets, the development of new transport and logistics flow management schemes will have to be addressed. Restructuring of raw materials, production and consumption markets can also be foreseen. Cooperation with China and the United States as potential consumer markets is important for the European Union.

EU consolidation can be linked to the wider use of integrated information systems in the management of transport infrastructure. Simpler, easier management of the logistics system, consumer information, simplified freight transport inside and outside the EU, as well as fast processing of Big Data, would allow for greater integration in the EU through the operation of logistics.

16. Blue Belt initiative for maritime transport

The Blue Belt is an area where vessels can operate freely within the EU internal market with a minimum of administrative burden while safety, security, environmental protection as well as customs and tax policies are enhanced by the use of maritime transport monitoring and reporting capabilities (processes, procedures and information systems).

Its official goal is to improve competitiveness of the maritime sector through the reduction of administrative burden and costs. Enhancing the attractiveness of maritime transport and Short Sea Shipping in particular stimulates employment, reduces the environmental impact of transport. In short, it promotes real Blue Growth.

17. Adriatic Beltway

Italian ports of Bari, Brindisi, Lecce and Taranto play a strategic role in the connection with the Eastern shores of Adriatic Sea through Durres in Albania and Bar in Montenegro, closing the southern segment of the "Adriatic Beltway" by connecting TEN-T Scandinavian – Mediterranean with Western Balkans. Sea links between Bari port in Puglia and Durres / Bar ports on the Eastern shores complete the circular composed by 3 TEN-T (Bari – North of Italy, intersecting with the TEN-T Mediterranean in Slovenia – Croatia –, and with Rhine- Danube Corridor in Belgrade, and then intersecting with Orient-EastMed).

2.3 Overview of relevant policy initiatives (International)

1. **UNCLOS (United Nations Convention on the Law of the Sea of 10 December 1982), especially Part XII on protection of the marine environment (incl. MARPOL regulations)**

United Nations Convention on the Law of the Sea (UNCLOS) as a main international legislative act regulating the area of sea related activities and issues, including very wide range of provisions for legal status, privileges, authorities, economic zones, maritime trade rules and facilitations, territorial sea, international interests on sea, exploitation of sea resources, organization of tribunal for law at sea, as well as arbitrations.

2. Marine Strategy Framework Directive

This directive established a special framework that enables the member states to achieve and maintain the good marine environmental status. For realization of the goals, the definition and development of a marine strategy for each country has been made mandatory. For determining the marine strategy, a member state should make: a) a preparation by assessment of current environmental status of regional waters, its features and characteristics, human activity impacts; b) monitoring programmes for ongoing assessment of the environmental status of their marine waters on the basis of the provided indicative lists. Also, the member state needs to ensure the adequate procedures of updating, reports and public information providing.

3. Artic Councils PAME

Special impact on the environment regulating the arctic regional countries has been made through the Arctic Council's Protection of the Arctic Marine Environment (PAME) Working Group, with the aim to make specific action programmes for dealing with contaminants, conservation of flora and fauna, emergency prevention, protection, preparedness and response and monitoring and assessment of marine and good environmental status of arctic circle member states. This council investigates and reports on important elements of arctic ecosystem such as biodiversity, safeguard, climate, ocean, pollutants, emergencies with support by realization of various R&D projects in this area. The PAME working group was established in 1991, with chairmanship in Finland, and its main concerns are Arctic Shipping, Marine Protected Areas, Resource Exploration and Development, Ecosystem Approach to Management and suppression Arctic Marine Pollution.

4. Polar Code

The safety of ships operating in the vulnerable polar areas and the protection of the environments around the two poles have always been a matter of concern for IMO and many relevant requirements, provisions have been developed over the years. Therefore, the IMO made the International Code for Ships Operating in Polar Waters (Polar Code) mandatory under both the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL). The Polar Code covers the full range of design, construction, equipment, operational, training, search and rescue and environmental protection matters relevant to ships operating in the inhospitable waters surrounding the two poles. The chapters in the Code each set out goals and functional requirements, to include those covering ship structure; stability and subdivision; watertight and weathertight integrity; machinery installations; operational safety; fire safety/protection; safety of navigation; communications; voyage planning; manning and training; prevention of oil pollution; prevention of pollution by sewage from ships; and prevention of pollution by discharge of garbage from ships.

5. Recent changes of IMO FAL Convention

In general, these policies are Single Window and Trade Facilitation initiatives and introduce a mandatory requirement for contracting states to IMO FAL Convention (currently 123 states) to implement National Maritime Single Windows. All information required by the public authorities in connection with the arrival, stay and departure of ships, persons and cargo, is to be submitted via a single portal, without duplication.

6. A Europe-wide (or even wider) collaboration of satellite service providers

Providing arctic ice information) to simplify and ease purchasing and pricing of their services in order to develop accordingly the arctic shipping services (like route optimization through ice) in solid basis.

2.4 Examples of recent initiatives in the framework of COVID-19

1. Increased focus on the TEN-T network e.g. : https://ec.europa.eu/transport/themes/infrastructure/news/2020-06-16-european-coordinators-completion-ten-t-network-necessary_en

2. All freight crossings at borders should take no more than 15 minutes to keep freight moving: https://ec.europa.eu/commission/presscorner/detail/en/ip_20_510

3. The Galileo Green Lane app has helped reduce waiting times at borders for freight vehicles. https://ec.europa.eu/transport/media/news/2020-06-04-galileo-green-lane-app_en

4. Directive for the transportation by air for essential supplies such as food, medicine and PPE: https://ec.europa.eu/transport/sites/transport/files/legislation/c20202010_en.pdf

5. EU and UK driving hours were relaxed temporarily (this is very significant when planning multimodal hinterland transport operations): https://ec.europa.eu/transport/sites/transport/files/temporary-relaxation-drivers-covid.pdf

6. The proposed waiving of track access charges as support measure in the EU: https://www.railfreight.com/policy/2020/06/24/eu-proposes-waiving-of-track-access-charges-as-support-measure/

2.5 Other developments relevant to ePIcenter

1. Russia's announcement that fresh food will be allowed through Russia provided containers are electronically sealed: https://www.railfreight.com/specials/2019/07/09/russia-lifts-ban-on-transit-of-sanctioned-eu-products-by-rail/

2. Use of the new Silk Road routes for mail and parcels from China to Europe: https://www.railfreight.com/beltandroad/2020/06/25/chinese-mail-finds-way-to-europe-by-train/

3. Low Emission Zones, Clean Air Zones and similar initiatives, such as those applied in London (https://tfl.gov.uk/modes/driving/low-emission-zone) and many other cities and regions will encourage modal shift and use of electric vehicles.

2.6 What about alignment between policy initiatives on different levels?

It is the clear ambition of the ePIcenter project to demonstrate a number of innovative solutions which can be duplicated and implemented as widely as possible, on a global scale. Taking into account the multitude of policy levels and organisations which are dealing with relevant issues, not only in the EU and its member states, but also in third countries (Canada, US, South America, China, …), alignment of policy priorities and implementation will be one of the most important aspects influencing the effective results of ePIcenter. Concrete alignment or a lack of alignment will determine how transferrable ePIcenter's results will really be. Therefore, it seems valuable to already touch upon this aspect in the framework of this report.

Policy initiatives are often quietly aligned, but recent global market changes and developments cause the need for more international coordination of trade relations and logistics processes.

We might say transport is one of the global technologies. However, the specificity of its functioning largely retains national characteristics. National protectionism has even become a more powerful trend during the pandemic. However, these tendencies objectively impede the development of the international economy. We experience a lack of agreed standards at national and international level in order to build real global logistics chains. Some examples of fields where this would be of great added value: rail infrastructure investments, transport modes and climate initiatives.

Some partners stress that on certain levels, there is a lot of useful work being done. However, as there is some kind of alignment at a high level (EU, IMO, UN), also at a local one (port authorities, cities), it is often the national level which lags behind. This is further stimulated by the current protectionist climate.

