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SETRIS PROJECT

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2	European Conference of Transport Research Institutes	ECTRI	Belgium
3	AVL List GmbH	AVL	Austria
4	BMT Group Limited	BMT	United Kingdom
5	Centro National de Competencia en Logistica Integral	CNC-LOGISTICA	Spain
6	The European Earth Friendly Logistics Association AISBL	CO-TREE	Belgium
7	Stichting Dutch Institute for Advanced Logistics	DINALOG	Netherlands
8	German Aerospace Center	DLR	Germany
9	Forum des Laboratoires Nationaux Europeens de Recherche Routiere	FEHRL	Belgium
10	Fraunhofer-Gesellschaft zur Forderung der angewandten Forschung e.v	Fraunhofer IML	Germany
11	Instytut Logistyki I Magazynowania	ILiM	Poland
12	Promotion of Operational Links with Integrated Services	POLIS	Belgium
13	Ships & Maritime Equipment Association of Europe	SEA EU	Belgium
14	Union Internationale des Chemins de fer	UIC	France
15	Union Internationale des Transports Publics	UITP	Belgium
16	The Association of the European Rail Industry	UNIFE	Belgium
17	Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek	TNO	Netherlands
18	European Organisation for the Safety of Air Navigation	EUROCONTROL	Belgium

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Version	Date	Modification reason	Modified by
Draft 1	28.01.2016	Draft topics for implementation Plan as result of ALICE Working Groups Meetings in Oct-Nov 2015	ALICE AISBL
Draft 2	07.03.2016	Input from ALICE Workshop in Feb. 2016	ALICE AISBL
Draft 3	14.04.2016	Inclusion of comments from ALICE members & 1st draft of the Benchmark main research and innovation activities	ALICE AISBL
Draft 4	14.06.2016	Inclusion of Draft Summaries of the Topics & update of benchmark	ALICE AISBL
Draft 5	17.10.2016	Refinement of the Implementation Plan Topics & update of benchmark after Presentation in ALICE Plenary Meeting 14th Oct 2016	ALICE AISBL
Final	03.08.2017	Consolidation in one document of the Implementation Plan and Monitoring Research	ALICE AISBL

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1. GLOSARY AND DEFINITIONS:

ACARE: Advisory Council for Aviation Research and Innovation in Europe**.** Air ETP (http://www.acare4europe.com/)

ALICE: Alliance for Logistics Innovation through Collaboration in Europe. Logistics ETP. (www.etp-alice.eu)

DTLF: Digital Transport and Logistics Forum (http://ec.europa.eu/transport/media/news/2015-04-15-setting-up-dtlf_en.htm)

ERRAC: European Rail Research Advisory Council. Rail ETP. (http://www.errac.org/)

ERTRAC: European Road Transport Research Advisory Council. Road ETP (http://www.ertrac.org/)

ETPs: European Technology Platforms.

SRIA: Strategic Research and Innovation Agenda.

WATERBORNE: WATERBORNE ETP (http://www.waterborne-tp.org)

DEFINITIONS:

European Technology Platforms. European Technology Platforms (ETPs) are industry-led stakeholder fora recognised by the European Commission as key actors in driving innovation, knowledge transfer and European competitiveness. ETPs develop research and innovation agendas and roadmaps for action at EU and national level to be supported by both private and public funding. They mobilise stakeholders to deliver on agreed priorities and share information across the EU. (http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=etp).

Internet of Things. The network of physical objects—devices, vehicles, buildings and other items—embedded with electronics, software, sensors, and network connectivity that enables these objects to collect and exchange data. (https://en.wikipedia.org/wiki/Internet_of_Things)

Physical Internet. Open global logistics system founded on physical, digital, and operational interconnectivity, enabled through modularization, standard interfaces and protocols, with the aim to move, store, produce, supply and use physical objects throughout the world in a manner that is economically, environmentally and socially efficient and sustainable. (http://physicalinternetinitiative.org/)

Shipper: Manufacturers, retailers and wholesalers, and in general cargo owners who sends goods for shipment, by packaging, labelling, and arranging for transit, or who coordinates the transport of goods.

Synchromodality. Synchromodality, or synchronized intermodality, is the optimally flexible and sustainable deployment of different modes of transport and hubs in a network in which the user or customer (shipper or forwarder) is offered or can directly access to an integrated solution for his (inland) transport. It involves informed and flexible planning, booking and management, that allows to make mode and routing decisions at the individual shipment level almost in real time. (http://www.synchromodaliteit.nl/en/definition/) and (http://www.etp-logistics.eu/?page_id=79).

2. EXECUTIVE SUMMARY

This Deliverable has been developed in the frame of the SETRIS project. SETRIS project aims to deliver a cohesive and coordinated approach to research and innovation strategies for all transport modes in Europe. SETRIS seeks to identify synergies between the transport European Technology Platforms' (ETPs) strategic research and innovation agendas (SRIAs) and between these and relevant national platforms. The 5 ETPs are:

1) ACARE (Advisory Council for Aviation Research and Innovation in Europe),
2) ALICE (Alliance for Logistics Innovation through Collaboration in Europe),
3) ERRAC (The European Rail Research Advisory Council),
4) ERTRAC (European Road Transport Research Advisory Council) and
5) WATERBORNE.

This document includes an analysis of the status of Implementation of ALICE Roadmaps delivered in 2014[1] as well as a specific implementation plan of the roadmaps including concrete topics to be implemented through R&I projects and initiatives.

ALICE Research and Innovation Roadmaps and this document address these Pillars of research and innovation in Logistics.

1. *Sustainable, Safe and Secure Supply Chains.*
2. *Corridors, hubs and synchromodality.*
3. *Information Systems for interconnected Logistics.*
4. *Global Supply Network Coordination and Collaboration.*
5. *Urban Logistics.*

Pillars 2 and 5 are addressed mainly within Work Package 2 within SETRIS project and through a close collaboration with modal ETPs: ACARE, ERTRAC, ERRAC and WATERBORNE. Still, and to provide a holistic overview of the field this deliverable incorporates a benchmarking analysis of main research and innovation activities within the scope of those pillars and roadmaps have been performed and research priorities have been incorporated in ALICE implementation plan of the research and innovation roadmaps.

At this stage, the document is divided in 2 separated sections:

- Benchmarking of main research and innovation activities within the scope of the pillars and based on ALICE R&I roadmaps[1].
- Identifying major research and innovation gaps not covered and define strategies and implementation plans for them.

Each of these sections is worked out to be an independent document towards communication and dissemination of the contents towards industry, research and public bodies.

[1] ALICE R&I Roadmaps: http://www.etp-logistics.eu/?page_id=13

The results of this deliverable will be further re-fined within *D3.3 ALICE Research Roadmaps Implementation Plans and Monitoring follow up.* D3.3 will incorporate a review of the contents of this deliverable and will include an elaboration of specific methodology to assess the overall performance of the logistics program in relation with the HORIZON 2020 and logistics sector goals.

Document 1: Benchmark main research and innovation activities within the scope of ALICE roadmaps

Document contributing to SETRIS Deliverable *D3.2. ALICE Research Roadmaps Implementation Plan and Monitoring*

Contents

1. Executive summary

The European Technology Platform, Alliance for Logistics Innovation through Collaboration in Europe (ALICE), was launched on 11 June 2013, and received official recognition from the European Commission in July 2013. ALICE was established to develop a comprehensive strategy for research, innovation and market deployment of logistics and supply chain management innovations in Europe with the mission: "*to contribute to a 30% improvement of end to end logistics performance by 2030".* The mission is addressed with a societal, environmental and economic approach and is based on the concept of the "triple bottom line". Therefore, the strategy will positively impact *People*, *Planet* and *Profit.*

In December 2014, ALICE delivered five Research and Innovation roadmaps in key Pillars to achieve this Mission:

1. Sustainable Safe and Secure Supply Chains
2. Corridors, Hubs and Synchromodality
3. Information Systems for Interconnected Logistics
4. Global Supply Network Coordination and Collaboration
5. Urban Logistics

The roadmaps included research and innovation gaps and challenges that needed to be addressed to drive the process from current situation to the desired one included milestones for 2020 and 2030. On top, several enablers and opportunities where identified in those roadmaps.

This document assesses the status of implementation of the roadmaps and identifies potential contributions from running projects and initiatives to these roadmaps implementation. Moreover, this assessment has been used to identify remaining gaps identified in the roadmaps that should be addresses by specific actions and projects compiled in ALICE Roadmaps Implementation Plan.

This document contributes to SETRIS Deliverable *D3.2. ALICE Research Roadmaps Implementation Plan and Monitoring* as part of Task 3.1. Main deliverables in this task will be:

- To benchmark main research and innovation activities within the scope of the pillars and roadmaps. *Addressed in this document.*
- Identify major research and innovation gaps not covered and define strategies and implementation plans for them. *Addressed in ALICE Research and Innovation Roadmaps Implementation Plan.*
- Elaborate specific KPI´s to assess the overall performance of the logistics program in relation with the HORIZON. 2020 and logistics sector goals. This will include: creating consensus towards KPIs, define a methodology to measure, monitor and assessment of KPIs. This aspect will be addressed in future deliverable *D3.3 ALICE Research Roadmaps Implementation Plans and Monitoring follow up (M22)*.

Pillars 1, 3 and 4 (above) have been addressed specifically within SETRIS project Task 3.1.2. Pillars 2 and 5 were elaborated mainly in the framework of SETRIS WP2. However, the benchmarking analysis

of main research and innovation activities within the scope of pillars 2 and 5 have been included in this document for the sake of clarity and completeness of this document.

3000+ projects and initiatives composed the initial sample. The results returned by the search engine in cordis were carefully analysed in order to determine their relation to ALICE roadmaps and potential contribution for their implementation. In total, 158 projects and initiatives have been identified as potentially contributing to ALICE Research and Innovation Roadmaps implementation (annex 1). The investment in these initiatives altogether has been 729 Million € with a public funding of 531 Million € in the period 2010-2015.

The Nr. of projects impacting in each of the roadmaps is as follows:

- Sustainable, safe and secure supply chains (67)
- Corridors, hubs and synchromodality (54)
- Information systems for interconnected logistics (40)
- Global supply network coordination and collaboration (36)
- Urban freight (50)

Calls for proposals within H2020 2016-2017 Work programs that include topics that may evolve in projects potentially contributing to ALICE roadmap implementations have been identified as well. These "Topics" are included in Annex 2.

Additionally, the topics included in *ALICE Implementation Plan* for the Roadmaps are also mentioned when relevant in the analysis.

SETRIS project partners analysed all these projects and identified the specific aspects and contributions to ALICE roadmaps. After that, and pooling together the contributions of all identified projects, the challenges identified in the roadmaps were assessed and classified in five different Degrees of Implementation (DoI). DoI ranks from 1 to 5 in the following meanings (colors are also used to provide additional clarity to the document):

- DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls
- DoI 2: Potentially foreseen in forthcoming calls for proposals
- DoI 3: Some research activities and small scale pilots
- DoI 4: Experiences but not deployed at a large scale
- DoI 5: Sufficient evidences of implementation

2. Introduction

The European Technology Platform, Alliance for Logistics Innovation through Collaboration in Europe (ALICE), was launched on 11 June 2013, and received official recognition from the European Commission in July 2013. ALICE was established to develop a comprehensive strategy for research, innovation and market deployment of logistics and supply chain management innovations in Europe with the mission: *"to contribute to a 30% improvement of end to end logistics performance by 2030".*

2.1. ALICE Vision and Mission

ALICE is based on the recognition of the need for an overarching view on logistics and supply chain planning and control, in which shippers and logistics service providers are indispensable and should closely collaborate to reach sustainable and efficient logistics and supply chain operations.

The key idea behind the logistics and supply chain planning and control concept is the recognition that decisions on a supply chain level may have effects on transportation that far outweigh decisions made in the transport area solely. At the same time, these effects can only be reached if shippers and logistics service providers join hands. An example is the decision to transport components instead of full products and postpone final product configuration until close to the customer. This serves sustainability (people, planet, profit) in a broad sense because of both less inventory investments due to uncertainty reduction, and an increased load factor of the transport means used due to a far higher packing density. Many shippers start to realize that efficient and sustainable logistics (referring to energy usage and environmental footprint) are two sides of the same coin. However, the decision to redesign the supply chain accordingly is typically a manufacturer/shipper decision, not a decision taken by the transport sector itself.

Enlarging the scope to fully include decisions made in the shipper's boardrooms means considering not only *"how to transport"* but also *"what to transport".* That means, we do not only view (multimodal) transport as such but also strategic decisions on a supply chain level that strongly influence economic, ecological and social effects of transportation.

One of the key elements identified by ALICE as the Vision to achieve *a 30% improvement of end-to-end logistics performance by 2030* is The Physical Internet (PI) Concept[2]. The PI Concept is based on an open global logistic system founded on physical, digital, and operational interconnectivity, enabled through encapsulation of goods, standard interfaces and protocols, with the aim to move, store, produce, supply and use physical objects throughout the world in a manner that is economically, environmentally and socially efficient and sustainable.

The mission of ALICE is to contribute to the development of new logistics and supply chain concepts and innovation for a more competitive and sustainable industry. ALICE aims to accelerate the deployment of more efficient, competitive and sustainable supply chains. To accomplish this mission,

[2] Ballot, E., B. Montreuil, and R.D. Meller, The Physical Internet: the network of logistics network. PREDIT. 2014: La Documentation Française. 271p.

ALICE brings together as primary stakeholders: shippers and logistics service providers, as well as other relevant stakeholders including but not limited to: transport companies, terminal operators, support industry (Finance, ICT, Equipment/vehicle/vessel manufacturers, infrastructure providers, inspections) and research and education institutions to:

- Define research and innovation strategies, roadmaps and priorities agreed by all stakeholders to achieve ALICE Logistics vision.
- Foster innovation in logistics and supply chains, stimulating and accelerating innovation adoption in order to make the growth of the European economy through competitive and sustainable logistic possible.
- Raise the profile and understanding of new logistics technologies and business processes, monitoring progress and adjusting research and innovation roadmaps accordingly.
- Contribute to a better alignment and coordination of European, national, regional innovation programs in logistics.
- Provide a network for interdisciplinary collaborative research involving industry, academia and public institutions.

2.2. ALICE Research and Innovation Roadmaps, Milestones and Expected Impacts

ALICE Working Groups, composed of industry, academia and public bodies analyse and define research and innovation strategies, roadmaps and priorities to achieve ALICE Vision and Mission. These Working Groups are:

1. Sustainable Safe and Secure Supply Chains
2. Corridors, Hubs and Synchromodality
3. Information Systems for Interconnected Logistics
4. Global Supply Network Coordination and Collaboration
5. Urban Logistics

In December 2014, each of these working groups delivered a research and innovation roadmap[3] including research and innovation gaps and challenges that need to be addressed to drive the process from current situation to achieve ALICE Vision and Mission.

Different milestones were identified as core elements to achieve the vision in each of the areas as shown in Figure 1. This implementation plan is specially targeting to achieve milestones set for 2020 and also paving the way to achieve 2030 milestones.