Furthermore, within the EU there might be alignment in many fields, but it's essential to align with other continents as well. A relevant question is also how we can involve better some smaller markets and economies, e.g. through international organisations and companies in transport and logistics networks.

To this end, special attention should be directed towards the significance of regional networking as well as to the impact of logistic networks development and international organizations investments on small and developing countries and companies which can be of great importance in the further process of global logistics chain transportation.

In 2014 the BSR INTERREG program project "BSR Transgovernance" (Source: http://www.bdforum.org/final-discussions-transport-bsr-transgovernance-project-close/) was implemented, which sought to analyse the nature of cooperation barriers and possible patterns of behaviour. Even then, it was noticed that to define a mission of public authorities in the field of development of the transport system, it is essential to analyse two most important segments of this broad system: the infrastructure and its users (carriers, operators) having different specific features of functioning and activity development. Within the transport system, carriers, operators and other transport service providers operating under market conditions have to work in a competitive environment. Here, the role of public authorities should be oriented to the creation and guaranteeing of equal competitive conditions for all transport service participants, usually acting based on private ownership and initiative, because the efficiency of the transport infrastructure (mostly acting based on public ownership) and benefits of its development in the civilized world are being assessed on the scale of an individual country or the whole region rather than on that of an individual enterprise. The recommendations of this project could be taken into account in the ePIcenter approach promoting high level of collaboration between various stakeholders.

The development and modernization of transport infrastructure is one of the essential measures that ensure economic progress in working out national economic development strategies and programmes of the EU and neighbouring countries.

One important aspect would be to interconnect individual transport networks of the BSR and neighbouring countries, diminish infrastructural drawbacks and harmonize various transport development priorities. Activities related to the planning and development of the transport networks should be aligned with the regional development perspective. This is already the idea within the EU, with the TEN-T network approach. But even

there, we might wonder if the TEN-T policy is effective enough in changing the focus of the different member states on their own national situation and replacing it with a regional approach.

2.7 Relevant (International) working groups

Members of the ePIcenter consortium are involved in a wide array of (international) organisations which deal with relevant issues for the work being done under the ePIcenter umbrella. The idea is to actively leverage on the networks of our partners in order to create a two way cross fertilization of ideas: allowing the ePIcenter project to take into account the work done in these working groups and organisations, but also making them aware of this project, its goals and specific results.

A first consultation of the consortium revealed ties to, amongst others:

- International Maritime Organisation (FAL committee)
- IMSO
- European Maritime Safety Agency
- International Association of Lighthouse Authorities: to harmonise Marine Aids to Navigation worldwide and to ensure that the movement of vessels are safe, expeditious and cost-effective while protecting the environment
- ISO working group ISO/TC 8/SC 11 (Intermodal and Short Sea Shipping)
- National working group for standardisation in the field of maritime transport and tourism (ISME/TK 011)
- CleanSeaNet, (Managed by EC and EMSA)
- EU Long Range Identification and Tracking of ships Data Center, (Managed by EC and EMSA)
- IMS (Integrated Maritime Services) (Managed by EC and EMSA)
- SafeSeaNet (Managed by EC and EMSA, Montenegro is not full member, participates in “ad hoc” basis)
- PANORAMED Governance Platform – Activities related to maritime surveillance in the Mediterranean.
- Maritime Safety Permanent Transnational Network formed in the framework of the EUREKA InterregADRION Project
- EUROPLATFORMS: a European Economic Interest Grouping oriented in the development of Logistic Platforms as nodal transport infrastructure
- EGTC Rhine Alpine
- ESPO: European Sea Ports Organisation
- IAPH: International Association of Ports and Harbours
- CHAINport: connecting ports worldwide to create a chain of intelligent ports around the world
- EC ENV Marine Team - The Working Group on Economic and Social Analysis
- Clean Shipping Index
- Corridor fora under TEN-T – managed by the EU corridor coordinators
- EWTCA: the international East West Transport Corridor Association. The Association was set up in 2010 by interested partners from 11 counties (namely, Belarus, Belgium, China, Denmark, Germany, Kazakhstan, Lithuania, Mongolia, Russian Federation, Sweden, and Ukraine) with the aim to improve the competitiveness of the East-West transport corridor linking the Southern part of Baltic Sea Region and the European and Asian countries beyond it. At the same time, the Association is an innovative instrument of regional and interregional cooperation among business, academia and public sector. Establishment of the EWTCA allows strengthen the cooperation between transport undertakers, logistics companies intermodal transport operators, shippers and consigners, national, regional and domestic authorities, science and research institutions along the East –West Transport Corridor in BSR and beyond it. Since establishment of the EWTCA several initiatives on reducing the bottlenecks and facilitating the functioning of the East-West transport corridor in Southern part of the BSR and beyond it have already been implemented. Some of them are worth mentioning. First, the EWTCA initiated and implemented a project to test the monitoring system by using the innovative e-Seals method for the tracing carriage arrival at the control stations. In the particular case the container transportation from Turkey to Lithuania was tested.

Second, the EWTCA efficiently contributed (thanks to partners from Blekinge Region) to the development of Brokerage Information System along the East West transport corridor axis. Third, the EWTCA is currently contributing in the preparation of the CEF EWC planning tool (as it is presented previously).

- The maritime-based Supply Chains Leadership Group headed by GS-1, which is in the process of being formed. This initiative is to connect individual improvements for parts of the Logistics Networks that rely on the Maritime Mode and weave them together.
- Working Groups of the New Silk Road
- ECTA digitalisation workgroup: Standardisation is an important topic within this workgroup, for example on transport milestones, ETA updates, performance KPI's. Also, the group is currently looking into how it can help boosting the implementation of digital transport documents like the eCMR and eECD.
- Northern Sea Route Council: aims to improve NSR usage internationally. This forum aims to have actions which improve NSR transport and environmental safety. Mainly focusing on future container traffic.
- The European Conference of Transport Research Institutes
- International Port Community System Association Port Call Optimization Taskforce IPCSA (https://ipcsa.international/)
- Alliance for Logistics Innovation through Collaboration in Europe (https://www.etp-logistics.eu/)
- Digital Container Shipping Association (https://dcsa.org/)
- Arbeitsgemeinschaft Logistik-Initiativen Deutschlands (working group logistics initiatives of Germany, an association of 10 regional logistics clusters within Germany; see: http://www.logistik-initiativen.de/index.php?id=391)
- Arbeitskreis Schiene (work group rail of logistiks Initiative Hamburg with 30+ market stakeholders and experts in rail transport and infrastructure; link: https://www.hamburg-logistik.net/ak-schiene/)
- ERTICO ITS Europe. (link: https://ertico.com/)

3 Ongoing Digitalisation & Visibility Initiatives

Many ongoing digitalisation & visibility initiatives will increase the availability of real-time data that could be used by systems such as those contemplated in ePIcenter. Examples include:

- The availability of live border crossings wait times are available on the Galileo Green Lane app https://www.gsa.europa.eu/newsroom/news/galileo-green-lane-easing-pressure-eu%E2%80%99s-internal-borders

- The Train Information System, supported by the CEF programme, (http://tis.rne.eu/) aims to provide real-time Europe-wide real time data with data taken from the Infrastructure Managers systems.

- AIS data sources such as MarineTraffic (https://www.marinetraffic.com/en/ais-api-services) provide APIs making available ship and barge data such as position, speed, voyage, port call events and ETAs.

- The C-point electronic communication network of systems and solutions in the Port of Antwerp, including for example the Barge Traffic System (BTS) web application (https://www.c-point.be/nl/services/barge-traffic-system-bts).

- The Digital Transport and Logistics Forum (https://www.dtlf.eu/) is driving increased adoption of appropriate business processes, technical standards and e-transport documents.

- The e-AWB initiative (https://www.iata.org/en/programs/cargo/e/eawb/), applicable to air freight, will be monitored as many of the concepts are applicable to containerised surface freight also.