[3] ALICE Research and Innovation Roadmaps (www.etp-alice.eu)

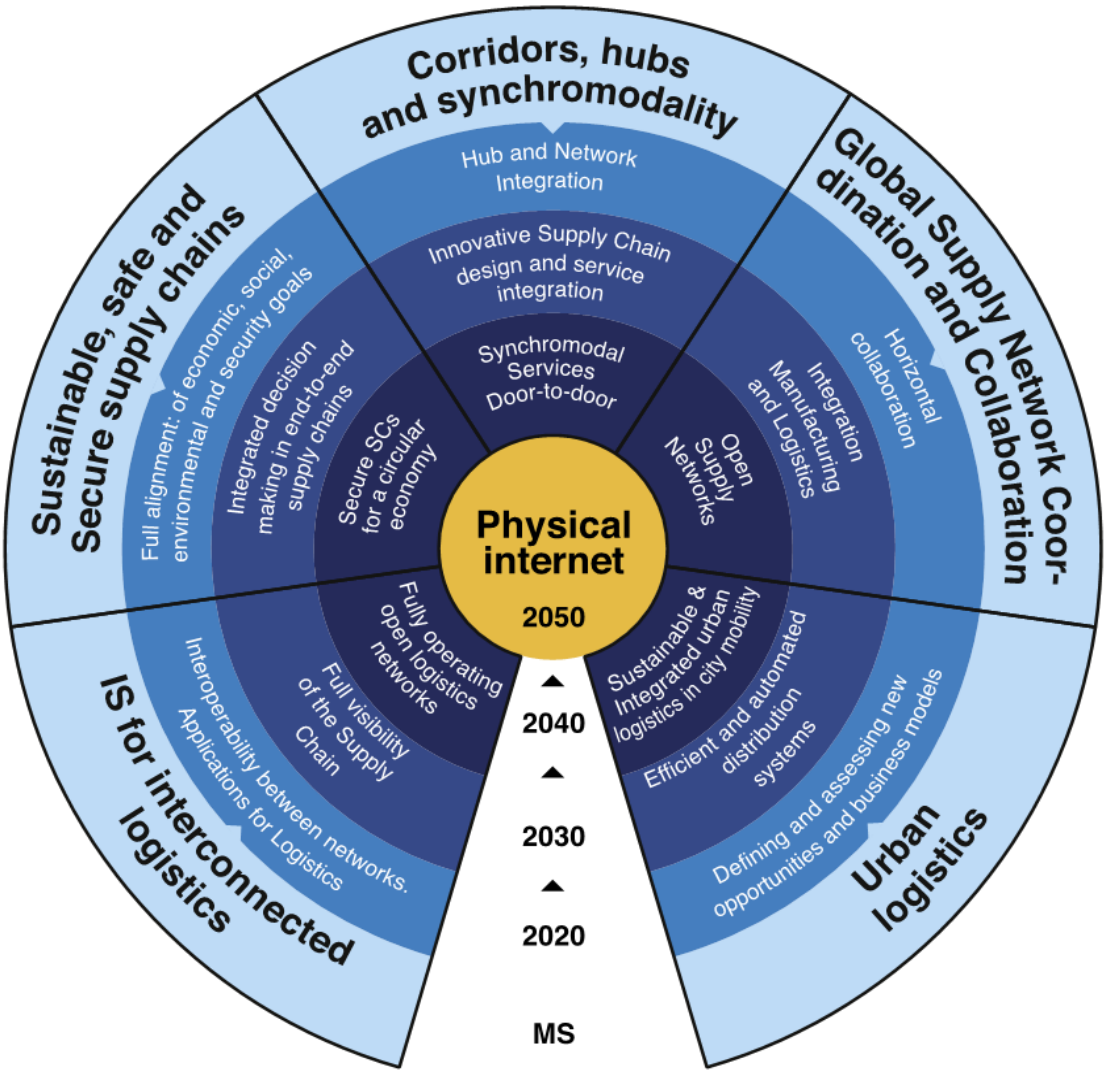

Figure 1 Milestones towards the Physical Internet

ALICE roadmaps identified expected impacts that should be addressed in order to "*contribute to a 30% improvement of end-to-end logistics performance by 2030".* These impacts should have a societal, environmental and economic approach based on the concept of the "triple bottom line." Therefore, expected impacts were identified in three dimensions: People, Planet and Profit.

The impacts discussed below are separated into one of these three categories for a more intuitive understanding by stakeholders.

The impacts are divided into primary and secondary impacts (Table 1). While primary impacts are the ultimate expected impacts, the secondary impacts will have a positive influence on the primary ones. For example, Energy Consumption is a primary impact while increasing load factors of vehicles is a secondary impact that positively influences energy consumption as well as other indicators such as emissions reduction.

Table 1 Expected impacts from the implementation of ALICE roadmaps proposed actions.

	Primary Impacts	Secondary impacts
People	+ Increase customer satisfaction + Products availability + Secure societies	+ Load factors: weight and cube fill of vehicles + Volume flexibility (Time to +/- capacity) + % Synchromodal + Asset utilization + Supply Chain Visibility + Reliability of transport schedules + Perfect order fulfilment + Transport routes optimization (reducing Kms) + Transport actors using automatic data exchange + Cargo and logistics units integrated in the automatic data exchange + Upside / Downside Supply Chain Adaptability and Flexibility + Decoupling logistics intensity from GDP - Empty Kilometres - Waiting time in terminals - Risk factor reduction - end-to-end transportation time - Travel distance to reach the market - Lead times
Planet	- Energy consumption (kWh Logistics/GDP) + Renewable energy sources share - CO2 Emissions	
Profit	+ Return on assets and working capital - Cargo lost to theft or damage - Total supply chain costs	

2.3. Benchmarking methodology

Research and Innovation Projects, mainly European 7th Framework Programs and H2020, have been assessed in order to evaluate ALICE Research and Innovation Roadmaps implementation. Additional projects from TEN-T, INTERREG and National Projects have also been considered when found relevant and importantly contributing to the analysis.

Moreover, certain private pioneering initiatives have been included when addressing the challenges included in the roadmap with a solution into the market.

The methodology used in the selection of the projects builds upon the one developed in the FP7 project WINN (European Platform Driving KnoWledge to INNovations in Freight Logistics[4]), more explicitly the one developed for D3.4 "*Status of EIRAC, EGCI and ALICE research and innovation agendas report*". Some of the relevant projects were already identified in that analysis that has been extended in this document to projects with start date up to October 2015.

In order to identify the projects, an advanced search in CORDIS website (http://cordis.europa.eu/search/advanced_en) was carried out by filtering by any of the following key words: logistics, supply, chain, multimodal, transport, co-modal, cargo, mobility, packaging, synchromodality, transportation, infrastructure, distribution, network, freight, road, carrier, rail and intermodal. Moreover, the initial analysis was shared with ALICE Working Group members so they could provide further references of relevant projects. This has been done in several iterations through e-mail and face to face meetings.

3000+ projects and initiatives composed the initial sample. The results returned by the search engine in cordis were carefully analysed in order to determine their relation to ALICE roadmaps and potential contribution for their implementation. In total, **158 projects and initiatives have been identified as potentially contributing to ALICE Research and Innovation Roadmaps implementation** (Nr. of projects impacting each roadmap in brackets)

- Sustainable, safe and secure supply chains (67)
- Corridors, hubs and synchromodality (54)
- Information systems for interconnected logistics (40)
- Global supply network coordination and collaboration (36)
- Urban freight (50)

A list of these projects as well as projects contribution to the roadmaps implementation is available in Annex 1.

ALICE roadmaps are structured in challenges and themes including concrete aspects that need to be addressed to achieve the different milestones and therefore, achieving the ALICE vision. The projects and initiatives have been analysed and main contributions to these challenges identified through a combination of desk analysis and specific interviews and ad hoc contacts with project partners in ALICE network to receive specific input on the outcomes and developments of the projects.

Calls for proposals within H2020 2016-2017 Work programs that include topics that may evolve in projects potentially contributing to ALICE roadmap implementations have been identified as well. These "Topics" are included in Annex 2.

Additionally, the topics included in *ALICE Implementation Plan* for the Roadmaps are also mentioned when relevant in the analysis.

SETRIS project partners analysed all these projects and identified the specific aspects and contributions to ALICE roadmaps. After that, and pooling together the contributions of all identified projects, the challenges identified in the roadmaps were assessed and classified in five different Degrees of

[4] http://cordis.europa.eu/project/rcn/105756_en.html

Implementation (DoI). DoI ranks from 1 to 5 in the following meanings (colors are also used to provide additional clarity to the document):

- DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls
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- DoI 3: Some research activities and small scale pilots
- DoI 4: Experiences but not deployed at a large scale
- DoI 5: Sufficient evidences of implementation

In parallel, it has been launched the:

- ALICE Liaison Program with Research and Innovation Projects[5].
- ALICE Letters of Support for R&D Project Proposals[6].

These two programs are seen as a good mechanism to get closer collaboration with projects and ensure proper interaction with them to follow up relevant research and innovation in the field of logistics and to assess the implementation of ALICE Roadmaps. Both of them have been launched with the support of SETRIS project. Currently, 8 projects[7] have signed up for ALICE Liaison Program with Research and Innovation Projects and 9 project proposals have requested ALICE Letter of Support. A summary of the programs can be found in Annex 3.

[5] http://www.etp-logistics.eu/?p=1006

[6] http://www.etp-logistics.eu/?p=1023

[7] http://www.etp-logistics.eu/?page_id=998

3. Benchmarking Sustainable Safe and Secure Supply Chains Roadmap

3.1. Supply Chain Sustainability

The vision of '*sustainable supply chains*' is to do more with less: to ensure that growth, competitiveness, innovation and industrial leadership does not take place at the cost of environmental sustainability in supply chains. Operational practices and theoretical principles of logistics and supply chain management serve as key mechanisms in: reducing dependence on non-renewable energy resources (oil dependency), minimising emission of greenhouse gasses, advancing re-use of products and materials, and transformation of supply chains towards a low-carbon economy.

The design of sustainable logistic systems not just depends on policies of transport and logistics service providers, but also crucially on decisions made by shippers and manufacturers (local versus global, product modularity, re-use of materials and components, item and package integrity) as well as by authorities' and governmental regulations.

The transformation to sustainable logistics solutions will require changes in business models regarding both demand and supply. Greater cooperation makes it possible to focus, simultaneously, on customisation, business process integration and sustainability. Knowledge about the relationships between shippers' demand specification and their needs is crucial in understanding the requisites of transport services. Such information would make it possible for logistics service providers to fully utilise the potential of their systems. The transformation will be taking place along four different dimensions[8]:

- Product focus
- Material Flow perspective
- Closed loop supply chains; a process perspective
- Information and ICT tools

3.1.1. Product Focus

There is a need for a holistic view of the customer offering, the product including the packaging and associated services, which are expected to constitute a larger part of the customer offering. In fact, a number of businesses have discovered the (after sales) product service market as an important additional source of revenues. This trend is often referred to with the term "servicization", a shift from product oriented to service oriented business models

Different challenges need to be addressed:

- Product size, shape and packaging, modularisation and postponements of product customization.
- Alternative packaging solutions again help to both increase efficiency and to reduce environmental impact (energy usage, carbon emissions).

[8] ALICE Research and Innovation Roadmap on Sustainable Safe and Secure Supply Chains.

- Product design, in which 'products-in-use' can communicate effectively with resources and actors in the wider logistics and transport system.
- Sourcing strategies and supplier selection across different tiers in the supply chain is also of great importance.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Product size, shape and packaging, modularisation and postponement of product customization	• **CASSAMOBILE:** Mobile, flexible, modular, small-footprint manufacturing system in a 20' ISO-container that can be easily configured for different products and processes. • **Flexlogic:** self-contained, autonomous '*factory in a box*' to facilitate the high volume manufacture of flexible printed ICs. • **Refresh:** Maximizing the value from unavoidable food waste and packaging materials • **Symbionica:** fully personalized bionics and smart prosthetics • **MOSART:** advanced manufacturing system for high quality custom-made mosaics. • **MANSYS:** 3D printing reducing material usage and waste
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Redesign of products to optimize utilization of load units (i.e. pallets, cases, etc.). Alternative packaging solutions again help to both increase efficiency and to reduce environmental impact (energy usage, carbon emissions). Improved packaging also reduces waste due to less damaged or deteriorated products, as well as the need for packaging material.	• **ESAVE:** What-if analysis for different distribution packaging to assess their environmental impact • **REPACK:** Reusable design packaging
'products-in-use' can communicate effectively with resources and actors in the wider logistics and transport system	• **i-CARGO:** Real time planning services including CO2 calculations and intelligent cargo.
Sourcing strategies and supplier selection across different tiers in the supply chain.	• **OPENMIND:** flexible process chain for the on-demand production of entirely customised minimally invasive medical devices. • **CAxMAN:** process planning for additive manufacturing to reduce and optimize material usage

DoI 2: Potentially foreseen in forthcoming calls for proposals   *(No challenges in this category)*
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls   *(No challenges in this category)*

3.1.2. Material Flow perspective

Materials flow through a number of nodes, manufacturing, warehouses and distribution centres will increasingly affect a company's competitiveness. The **design, organisation and control of supply, production and distribution networks** will influence not only the cost of shippers and logistics services providers, but also the environmental impact of both production and transport, and of course customer service. Furthermore, research on transport demand requires analysis of the interaction between the shippers' production philosophy, planning and control models and the transport system design.

Challenges that need to be addressed are:

- The design and implementation of fully automated, energy efficient warehouses and cross-docking terminals.
- New material flow technologies and intelligent load carriers, standardized ULD's.
- Vertical collaboration between shippers and logistics providers that allows for mode-free booking. Horizontal collaboration within transportation for better utilisation of capacity (See chapter 5)
- Use of less energy-intensive distribution strategies. Use of distribution strategies that are to a higher degree based upon use of renewable energy resources.
- Development and implementation of integrated planning processes, including demand shaping and capacity planning, with financial and inter-organisational supply perspectives.
- Design and implementation of materials control processes for supply chain optimised cost, inventory turnover, service and environmental impact.
- Mitigation and management of supply chain disruptions. Development of material flow performance indicators and analysis models.
- Distribution systems based upon real-time information about condition of equipment (after-market products) and consumption (new products).
- Seamless, intelligent automated operations at multimodal nodes and hubs.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4

New material flow technologies and intelligent load carriers, standardized ULD's.	• **FURBOT:** Load standardization and modularization for loading/unloading operations in urban transport. • **MODULUSHCA:** Iso-modular logistics units • **NEWS:** Eco-friendly ship concept in order to supports the full integration of waterborne transport into the EU transport and logistics chain. • **FMContainer:** A new design for the standard container for faster and automated operations (among other) • **HERMES:** optimization of the performance of the rail freight wagon. • Topic M.G 5.1 -2016: *Networked and efficient logistics clusters* • ALICE Implementation Plan Topic: *Interoperable standard modular urban loading units*
Vertical collaboration between shippers and logistics providers that allows for mode-free booking. Horizontal collaboration within transportation for better utilisation of capacity.	*[see chapter 5]*
Seamless, intelligent automated operations at multimodal nodes and hubs.	*[see chapter 3]*
Distribution systems based upon real-time information about condition of equipment (after-market products) and consumption (new products).	• **Get SERVICE:** To reduce CO2 emissions by means to plan, re-plan and control transportation routes efficiently by using real-time information from multiple information sources. • **ICARGO:** Real time planning services including CO2 calculations and intelligent cargo.
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Use of less energy-intensive distribution strategies. Design of effective materials supply methods (continuous supply, batches, kitting, sequencing...) including efficiently preparing and present materials. Use of distribution strategies that are to a higher degree based upon use of renewable energy resources.	• **COFRET:** harmonisation of methodologies along multi-leg transport chains • **COMPANION:** Improving fuel efficiency in heavy-duty vehicle platoons by automatic decision making system • **ECOHUB:** the first calculator for assessing the environmental profile of hubs, Validating the Common Framework • **ECOMPASS:** Design of urban logistics scenario's using mobility of humans to avoid CO2 • **Green Freight Europe** and **Global Logistics Emissions Council.** (http://www.smartfreightcentre.org/glec) group of companies, industry associations and programs that want to make carbon accounting work for industry and is backed by leading experts, governments and other stakeholders. • **GREEN EFFORTS:** Detailed view on consumption, supply, production and management of energy by investigating the current energy mix in ports and terminals while identifying the activities which account for real energy saving and

	investigating the range of regenerative energy sources which could be adapted to the port and terminal environment. • **SYNCHRONET:** Ultimate goal of De-stressing the supply chain and smart steaming. • **U-TURN:** Consolidation of transportation flows from food manufacturers to the various point-of-sales located in urban areas. • Topic MG5.3 2016**.** *Promoting the deployment of green transport, towards Eco-labels for logistics*
Mitigation and management of supply chain disruptions. Development of material flow performance indicators and analysis models.	• **DISRUPT:** Sustainable management of natural disruptions of the supply chains. • **EfficienSEA:** Improve navigational safety and efficiency and ships connectivity.
Development and implementation of integrated planning processes, including demand shaping and capacity planning, with financial and inter-organisational supply perspectives.	• **InnoMarket:** Innovations for better utilisation of trucks capacity, identifying market development for LTL. • **NEXTRUST:** One of the strategies is to bundle freight volumes for increasing efficiency
The design and implementation of fully automated, energy efficient warehouses and cross-docking terminals.	• **STAMINA:** develop a fleet of autonomous and mobile industrial robots with different sensors, planning and physical capabilities for handling tasks. • **COFATRANS:** faster loading and unloading of the ships • **RCMS:** Robotic Container Management System will help the flow of goods at ports. • Topic M.G 5.1 -2016: *Networked and efficient logistics clusters* • ALICE Implementation Plan Topic: *Logistics operations automation: The Matrix for Logistics.*
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Design and implementation of materials control processes for supply chain optimised cost, inventory turnover, service and environmental impact.	• **HIGH TOOL:** Software development to assess economic, social and environmental impacts of transport policy • **EcoContainerCleaner:** cheaper and more environment friendly way to wash containers by means of a robot. • **SYMBIOPTIMA:** critical resources (materials, energy, waste and by-products) are coordinated among multiple autonomous Production Units organized in industrial clusters.

3.1.3. Closed loop SC; a process perspective

A process perspective may be applied on the whole supply chain in how all the links in the chain are connected in a closed-loop and can contribute to sustainability, efficiency and effectiveness. Shifts from product to service offerings, but also from ownership to functional usage of the product, are becoming visible in different sectors and markets.

Challenges that need to be addressed are:

- Define roles and responsibilities for all companies in the supply chain (manufacturer, shipper, logistics provider, user) the 'closed-loop supply chain'.
- Supply chain design for 'closed-loop supply chains', with efficient, cost-saving and environmental-friendly options for disposal (reuse, repair, remanufacturing, refurbishing, recycling, landfill).
- Development of circular business models that help manufacturers, shippers, logistics providers and users to achieve their sustainability objectives.
- Opportunities in reverse logistics needs to be transformed into true 'closed-loop supply chain' business models, in which environmental and business 'eco systems' are integrated.
- How to take the increased importance of functionalities of a product as compared to the ownership into account.
- Supply chain design supports 'through-life management' of equipment, facilities and products.
- How to take advantage of new technology and trends like shorter product life cycles or the demand for more customization against the background of closed-loop supply chains.
- Development of holistic logistics performance measurement.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Supply chain design for 'closed-loop supply chains', with efficient, cost-saving and environmental-friendly options for disposal (reuse, repair, remanufacturing, refurbishing, recycling, landfill).	• **LOCIMAP:** Profile matching and integration of resources or waste streams in Industrial Parks • **ECO-SOLAR:** closed-loop system for solar panel manufacturing • **HISER:** economic and environmental impact of HISER solutions will be quantified from a viewpoint of lifecycle. • **SYMBIOPTIMA.** Management platform for intra- and inter-cluster streams and cross-sectorial re-use for particularly impacting waste streams, proposing advanced WASTE2RESOURCE initiatives for PET. • TOPIC: CIRC-01-2016-2017. *Systemic, eco-innovative approaches for the circular economy: large-scale demonstration projects. Design for circular value and supply chains (2016)*

Holistic logistics performance measurement	• **HIGH TOOL:** Software development to assess economic, social and environmental impacts of transport policy • **COFRET:** C-footprint and greenhouse gas emissions calculations of freight transport and logistics. • **E-SAVE:** e-SAVE's information exchange model follows certain rules which govern the level of abstraction at which data is shared among collaborating stakeholders. For example, instead of exchanging "raw" data, such as orders, invoices, product details, CO2 footprint per sensor, etc. partners may exchange cumulative reports and KPIs. Therefore, depending on the level of collaboration, different data sharing policies may apply. • **COGISTICS:** CO2 Footprint estimation and Monitoring, Multimodal Cargo. • TOPIC: MG-5.3-2016. *Promoting the deployment of green transport, towards Eco-labels for logistics.* • Implementation Plan Topic: *Measurement and managing data for effective assessment and management of Logistics performance*
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Define roles and responsibilities for all companies in the supply chain (manufacturer, shipper, logistics provider, user) the 'closed-loop supply chain'.	• **RESCOMS:** To pilot different closed loop product systems in 4 different businesses to demonstrate the differences regarding costs and sustainability compared to the current linear manufacturing systems.
Opportunities in reverse logistics needs to be transformed into true 'closed-loop supply chain' business models, in which environmental and business 'eco systems' are integrated	• **ADIR:** automated disassembly of electronic equipment will be worked out to separate and recover valuable materials. • **SYMBIOPTIMA:** developing a cross-sectorial energy & resource management platform for intra- and inter-cluster streams, characterized by a holistic model for the definition, life-cycle assessment and business management of a human-mimetic symbiotic cluster. The platform multi-layer architecture integrates process optimization and demand response strategies for the synergetic optimization of energy and resources within the sectors and across value chains. • Topic: CIRC-01-2017: *Systemic, eco-innovative approaches for the circular economy: large-scale demonstration.* • Implementation Plan Topic: *New business models and vertical collaboration for logistics in the circular economy.* • Implementation Plan Topic: IT design and logistics performance in the scarce resources paradigm: Logistics in the full circular economy
DoI 2: Potentially foreseen in forthcoming calls for proposals	
Challenges	Specific contributions justifying DoI 2

Development of circular business models that help manufacturers, shippers, logistics providers and users to achieve their sustainability objectives.	• **GREENSUPPLYCHAIN2009:** Innovate decision-making technologies to determine the economic and managerial impact of pollution emission trading systems in logistics chains. • **Refresh:** Maximizing the value from unavoidable food waste and packaging materials • **FREVUE:** Business cases and economic and environmental impact of electric vehicles in urban freight. • Topic: CIRC-01-2017: *Systemic, eco-innovative approaches for the circular economy: large-scale demonstration.* • ALICE Implementation Plan Topic: *New business models and vertical collaboration for logistics in the circular economy*. • ALICE Implementation Plan Topic: *IT design and logistics performance in the scarce resources paradigm: Logistics in the full circular economy.*
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
How to take the increased importance of functionalities of a product as compared to the ownership into account.	
Supply chain design supports 'through-life management' of equipment, facilities and products.	• ALICE Implementation Plan Topic: *New business models and vertical collaboration for logistics in the circular economy*.
How to take advantage of new technology and trends like shorter product life cycles or the demand for more customization against the background of closed-loop supply chains.	• ALICE Implementation Plan Topic: *IT design and logistics performance in the scarce resources paradigm: Logistics in the full circular economy.*

3.1.4. Information & ICT tools

Working group 3 in ALICE will develop research and innovations related to ICT systems and data sharing capabilities in supply chains. This will have an impact on the development of sustainable supply chains, WG1, but there are some areas that will be more explicitly handled in WG1. Among these are the use of RFID technology, Internet of Things and sensor technology, which creates context-aware autonomous products and packaging. Improved tools for tracking and tracing will support rapid response systems. A number of sources for "Big data" is expected and in WG3 methods for collecting and processing will be developed. However, in order to take advantage of this it is necessary to develop capabilities supporting the exploiting of data in real-time, i.e. making sure that decisions are carried out in the physical system. To make this possible, we need sophisticated communication systems, supporting organizations and a system's perspective as well as change management capabilities.

Challenges that need to be addressed are:

- Smart cargo/ intelligent goods, connected goods.
- Exploitation of data in real-time. This includes collection, processing and decision making in real-time, often based on complex (and "big") data sources.
- Continuous condition monitoring and diagnosis supporting condition-based maintenance of products-in-use, effective re-use and refurbishment. This is supported by a supply chain design that allows for an effective allocation of products towards repair, re-use, refurbishment, remanufacturing and recycling.
- Internalizing external costs (i.e. environmental effects).

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Smart cargo/ intelligent goods, connected goods.	• **CORE:** A federated event driven connectivity infrastructure for real-time smart cargo applications • **FlexlogIC:** flexible integrated logic circuits to be integrated onto goods packaging • **REPACK:** track and trace capabilities for cargo *[See Chapter 4]*
Exploitation of data in real-time. This includes collection, processing and decision making in real-time, often based on complex (and "big") data sources.	• **ECOMPASS:** integration of real-time traffic into urban distribution scenario's; using self-organised (by consumer) deliveries *[See Chapter 4]*
Continuous condition monitoring and diagnosis supporting condition-based maintenance of products-in-use, effective re-use and refurbishment. This is supported by a supply chain design that allows for an effective allocation of products towards repair, re-use, refurbishment, remanufacturing and recycling.	• **HISER:** intelligent tool and a supply chain tracking system, for highly-efficient sorting at source in demolition and refurbishment works.
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	

DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Internalizing external costs (i.e. environmental effects).	

3.2. Supply chain safety & security

The key issue in supply chain security is how to better balance societal and business driven objectives in supply chain management. In other words, how to enhance the efficiency, speed and reliability of legitimate trade and logistics whilst enhancing the effectiveness of supervising global trade and safeguarding supply chain safety and security and other societal challenges related to global trade and logistics.

Currently, a holistic integrated vision is lacking resulting in attempts to independently safeguard supply chain security at different levels causing unnecessarily high costs and disturbances in global supply chains. The ALICE vision is that with the right multidisciplinary and integrative approach, the knife cuts on both sides, i.e. both groups of objectives can be realized simultaneously. This, however, would require two major transitions. First, supply chain actors have to reconsider their supply chain risk management portfolio (4Ts: Transfer, Tolerate, Terminate and Treat), leading to a shift from transfer and tolerate risks towards better control. Though many companies already apply effective internal control measures for crucial enterprise risks, the potential of collaborative chain controls is underutilized. Innovation is aimed at awareness raising, changing perception and tooling to simplify collaborative implementation.

The second transition is aimed at supervision authorities. They need to truly understand supply chain dynamics, redesign their supervision strategies and apply their control and supervision instruments accordingly. This will not only improve the effectiveness of their work, it also has a major impact on the reduction of trade transaction costs and supply chain predictability. This provides the basic vision behind the Innovation Agenda.

Supply chain safety & security innovation agenda is progressing along three perspectives:

- Enabling IT / technology perspective
- Proactive and responsive supply chain concepts
- Collaboration & recognition concepts

3.2.1. An enabling IT/technology perspective

The primary purpose of supply chain visibility is to improve company performance, also by supporting the decision-making process. Lack of data interoperability manifests in data exchange between businesses and government, but also between supply chain stakeholders. Technologies such as scanning technology, container security devices and other tracking and tracing technologies have undoubtedly huge potential to contribute to supply chain security. However, the impact it has on

seamless supply chains strongly depends on the contextual situation. In many cases there might be better alternatives to realize similar levels of security in less disturbing ways.

Challenges within the enabling IT / technology perspective are:

- Low intrusive security technologies enhancing security levels but avoiding too much impact on supply chain operations.
- Enhancing seamless data interoperability by finding ways of optimising use of data throughout supply chains.
- Realising end-to-end visibility in supply chains incorporating multi stakeholder and multi-echelon supply chain information sources.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Low intrusive security technologies	• **CASSANDRA:** Risk Management technics for Supply Chain Security**.** • **EUROSKY:** Integrated Air-cargo Security Solutions • **MODULUSHCA:** Digital interconnectivity towards transport monitoring along the journey. • **SAFEPOST:** New screen technologies • **SPICED:** On site diagnostic methods for detection of adulterations of spices and herbs • **SUPPORT:** Upgrading port security with new surveillance and information management solutions. • ALICE Implementation Plan Topic: *Effective Trade Facilitation.*
Visibility of end-to-end supply chains and visibility of supply chain risks	• **CASSANDRA:** Data-sharing for SC visibility • **COMCIS:** Develop a system that could merge data from multiple sources, deliver situational awareness throughout the whole supply chain • **CONTAIN:** Specify and demonstrate a European Shipping Containers Surveillance system for container security processes • **CORE:** tracking and tracing solution based on the use of the European satellite navigation and many other technologies demonstrated in several demos around Europe for end to end visibility/security • **LOGSEC:** Evaluation of container and goods/inventory, authentication, traceability, inspection and monitoring technologies; Information transfer systems • **Rising:** Complete tracking of cargo plus analysis of the effect of events and combination of events • **TCBL:** Customer-driven production for Textile Clothing Sector
DoI 3: Some research activities and small scale pilots	

Challenges	Specific contributions justifying DoI 3
Seamless data interoperability	• **COMCIS:** Develop a system that could merge data from multiple sources, deliver situational awareness throughout the whole supply chain • **E-FREIGHT:** Covering all aspects of freight transport management from long-term planning through to completion. Contributed to the ISO/IEC 19845 standard for information exchange. • **SHAREBOX:** Develop a secure ICT platform • **CITRIMAC:** smart and secure cargo container and information exchange platform that can reduce screening costs and eliminate tampering risks • **SMART-RAIL:** One of the objectives is to increase railway SC visibility. • Topic: MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.* • ALICE Implementation Plan Topic: *Secure data exchange and access to build trust*
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	

3.2.2. Proactive and responsive SC concepts

This perspective covers security along the full end-to-end supply chain aimed at enhancing a chain of custody based on supply chain risk management, including both internal controls and chain controls. The presumption is that applying supply chain risk management (SCRM) is far from mature, thus leaving room for considerable improvement. Innovative funding and lending mechanisms applied at the supply chain level are part of SCRM, but are also just being introduced, and currently focus exclusively on a small group of multinational companies. There is economic justification for being in control of the value chain, which is the intrinsic commercial value of a trusted and integrated supply chain. Gartner identifies this as the key trend under supply chain Leaders in 2014. Becoming trusted is seen as the right way enabling businesses to compete for the future and rethinking the design of their global supply networks.

Challenges within the proactive and responsive SC concepts are:

- Enhancing supply chain resilience in order to increase the robustness of supply chain operations.
- Building advanced supply chain risk management systems to identify and characterise potential risks.

DoI 5: Sufficient evidences of implementation

Challenges	Specific contributions justifying DoI 5
Supply chain resilience	• **CONTAIN:** Secure Multimodal Corridor Design • **DISRUPT:** Managing natural disruptions on globalized supply chain networks for manufacturing of goods • **CORE:** Core project aims Development and demonstration of SC resilience tools and instruments, such as Resilience optimizer (LARG+O) and the Toolkit for. Risk Mitigation Reasoning (TRIMIT). • **ENRICH:** increase container supply chain resilience and sustainability in present and future operational environments • **LOGSEC:** Evaluation of risk assessment systems and models • **MANSYS:** Development of QA/QC procedures and protocols to allow operation at multiple-locations and across multiple-machines. Demonstrating the ability to handle supply-chain interruptions and improve robustness • **REFERENCE:** formal safety assessment framework to supply chain and transport management • **RESPONSIVESUPPLYCHAIN:** Impact of SC capabilities on competitiveness of retailers and manufacturers. • **ROBUSTPLANET**: shock-robust design of plants and supply chains • **RESOLUTE:** RESilience management guidelines and Operationalization appLied to Urban Transport Environment (including goods)
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Advanced supply chain risk management	• **CASSANDRA:** Piggybacking for risk assessment • **CORE:** Building on CASSANDRA and CONTAIN, CORE is implementing novel risk management tools in different demonstrators. • **E-MAR:** e-maritime solutions for or safety and security risk management • **FLOUE:** Network design decisions under disruption and in an uncertain environment • **FOODINTEGRITY:** A predictive modelling for food fraud incidents • **IMCOSEC:** Identify security gaps and define preventive measures in container transport • **SAFEPOST:** Risk model for postal security • **SPICED:** characterize relevant hazards that can lead to contaminations in the food supply chain • **NAVDEC:** Marine navigation system to perform decision support functions in order to avoid collisions
DoI 3: Some research activities and small scale pilots *(No challenges in this category)*	

DoI 2: Potentially foreseen in forthcoming calls for proposals   *(No challenges in this category)*
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls   *(No challenges in this category)*

3.2.3. A collaboration and recognition perspective

It is important to recognize the effectiveness of the control mechanisms already in place in the commercial domain by customs and other control agencies: system based supervision. The AEO already recognizes economic actors to be trustworthy, auditable through transparency of their internal control frameworks and corresponding monitoring systems. This would allow for maximum piggy-backing control mechanisms in the commercial domain, not only internal controls, but moreover chain based controls.