- The EU Single Window environment for customs will further streamline processes and increase availability of data (https://ec.europa.eu/taxation_customs/general-information-customs/electronic-customs/eu-single-window-environment-for-customs_en)

- THE EUROPEAN RAIL TRAFFIC MANAGEMENT SYSTEM is expected to increase the availability of real-time rail data that can be used for optimisation (http://www.ertms.net/).

- The WCO and IMO have recently announced a partnership for maritime digitalization to support flow of trade by ship, which will develop the IMO Reference Data Model and encourage interoperability between the respective standards of each organization, such as the WCO Data Model (http://www.wcoomd.org/en/media/newsroom/2020/may/partnership-for-maritime-digitalization-to-support-flow-of-trade-by-ship.aspx)

- The digital logistics platform for supply chain management, start-up “Forto” (known as “Freighthub” until April 2020 – www.forto.com) can draw on a loan from the European Investment Bank (EIB).
Forto's approach is to use precise real-time data to make the logistics process more transparent and efficient.

- It is worth mentioning the attempts made to carry out projects of electronic consignment. The Additional Protocol to the CMR Convention on Electronic CMR Consignment Notes was signed in Geneva on 20 February 2008. From a legal point of view, the electronic CMR consignment note has the same power as the "paper" version. At the beginning of 2018, the protocol on the electronic CMR consignment note was signed by 16 countries, including Lithuania, Latvia and Estonia, as well as by Luxembourg, Russia and Turkey. It has been pointed out that data compiled and stored in electronic format is much more reliable, as the possibility of human error is eliminated, and such a document is available to all actors in the logistics chain at any time, as well as saving time. On the other hand, the electronic CMR consignment note also has several shortcomings. In particular, the use of an electronic consignment note may be too costly for small and medium-sized transport companies, as this system requires a certain IT infrastructure, which may not be appropriate to have in their companies and would require the use of specialized partners. Secondly, the use of an electronic consignment note for the transport of goods to third countries may not be possible due to certain specific customs procedures in those countries, so it would be good if the electronic consignment note system worked primarily at least in the European Union. (Source: https://www.cargonews.lt/aktualijos/elektroninis-cmr-vaztarastis-jis-yra-bet-jo-nera).

Summarizing the experience of the implementation and use of the electronic CMR consignment, it is worth noting that there have been faced with the significant problems inherent in international transport, logistics or freight flows - incompatible systems, different legal regulations, different standards or differences in customs procedures. However, despite all the shortcomings observed, the digitization of logistics and transport documents is taking place and various tools are being used for this purpose, from specialized programs and integrated systems to document scanning, electronic signatures and the like.

- 5G: Digitalisation and visibility initiatives and projects should accelerate with the introduction of 5G communication tools and channels. According to the specialists of the Ministry of Transport and Communications of the Republic of Lithuania, Lithuania is preparing to use 5G tools in transport and logistics by implementing information, management and prevention measures that will use 5G communication. On June 3, 2020, the government of the Republic of Lithuania adopted a resolution (no. 577) On the Approval of The Guidelines for the Development of the Fifth Generation Mobile Communication (5G) Of the Republic of Lithuania For 2020–2025. The document states that by 2025, high-speed mobile communications are expected to cover key land transport corridors and urban areas. The aim is that the 5G connection should be developed primarily (commercial 5G communication services have been launched) by 2025 in urban areas, TEN-T core network corridors (Via Baltica, Rail Baltica) and other trunk roads and national trunk lines, airports and seaports. Lithuania, participating in the negotiations on the financial instrument of the European Infrastructure Networks for 2021–2027 proposed by the European Commission, together with other countries of the Baltic region, proposed to add the main Lithuanian transport corridors to the list of projects to be financed, as well as TEN-T (Trans European Transport Network) transport corridors to be covered by a continuous 5G link. The capabilities of 5G connectivity will likely allow the development of digitalisation and visibility tools in transport and logistics, such as real-time monitoring of traffic flows, ensuring security and safety, measures to perform operational management actions.

- The European data cloud "Gaia-X" should make Europe independent of large IT groups from the USA and China. More than 300 organizations and companies are to be involved in the project. The project is controlled by a not-for-profit organization under Belgian law. The 22 founding members include e.g. Deutsche Telekom, SAP, Siemens, Bosch and BMW as German companies.

- Port-centric initiatives like NxtPort (one of the partners in ePIcenter): NxtPort's main goal is to unlock the potential of sharing existing data amongst the port's players. The NxtPort Data Utility Platform allows faster, more cost-effective, as well as more efficient transfers of data between the different players. The platform creates more transparency in the whole shipping process. NxtPort aims to increase operational efficiency, safety and revenue. A second means to unlock the huge value at stake is to allow market applications to be built upon the existing data. This way, the data within the port is not only shared in a better way, the combination of existing data will lead to innovative solutions as well. They create new business and fresh revenue streams for the Port Community and its individual players. www.nxtport.com

- Private initiatives of which Logit One (one of the partners in ePIcenter) is an example that focusses on end-to-end visibility and high-quality data and value added services

- Individual transport Online Freight Exchange platforms

- Container X-Change

- ECLIC is such an initiative, a neutral platform, aimed at safe data exchange within chemical logistics. Currently it focuses on the eECD use case, but is also looking into other subjects, such as supply chain visibility.

- At Algeciras Port many digital initiatives are focused on getting real-time data and operational awareness.

- Tracking and tracing containers via RFID chips and wireless cellular and/or satellite links and back-end info-communication systems.

- VTG Rail Europe status oriented and predictive maintenance (EU CEF Transport project; link: https://ec.europa.eu/inea/en/connecting-europe-facility/cef-transport/2018-de-tm-0022-m)

- Several tools that use real-time data to alert ships to the presence of whales, 'whale alert schemes'

- Integration of PCS systems with other systems (TOS, CIMIS, etc.). This is already present in neighbouring countries of Montenegro, like Croatia. The goal is to develop a port logistics centre and enable the automated data exchange based on the concept of Single Window. Montenegro is in the initial phase of implementing NMSW. Experience and lessons learnt in Croatia will be useful for NMSW deployment in Montenegro and PCS implementation in main Montenegrin ports. Montenegro has performed an initial Cost-Benefit analysis for NMSW implementation. The study is universal and can be used for coastal countries that have limited human resources and infrastructure related to maritime traffic like Montenegro. A general method for conducting a cost-benefit analysis of NMSW implementation is proposed. Using this method and the input data for Montenegro, as an example of a small-sized coastal country, the authors assess whether such an investment in NMSW implementation can be beneficial to coastal countries with limited resources.

4 Relevant International Standards & Regulations

For shipping, the IMO's FAL forms are relevant, especially:

- IMO General Declaration (FAL form 1)
- Cargo Declaration (FAL form 2)
- Dangerous Goods (FAL form 7)

Similarly the messages used by River Information Systems such as ERINOT, BERMANN, etc. are relevant for inland waterways.

The e-Freight standards described in ISO/IEC 19845:2015 are relevant to support integration between the multimodal logistics optimisation activities in ePIcenter and third party systems. For example the following e-Freight messages are of relevance:

- Transport Service Documents (TSD)
- Transport Equipment Plan Request (TEPR)
- Transport Execution Plan (TEP)
- Transportation Progress Status Request (TPSR)
- Transportation Progress Status (TPS)
- Transportation Status Request (TSR)
- Transportation Status (TS)

Multimodal logistics optimisation makes use of vector mapping and routing data, for which there are several standard formats available. Open datasets such as OpenStreetMap are available, and MID/MIF format is commonly used, and will be considered for ePIcenter.

In general ISO standards related to transportation framework, amongst which one can be distinguished ISO/TR 13185-1 (2012), -2(2015), -3(2018), -4(2020); ISO/TR 17187:2019; ISO/TR 17261:2012; ISO/TR 17267:2009; ISO 18495-1:2016; ISO/TS 20452:2007; ISO/TR 25100:2012 (https://www.iso.org/ics/03.220.01/x/), as well as Regulation (EU) No 1315/2013 (TEN-T) and Regulation (EU) 2019/1239 establishing a European Maritime Single Window environment.