Coordinated border management (CBM) refers to a coordinated approach by border control agencies, both domestic and international, in the context of seeking greater efficiencies over managing trade and travel flows, while maintaining a balance with compliance requirements. CBM will result in eliminating contradictions and redundancies between different policies, thus enhancing their effectiveness. Lack of coordination in processes and procedures results in excessive delays at borders and high costs to comply, particularly for cargo subject to both customs and product/food safety compliance authorities.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small-scale pilots	
Challenges	Specific contributions justifying DoI 3
System based supervision	• **CONTAIN:** Specify and demonstrate a European Shipping Containers Surveillance system for container security processes • **CORE:** System supervision pursuing harmonization of approaches and cooperation within and outside of the EU regarding security requirements and certifications • **EMAR:** Interfaces with e-Freight, e-Customs and National Single Windows among others
Coordinated border management	• **CORE:** System supervision pursuing harmonization of approaches and cooperation within and outside of the EU regarding security requirements and certifications involving different Customs organizations.

	• **EMAR:** Interfaces with e-Freight, e-Customs and National Single Windows among others • **EUROSKY**: harmonisation in regulations and in supporting further development and implementation of international standards • **LOGSEC:** Evaluation of modernization of customs procedures

4. Benchmarking Corridors, Hubs and Synchromodality

The ambition of the Roadmap on Corridors, Hubs and Synchromodality is the achievement of EU wide co-modal transport services within a well synchronized, smart and seamless network, supported by corridors and hubs, providing optimal support to supply chains. It involves a step change from the current system, towards the ultimate vision of the Physical Internet, by synchronizing intermodal services between modes and with shippers, (referred to as Synchromodality), aligning equipment and services on corridors and hubs and integrating these into networks.

To arrive at a connected system, integration must be achieved between the horizontal layers. We arrived at two main areas of innovation, with each 3 underlying pathway topics that are benchmarked below.

A. Integration of Transport Services and Supply Chain, which means Innovative Supply-Chain Design based on Integrated Synchromodal Services:
    1. Understanding the demand for the synchromodal freight transport system
    2. Optimize alignment between supply chains and transport services
    3. New roles for hubs in the supply chain

B. Integration of Transport Services and infrastructures, which means Hubs and Network Integration for a resilient supply-chain addressing:
    4. An integrative freight network strategy
    5. Transport chain design and operation for Synchromodality
    6. Deploying ICT as integrating technology

4.1. Innovative Supply-Chain Design based on Integrated Synchromodal Services

The novel approaches to supply chain design will concentrate on fostering synchro-modal operations by the following targets:

- **Improving specialization** (per production process, warehousing, storage, transport) and focusing on the specific quality of transport services (next to costs) that are needed to support production and consumption processes. For this, a deeper understanding of the needs of users

of the transport system – the shipper – is needed in terms of their logistics processes at individual item level.

- **Strengthening digital and physical flows** (systems' interoperability and operations standardization) between shippers and carriers, working towards optimal total service/cost solutions. Transport services and distribution chain functions should be optimized and standardized at the supply chain level, otherwise the systemic effect would be wasted.
- **Defining novel governance and business models**, with market oriented dynamics able to equilibrate supply and demand and then make more efficient supply chains at global level. This will allow hubs to exploit their business models, i.e. to develop trade and manufacturing functions from physical transport support to value added logistics services. Eventually, clusters will be better embedded in local economies.

Note that in this exercise, two different kind of projects are included: i) Projects directly addressing the challenge and ii) Projects that while not addressing the challenge directly may have an impact to it as some play field conditions may change or could provide some background solutions that could be further used to address the challenges.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Optimize alignment between supply chains and transport services. Innovative strategies to align transport service design and global supply chains: • synchronization of transport and production schedules, • hybrid channels for parallel distribution, • re-organisation of planning (interactive), • booking processes (a-modal) and bundling internally and externally (collaboration). R&D to connect demand forecast/supply methods to create transport	**Projects directly contributing to address this challenge:** • **CO3** (FP7) project encouraged a mind change in the competitiveness and sustainability of European logistics by stimulating horizontal collaboration between European shippers to optimize alignment between supply chains and transport services. • **COMCIS** (FP7) Supported interoperability between ICT systems using Common Framework. Employed situational awareness tools to solve problems of data fragmentation, delay and inconsistency through the global supply chain. Provided demonstrations on existing cargo flows and logistics chains. • **LOCIMAP** (FP7) In the frame of Low Carbon Integrated Manufacturing Parks addressed, among others, optimal and highly integrated connections into upstream and downstream supply chains with minimum cost for logistics. • **NEXTRUST** project (H2020) will create interconnected, trusted networks that collaborate along the entire supply chain: shippers, LSPs and intermodal operators as equal partners. To reach a high level of sustainability, NEXTRUST will not only bundle freight volumes, but shift them off the road to intermodal rail and waterway. It will build trusted collaborative networks bottom up adding multiple layers of transport flows that have been de-coupled and then re-connected more effectively along the supply chain. • **News** (FP7) It adapted logistics and supply system for the respective demands of market through enlargement of the European inland waterway system for container transport = adapting the novel container ship for a use on UN-classes III and IV and making secondary waterways in Europe accessible.

optimization tools and identifying supply chain/transport optimization best practices Production/transport optimization Supply chain/transport optimization best practices	• **RobustPlaNet** (FP7) aimed at developing an innovative technology-based business approach that will drastically change the current rigid supply chain mechanisms and the current product-based business models into collaborative and robust production networks able to timely deliver innovative product-services in very dynamic and unpredictable, global environments. This technology-based business approach will allow distributed supply networks to efficiently deliver innovative product-services to customers with extremely high service levels (at least 95%) in global markets characterized by demand and variant turbulence, thus particularly exposed to worldwide disruptive (mainly economic) events. The development of this new business approach is based on four major pillars, namely (i) innovative supply services, (ii) innovative product-services enabled by ICT, (iii) innovative methodologies for decision-making integrating the plant and the supply network level and (iv) innovative business and assessment models for value creation based on partnership. • **SMARTRAIL** (H2020) will develop approaches for demand driven rail service innovations with the focus on supply chain. • **SUPERGREEN** (FP7) It analysed on how information can be utilised to achieve "greener" logistics along the "green corridors" (e.g. e-freight, Supply Chain Management (SCM), smarter planning, scheduling and tracking & tracing). • **SYNCHRO-NET** (H2020) development of eco-NET to catalyse the uptake of the slow steaming concept and synchro-modality. • Topic: MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications*. • Topic M.G 5.1 -2016: *Networked and efficient logistics clusters.* • ALICE Implementation Plan Topic: *An Adaptive Synchromodal European Freight Network Strategy*. …design a freight network integrating core and comprehensive networks and pulling together current hub and corridor developments including innovative technologies into one coherent framework serving the manufacturing and logistics industry. • *ALICE Implementation Plan Topic: Integration of Information Systems for Cargo, Transport and Traffic*: … real-time information should promote optimization of production, transport & logistics processes through vertical and horizontal cooperation… • ALICE Implementation Plan Topic: *Green Logistics Networks: Carbon and beyond.* – key challenges of the topics are: adopt systemic approach for Green Logistics, extending the design of green hubs and corridors into green networks/grids able to support the achievement of EU sustainability goals and favouring the coordination among transport corridors and enabling the interoperability among smart grids; establish standardised Multi-Criteria evaluation methodologies for ex-ante and ex-post evaluation towards the establishment of virtuous circle of Green Certification for Companies and Consumers' increased awareness, exploiting IoT potential. • ALICE Implementation Plan Topic: *Development of a strategic European industry supply network design towards TEN-M (Manufacturing)* **Other related projects that may provide background solutions or change some playfield conditions for this challenge:** • **ADVANCE** (FP7) ADVANCE software provided a dual perspective on transport requirements and decision making dependent on the latest snapshot information and the best higher-level intelligence. • **Bestfact-BLU** (TaT project) provided control system for container loading stations in intermodal transport. BLU provided a better use of resources by shorter crane cycle time through an optimised handling plan, better utilisation

	of buffer storage capacity, shorter turn-around of loading units in the terminal, faster processing of trucks at the gate and at the loading lane. • **CassaMobile** (FP7) Development of a prototype mini-factory for local, flexible and environmentally friendly production of highly customised parts. the prototype was mobile, flexible, modular, small-footprint manufacturing system in a 20' ISO-container that can be easily configured for manufacturing different products and processes. • **CASSANDRA** (FP7) was focused on actual needs of intensified security in global container transport movements. For the improvement of traffic across countries with respects to national border control and different trade regulations the project's special attention was laid upon supply chain visibility. It demonstrated an increase in security through the optimal visibility and use of all existing information. • **CLOSER** (FP7) provided an overview of how to support knowledge sharing in the interface between long and short-distance transport networks in the transport chain for both passengers and freight to get more systematic approach within the whole system of the new mobility/organization schemes for the stakeholders. • **DISCO** (H2020) project has the objective to commercialise 'Valuechain.com' which is a scalable cloud-based platform that enables manufacturing businesses to optimise overall supply chain performance by connecting with supply chain partners, capturing and analysing real-time structured and unstructured data from internal and external sources, and providing multiple scenario plans to optimise individual company and overall supply chain performance through predictive analytics. • **DISRUPT** (7FP) project developed quantitative modelling of sustainable supply chains under major disruptions - advanced knowledge and management practice on supply chain approaches to managing sustainability and responding to natural disruption. • **EfficienSea2** (H2020) It will implement innovative and smart solutions for efficient, safe and sustainable traffic at sea through improved connectivity for ships allowing better management of cargo flows and better alignment of supply chains and transport services. • **e-Freight** (FP7) project introduced Information Highways for Co-modality to denote solutions assisting transport operators to establish common end-to-end transportation processes incorporating regulations compliance and 'intelligent' monitoring and control. • **EMAR** (FP7) project aimed to empower the European maritime sector in offering efficient quality shipping services fully integrated in the overall European transport system over an upgraded information management infrastructure. • **e-SAVE** (FP7) developed the information infrastructure, applications and decision support tools to support operations and supply chain management and design decisions, considering environmental KPIs and the dynamic energy profile of products and processes. • **FInest** (FP7) developed a Future Internet enabled ICT platform for better supporting and optimizing the collaboration and integration within international transport and logistics business networks. • **FLOUE** (FP7) aimed to propose models, solution methods and algorithms that may be used by managers in designing logistic network considering uncertainties both on facilities availability, and on demands and costs. • **HERMES** (H2020) is working on improving freight wagon performance at competitive prices: enhanced logistics operations, higher wagon load capacity,

	optimised loading/discharging processes and increase wagons flexibility to foster intermodality and allow a diversification of carried goods. • **i-Cargo** (7FP) Developed an open information architecture allowing real word objects, existing systems and new applications to efficiently co-operate. The platform enabled companies to exchange data and share processes with other companies. It was not a software program, but rather a set of specifications and guidelines that allow interaction between the different data exchange systems used by clients and providers of transport & logistics services. Among the solutions provided, I-Cargo provides alternative logistics chains composed on the available transport services for a specific shipment. • The aim of **IMCOSEC** project (FP7) was to make the supply chains more secure without major negative impacts on their performance and without creating unjustifiable additional cost. • The objective of **INTRASYS** (H2020) project is the creation of an integrated platform providing all the necessary information to transport SMEs that will use a fleet tracking and management platform to integrate continuously updated traffic data, tracking services, rich communication with driver and eco-driving tools into a single cloud based application. This real-time integration will allow transport companies to optimize operations on the go 24/7. • **LOGICON** (7FP) Developed solutions for data exchange in logistics operations incl. a communication platform for managing intermodal operations in terminals, apps for smart devices for SME trucking companies to support service information exchange, a web-based transport market place. • **MODULUSHCA** (FP7) Developed models to assess the supply chain benefits providing a methodology for cross process and cross company supply chain analysis. Gave a clear information handling approach, including data consistency and transport monitoring along the journey as model contributing to extend and enhance standardization developments in e-Freight and i-Cargo. Developed optimization algorithms for loading capacity optimization and scheduling transferring especially to SME user groups. • The aim of **OPTICITIES** (FP7) Deployed truly multimodal services, supporting the diversity of services' offer, sustaining high value services. • **PLANTCockpit** project (FP7) developed a central environment for monitoring and controlling of all intra-logistical processes to make well-informed decisions for optimizing plant processes. • **RESCOM** project (FP7) will develop an innovative methodology for the industrial implementation of closed-loop manufacturing systems enabling understanding how collection, remanufacturing and reuse of products can lead to more profitable, resource-efficient and resilient business practices. • **SHAREBOX** (H2020) will develop a secure ICT platform for the flexible management of shared process resources that will provide plant operations and production managers with the robust and reliable information that they need in real-time to effectively and confidently share resources (plant, energy, water, residues, and recycled materials) with other companies in a symbiotic eco-system. • **SPIDERPLUS** (FP7). Provided a new 2050 mobility vision for freight and passengers through a strategic design and plan and a RoadMap delivering sustainable solutions. Synchro Mobility is one of the project final goals. • **SYMBIOPTIMA** project (H2020) will focus on new industrial symbiosis paradigm - the human-mimetic symbiosis - where critical resources (materials, energy, waste and by-products) are coordinated among multiple autonomous Production Units organized in industrial clusters. Will lead to improvements of

	the overall sustainability of process industries from an economic, environmental and social point of view. • **TIGER DEMO** (FP7) provided co-modal solutions for maritime traffic flows finding the right balance between natural barriers, infrastructures availability, local characteristics, competitive reach, hinterland penetration, costs/services competitiveness and environmental protection.
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Understanding the demand for synchromodal freight transport. Dynamic (predictive and responsive) mapping of commodity chains and their requirements using operational data. Detailed demand mapping and forecasting tools. Big data used for demand prediction. R&D in Demand Data Analytics to develop synchromodal demand forecasting models that should be integrated with demand mapping tools already in the market.	**Projects directly contributing to address this challenge:** • **OpenTransportNet** (OTN) (CIP) will create collaborative virtual service hubs that aggregate, harmonise and visualise open transport-related data to drive the rapid creation of innovative new applications and services. • ALICE Implementation Plan Topic: *An Adaptive Synchro-modal European Freight Network Strategy*. Including research on flow development, shipment preferences and transport customer choice behaviour. • ALICE Implementation Plan Topic: *Integration of Information Systems for Cargo, Transport and Traffic*: … real-time information should promote optimization of production, transport & logistics processes through vertical and horizontal cooperation… **Other related projects that may provide background solutions or change some playfield conditions for this challenge:** • **CLOSER** (FP7) provided an overview of how to support knowledge sharing in the interface between long and short-distance transport networks in the transport chain for both passengers and freight to get more systematic approach within the whole system of the new mobility/organization schemes for the stakeholders. • **MODULUSHCA** (FP7) Gave a clear information handling approach, including data consistency and transport monitoring along the journey as model contributing to extend and enhance standardization developments in e-Freight and i-Cargo. Developed optimization algorithms for loading capacity optimization and scheduling transferring especially to SME user groups. • **NEXTRUST** project (H2020) will build trusted collaborative networks bottom up adding multiple layers of transport flows that have been de-coupled and then re-connected more effectively along the supply chain. • **PLANT Cockpit** project (FP7) developed a central environment for monitoring and controlling of all intra-logistical processes to make well-informed decisions for optimizing plant processes. • **Spoilage Down** (H2020) project will develop supply chain management solution for the demand forecasting and inventory optimisation of retailers and wholesalers. • **SYNCHRONET** (H2020) Development of eco-NET incorporating: real-time synchro-modal logistics optimisation (e- Freight-enabled); slow steaming ship simulation & control systems; synchro-modal risk/benefit analysis statistical modelling; dynamic stakeholder impact assessment solution; and a synchro-operability communications and governance architecture.
New roles for hubs in the supply chain. Identification of new roles and business	**Projects directly contributing to address this challenge:** • **ECOHUBS** (FP7). Provided models and capabilities for cooperation and communication between green hubs' stakeholders. Established Value Adding Services to make co-modal networks attractive while contributing to reduction of pollutants. Demonstrator BOLANO established a network of intermodal rail

models for hubs in the supply chain. Extended hubs acting as freight forwarders, able to specialize physical operations in cargo (de) consolidation, negotiate transport services, balance the traffic in its proximity network, manage exceptions, create community added value. The role of clusters should be identified, including clusters of different players, clusters of hubs. Important innovations include solutions for collaborative cluster business models made possible through reliable and fast exchange of information. R&D to define hub business model principles and enabling smart specialization of/for hubs.	freight services linking several terminals enabling the growth of Terminals as dynamic and collaborative facilitator for transport networks. • **Green EFFORTS** (FP7) aimed at the reduction of energy consumption and a cleaner energy mix at terminals (container, RoRo and inland waterway) to be controlled in a standardized transparent and easy-to-follow way. • **HUBWAYS** (FP7) established Common Value Added Services which, combined with existing services, facilitated end-to-end co-modal, low-CO2 transport solutions that maximised utilisation of terminal and logistics resources and transformed multimodal terminals into Green Hubs. • **LOCIMAP** (FP7) In the frame of Low Carbon Integrated Manufacturing Parks addressed among others optimal and highly integrated connections into upstream and downstream supply chains with minimum cost for logistics • **NEWS** (FP7) developed new river ports infrastructure concepts. • **TIGER DEMO** (FP7) It analysed how inland terminals (so-called dry ports) can relieve maritime facilities and how such plant layouts should be designed. • Topic M.G 5.1 -2016: *Networked and efficient logistics clusters*. • Topic M.G 5.4 -2017: *Potential of the Physical Internet.* • ALICE Implementation Plan topic*: Fully Integrated Smart Synchromodal Hubs*. Development of Hub Community Systems idea for hinterland hubs including development of ICT architecture for hubs as layer on existing IT systems, allowing development of applications for booking, planning and execution within supply chains. Blueprints should allow cooperation and integration between HCS functions at European level e.g. for Single Window usage. **Other related projects that may provide background solutions or change some playfield conditions for this challenge:** • **MARVIN** project (H2020) will develop and commercialize a fully automatic, high accuracy machine vision based scanner for handling and counting of neo-bulk cargo. • **MODULUSHCA** (FP7) Recommended industry standards for iso modular logistics units to be deployed along the entire supply chain. Developed models to assess the supply chain benefits providing a methodology for cross process and cross company supply chain analysis. Gave a clear information handling approach, including data consistency and transport monitoring along the journey as model contributing to extend and enhance standardization developments in e-Freight and i-Cargo. Developed optimization algorithms for loading capacity optimization and scheduling transferring especially to SME user groups.
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) no foreseen in current calls *(No challenges in this category)*	

4.2. Hubs and Network Integration for a resilient supply-chain

Novel hubs should support the need to rethink Supply Chains to remain agile without assuming that main features pass just over the maximization of efficiency and reduction of operating costs. They drive innovation by transforming their traditional supplier of nodal service into integrated value chains. Hubs

should operate as more than isolated collections of resources, equipment, and functions, each independently pursuing its own activities and goals.

Integration of hubs and corridors at strategic level (freight TEN-T), tactical level (Pan-European service profiles) and operational level (network sense and respond approaches) has also to be considered. Standard protocols and operations per layer and self-regulated dynamics for improving specialization, reliability, scalability can enable collaboration and integration. The new TEN-T guidelines and the CEF will support the realization of a EU freight network, connecting the TEN-T corridors for different modes at strategic hub locations.

Then, it can be deduced that Collaboration and Network Integration are two major patterns of the new role of the hubs. This approach is strongly supported by the "Physical Internet" core concepts:

- physical and digital encapsulation: the former by modular and standardized rules and processes, the latter by reproducing the Internet ISO/OSI layers in shipment transaction;
- standardized vertical transactions among close layers;
- horizontal transactions only among homologue layers.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Support to ICT as integrating technology. Support to ICT systems at EU network level as facilitator of the process of integration with multidimensional approach (social, trade, service provision, capacity, legal). Interoperability among IT systems of the various transport chain actors. Applications to manage the various stages of freight transport with user-friendly interfaces. Web based systems to facilitate the accessibility to the freight transport, from both the stakeholder and the customer sides, to allow well-	**Projects directly contributing to address this challenge:** • **ADVANCE** (FP7) Delivered the open-source ADVANCE platform. Supports networked companies in improving their information collecting and processing infrastructure, enabling strategic planning coupled with instant decision making. ADVANCE software provided a dual perspective on transport requirements and decision making dependent on the latest snapshot information and the best higher-level intelligence. • **CASSANDRA** (FP7) It introduced a Data Pipeline for the exchange of required information along the entire supply chain enabling open, flexible and standardised communication amongst all partners. • **Central Booking Platform** (CBP) Antwerp enabled Flemish logistics players to send consolidated consignments by barge and rail. • **CO-GISTICS** (EU CIP) project developed and deployed the cooperative intelligent transport systems (C-ITS) focused on logistics to optimise and increase the efficiency of cargo transport operations, support planning and synchronisation between different logistics operations and provide real-time information on delivery. Deployed in: Bordeaux, Thessaloniki, Trieste. • **COMCIS** (FP7) Supported interoperability between ICT systems using Common Framework. Employed situational awareness tools to solve problems of data fragmentation, delay and inconsistency through the global supply chain. Provided demonstrations on existing cargo flows and logistics chains. • **DISCWISE.** Developed, demonstrated and deployed a Common Framework for Interoperability in transport and logistics to integrate SME providers of transport & logistics services into efficient supply chains at affordable cost as well as enable all transport users to select environment-friendly alternatives.

synchronized functioning of all the system components. It includes ITS Logistics architecture for connected applications: operational (ITS), tactical (service design) and strategic (BI / business intelligence). Deploy connected ITS / MTMS (multimodal TMS) applications	• **DockingAssist** (FP7) created a centralised, cost-effective, real-time, accurate vessel location and monitoring system, providing the necessary centimetre positioning/speed accuracy. The system provided efficient and safe manoeuvring within the entire navigation harbour zone enhancing vessel trajectory, and providing constant monitoring for moored/docked vessels. • **e-Freight** (FP7) It developed the EU and National Single Windows to streamline traffic and cargo reporting to authorities particularly in the context of co-modal transport. Introduced Information Highways for Co-modality to denote solutions assisting transport operators to establish common end-to-end transportation processes. • **e-Port** is a port management system developed within RISING project. E-Port makes all relevant data accessible for port managers for planning purposes before vessels arrive at the port allowing better utilization of port resources. • **e-SAVE** (FP7) developed the information infrastructure, applications and decision support tools to support operations and supply chain management and design decisions, considering environmental KPIs and the dynamic energy profile of products and processes. • **FIspace** (FP7) developed and validated novel Future-Internet-enabled solutions to address collaborative business networks, focussing on use cases from the agri-food, transport and logistics industries. • **GET Service** (FP7) provided a Service Platform for Green European Transportation providing transportation planners and drivers of transportation vehicles with the means to plan, re-plan and control transportation routes efficiently and in a manner, that reduces CO2 emission. • **i-Cargo** (7FP) Developed an open information architecture allowing real word objects, existing systems and new applications to efficiently co-operate. The platform enabled companies to exchange data and share processes with other companies. It was not a software program, but rather a set of specifications and guidelines that allow interaction between the different data exchange systems used by clients and providers of transport & logistics services. Among the solutions provided, I-Cargo provides alternative logistics chains composed on the available transport services for a specific shipment. • The **Intermodal Links Planner** combined time schedules of rail, barge and short sea operators in Europe to select the best intermodal connections at tactical level. • **ISO-COLD** project (H2020) will develop ICT solution able to collect and aggregate information from transport &logistics operations, including track & trace and temperature data that allow the users to have a complete and updated status of deliveries, and historical records depot for regulation compliance, and a platform to distribute data to its stakeholders. • **LISy** – Logistic Information System provided an open and neutral electronic platform enabling all port community members to exchange information per specific needs and the processes to be managed. • **LOGICON** (7FP) Developed solutions for data exchange in logistics operations incl. a communication platform for managing intermodal operations in terminals, apps for smart devices for SME trucking companies to support service information exchange, a web-based transport market place. • **MIELE** - Multimodal Interoperability E-services for Logistics and Environment sustainability (TEN-T) project designed and developed pre-deployment pilots allowing interoperability between ICT systems (i.e. maritime single windows, port community systems) in the logistic chain in various EU corridors.

	• **NEXTRUST** project (H2020) It will develop C-ITS cloud based smart visibility software to support the re-engineering of the networks, improving real-time utilisation of transport assets. • **OpenTransportNet** (OTN) (CIP) will create collaborative virtual service hubs that aggregate, harmonise and visualise open transport-related data to drive the rapid creation of innovative new applications and services. • **SAIL** (Scalable & Adaptive Internet Solutions) (FP7) developed a high-level technology platform supporting management operations for port intermodal facilities. • **SHAREBOX** (H2020) will develop a secure ICT platform for the flexible management of shared process resources that will provide plant operations and production managers with the robust and reliable information that they need in real-time in order to effectively and confidently share resources (plant, energy, water, residues, and recycled materials) with other companies in a symbiotic eco-system. • **SMARTIE** (FP7) (Secure and sMArterciTIEs data management) is to create a distributed framework for IoT based applications sharing large volumes of heterogeneous information. • **SUPPORT** (FP7) aimed to raise the current level of port security by integrating legacy port systems with new surveillance and information management solutions. • **SUPER GREEN** (FP7) It analysed on how information can be utilised to achieve "greener" logistics along the "green corridors" (e.g. e-freight, Supply Chain Management (SCM), smarter planning, scheduling and tracking & tracing). • Topic: MG 6.3.2015 Common communication and navigation platforms for pan-European logistics applications. • ALICE Implementation Plan topic*: Integration of Information systems for Cargo, Transport and Traffic*. Integration of Information systems for Cargo, Transport and Traffic. To achieve efficiencies in transportation through collaboration, a proposal on how fragmentation of information and systems can be overcome is necessary. This regards mostly integration between the 3 levels of Cargo, Transport and Traffic. **<u>Other related projects that may provide background solutions or change some playfield conditions for this challenge:</u>** • **BONVOYAGE** (H2020) will design, develop and test a platform optimizing multimodal door-to-door transport of passengers and goods. BONVOYAGE will trial and demonstrate the platform and communication network in integrated, large-scale, real-life application scenarios, incorporated into the normal business operations of our transport operator partners. • The objective of **DISCO** (H2020) project is to commercialise 'Valuechain.com' which is a scalable cloud-based platform that enables manufacturing businesses to optimise overall supply chain performance by connecting with supply chain partners, capturing and analysing real-time structured and unstructured data from internal and external sources, and providing multiple scenario plans to optimise individual company and overall supply chain performance through predictive analytics. • **PLANT Cockpit** project (FP7) Developed flexible integration application platform that bridges the gap of connecting various systems of the enterprise and services across the whole value chain. Specifically, controling of all intra-logistical processes to make well-informed decisions for optimizing plant processes. • **RESCOM** project (FP7) will develop an innovative methodology for the industrial implementation of closed-loop manufacturing systems enabling

	understanding how collection, remanufacturing and reuse of products can lead to more profitable, resource-efficient and resilient business practices. • **RobustPlaNet** (FP7) aimed at developing an innovative technology-based business approach that will drastically change the current rigid supply chain mechanisms and the current product-based business models into collaborative and robust production networks able to timely deliver innovative product-services in very dynamic and unpredictable, global environments. This technology-based business approach will allow distributed supply networks to efficiently deliver innovative product-services to customers with extremely high service levels (at least 95%) in global markets characterized by demand and variant turbulence, thus particularly exposed to worldwide disruptive (mainly economic) events. The development of this new business approach is based on four major pillars, namely (i) innovative supply services, (ii) innovative product-services enabled by ICT, (iii) innovative methodologies for decision-making integrating the plant and the supply network level and (iv) innovative business and assessment models for value creation based on partnership.
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
An integrative freight network strategy. With a view towards robust and flexible services, the network vision behind the co-modal concept needs to be developed in more detail, aiming at synchronization of modes. Innovations include new frameworks for network design, methodologies for investment decision making including involvement of local authorities. R&D in KPI's and design principles for EU freight network, EU freight network design, TEN-T guidelines	**Projects directly contributing to address this challenge:** • **CLOSER** (FP7) provided an overview of how to support knowledge sharing in the interface between long and short-distance transport networks in the transport chain for both passengers and freight to get more systematic approach within the whole system of the new mobility/organization schemes for the stakeholders. • **EMAR** (FP7) project aimed to empower the European maritime sector in offering efficient quality shipping services fully integrated in the overall European transport system over an upgraded information management infrastructure. • **FLOUE** (FP7) aimed to propose models, solution methods and algorithms that may be used by managers in designing logistic network considering uncertainties both on facilities availability, and on demands and costs. • **LOGICAL** (Interreg CE) provided the CoSPaM prototype that introduced an innovative approach that ensures the collaboration of transport stakeholders along multimodal transport corridors. • **Rail line creation and network link to National Retail Distribution Centre**. A rail link and rail lines solutions, to link 1 main National Distribution Centre with 3 large Regional Distribution Centres. The rail infrastructure was created and improved. • **TIGER DEMO** (FP7) provided co-modal solutions for maritime traffic flows finding the right balance between natural barriers, infrastructures availability, local characteristics, competitive reach, hinterland penetration, costs/services competitiveness and environmental protection. • **FLAVIA** (Interreg CE), **BE-LOGIC, SUPERGREEN** (FP7) developed repositories of freight transport network characteristics and strategies for green corridors. • **SMARTRAIL** (H2020) will develop approaches for demand driven rail service innovations with the focus on supply chain. • **SWIFTLY GREEN** (TEN-T). Provided a toolbox for green corridors, consisting of guidelines, tools and recommendations for greening of logistics and transport. It is based on best practices and transferable results.

	• **SYNCHRONET** (H2020) Development of eco-NET incorporating: real-time synchro-modal logistics optimisation (e- Freight-enabled); slow steaming ship simulation & control systems; synchro-modal risk/benefit analysis statistical modelling; dynamic stakeholder impact assessment solution; and a synchro-operability communications and governance architecture. • **TIMON** (H2020) is the creation of the cooperative networks and open data that will help increase the overall safety, sustainability, flexibility and efficiency of road transport systems. • Topic M.G 5.1 -2016: *Networked and efficient logistics clusters*. • ALICE Implementation Plan topic: *An Adaptive Synchromodal European Freight Network Strategy*. A key challenge of this topic is to design a freight network integrating core and comprehensive networks and pulling together current hub and corridor developments including innovative technologies into one coherent framework serving the manufacturing and logistics industry. • ALICE Implementation Plan topic: *Green Logistics Networks: Carbon and beyond*. – key challenges of the topics are: adopt systemic approach for Green Logistics, extending the design of green hubs and corridors into green networks/grids able to support the achievement of EU sustainability goals and favouring the coordination among transport corridors and enabling the interoperability among smart grids; establish standardised Multi-Criteria evaluation methodologies for ex-ante and ex-post evaluation towards the establishment of virtuous circle of Green Certification for Companies and Consumers' increased awareness, exploiting IoT potential. • ALICE Implementation Plan Topic: *Development of a strategic European industry supply network design towards TEN-M (Manufacturing)* **Other related projects that may provide background solutions or change some playfield conditions for this challenge:** • **ADVANCE** (FP7) Supports networked companies in improving their information collecting and processing infrastructure, enabling strategic planning coupled with instant decision making. ADVANCE software provided a dual perspective on transport requirements and decision making dependent on the latest snapshot information and the best higher-level intelligence. • **CASSANDRA** (FP7) was focused on actual needs of intensified security in global container transport movements. For the improvement of traffic across countries with respects to national border control and different trade regulations the project's special attention was laid upon supply chain visibility. It demonstrated an increase in security through the optimal visibility and use of all existing information. • **CONTAIN** (FP7) demonstrated a European Shipping Containers Surveillance system in a global context. It demonstrated Secure Multimodal Corridor Design and Chain Monitoring & Control across international and European corridors on a full-scale basis at Interporto Bologna. • **COMCIS** (FP7) Supported interoperability between ICT systems using Common Framework. Employed situational awareness tools to solve problems of data fragmentation, delay and inconsistency through the global supply chain. Provided demonstrations on existing cargo flows and logistics chains. • The overall objective of **EfficienSea2** (H2020) project is to co-create and deploy innovative solutions for safer and more efficient waterborne operations. • **e-Freight** (FP7) project introduced Information Highways for Co-modality to denote solutions assisting transport operators to establish common end-to-end transportation processes.