For the Single Window, the ISO 28005 standard is significant and has two parts:

ISO 28005-1:2013 Security management systems for the supply chain -- Electronic port clearance (EPC) -- Part 1: Message structures.

ISO 28005-2:2011 Security management systems for the supply chain -- Electronic port clearance (EPC) -- Part 2: Core data elements.

These standards supply mechanisms to implement an XML based NMSW system, covering requirements in the FAL Convention as well as various other reporting requirements.

Also, by realization of the Maritime Single Windows it is expected to have a more simplified implementation of the FAL Convention and its forms; faster and easier way of receiving and sending forms, which maritime agents enter into the system; forwarding documents according to priority, i.e. institutions; lack of administrative capacity within the state; the amount of funds; interinstitutional barriers.

Further to the mentioned advantages, the challenges and obstacles are visible in the following example: Italian NMSW "UIRNet". Efficient administrative procedures, already present in several European ports (e.g. "pre-clearing" activity), cannot be easily implemented in Italian ports due to the co-existence of several authorities

with their own administrative and information systems within the seaport. Due to the aforementioned issue, it is difficult to improve sustainability/sustainable business because of increased costs, increased waiting time etc. The issue may be solved through the unification of the control and information systems (so-called "one-stop-shop") of the different authorities and with the simplification of the administrative procedures improving the coordination of the several public bodies involved. Furthermore, most Single Window and total logistics chain systems will in the future have to be aligned with significantly increased requirements of the proposal for a Regulation of the European Parliament and of the Council establishing a European Maritime Single Window environment and repealing Directive 2010/65/EU (COM (2018) 0278 – C8‑0193/2018 – 2018/0139 (COD)). If the above-mentioned issues were solved, every party involved (both commercial stakeholders and administrative authorities) could benefit from the implementation of a Single Window (reducing costs, reducing average processing times, increasing service predictability, etc.), therefore increasing sustainability.

The new ISO/IEC 21823-3 standard relating to IoT could be of relevance, addressing transport interoperability and focussing on information exchange, peer-to-peer connectivity and seamless communication both between different IoT systems.

ISO/IEC 27009 has been updated recently, making it easier for businesses to address information security, cybersecurity and privacy protection.

ISO14007 provides a framework for companies to determine and report the costs and benefits of environmental aspects of their businesses. In particular the guidance on how to carry out cost-benefit analyses for different environmental options is interesting. Related to this is ISO14008 "Monetary valuation of environmental impacts and related environmental aspects". It describes methods for valuing environmental aspects and impacts, providing the essential data that feeds into such cost-benefit analyses.

Using the case study GVZ Wolfsburg (VW and Hyperloop-technology), we will identify and take these into account in the ePIcenter project process. The logistical requirements of the automotive industry are of particular interest. For example, which standards are expected for transport equipment or logistical processes.

Research at the DIN Institute in Berlin (https://www.din.de/en) or on European Level CEN (European Committee for Standardization) could be helpful.

In intermodal transport the UIRR (International Union for Road-Rail Combined Transport) is continually active in standardization.

6 (CEN/TC 320) standards were identified of which one is of significant interest for the whole supply chain: adopted by The Technical Committee CEN/TC 320 "Transport – Logistics and services" of European Committee for Standardisation.
These 6 documents are, as follows:

1) EN 14310: 2002 Declaration and reporting of environmental performance in freight transport chains.

This document is a Technical Report, which is a guideline for preparing environmental declarations and reporting. The guideline recommends the content and structure for documentation and evaluation of environmental performance in freight transportation. It is applicable to freight transport purchasers and freight transport operators.

2) EN 12507: 2005 Guidance notes on the application of EN ISO 9001:2000 to the road transportation, storage, distribution and railway goods industries. This European Standard provides guidelines for the application of EN ISO 9001, Quality management system, to the provision of freight transportation services by road and rail, including storage and distribution activities. Operating procedures should address the requirements of legislation applicable, e.g. speed limits and driving time according to the European Regulation or ADR/RID Directives.

3) EN 12798:2006 Quality management system requirements to supplement EN ISO 9001 for the transport of dangerous goods with regard to safety. This European Standard specifies quality management system

requirements, supplementary to those of EN ISO 9001:2000, for the management of safety in the field of the transport of dangerous goods by road, rail and inland navigation.

The documents of external origin mentioned in 4.2.3 of EN ISO 9001:2000 should include all applicable standards, regulations, codes of practice, service manuals, and general documentation related to safety practices in the transport of dangerous goods. The company shall document its policy for quality and safety and these documents shall be signed by the manager in charge. The responsibility for the safety management system shall be specifically allocated to a named individual.

4) EN 13011: 2000 Declaration of quality performance in transport chains. This European Standard is intended to be a tool for the definition, declaration and control of services involved throughout the transport chains. It can therefore be used by both shippers and providers within the framework of their contractual relationship, in order to define and declare the relevant performance conditions. A purpose of this standard is to facilitate the provision or information by the transport industry so as to assist shippers to meet their obligations under the Directive of Packaging and Packaging Waste (94/62/EF).

Further, this European Standard specifies requirements for making declarations with regard to the quality of performance of a goods transport service. EN 13011 :2000 standard incorporates by dated or undated reference, provisions from other publications (EN 12830, EN 13485: 1999, EN 13486: 1999, EN 22248, EN 22872, EN 22873, EN 28318, EN 28768).

5) EN 13876:2002 Code of practice for the provision of cargo transport services. This European Standard specifies in the form of a Code of Practice' the management controls and key performance indicators necessary for the effective and efficient management of customer's cargo throughout the transport process. Code of Practice strongly recommends that the service provider carry out regular self-assessment of performance against defined criteria with the objective of continually improving the quality of services provided and is prepared in a manner which facilitates independent audit of the service provider's performance in order to give confidence to customers that the integrity of performance measurement is maintained.

6) EN 15696:2007 Specification for self-storage services. This European Standard specifies requirements for the provision of self-storage facilities and related services, for both personal and business purposes. Given the various implications attaching to the provision of such services, it is recognized that the applicable legislative framework may be subject to change and it is therefore strongly recommended that service providers establish a system designed to identify European, national or local legislation applicable to such facilities and ensure that they are kept abreast of changes as they occur.

Also, a standard that complements the above group must be mentioned – the GS1 standard EPCIS (Source: https://www.gs1.org/docs/tl/GS1_visibility_in_rail_leaflet.pdf): this standard enables rail operators, infrastructure companies and even cargo owners to share information about the physical location and movement of individual rail vehicles and entire trains as they travel from country to country. EPCIS is capable of supporting additional, rail-specific requirements as implementations grow, ensuring end-to-end visibility for all stakeholders.

Arctic shipping is regulated by multiple international standards (provided by for example IMO Polar Code etc) and rules / regulations provided by local governmental authorities and classification societies.

GS1 standards currently are under development (source: https://www.gs1.org/standards). The GS1 Industry & Standards Event provides working groups with opportunities to accelerate the development of the GS1 system of standards and guidelines, to collaborate with industry partners and to discover innovative business solutions. This 5-day - all virtual - event includes Industry workshops, standards development group meetings, educational sessions and networking events. (Date: 30 November - 04 December 2020).

As far as EDIFACT standard it is necessary to note that this standard was developed by UN. The work of maintenance and further development of this standard is done through the United Nations Center for Trade Facilitation and Electronic Business (UN/CEFACT) under the UN Economic Commission for Europe.

The EDIFACT standard provides a set of syntax rules to structure, an interactive exchange protocol and provides a set of standard messages which allow multi-country and multi-industry exchange of electronic business documents. EDIFACT is widely used across Europe, mainly due to the fact that many companies adopted it very early on. EDIFACT has seen some adoption in the ASPAC region however there are currently more XML based standards being used in this particular region today. The latest version is based on UN-EDIFACT Directory D10.A. (Source: https://www.edibasics.com/edi-resources/document-standards/edifact/).

The ECTA Workgroup set a standard for transport visibility within chemical bulk transport. Further standardisation within this (and other) area(s) would make it easier for more stakeholders to start implementing a solution and start the digital transition.

Fenix will result in a standard for interconnecting platforms, however this is still early stage in its definitions.

Initiatives on electronic documents for freight carriage on EU level: REGULATION ON ELECTRONIC FREIGHT TRANSPORT INFORMATION, leading to a standardisation (see for example: https://www.europarl.europa.eu/legislative-train/api/stages/report/current/theme/resilient-energy-union-with-a-climate-change-policy/file/electronic-freight-transport-information) - regulatory framework on autonomous and connected driving/transport (on national as well as EU/international level)

5 Lessons Learned from Previous EC-funded & International Projects

ePIcenter will develop a range of innovations and new technologies that exceed the current state-of-the-art. However it is recognised that major steps have been taken in many previous (EC-funded) projects that are relevant to ePIcenter, and this project will build on the successes and lessons learned from previous work.

5.1 European funded projects (central programmes)

SYNCHRO-NET

Title: "Synchro-modal Supply Chain Eco-Net"

Funded under: H2020-EU.3.4

SYNCHRO-NET developed integrated optimization and simulation solutions consisting of a number of modules, including smart steaming ship simulation & control systems, synchromodal benefit analysis statistical modelling and real-time multimodal logistics. The solutions proved to be highly successful and it is likely that many of the ideas developed will feed into ePIcenter. The key lesson learned is the very large search space presented by multimodal logistics optimisation problems – this is only expected to get larger still as new modes (e.g. hyperloop, autonomous services) emerge, and as more traditional rail and barge services become available e.g. due to CEF investments.

http://www.synchronet.eu

E-FREIGHT

Title: "European e-freight capabilities for co-modal transport"

Funded under: FP7-TRANSPORT

E-FREIGHT developed a new standard (known as eFreight) for the exchange of data between logistics operators and users. This was done while considering ship, barge rail and truck movements meaning all aspects could be optimized. The eFreight standard is likely to be relevant for ePIcenter. The key lesson learned from E-FREIGHT is the unexpectedly large benefits that can accrue from exploiting standards of this type in relation to optimising large logistics operations.

https://trimis.ec.europa.eu/project/european-e-freight-capabilities-co-modal-transport#tab-outline

EMAR

e-Maritime Strategic Framework and Simulation based Validation

Funded under: FP7-TRANSPORT

EMAR explored the digitalization of port operations and the Single Windows concept, allowing data to be shared between a number of stakeholders in port operations. This allowed for improvements in a number of areas such as safety, security and environmental impact. The key lesson learned was the value of using such information for integrating the optimisation of port logistics operations.

https://trimis.ec.europa.eu/project/e-maritime-strategic-framework-and-simulation-based-validation

CORE

Consistently Optimised Resilient Secure Global Supply-Chains

Funded under: FP7-SECURITY

CORE focused on improving the resilience of supply chains to natural and human made disasters and disruption, such as earthquakes, floods and explosions. CORE developed new algorithms and optimisation techniques to help anticipate and react to such major events. Sadly the recent Covid-19 problems have had a major impact on supply chains and it is likely that the CORE tools will be even more relevant to ePIcenter than previously thought. The key lesson learned from CORE is the concept that resilience, sustainability and true cost reduction can be achieved by exploiting digitalisation and new optimisation algorithms.

http://www.coreproject.eu/about.aspx

EUROSKY

Single European Secure Air-cargo Space

Funded under: FP7-SECURITY

EUROSKY developed a range of innovative solutions for air cargo security while also improving operational efficiencies in the movement of cargo to and through the airport. The integration of systems used by multiple actors along the logistics chain was key to make the most of the improvements. The key lesson learned of relevance to ePIcenter is the significant possibility for reduction of queueing in major multimodal terminals through the adoption of relatively low-cost and low-disruption procedures, supported by appropriate planning and simulation tools.

https://cordis.europa.eu/project/id/312649

SAFEPOST

Reuse and development of Security Knowledge assets for International Postal supply chains

Funded under: FP7-SECURITY

SAFEPOST focused on producing a set of algorithms and techniques for improving the security in post and parcel operations while also increasing the efficiency. Real-time data of vehicle locations allowed for continual optimization of operations and reduced wasted time for drivers and depots, while innovative streaming and flow control algorithms improved throughput at the hubs. The relevant lesson learned for ePIcenter is the value of integrating real-time vehicle/driver security data with hub optimisation algorithms.

https://www.posteurop.org/SAFEPOST

CONTAIN

Container Security Advanced Information Networking

Funded under: FP7-SECURITY

CONTAIN developed an array of new techniques for enhancing the security of container freight including the use of artificial intelligence and container monitoring technology. Along with the increased security, efficiency improvements were produced as thousands of containers could be tracked, processed and scheduled in seconds. The main lesson learned for ePIcenter is how container tracking (as compared to truck/vehicle tracking) can deliver not only increased security and control, but open up new possibilities for real-time logistics optimisation.

http://containproject.com/

FLAGSHIP

European Framework for safe, efficient and environmentally- friendly ship operations

Funded under: FP6-SUSTDEV

FLAGSHIP focused on improvements for the European maritime transport industry, considering efficiency, safety, environmental friendliness and competitiveness. Large reductions in the amount of container repositioning movement allowed for reduced carbon footprint and more efficient use of resources. The main lesson learned for ePIcenter was the significant possibilities for congestion reduction in the port through optimisation of hinterland logistics of empty containers. This concept may be relevant to ePIcenter's wider-ranging work in this area.

https://cordis.europa.eu/project/id/31406

COREALIS

Title: "Capacity with a positive environmental and societal footprint: ports in the future era"

Funded under: Horizon 2020

COREALIS proposes a strategic, innovative framework, supported by disruptive technologies, including Internet of Things (IoT), data analytics, next generation traffic management and emerging 5G networks, for cargo ports to handle upcoming and future capacity, traffic, efficiency and environmental challenges. The proposed beyond state of the art innovations, target to increase efficiency and optimize land use, while being financially viable, respecting circular economy principles and being of service to the urban environment. The innovations will be implemented and tested in real operating conditions in 5 Living Labs, namely Piraeus port, Valencia port, Antwerp port, Livorno port and Haminakotka port.

https://www.corealis.eu/

ICONET

Title: "New ICT infrastructure and reference architecture to support Operations in future PI Logistics NETworks"

Funded under: Horizon 2020

ICONET will explore and create innovative Physical Internet network services that optimise cargo flows against costs and environmental performance. The project will be based on Governance policies and Service Level Agreements and constantly and fully aware of network operations and status.

http://www.iconetproject.eu

T-TRANS

Enhancing the transfer of Intelligent Transportation System innovations to the market

Funded under: FP7

T-TRANS aims to provide information on innovation mechanisms for the Intelligent Transport Systems, in order to facilitate the upbringing of related innovative products and services to the market. The results from the ITS study cases will be streamlined into best practices for technology commercialization, bringing out a better understanding of their market potential and providing a guideline for their future exploitation. By identifying and analysing new business opportunities from the case studies, T-TRANS consortium will also create a systemic approach for ITS specific Technology Commercialization strategy analysis

http://www.ttransnetwork.eu/ttrans/

B2B LOCO
Baltic–to–Balkan Network for Logistics Competenc

Funded under: FP7

B2B LOCO targets Regional Clusters gathering different types of SMEs: transport and logistics companies, manufacturing and retail companies, hi-tech companies and green technologies companies that are of a particular focus of this call. As a result of B2B LOCO activities, SMEs benefit from advanced solutions developed by FP consortia, experiences of successful SME-RTD-Academia co-operation cases which are laudable and should be copied. In addition to this, project supports processes of forming partnerships for future Framework Programmes. Moreover, new information channels which will be created during the project, will support transfer of essential information on transport and logistics.

http://www.b2bloco.eu/

SEDNA

Title: "New ICT infrastructure and reference architecture to support Operations in future PI Logistics NETworks"