	• **i-Cargo** (7FP) Developed an open information architecture allowing real word objects, existing systems and new applications to efficiently co-operate. The platform enabled companies to exchange data and share processes with other companies. It was not a software program, but rather a set of specifications and guidelines that allow interaction between the different data exchange systems used by clients and providers of transport & logistics services. Among the solutions provided, I-Cargo provides alternative logistics chains composed on the available transport services for a specific shipment. • The aim of **IMCOSEC** project (FP7) was to make the supply chains more secure without major negative impacts on their performance and without creating unjustifiable additional cost. • **LOGICON** (7FP) Developed solutions for data exchange in logistics operations incl. a communication platform for managing intermodal operations in terminals, apps for smart devices for SME trucking companies to support service information exchange, a web-based transport market place. • **MODULUSHCA** (FP7) Recommended industry standards for iso modular logistics units to be deployed along the entire supply chain. Developed models to assess the supply chain benefits providing a methodology for cross process and cross company supply chain analysis. Gave a clear information handling approach, including data consistency and transport monitoring along the journey as model contributing to extend and enhance standardization developments in eFreight and iCargo. Developed optimization algorithms for loading capacity optimization and scheduling transferring especially to SME user groups. • **NEXTRUST** project (H2020) will create interconnected, trusted networks that collaborate along the entire supply chain. • **SPIDERPLUS** (FP7). Provided a new 2050 mobility vision for freight and passengers through a strategic design and plan and a RoadMap delivering sustainable solutions. Synchro Mobility is one of the project final goals. • **SYMBIOPTIMA** project (H2020) will focus on new industrial symbiosis paradigm - the human-mimetic symbiosis - where critical resources (materials, energy, waste and by-products) are coordinated among multiple autonomous Production Units organized in industrial clusters. Will lead to improvements of the overall sustainability of process industries from an economic, environmental and social point of view. • **TIGER DEMO** (FP7) provided co-modal solutions for maritime traffic flows finding the right balance between natural barriers, infrastructures availability, local characteristics, competitive reach, hinterland penetration, costs/services competitiveness and environmental protection.
Transport chain design and operation for Synchromodality. Tools and data are needed for the design of synchronized services, execution of multimodal routings and for multimodal network management. The focus should be on optimized efficiency, responsiveness and customizability.	**Projects directly contributing to address this challenge:** • **ADVANCE** (FP7) Supports networked companies in improving their information collecting and processing infrastructure, enabling strategic planning coupled with instant decision making. ADVANCE software provided a dual perspective on transport requirements and decision making dependent on the latest snapshot information and the best higher-level intelligence. • **BONVOYAGE** (H2020) aiming at designing, developing and testing a platform optimizing multimodal door-to-door transport of passengers and goods. • **Cargo Domizil** provided door-to-door general cargo transports within 24 hours. In a project freight was transported in a combined transport system where pre-haulage and last mile distribution was done with trucks while the main haul was executed on rail. • **CREAM** project developed "*ISU – Innovative Semi-Trailer Handling Unit*" enabling rail transportation of noncraneable semi-trailers.

R&D Synchromodal operation principles and technologies Products: Performance based a-modal transport planning and booking Modular transport technology Market: Synchromodal services widely available	• **European GateWay Services.** (Industrial Initiative) ECT offers high frequent rail and barge connections between Rotterdam and an integrated and rapidly expanding network of inland terminals in the European hinterland operated in a synchromodal way • **HERMES** (H2020) is working on improving freight wagon performance at competitive prices: enhanced logistics operations, higher wagon load capacity, optimised loading/discharging processes and increase wagons flexibility to foster intermodality and allow a diversification of carried goods • **i-CARGO** (FP7) Synchronize vehicle movements and logistics operations across various modes and actors to lower CO2 emissions. • **Intermodability.** increased the use of the intermodal freight transport in the fast-moving consumer goods aggregating the demand of freight transport of all the project partners. A project proposed a new business model based on horizontal collaboration in aggregating a higher transport demand of many companies. • **Intermodal Links Planner** combined time schedules of rail, barge and short sea operators in Europe to select the best intermodal connections at tactical level. • **INTEGRITY, GET SERVICE** develop synchromodal planning tools. • **MODULUSHCA** (FP7) Recommended industry standards for iso modular logistics units to be deployed along the entire supply chain. Developed models to assess the supply chain benefits providing a methodology for cross process and cross company supply chain analysis. Gave a clear information handling approach, including data consistency and transport monitoring along the journey as model contributing to extend and enhance standardization developments in eFreight and iCargo. Developed optimization algorithms for loading capacity optimization and scheduling transferring especially to SME user groups. • **SYNCHRONET** (H2020) Development of eco-NET, an integrated optimisation and simulation eco-net, incorporating: real-time synchro-modal logistics optimisation (e- Freight-enabled); slow steaming ship simulation & control systems; synchro-modal risk/benefit analysis statistical modelling; dynamic stakeholder impact assessment solution; and a synchro-operability communications and governance architecture. • **TelliSys** (FP7) was a modular "family" of volume-optimised loading units for intermodal traffic, so called MegaSwapBoxes (MSB). • **TRANSFORMERS** (FP7) is to develop and demonstrate innovative and energy efficient trucks and load carriers. • **VEL-WAGON** project (FP7) developed larger, more efficient and adaptable train wagons. • **ViWaS** (FP7) searched for solutions, strengthening the competitiveness of single wagonload and wagongroup transport. • ALICE Implementation Plan topic: *An Adaptive Synchromodal European Freight Network Strategy*. A key challenge of this topic is to design a freight network integrating core and comprehensive networks and pulling together current hub and corridor developments including innovative technologies into one coherent framework serving the manufacturing and logistics industry. • ALICE Implementation Plan topic: *Green Logistics Networks: Carbon and beyond.* – key challenges of the topics are: adopt systemic approach for Green Logistics, extending the design of green hubs and corridors into green networks/grids able to support the achievement of EU sustainability goals and favouring the coordination among transport corridors and enabling the interoperability among smart grids; establish standardised Multi-Criteria

	evaluation methodologies for ex-ante and ex-post evaluation towards the establishment of virtuous circle of Green Certification for Companies and Consumers' increased awareness, exploiting IoT potential. **Other related projects that may provide background solutions or change some playfield conditions for this challenge:** • **CASSANDRA** (FP7) was focused on actual needs of intensified security in global container transport movements. For the improvement of traffic across countries with respects to national border control and different trade regulations the project's special attention was laid upon supply chain visibility. It demonstrated an increase in security through the optimal visibility and use of all existing information. • The mission of **CO3** (FP7) project was to encourage a mind change in the competitiveness and sustainability of European logistics by stimulating horizontal collaboration between European shippers. • **CO-GISTICS** (EU CIP) project developed and deployed the cooperative intelligent transport systems (C-ITS) focused on logistics to optimise and increase the efficiency of cargo transport operations, support planning and synchronisation between different logistics operations and provide real-time information on delivery. Deployed in: Bordeaux, Thessaloniki, Trieste • **CONTAIN** (FP7) demonstrated a European Shipping Containers Surveillance system in a global context. It demonstrated Secure Multimodal Corridor Design and Chain Monitoring & Control across international and European corridors on a full-scale basis at Interporto Bologna. • **COMCIS** (FP7) Supported interoperability between ICT systems using Common Framework. Employed situational awareness tools to solve problems of data fragmentation, delay and inconsistency through the global supply chain. Provided demonstrations on existing cargo flows and logistics chains. • The objective of **DISCO** (H2020) project is to commercialise 'Valuechain.com' which is a scalable cloud-based platform that enables manufacturing businesses to optimise overall supply chain performance by connecting with supply chain partners, capturing and analysing real-time structured and unstructured data from internal and external sources, and providing multiple scenario plans to optimise individual company and overall supply chain performance through predictive analytics. • **DockingAssist** (FP7) created a centralised, cost-effective, real-time, accurate vessel location and monitoring system, providing the necessary centimetre positioning/speed accuracy. The system provided efficient and safe manoeuvring within the entire navigation harbour zone enhancing vessel trajectory, and providing constant monitoring for moored/docked vessels. • **ECOHUBS** (FP7). Provided models and capabilities for cooperation and communication between green hubs' stakeholders. Established Value Adding Services to make co-modal networks attractive while contributing to reduction of pollutants. Demonstrator BOLANO established a network of intermodal rail freight services linking several terminals enabling the growth of Terminals as dynamic and collaborative facilitator for transport networks. • The objective of **INTRASYS** (H2020) project was a creation of an integrated platform providing all the necessary information to transport SMEs that will use a fleet tracking and management platform to integrate continuously updated traffic data, tracking services, rich communication with driver and eco-driving tools into a single cloud based application. This real-time integration will allow transport companies to optimize operations on the go 24/7.

	• **ISO-COLD** project (H2020) will develop ICT solution able to collect and aggregate information from transport &logistics operations, including track & trace and temperature data that allow the users to have a complete and updated status of deliveries, and historical records depot for regulation compliance, and a platform to distribute data to its stakeholders. • **LOCIMAP** (FP7) In the frame of Low Carbon Integrated Manufacturing Parks addressed among others optimal and highly integrated connections into upstream and downstream supply chains with minimum cost for logistics. • **NEXTRUST** project (H2020) will create interconnected, trusted networks that collaborate along the entire supply chain. • The aim of **OPTICITIES** (FP7) project was optimisation of transport networks through the development of public/private partnerships and the experimentation of innovative ITS services. • **SWIFTLY GREEN** (TEN-T). Provided a toolbox for green corridors, consisting of guidelines, tools and recommendations for greening of logistics and transport. It is based on best practices and transferable results. • **TIGER DEMO** (FP7) provided co-modal solutions for maritime traffic flows finding the right balance between natural barriers, infrastructures availability, local characteristics, competitive reach, hinterland penetration, costs/services competitiveness and environmental protection.
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) no foreseen in current calls *(No challenges in this category)*	

5. Benchmarking Information Systems for Interconnected Logistics Roadmap

The ambition of the Information Systems for Interconnected Logistics Roadmap is to define research and innovation paths that need to be addressed to achieve real-time (re)configurable supply chains in (global) supply chain networks with available and affordable ICT solutions for all types of companies and participants.

The major gaps identified in the roadmap are:

- The ability to rapidly connect to, and disconnect from, supply networks at two levels; the business level and the technical ICT level.
- The simplification of ICT systems, information interfaces and business models so that domain users are shielded from having to become technology experts and can focus instead on the efficient execution of transport and logistics operations;
- The simplification and standardization of device interconnections so that the rapid connection and disconnection of sensor enabled transport items is facilitated;
- Open cloud based collaboration platforms to facilitate the dynamic and cost effective formation and management of complex supply networks;
- Secure and reliable data management approaches that facilitate the collection and analysis of authorized data so that operational efficiency can be improved while assuring the public that privacy is maintained;
- The development of appropriate standards and data collection systems for reporting commercially and socially important information (e.g., emissions, load factors, congestion levels, etc.) so that proper comparisons can be obtained and informed decisions made;
- The ability to properly manage goods flows so that infrastructures, transport assets, modal nodes and other supply network assets are optimally utilized; and
- The adoption, integration and use of smart infrastructures, Intelligent Transport Systems (ITSs), IoT devices and other intelligent edge based technologies in supply chains to increase the efficiency, effectiveness and control of supply networks

To address these gaps, innovation is required in ICT, but also in business models and data governance. The themes addressed in the roadmap and benchmarked in this document are shown in the figure below.

ICT Innovation

- Intelligent objects, smart devices, IoT, ITS
- Big data
- Data analytics
- Dematerialization
- Intelligent information nodes
- PI support and planning systems
- Logistics BPaaS
- Autonomous Logistics operations

Operations visibility and planning

New Business Models

- Increase Asset and Infrastructure Utilization by Sharing
- Collaboration tools
- Revenue/Gain sharing

Data Governance

- Improved security, privacy and trust Services
- Data ownership and management services
- Information and data sharing policies and services
- Supportive legal and regulatory practices

5.1. ICT Innovation

A supply chain model based on concepts analogous to the digital Internet requires substantial changes in the types of ICT employed to operate supply chains. In the new model, ICT will be required to manage and control access to infrastructures, manage routing and congestion, ensure proper shipment disaggregation and aggregation, manage quality of service, collect costs and revenues and manage allocations, optimize collaboration, manage sorters and storage areas, etc. Such a model should be developed so that issue areas can be surfaced early and research and development projects developed accordingly. In addition, data generated through the use of supply networks will need to be analysed so that better decisions can be made by network operators and users.

5.1.1. Intelligent objects, smart devices, IoT and ITS: data capture and communication

Current devices and systems utilize non-standard connection and communication protocols making it difficult to cost effectively implement these technologies. For IoT, ITS, smart objects and intelligent objects to become pervasive and commercially useful, standards and interoperability across different platforms are required so that these impediments are overcome. In addition, device-to-device communications require standards so that edge based intelligent devices can autonomously connect to create ad hoc networks so that better operation of production, traffic, logistics, transport and other systems can be realized. The challenges identified in the roadmap are assessed as follows:

DoI 5: Sufficient evidences of implementation

(No challenges in this category)	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Further development of energy-efficient smart devices and systems to manage their energy use (e.g., promotion of energy harvesting techniques for smart devices). Remaining challenges: Adopt developed smart devices for logistics usage and achieve affordable (low) costs.	• **DyCoNet** and other ICT projects have developed already a good base for this • **E-SAVE.** Input from numerous sensors measuring energy consumption at near-real-time.
Intelligent inter-device and system communication processes to facilitate automated inter-device/system network setup and integration. (e.g., Container Security Devices (CSD), RFID, telematics systems, road based sensors, cargo monitoring, etc.).	• **CASSANDRA.** Tracking containers pilots • **DyCoNet:** Smart air freight containers and pallets with inter-device communications and ad-hoc networking. • **ECOMPASS.** Development of intelligent on-board and centralized vehicles' fleet management systems. • **iCargo**. Intelligent cargo architecture from the EURIDICE project into a more generic entity-centric approach where both physical objects and abstract objects have the ability to store and actively collect information about an entity, and semantic mediation, through the establishment of a "digital shadow" for each entity. • **INTE-TRANSIT:** Reduce intra-port congestion issues via enhanced container localisation and queuing through the use of modern/emerging technologies (e.g. DGPS, RFID, OCR). • **OPTICITIES.** Urban freight navigator to support drivers and fleet operators in optimising their deliveries • Possible results from Topic: MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.* • ALICE Implementation Plan topic: *IoT Large Scale Pilots in the Field of Logistics* should contribute to this area.
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Security, privacy and trust approaches to managing the capture of data and communication between intelligent devices to ensure that only authorized individuals or devices are able to access the data.	• **SMARTIE.** Smart objects pilot in Novi Sad demonstrates security aspects within transport and air pollution data. Murcia pilot is focused on BMS and security aspects related to this domain including the required devices. Frankfurt pilot utilises smart devices to control traffic lights. Overall, secure communication is also utilised within the entire architectural stack. • Possible results from Topic: MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.*

	• ALICE Implementation Plan topic: *System of systems for Self-Organizing Logistics* plans to build on this topic to operationalize these aspects in real end-to-end self-organizing logistics chains
Interface standards to facilitate rapid connect/disconnect of objects, smart devices, IoT components and collaborative ITS solutions.	• **CO-GISTICS.** Deploy, validate and set-up after project life cooperative logistics (including intelligent cargo) services through the convergence of M2M (and Freight Object to Object) and Cooperative Systems (the connected car) technologies in 5 EU scenarios. • **TEAM**. Promote collaborative mobility with use cases such as smart intersections and collaborative dynamic corridors. • Possible results from Topic: MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.*
DoI 2: Potentially foreseen in forthcoming calls for proposals	
Challenges	Specific contributions justifying DoI 2
Intelligent tools that enable the automated reconciliation of technical, syntactic and semantic differences between business actors and communities wishing to connect and collaborate.	• Possible results from FoF-11-2016 Digital automation • Possible results from Topic: MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.*
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	

5.1.2. Big data

Development of IoT, ITS, and other intelligent technologies will exponentially increase volume, variety and velocity of data handled by ICT systems in the domain. Current data management systems are focused on historical, structured data models making them inadequate for handling the large volumes of high velocity, unstructured data that will be available via fully enabled intelligent infrastructures.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Linking of data from heterogeneous sources, including semantic matching	• **OTN:** collect and harmonise transport related data to drive the rapid creation of innovative new applications and services. • **Industry Pilots in Other Sectors.** • Projects funded under the following topics may contribute: ICT-14-2016-2017. *Big Data PPP: cross-sectorial and cross-lingual data integration and experimentation.* To foster

	exchange, linking and re-use data, as well as to integrate data assets from multiple sectors and across languages and formats. ICT-15-2016-2017. *Big Data PPP: Large Scale Pilot actions in sectors best benefitting from data-driven innovation.* Demonstrate how industrial sectors (transport, manufacturing…) will be transformed by putting data harvesting and analytics at their core (large scale pilots) • ALICE Implementation Plan topic: *IoT Large Scale Pilots in the Field of Logistics* should contribute to this area.
Standardisation in data collection and storage approaches to cope with distributed processing	• **SMARTIE:** create a distributed framework to share large volumes of heterogeneous information for the use in smart-city applications • **ISO-COLD:** ERPlan developed a comprehensive ICT solution able to collect and aggregate information from T&L operations. • ALICE Implementation Plan topic: *IoT Large Scale Pilots in the Field of Logistics* should contribute to this area.
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Processing, storing and indexing capabilities to manage the inflow of sensor information on a scale significantly beyond what is seen today	• ALICE Implementation Plan topic: *IoT Large Scale Pilots in the Field of Logistics* should contribute to this area.
Real time context enriched decision making tools	• ALICE Implementation Plan topic: *System of systems for Self-Organizing Logistics* plans to build on this topic to operationalize these aspects in real end-to-end self-organizing logistics chains. • ALICE Implementation Plan topic: 18. *IoT Large Scale Pilots in the Field of Logistics* should contribute to this area.
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Visualisation and analytical services for high volume, high variety, static data	

5.1.3. Data analytics

Intelligent edge based systems (IoT, ITS, smart objects, etc.) will provide supply chain partners with access to information that historically did not exist. This information contains valuable business

information that, if analysed correctly and in a timely manner, could improve performance, competitiveness and service. Current approaches to analysing these data require significant expertise and decision support tools to enable implementation.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Simple to use tools for the rapid analysis of large volumes and varieties of transport and related data	• **E-SAVE:** implement generic and interoperable IS components for energy efficiency monitoring able to integrate with ERP
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Easy to use software for predictive analytics that can be integrated into IoT, ITS and sensor generated data flows	• **ADVANCE:** Open-source software to develop predictive-analysis-based decision support platform for novel competitive strategies in logistics operations • ALICE Implementation Plan topic: *System of systems for Self-Organizing Logistics* plans to build on this topic to operationalize these aspects in real end-to-end self-organizing logistics chains. • ALICE Implementation Plan topic: *IoT Large Scale Pilots in the Field of Logistics* should contribute to this area.
"In line" tools to facilitate dynamic configuration and operational changes based on real time IoT data	• **DISCO:** capturing and analysing real-time structured and unstructured data from internal and external sources, and providing multiple scenario plans to optimise individual company and overall supply chain performance through predictive analytics • ALICE Implementation Plan topic: *System of systems for Self-Organizing Logistics* plans to build on this topic to operationalize these aspects in real end-to-end self-organizing logistics chains
Visual data analytics tools and approaches to facilitate rapid decision making	• **OPTICITIES:** Decision support tools based on predictive data for proactive transport management and Multimodal Traffic Control Systems • **Spoilage Down:** RELEX has built an innovative supply chain management solution for the demand forecasting and inventory optimisation of retailers and wholesalers, built on a unique columnar in-memory database
Robust assessment techniques for data certainty and trust	• ALICE Implementation Plan topic: *System of systems for Self-Organizing Logistics* plans to build on this topic to operationalize these aspects in real end-to-end self-organizing logistics chains
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	

DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	
Other challenges	• Software platform consisting of a closed-loop product lifecycle management module coupled with a materials information module

5.1.4. Dematerialization

Capabilities to produce end-user products and/or spare parts at the site of their consumption (3D printing) will influence the flow of (raw) material, including recycling of materials, changing how products and parts are distributed and requiring innovative logistic concepts supported with information flows to be developed.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Automated material ordering, delivery planning, and delivery systems to ensure that the highly distributed production operations enabled by dematerialization processes can be operated and logistically supported in an economical and environmentally sound manner	• **MANSYS:** develop and demonstrate a set of e-supply chain tools; to enable the mass adoption of Additive Manufacturing
DoI 2: Potentially foreseen in forthcoming calls for proposals	
Challenges	Specific contributions justifying DoI 2
Systems for managing highly distributed and disaggregated production operations to ensure that printed components are produced as required	Possible results from FOF-01-2016: *Novel hybrid approaches for additive and subtractive manufacturing machines.*
Distributed quality control systems that can monitor 3D printing processes, check items that are printed and determine/ensure their quality level based on producer specifications	• Possible results from FOF-03-2016. *Zero-defect strategies at system level for multi-stage manufacturing in production lines*

DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
IP management systems that can monitor the use of IP and ensure that proper payment is made to IP owners	

5.1.5. Intelligent nodes

Congestion, pollution and cost are all driving a need for more efficient mode utilization from transport and logistics operations. Unfortunately, most switching/transfer points for mode switching (hubs) are operated under historical business systems that do not allow them to facilitate "flow through" operations and provide data to the stakeholders operating and coordinating the different transport modes. This must change in order for the vision of synchromodal activities to be realized. Flow synchronization through the various modal switching nodes involved in a supply chain requires new approaches to managing the inflow, outflow and operations within these nodes. Whether the goal is synchromodal operations or the Physical Internet, switching nodes become the locus for ensuring efficient supply chain operations. Software must be developed that allows these switching/transfer points to act like routers and switches in the Internet enabling the implementation of the Corridors, Hubs and Synchromodality roadmap and laying a foundation for the Physical Internet.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Routing and planning software to properly route shipments in a dynamic manner across appropriate infrastructures and nodes	• **ECOMPASS:** Route planning mainly in terms of the transports' environmental footprint. • **GET Service.** The GET Service platform provides transportation planners with the means to plan transportation routes more efficiently and to respond quickly to unexpected events during transportation. • **iCargo:** Advance and extend the use of ICT to support new logistics services that adapt to changing conditions through dynamic planning methods involving intelligent cargo, vehicle and infrastructure systems, synchronize vehicle movements and logistics operations. • **CO-GISTICS:** The Trieste Pilot is piloting an innovative decision support system through real time data collection. The Cargo Transport Optimisation service supports planning and synchronisation between different transport modes and route shipments in a dynamic manner during the various logistic operations

	• Possible results from Topic: MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.* • Possible Results from *Topic M.G 5.1 -2016: Networked and efficient logistics clusters.* • Possible Results from Topic MG-5.2-2017. *Innovative ICT solutions for future logistics operations.* • ALICE Implementation Plan topic: *Information and Collaborative Business Processes in Smart Synchromodal Hubs* is expected to contribute to this area.
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Dynamic matching algorithms to rapidly match (changed) goals with available services and capacity	• **iCargo** "digital shadow" can autonomously detect deviations during execution of a transport service that may affect the whole intermodal chain. The event is propagated through the "digital shadows" of the relevant transport handling units (parcels, pallets, containers, etc.) and/or vehicles with updated itinerary information. • ALICE Implementation Plan topic: *Affordable C-ITS solutions for end to end logistics* is expected to contribute to this area. • ALICE Implementation Plan topic: *Physical Internet Business Use Case Demonstrations* is expected to contribute to this area. • ALICE Implementation Plan topic: *Information and Collaborative Business Processes in Smart Synchromodal Hubs* is expected to contribute to this area.
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Node management software is required to facilitate the efficient and synchronous flow of goods through the various nodes in a network	• The topic: *MG-5.1-2016. Networked and efficient logistics clusters* may contribute to this challenge • ALICE Implementation Plan topic: *Information and Collaborative Business Processes in Smart Synchromodal Hubs* is expected to contribute to this area. • ALICE Implementation Plan topic: *Physical Internet Business Use Case Demonstrations* is expected to contribute to this area.

5.1.6. PI support and planning systems

The PI vision requires a radical rethinking of how supply chains are operated and managed. Systems must be developed that mirror for physical goods movements the movement of packets on the Internet. However, unlike the Internet, these systems must ensure that the physical goods, flowing

like packets, do not get lost while in transit. To realize this vision, considerable analysis and research is required.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small scale pilots *(No challenges in this category)*	
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
An understanding of the ICT challenges of implementing the PI must be developed. This will require initially: A workable architecture for the PI; Requirements definition for PI related systems	• ALICE Implementation Plan topic: *Physical Internet Business Use Cases Demonstrations* is expected to contribute to this area.
Dynamic human resource management systems to properly assign personnel operating vehicles or node activities to the next scheduled action required by the PI shipment and the system of shipments currently being moved through the network	• ALICE Implementation Plan topic: *System of systems for Self-Organizing Logistics* may address this item partially.
A layered system model for the management of the PI	• ALICE Implementation Plan topic: *Physical Internet Business Use Cases Demonstrations* is expected to contribute to this area.
Software at each layer, analogous to the digital Internet, for the proper routing, management, flow control, assembly/disassembly of shipments, etc.	• ALICE Implementation Plan topic: *Logistics Operations Automation: The Matrix for Logistics* is expected to contribute to this area. • ALICE Implementation Plan topic: *Physical Internet Business Use Case Demonstrations* is expected to contribute to this area.

5.1.7. Logistics BPaaS

Logistics Business Process as a Service (BPaaS) facilitates the bundling together of several logistics cloud services, or single business processes from different clouds, vendors and providers, to produce a directly useable logistics turnkey application. These services can work across multiple industry sectors, are highly configurable, scale globally, and are of high performance. BPaaS services require a blend of software and data services, again from different cloud services and providers. The development of robust commercial BPaaS services is in its early stages. Significant work is required to move from the current state to a more flexible and mature state.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
BPaaS services need to be developed so that they can operate on federated cloud environments or platforms that can be configured by end-users	• **Logistics Mall:** Cloud-based marketplace offering individualized logistics services based on combinable services and common business objects. • **iCargo** developed a cloud-based ecosystem infrastructure. This layered, flexible implementation supports alternative services deployment scenarios, ranging from on 'on-premise' to fully cloud-based SaaS, including: - Transport planning and monitoring, - Route optimization, - Service planning and re-planning, and - CO2 emissions calculation. • Possible results from Topic: MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.*
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Software for the dynamic configuration, automated provisioning and orchestration of logistics services needs to be developed	• **FINEST:** Finest implements a platform to facilitate the operation of Logistics as a Service
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	

5.1.8. Autonomous logistics operations

The logistics industry is a promising domain for the use of autonomous systems within controlled areas and corridors, in public spaces and in cooperation with humans. However, for these types of systems to be used in a safe and effective manner, significant technical obstacles need to be overcome.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Automation of transport, specifically road/self-driving vehicles, within controlled and public areas to provide a foundation for Automated Transport Systems (ATS)	• **AINARA:** software solutions for vehicle automation and fleet management, for goods transportation • **CARGO ANTS***: Cargo handling by Automated Next generation Transportation Systems for ports and terminals* aims to create smart Automated Guided Vehicles (AGVs) and Highly Automated Trucks (HATs) that can co-operate in shared workspaces for efficient and safe freight transportation in main ports and freight terminals. The specific objectives are: - Increase performance and throughput of freight transportation in main ports and freight terminals and maintain a high level of safety. - Develop an automated shared work yard for intelligent AGVs and highly automated trucks - Develop and demonstrate planning, decision, control and safety strategies for automated vehicles. - Develop and demonstrate an environmental perception system and a grid-independent positioning system. • **CLEV:** efficient automated parcel delivery solution. • **CityMobil2:** pilot platform for automated road transport systems, implemented in urban environments across Europe; vehicles operating without a driver in collective mode • ALICE Implementation Plan topic: *Affordable C-ITS solutions for end to end logistics* is expected to contribute to this area.
Autonomous technologies in warehousing and for yard logistics, and then for last mile delivery focused on low speed operations	• **FURBOT:** intelligent automated driving and freight handling robotic vehicle • **MARVIN:** Alekon Cargo will develop and commercialize a fully automatic, high accuracy machine vision based scanner for handling and counting of neo-bulk cargo • **Cellular Transport System:** The intelligent, interlinked transport vehicles carry out transport from a high-rise store to workstations. They coordinate with each other independently without any central control. They are capable of moving on

	rails in the high-rise store and completely freely on the ground, i.e. without any guide markings. This ensures the maximum of flexibility. The transport performance of the total system can be adjusted by the number of vehicles. • **RCMS.** A well-defined Rethinking of Container Management System control logic; a dynamic physical AGV model to test AGV behaviour; definition of operational procedures for RCMS; a generic simulation tool enabling testing of RCMS for various sites by non-simulation experts; an efficient entire terminal design with RCMS; a set of validated and quantified benefits of RCMS compared to commonly used handling systems; a set of Key Performances Indicators of the transport network using RCMS. • ALICE Implementation Plan topic: *Affordable C-ITS solutions for end to end logistics* is expected to contribute to this area. • ALICE Implementation Plan topic: 15. *Logistics Operations Automation: The Matrix for Logistics* is expected to contribute to this area.
Autonomous logistics for all modes: self-driving vehicles, trucks, trains, ships and planes (long distance and short distance (drones))	• **DOCKINGASSIST:** develop a cost-effective location system to vessels in port areas to enabled automated traffic management • **EfficienSea 2:** e-Navigation. • ALICE Implementation Plan topic: *Affordable C-ITS solutions for end to end logistics* is expected to contribute to this area. • ALICE Implementation Plan topic: *Logistics Operations Automation: The Matrix for Logistics* is expected to contribute to this area.
Automated transport services based on V2I communications (convergence of connectivity with automation)	• **CO-GISTICS:** Intelligent intersection services provides for the next generation Traffic management and automation. The Priority and Speed Advice service enable saving fuel consumption, reducing emissions and heavy vehicle presence in urban areas (mainly in intersections). • Possible results from Topic MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.* • ALICE Implementation Plan topic: *Affordable C-ITS solutions for end to end logistics* is expected to contribute to this area.
Automated traffic regulation from traffic management services to enable smoother logistic operations (e.g., platooning).	• **COMPANION:** Create, maintain and dissolve platoons according to an online decision-making mechanism. • ALICE Implementation Plan topic: *Affordable C-ITS solutions for end to end logistics* is expected to contribute to this area.
Automated operations for managing the entry and exit of intermodal hubs (e.g., entering, billing, tolling, loading, etc.)	• The **CO-GISTICS** Trieste Pilot implements and automates the intelligent truck parking service in the Trieste port through the Transpark and MyCicero capabilities. • ALICE Implementation Plan topic: *Affordable C-ITS solutions for end to end logistics* is expected to contribute to this area. • Possible Results from Topic M.G 5.1 -2016*: Networked and efficient logistics clusters.* • Possible Results from Topic MG-5.2-2017. *Innovative ICT solutions for future logistics operations.*

DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) no foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Convergence of electro-mobility and automation for logistic operations	• ALICE Implementation Plan topic: *Affordable C-ITS solutions for end to end logistics* is expected to contribute to this area.
Goal modelling across different dimensions (e.g., enterprise internal, across enterprise boundaries, governance by authorities).	
Development of prescriptive analytics and anomaly detection (machine learning) algorithms to control the actions of autonomous vehicles and robots	• ALICE Implementation Plan topic: *Logistics Operations Automation: The Matrix for Logistics* is expected to contribute to this area.