Funded under: Horizon 2020

The SEDNA project is developing an integrated risk-based approach to safe Arctic navigation, ship design and operation. SEDNA addresses challenges of ensuring safe Arctic operation through 5 innovations: human-centred "Safe Arctic Bridge" for ice-going vessels, optimised Arctic voyage planning, combining ice monitoring and weather forecasting, using Big Data and Data Management, anti-icing solutions for vessels, risk-based design frameworks to encompass all aspects of Arctic ship operation as well as enhancing the safety of Methanol bunkering through the use of Low Flash Point Fuels in Arctic shipping. This will be of relevance for ePIcenter's approach with regard to logistics concepts through new disruptive technologies including new trade routes such as arctic routes and new Silk routes as well as the envisaged development of Environment- and Wildlife-Friendly Shipping Navigation/Control Modules for those new trade routes.

https://www.sedna-project.eu/

SAFEPOST

Title: "New ICT infrastructure and reference architecture to support Operations in future PI Logistics NETworks"

Funded under: FP7

SAFEPOST aimed to raise the current level of postal security by integrating innovative screening solutions suitable for uninterrupted flow of the enormous volumes of parcels and letters with operational postal processes and the criminal and customs intelligence work in a European wide cooperative distributed model.

https://www.posteurop.org/SAFEPOST

The European Hyperloop Development Initiative

Funded under: Joint investment collected through the European investment project portal

The SEDNA project will develop an integrated risk-based approach to safe Arctic navigation, ship design and operation.

https://ec.europa.eu/eipp/desktop/en/projects/project-11397.html

NOVIMAR

Title: “NOVel Iwt and MARitime transport concepts”

Funded under: Horizon 2020

NOVIMAR aims to adjust inland/short-sea shipping such that it can make optimal use of the waterborne system of waterways, vessels and ports/terminals. To achieve this NOVIMAR introduces the waterborne version of 'platooning', the Vessel Train. NOVIMAR technology developments include measuring, control and communication systems, and navigation aids for IWT use, with which the project results contribute to ePIcenter's aim of developing navigation/control modules for environmentally friendly and wildlife-friendly shipping and supplement these with inland navigation components ans aspects.

https://novimar.eu/

NEXTRUST

Title: “Building sustainable logistics through trusted collaborative networks across the entire supply chain”

Funded under: Horizon 2020

The NEXTRUST project objective is to increase efficiency and sustainability in logistics by developing interconnected trusted collaborative networks along the entire supply chain.
Key learning is the challenge to combine loads and transport modes between different parties considering their individual requirements into one flow. Sometimes, although a significant saving could have been achieved, it could not be realised due to different structural and organisational set-up of the parties involved.
NEXTRUST can thus provide important insights for ePIcenter's goal of creating secure, innovative and transparent communication with open standards and governance architecture in order to catalyze digitization among (system) relevant stakeholders.

https://nextrust-project.eu/

JOULES

Title: “Joint Operation for Ultra Low Emission Shipping

Funded under: FP7

The JOULES project is accepting the future challenges for the European Maritime Industry to siginificantly reduce energy consumption, emission of climate gases and other harmful emissions to air. The simulation of the vessels energy grid in early design stage has been identified to be a key solution in this respect. The impact on ship design with respect to integration of proven and innovative technologies in vessels energy grid were assessed from an economical point of view. In addition, the environmental impacts taking into account the cradle to grave concept were evaluated in depth. Thus a new holistic approach on ship design for two future scenarios (2025 and 2050) has been realized, lifting the potential of the European Maritime Industry to contribute to a more sustainable future. The JOULES project has been completed in May 2017.

http://www.joules-project.eu/Joules/index.xhtml

NIMBLE
Title: “Collaboration Network for Industry, Manufacturing, Business and Logistics in Europe”

Funded under: Horizon 2020

NIMBLE's vision is to create a federated interoperable eco-system of medium-sized platforms that provide B2B connectivity for the 99% of European businesses that are SMEs and would profit from Internet platforms. NIMBLE developed a cloud-based, Industry 4.0, Internet-of-Things-enabled B2B platform on which European manufacturing firms can register, publish machine-readable catalogues for products and services, search for suitable supply chain partners, negotiate contracts and supply logistics, and develop private and secure B2B and M2M information exchange channels to optimise business work flows.
Since December 2017 the NIMBLE platform has been released. In April 2020, the official final release No 17 of the platform, with an increased set of functional services and updated interface with new design, has been published. The current release as well as supporting materials and source code is accessible through the project website.

https://www.nimble-project.org/

COMCIS
Title: "Collaborative Information Services for Container Management"

Funded under: FP7

COMCIS is a collaborative project between multiple transport and logistics actors that generates situational awareness along global supply chains in support of enhanced logistics services. COMCIS uses the so-called Common Framework, which supports interoperability between ICT systems in logistics and provides a basis for semantic (i.e. content-related) standards in the transport and logistics sector. Key elements of the Common Framework are part of the UBL version 2.1 standard. A link is being established between the Common Framework and the GS1 Logistics Interoperability Model. The COMICS project has been finished in August 2013.

http://www.comcis.eu/

FENIX
Title: "A European FEderated Network of Information eXchange in LogistiX"

Funded under: CEF Transport

FENIX will develop the first European federated architecture for data sharing serving the European logistics community of shippers, logistics service providers, mobility infrastructure providers, cities, and authorities in order to offer interoperability between any individual existing and future platforms.

https://fenix-network.eu/

BESTFACT
Title: "Best Practice Factory for Freight Transport"

Funded under: FP7

The objective of the BESTFACT project was to develop, disseminate and enhance the utilization of best practices and innovations in freight transport to contribute to meeting European transport policy objectives with regard to competitiveness and environmental impact. Its recommendations for green logistics and co-modality are focusing on intermodal services and connections including rail, maritime and inland waterways, concepts, and methods supporting competitiveness of companies, such as new technologies, and collaboration concepts, actions related to environmental issues like increasing the awareness resulting in energy use and emissions reduction of freight operations, as well as promoting alternative fuels. The resultsof the BESTFACT project could be assessed in the development of new logistics concepts and in preparation of proposals for multimodal transfer zone optimization during the implementation ePIcenter project.

http://www.bestfact.net

BELOGIC
Title: Benchmark Logistics for Co-modality

Funded under: FP7

BELOGIC's aim was to support the development of quality and efficiency within and across different modes of transport by means of benchmarking in logistics and co-modality.

The efficient use of transport modes and means of transport requires recognizing the possibilities and making the right logistical decisions. An indicator for the corresponding performance (benchmarking) is an instrument that helps to answer this question. The greatest potential for improving logistics performance exists among small and medium-sized enterprises (SMEs), including shippers of relatively small transport volumes. Therefore, BELOGIC applied the benchmarking methodology primarily to measure the logistics performance of SMEs.

The main objectives of BELOGIC were to improve the efficiency of the various modes of transport and their interaction and to promote the development of a high-quality logistics system.

http://www.uirr.com/de/component/downloads/downloads/14.html

SMARTLOG

Title: "Smart Logistics and Freight Villages Initiative"

Funded under: H2020

Smartlog wants to agree on structured messages for trade transactions between ecosystem parties, facilitate flexibility in messages to include necessary documents, create immutable trusted transaction register of trades and provide solid data for ecosystem level analysis by using the blockchain technology.

The platform consists of supply chain messaging APIs, shared ledger of trade transactions, and services for data analysis. Validated transactions are time stamped and hashed including references to actual documents. This HyperLedger Fabric is the magic that has not existed before.

https://trimis.ec.europa.eu/project/smart-logistics-and-freight-villages-initiative

5.2 National/regional projects (incl. EU funds under shared management)

SAGOV

Title: South Adriatic Connectivity Governance

Funded under: Interreg Albania-Italy-Montenegro

The main goal of the project SAGOV is to promote connectivity networks in the South Adriatic area, with a focus on the maritime transport infrastructure. The project will provide an exchange of best practices, will single out respective challenges and will come up with concrete examples of integrated governance on the policy-making of strategic connectivity projects in this region. The final aim is to provide innovative tools and procedures that may be used by all stakeholders to improve the planning, implementation and monitoring of CBC connectivity projects.
Main Outputs:
- Transport Connectivity e-platform with Semaphore System
- Trilateral Memorandum of Understanding/Agreement for maritime coordination in the South-Adriatic
- Preparatory activity for a pilot maritime transport initiative (i.e Vessel Traffic Monitoring Information System)

https://sagov.italy-albania-montenegro.eu/

EUREKA

Title: Adriatic-Ionian joint approach for development and harmonisation of procedures and regulations in the field of navigation safety

Funded under: Interreg ADRION

EUREKA aims to increase the level of maritime safety in the Adriatic-Ionian region by introducing systematic cooperation and coordination of maritime administrations of all countries of the region. The specific objectives of the project, coordinated by the Ministry of the Seas, Transport, and Infrastructure of Croatia, are to develop systematic coordination, harmonise the legal basis for cooperation, increase the level of data exchange, harmonize and standardize the Vessel traffic services (VTS), as well as develop a common educational system for VTS operators.

TransBaltic

Title: Towards an integrated transport system in the Baltic Sea Region

Funded under: Baltic Sea Region Program

TransBaltic as one of few transnational projects so far, has been granted a strategic status by the authorities of the Baltic Sea Region Program 2007-2013. In that way the decision-makers acknowledged the role of TransBaltic in fostering the sustainable development of the Region, the project's wide geographical coverage, deep focus on implementation and the strong political backup at the national level.

http://www.transbaltic.eu/

C.A.S.H.

Title: Connecting Authorities for Safer Heavy Goods Traffic in the Baltic Sea Region

Funded under: Baltic Sea Region Programme

C.A.S.H. project aims to make international road freight transport safer in the Baltic Sea region. The project intends to do this by: improving co-operation between authorities, harmonising training of inspection officials and testing safety equipment and IT systems to be used by relevant authorities. The project brings together

police officers and other authorities inspecting Heavy Goods Vehicles (HGVs) in the Baltic Sea area. The project benefits not only them through harmonized practices, but logistics business as a whole.

http://www.cash-project.eu/

NextIT

Title: National Program for Next Generation Information and Communication Technology Research

NextIT aims to develop scientific competence in the field of next generation ICT systems by creating new competitive approaches to integrating physical and virtual worlds into cyber physical systems, developing competitive innovative hardware and software platforms for smart sensors and their networks, researching and further developing competitive new model-based information and communication technologies, their applications in today's web environment.

http://www.tsi.lv/lv/content/nakamas-paaudzes-informacijas-un-komunikaciju-tehnologiju-ikt-petniecibas-valsts-programma

TransLab

Title: Development of the model of intelligent transport system of Europe-Asia multimodal corridor for optimization of Latvia-Belarus international logistics chain

NextIT aims to improve the efficiency of the interstate transport corridors by the way of united hierarchical system of governance based on principles of intelligent transportation systems (ITS). The project outcomes include the project methodology, the concept, models and recommendations, joint publications and information distributed via CD, WEB, reports on seminars and conferences being important for policy decisions on the establishment of intellectual transport system "Latvia-Belarus" at the level of both governments countries and having an independent scientific value, developed in the project.

http://www.tsi.lv/lv/content/development-model-intelligent-transport-system-europe-asia-multimodal-corridor-optimization

NEMES I & II

NEMES is a Canadian-led project that looked into addressing the impacts of shipping and exploring management measures that specifically targeted reducing shipping noise.

Cetacean Well-being in the Hauraki Gulf

A New Zealand project aimed at identifying and addressing the impacts of vessel traffic on cetaceans in the HG).

ITS Hamburg projects

Funded under: regional level, mostly privately funded

Several ITS (intelligent transport systems) projects are ongoing in in Hamburg, Germany, implementing intelligent transport systems, connected and/or automated driving solutions in real live trials or pilots prior to the ITS World Congress 2021 in October 2021 in Hamburg. Exemplary projects are Cargo24/7, Smart City Loop, Hafen Hub

https://www.hamburg-logistik.net/en/our-activities/projects/its-strategy-for-hamburg/)

HANSEBLOC

Title: Hanseatic Blockchain Innovations for Logistics and Supply Chain Management

Funded under: funded nationally under German funding scheme KMU-NetC by Federal Ministry of Education and Research

HANSEBLOC is an SME-centered research project on Blockchain-based transport management tools. So far, transport accompanying documents, consignment notes and customs documents of transport and logistics companies are still exchanged in paper form, via e-mail and cloud services as well as freight exchanges. However, these forms are not counterfeit-proof and due to the different software solutions also error-prone. With the HANSEBLOC project, sustainable solutions are now to be found using blockchain technology.

In addition, HANSEBLOC develops a "Sensorchain" concept, which allows data from sensors to be secured via a blockchain, which builds them independently and exchanges data via Bluetooth. The manipulation of sensors, e. g. to avoid expensive cooling of goods, is thus made significantly more difficult. The sensorchain serves as a secure, trusted data source for each blockchain and has versatile applications.

The HANSEBLOC platform will serve as the basic framework for logistics by documenting the transport of all goods in an identity-protecting manner.

https://www.hamburg-logistik.net/en/our-activities/projects/hansebloc/)

Scandria2Act

Title: Sustainable and Multimodal Transport Actions in the Scandinavian-Adriatic Corridor

Funded under: EU INTERREG Baltic Sea Region

The project approach of Scandria®2Act follows an initiative of regions located along the Baltic Sea Region stretch of the Scandinavian-Mediterranean Core Network Corridor for a harmonized corridor development. Representing urban as well as multimodal nodes along the corridor, regional development challenges associated with transport are addressed.

Main objective is to foster clean, multimodal transport to increase connectivity and competitiveness of corridor regions while minimising negative environmental impact induced by transport. For this purpose, project partners have developed a joint project approach addressing: the deployment of clean fuels, the deployment of multimodal transport services and the establishment of a multilevel governance mechanism, the Scandria®Alliance.

https://www.hamburg-logistik.net/en/our-activities/projects/scandria2act/)

AVATAR

Title: Sustainable urban freight transport with autonomous zero-emission vessels >>> modal shift from road to water

Funded under: EU INTERREG North Sea Region

AVATAR is an innovation project on autonomous IWT vessels for urban last mile transport. The AVATAR project aims to developing, testing and assessing adequate technologies and business models for urban autonomous zero-emission IWT. Through this, the project unlocks the economic potential of urban vessels and corresponding waterways, increases available solutions for full-cycle automation and sets up a sustainable supply chain model for urban goods distribution and waste return.

https://www.hamburg-logistik.net/en/our-activities/projects/avatar/)

INCONE60

Title: Inland Blue Transport Connector E60 project

Funded under: INTERREG South Baltic Programme 2013-2020)

INCONE60 aimed at developing a concept for the creation of an alternative transport route along the international waterway E60 and link it to a network of other inland waterways – E30, E40 and E70. Within the project, special simulating software has been created. This online system would indicate the best alternative routes of cargo transportation covering the International Waterway E60 area. These modelling results will be exploited by ePIcenter where relevant.

https://southbaltic.eu/-/incone60#:~:text=The%20aim%20of%20the%20INCONE60,Gibraltar%20to%20the%20White%20Sea.

CBP project

A Flemish funded project that optimized multi-modal connections between ports and their hinterland

Pit-Stop Project

A project between Algeciras Port Authority, Terminals and port services focused on optimization of operational processes related to port calls

https://innovacion.apba.es/en/pit-stop-port-operations-algeciras-2/

TENtacle

Title: Capitalising on TEN-T core network corridors for prosperity, growth and cohesion

Funded under: EU INTERREG Baltic Sea Region

TENtacle aimed to increase the stakeholder capacity to capitalize on the TEN-T core network corridors for prosperity, sustainable growth and territorial cohesion in the BSR. The project was carried out during the years 2016-2019 in the partnership with 23 organizations from nine countries in the BSR. The project, apart from macro-regional analyses, contained nine pilot case (studies) displaying a variety of context–related opportunities to reap core network corridor gains in diverse geographical locations. Among these studies was thematic study on interactions between the TEN-T core network corridors (CNCs) and the transport networks of the EU Eastern Partnership countries (EaP). Which aims at finding solutions to ensure seamless traffic flows, enhance economic growth and competitiveness thought interconnected subsets of transport networks (CNCs vs. EAP) and identify priority action areas to achieve a time and resource reduction for transport operations. Based on the research performed the model of the synchronization of activity of transport hubs along intermodal transport corridor was developed (is attached). As it was mentioned earlier, this model can be adopted to address the WP3 tasks of the ePIcenter project.

https://projects.interreg-baltic.eu/projects/tentacle-21.html

S-BSR project

Interesting due to the Multi-Agent-Based Simulation tool (TAPAS) used. This tool allows to identify the breakpoints concerning to choice of traffic mode, truck type, and transport route as well as the size of consignments along international East-West transport corridor. Also, TAPAS is interesting and promising because of its ability to be integrated into a decision support system for transport policy analysis.

5.3 Others

- Study on the ranking of Freight Villages (Logistics Centers) in Europe. For many years, the European freight villages have been playing an important role in the transport sector. They are substantially involved in managing international supply chains. Logistics trends have a huge impact on all freight villages located in Europe. Nowadays, the importance of issues like digitalization, the shortage of skilled employees, urban logistics and sustainability has increased. The evaluation criteria for the Freight Village locations were based on the European rankings in 2010 and 2015. But there was a change of the evaluation criteria. Now the current third benchmarking is completed and available. The report was compiled in cooperation with the European Logistics Platforms Association „Europlatforms".See managing summary ("European Freight Village Ranking 2020") in the attachment
- The Connectivity Agenda (CA) is considered as one of the main EU assistance mechanisms to support economic growth in the Balkan countries and to speed up the economic convergence of the region with EU member states. The Connectivity Agenda is also one of the main priorities of the SEE6 countries. In practical terms, it consists of developing and financing concrete regional infrastructure investment projects in transport, energy, and digital connectivity, and on developing and adapting a legal and regulatory framework compliant with EU technical standards. It impacts directly the cooperation of three South Adriatic countries in the transport sector. In 2015, the European Commission earmarked 1 billion Euro in grants to be awarded from the Instrument of Pre-Accession Assistance (IPA) by 2020, in support of the connectivity agenda. These grants are expected to leverage between 3.2 and 4 billion Euro in investments and create more than 45,000 jobs.
- Administration for Maritime Safety and Port Management will lead the national project of NMSW implementation in Montenegro. The project will be financed through the EU IPA (Instrument for Pre-accession Assistance) funds. One of the MSP project team members from Croatia participated in the Study of development of Maritime National Single Window (MNSW). The study includes the preparation of four units:
    - Detailed recording of all business processes of all entities that make up the complete official procedure of ship registration in the ports of Rijeka, Split and Ploče, by creating a detailed flow of information in the following phases: before the ship arrives in port, arrival at the port, stay in the port, and departure of the ship from the port
    - Preparation of the proposal "Catalogue of documents and data" which contains: a complete list of documents and data (with detailed definitions) that NSW defined entities receive, deliver and exchange
    - Proposals and measures (short-term, medium-term and long-term) for the establishment of a complete NSW interface through which orchestration, one-time receipt and exchange of documents and data between all involved (current and future) information platforms and NSW entities
    - Proposals and measures for integration with the unique Port Community System of the Port of Rijeka Authority

  Conclusions of the study

  In the establishment of NSW, it is crucial to consider a) legal requirements (Regulation, Ordinance) b) the state of development of stakeholder information systems and c) professional recommendations and best practice in the implementation of NSW systems (EU, UNECE)

  There is no one best way to establish an NSW that is universally applicable; each establishment must take into account the wider stakeholder integration infrastructure (at national, regional and European level)

- The ECTA workgroup on digitalisation. First results have been a Best Practice guideline on transport visibility within bulk chemical logistics, where a standard is set within our industry. The current focus is on digital documents and performance KPI's.

5.4 Hurdles, gaps and requirements identified in the above mentioned projects

From the technical perspective several of the projects mentioned above highlighted the enormous complexity and challenge of solving a multimodal optimisation problem. Individual projects were very successful in terms of solving some of these issues and making major steps forward. However, opportunities still remain for further innovation and an increased impact of project results.

This is the case for example in terms of the algorithms that could be applied to global logistics operations. In particular the emergence of new routes such as the Arctic and Silk Road, and new technologies (autonomous transport solutions, Hyperloop) present new challenges and additional complexity.

From an operational perspective the key take-away from other relevant projects is that sustainability, security, safety, resilience and cost reduction are not mutually exclusive. Harmonisation and compliance enhance all of these, while synchromodality leads to a win-win for all stakeholders. The important requirement is to get this message across to the stakeholders. The successes in the previous projects need to be built on to reinforce the message that standardisation does not just reduce administrative effort, but it enables automated logistics optimisation algorithms to make huge increases in efficiency.

This is absolutely crucial, as we notice that, although many logistics companies believe that digitization will change logistics over the long term, there is currently a lack of resources and expertise to define a clear strategy for the future. This also means that there is a risk that companies from outside will force their way into the logistics market and use digitization to their advantage. The greatest technical obstacle is often a lack of standards and the inadequate interfaces for data exchange between different actors in the chain.

It is however the expectation that new business models are likely to provide new or improved service offerings or greater efficiency. Existing models that are based on non-transparent structures or that do not exploit the optimization potential of the logistical chain are therefore expected to disappear in the long run.

Another important hurdle experienced in many previous projects is the lack of data sharing, not only because of a lack of standards and inadequate interfaces for data exchange, but mainly because of conservative positions of many stakeholders, for example ocean carriers that are not willing to share meaningful data on empty containers that can be reused or forwarders and transport service providers not willing to engage in a shared planning environment in order to create collaborate multi-modal plans that aim for less empty trucks/containers being transported. It is essential, if we want to move beyond application within individual companies or closed networks, to take the design of a collaborative business model as a starting point - focussing on sharing benefits. But even then it will be difficult to overcome inherent opposed interests within the market.

Furthermore, the multitude of commercial platforms in the market does not help in this regard, as it only makes stakeholders even more hesitant to share data. The point of departure for ePIcenter therefore is that a standardised, neutral approach would be the best way to boost digitalisation and the adoption of new technologies in transport and logistics. In order to avoid a lack of media/data continuity, it is also important that the entire transport chain is digitised.

But these kinds of collaboration need a legally safe environment, using approved standard contracts, agreements and documentation as well as a sound, acknowledged and accepted Governance approach. Experience in previous projects showed that the final operational execution was usually the easier part once all preparation was done. Data gathering, analysis, standardisation, legal agreements etc. took around 1/3 of the total project timeline. After that, it is paramount to invest in proper preparation in terms of data and legal protection of the project results.

More specifically for the Northern Sea Route, an important bottleneck perceived is the absence of harmonization and consolidation of rules, regulations, fees etc. Today these things are improved but still some concerns related to the volatility of policy regarding Northern Sea Route shipping exists. These concerns make long term planning difficult.

More generally on the regulatory side, lack of integration across the EU and between/in individual countries is also a concern, for example rules on using drones for last mile transport. The lack of regulatory incentives to stimulate more sustainable transport is also very impactful.

Finally, but not less importantly, many projects have showed true potential but the funds to implement them are simply lacking. This is the case in the individual companies, but also on national and regional level when it comes to transport infrastructure on the one hand and investing in future proof logistics, e.g. through digitalisation.

EPIcenter could help to overcome a number of these issues by a) providing high quality guidelines on how to get started with these topics b) development of recommendations for the necessary adaptation of the regulatory framework and incentive schemes towards EU and national legislation c) creating easily accessible, suitable digital tools, that are open source and tackle common EU-wide or global challenges.