5.1.9. Operations Visibility & Planning

Information and Communication Technologies are seen as a key enabler to achieve supply chain operational visibility so better planning and exception management is achieved.

DoI 5: Sufficient evidences of implementation	
Achieve situational awareness in the chain by merging data from different sources	• **COMCIS:** Developed a system that could merge data from multiple sources, deliver situational awareness throughout the whole supply chain. • **iCargo:** The iCargo "digital shadows" detect deviations through a number of means: Monitoring position of goods and comparing it to itinerary using GPS, utilising "intelligent" infrastructure (like the RFID reads along the Swedish railways that monitor the movement of rail wagons), observing the condition of the transport handling unit or the cargo itself.
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Ensure real-time visibility of operations in a supply chain.	• **ENRICH:** Container supply chain integration methodology from an overall supply chain perspective. • **PLANTCockpit:** Model for integrating heterogeneous shop floor management systems in order to control all intra-logistical processes.

	• **RESCOM:** software platform consisting of a closed-loop product lifecycle management module coupled with a materials information module • **DISCO:** scalable cloud-based platform that enables manufacturing businesses to optimise overall supply chain performance by connecting with supply chain partners • **BONVOYAGE:** Multimodal door-to-door transport planning platform • **CO-GISTICS**: the Cargo Transport Optimisation service supports planning and synchronisation between different transport modes during the various logistic operations. Also, the CO2 Footprint Monitoring and Estimation service measures the CO2 output of the vehicles and providing an estimation of CO2 emissions of a specific cargo operation. Finally, it is provided in some sites an Eco-Drive app supporting truck drivers in adopting a more energy efficient driving style, therefore reducing fuel consumption and CO2 emissions. • **INTE-TRANSIT:** Reduce intra-port congestion issues via enhanced container localisation and queuing through the use of modern/emerging technologies (e.g. DGPS, RFID, OCR). • **INTRANSYS:** INTRANSYS will use our award-winning fleet tracking and management platform Trust-Track as a foundation to integrate. • **LOGICON:** Enabling visibility and traceability of transport operations in road transport including SMEs. • **ISO-COLD:** continuously updated traffic data, tracking services, rich communication with driver and eco-driving tools into a single cloud based application. Includes complete and updated status of deliveries, an historical records depot for regulation compliance including track & trace and temperature data, and a platform to distribute data to its stakeholders. • Possible results from Topic MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.* Develop architectures and open systems for information sharing and valorisation, connecting key stakeholders with information and expertise enabling exploitation on the basis of trusted business agreements and with the relevant authorities. • Possible results from FoF 10 – 2015.*Manufacturing of custom made parts for personalised products. Seamless data integration across the process and supply chains for the fast production and distribution of custom made parts and products.* • ALICE Implementation Plan topic: *IoT Large Scale Pilots in the Field of Logistics* should contribute to this area.
DoI 3: Some research activities and small scale pilots *(No challenges in this category)*	
DoI 2: Potentially foreseen in forthcoming calls for proposals	

(No challenges in this category)
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*

5.2. New Business Models

Today's approach to the management of ICT systems can best be described as a private ownership approach. Each individual player in a supply chain operates their own ICT systems connecting to external systems through bilaterally agreed connectivity (EDI) links. This structure to the management of ICT has benefited the software industry, as well as those domain participants with the financial and technical resources necessary to employ this business model. Unfortunately, new business models and governance will be required in the future as proposed in Global Supply Network Coordination and Collaboration roadmap if the goals set for the industry are to be achieved. To improve operating efficiencies and lower social and environmental impacts will require the industry to better utilize assets, improve coordination, openly share information and generally operate in a more collaborative manner. Models will need to be developed on how assets are to be shared, how asset owners are to be compensated for asset use, how access to infrastructures is to be managed, how nodal/chain/corridor/network operators are to coordinate flows through their nodes/chain/corridor/network, and how logistics customers are to bundle their supply flows.

5.2.1. Increase asset and infrastructure utilization by sharing

Business as usual will not result in the dramatic reductions in resource usage that is required to meet mandated improvements in logistics operations. Sharing of assets to improve their utilization and lower requirements for additional assets (pooling) is needed if there is to be any chance of meeting these targets. To achieve a shared asset model will require significant business model and process modification, which may not be possible given existing approaches to measuring business performance. ICT will need to support this change.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Pooling, controlling and asset management tools	• **E-SAVE**: e-SAVE promotes and technologically supports collaboration between supply chain stakeholders, which leads to more efficient utilisation of logistics resources (warehouses, vehicles, routes etc), based on energy efficiency and cost. • ALICE Implementation Plan topic: *Collaborative Data Analytics for Logistics and Supply Networks* is expected to contribute to this area.

	• ALICE Implementation Plan topic: *IoT Large Scale Pilots in the Field of Logistics* should contribute to this area.
DoI 3: Some research activities and small scale pilots *(No challenges in this category)*	
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Open systems management tools	• ALICE Implementation Plan topic: *Collaborative Data Analytics for Logistics and Supply Networks* is expected to contribute to this area.
Nodal management systems (e.g., warehouse and port nodal systems) constructing an information network for logistics and supply chains	• ALICE Implementation Plan topic: *Collaborative Data Analytics for Logistics and Supply Networks* is expected to contribute to this area.
Corridor, suburban and urban flow management systems	

5.2.2. Collaboration tools

New interoperable platforms for collaboration are required so that assets can be shared and compensation for use realized. These collaborative platforms need to be easy to use, to integrate communication and information sharing services, operate in a quick to connect manner, and provide appropriate tools so that collaborators can accomplish their tasks in a convenient and timely manner.

DoI 5: Sufficient evidences of implementation	
Challenges	**Specific contributions justifying DoI 4**
Marketplace and matchmaking tools (including algorithms).	• **E-FREIGHT:** Development of e-Freight market places and a platform. • **E-SAVE:** Develop a Future Internet enabled ICT platform for better supporting and optimizing the collaboration and integration within international transport and logistics business networks • **EUROSKY:** design and implement a decentralized ICT infrastructure that allows existing systems to co-exist and efficiently co-operate at an affordable cost for logistics stakeholders • **FINEST:** Service platform that provides novel real-time transportation planning algorithms; a transportation-specific service development subsystem, transportation control and

	reconfiguration mechanisms and automated real-time information aggregation mechanisms • **FINISH:** Information sharing and collaboration infrastructure among SC partners. • **GET Service:** Connects to existing transportation management systems and improves on their performance by enabling sharing of selected information between transportation partners, • **iCargo:** The iCargo ecosystem infrastructure has been applied to support two specific collaboration cases: to consolidate wagon loads coming from three different inland terminals in Italy, and to maximise vehicle utilisation through collaborative cross-docking in pilot DHL warehouses. • **LOGICON:** Data and information sharing infrastructure to allow SMEs and freelances truck drivers to provide high added value services such as track and tracing, order fulfilment and status of the operations. • **MOBiNET:** platform providing components and tools that enable interactions between users and suppliers of mobility services; e-marketplace allows content and service providers to exchange transport services. • **CO-GISTICS:** Deployed services at different pilot sites create local collaboration platforms through vehicle to infrastructure technology to for data and information sharing. • Possible Results from Topic MG-5.2-2017. *Innovative ICT solutions for future logistics operations.* ..Planning and data/dynamic routing and business models/Interoperability and everything connected..
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Service/business capabilities repository	• Possible results from Topic MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.*
Process innovation (models & best practices) that show how a transition from present to large-scale collaboration (involving PI) can be made	• **DISCO:** see www.valuechain.com
Open collaboration platforms for dynamically establishing collaborations	• **FISPACE:** Develop a multi-domain Business Collaboration Space that employs future internet technologies. • ALICE Implementation Plan Topic: *European Open Market for Collaborative Logistics* is expected to contribute to this item
DoI 2: Potentially foreseen in forthcoming calls for proposals	

Challenges	Specific contributions justifying DoI 2
Detailed assessment of strengths, weaknesses, opportunities, and threats for PI within present market structures and business models	• MG 5.4 2017 *Potential of The Physical internet* should contribute to this one
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Analytics, trust rating, and performance tools to rapidly assess trustworthiness of a stakeholder	

5.2.3. Revenue/gain sharing

New systems will be required to determine how to fairly distribute revenues from shared assets and any bonuses or penalties incurred during the execution of a supply chain activity. Potential examples are the systems used in mobile telecommunications where service providers collect information on roaming usage of their networks and cross bill "*home*" providers.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small scale pilots *(No challenges in this category)*	
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Tools to manage and control sales, use and share revenue and costs	
Contract development and management tools	

Inter-platform/inter-community management and revenue sharing tools	

5.3. Data Governance

The requirement to more efficiently utilize assets leads to a more collaborative approach to operations and, therefore, to the more open sharing of data between supply chain partners. For partners to agree to share the information needed to make this business model work, they must feel that their data is being securely managed and that only those organizations that are authorized to view the data have access to it. This means that significant work must be done on the issues of security, privacy and trust or domain players will not be willing to provide the data needed to make the collaborative business model envisioned in ALICE work.

5.3.1. Security, privacy and trust

To allow novel new interactions between supply chain partners, it is crucial to ensure conditions to achieve trust in open systems.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Data privacy and security	• **BONVOYAGE:** It will investigate data-centric techniques, where security and privacy rely on information exclusively contained in the message itself, or, if extra information provided by trusted entities is needed, this should be gathered through offline, asynchronous, and non-interactive communication, rather than from an explicit online interactive handshake with trusted servers • **CASSANDRA:** Keep data in the pipeline secure and inaccessible for external parties • **E-SAVE:** e-SAVE developed a model for the secure exchange of information between supply chain stakeholders to enable collaboration and optimisation of their logistics operations • **FISPACE:** infrastructure for electronically connecting stakeholders together amplifying their security capabilities. • **LOGICON:** Affordable, reliable and trusted data-interchange solutions • **SMARTIE:** A secure, trusted, but easy to use IoT system for a Smart City. Security and privacy framework developed within SMARTIE enables information sharing mechanisms based on

	the lightweight access and authentication control together with the secure storage and service discovery. • **SMART-RAIL:** Addressing this in Railway ecosystem.
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Access and authentication services.	• ALICE Implementation Plan topic: *Secure data exchange and access to build trust* is expected to contribute to this area.
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Data Integrity and recovery, roll back and resumption services (non-repudiation services)	• ALICE Implementation Plan topic: *Effective Trade Facilitation* is expected to contribute to this area.

5.3.2. Data ownership

To be able to identify any opportunities and/or barriers in sharing data and events across the boundaries of an organization.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small scale pilots *(No challenges in this category)*	
Challenges	Specific contributions justifying DoI 3
IPR management services	• ALICE Implementation Plan topic: *Secure data exchange and access to build trust* is expected to contribute to this area.
Data rights management services	• ALICE Implementation Plan topic: *Secure data exchange and access to build trust* is expected to contribute to this area.
Data location reporting and management	• ALICE Implementation Plan topic: *Secure data exchange and access to build trust* is expected to contribute to this area.
Liability and commercial sensitivity	• ALICE Implementation Plan topic: *Secure data exchange and access to build trust* is expected to contribute to this area.
DoI 2: Potentially foreseen in forthcoming calls for proposals	

(No challenges in this category)
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*

5.3.3. Information & data sharing policies

Establishing policies with respect to sharing data and events across the boundaries of an organization. Different data/event classifications can be established, e.g. open/public, restricted to a community in a specific area (terminals in a port or a particular authority), restricted to a specific relation, or only accessible within an organization.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Tools for the collection, distribution, management, and analysis of data.	• **CASSANDRA.** Keep data in the pipeline secure and inaccessible for external parties with no access rights. Keep data in the pipeline secure and inaccessible for external parties. The CASSANDRA interoperability approach is aligned with other international eFreight and eCustoms initiatives and also international standardisation and legislation bodies. This will be the first step towards global implementation. • **FISPACE.** infrastructure for electronically connecting stakeholders together amplifying their security capabilities • **SMART-RAIL.** Develop and implement an effective set of tools and measures which supports freight rail stakeholders in controlled data sharing, thus improving the rail service quality. • Topic SEC-17-BES-2017. *Architectures and organizations, big data and data analytics for customs risk management of the international goods supply chain trade movements.* Data governance policies and mechanisms for data sharing • ALICE Implementation Plan topic: *Secure data exchange and access to build trust* is expected to contribute to this area.
Protocols for establishing data/event sharing	• **E-SAVE:** e-SAVE's information exchange model follows certain rules which govern the level of abstraction at which data is shared among collaborating stakeholders. For example, instead of exchanging "raw" data, such as orders, invoices, product details, CO2 footprint per sensor, etc. partners may exchange cumulative reports and KPIs. Therefore, depending on the level of collaboration, different data sharing policies may apply. • **EfficienSea 2:** e-maritime
Information sharing through ITS	• **CO-GISTICS.** Deploy, validate and set-up after project life cooperative logistics (including intelligent cargo) services

	through the convergence of M2M (and Freight Object to Object) and Cooperative Systems (the connected car) technologies in 5 EU scenarios
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Information semantics and ontology systems	• **E-freight.** Development of the Common Framework. • **SMART-RAIL.** Development of a unified semantic model for the railway ecosystem.
Data access rules, encryption and authentication/authorization	• **I-Cargo:** Access-point based infrastructure for sharing logistic services in a logistic business ecosystem. • **SMART-RAIL.** An appropriate governance model with access control measures, will ensure data privacy and safety for data owners and offer controlled data sharing. Among others, the applicable legislative, liability aspects and commercial sensitivity are considered here.
Service Level Agreement (SLAs)	• **CO-GISTICS** is providing the first step towards service level agreements among public authorities, services providers and fleet operators
Data/event classification services	• ALICE Implementation Plan topic: *Secure data exchange and access to build trust* is expected to contribute to this area.
Data quality and metadata services	• **OPTICITIES:** governance scheme between public and private stakeholders through a contractual architecture fostering data quality and implementing data access policy • ALICE Implementation Plan topic: *Secure data exchange and access to build trust* is expected to contribute to this area.
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	

5.3.4. Supportive legal and regulatory practices *(see also chapter 3)*

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Trusted trader certificate programmes (e.g., AEO, C-TPAT)	• See benchmarking WG1 on Safety and Security. • ALICE Implementation Plan, Topic "*Effective Trade Facilitation*"
DoI 3: Some research activities and small scale pilots	

Challenges	Specific contributions justifying DoI 3
Legal/Policy frameworks (e.g., Union Customs Code, SAFE Framework of Standards)	• **E-FREIGHT:** Single Transport Document to simplify and harmonise regulatory requirements across modes and EU States. Transport chain management solutions to establish common end-to-end transportation processes incorporating regulations compliance and 'intelligent' monitoring and control. • **CO-GISTICS.** Interface standards to facilitate rapid connect/disconnect of objects, smart devices, IoT components and collaborative ITS solutions. CO-GISTICS. Deploy, validate and set-up after project life cooperative logistics (including intelligent cargo) services through the convergence of M2M (and Freight Object to Object) and Cooperative Systems (the connected car) technologies in 5 EU scenarios. • Possible results from Topic MG 6.3.2015 *Common communication and navigation platforms for pan-European logistics applications.*
Common and transparent behavioural rules. Cross border data requirements and System-Based Control/Audit	*See chapter 2.*
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Coordinated Border Management (CBM)	

6. Benchmarking Global Supply Networks Coordination and Collaboration Roadmap

To reach the milestones for 2020 and 2030, the following Challenges and Themes were defined in our roadmap to reach:

1. Full Horizontal Collaboration (2020):

   a) Collaborative supply network design

   b) Supply network coordination

   c) Drivers and enablers for Collaboration and Coordination

2. Integration of Manufacturing and Logistics (2030).

6.1. Full Horizontal Collaboration

6.1.1. Collaborative supply network design

The following research and innovation activities were identified in the roadmap:

Strategic collaborative logistic network design

Research and innovation activities in this area aim at supporting the strategic-level decisions that lead to the creation of collaborative supply networks, taking into account the typology and characteristics of logistic flows for the collaboration to identify collaboration opportunities and lead to network designs that maximise the resource utilization.

Tactical planning and execution of collaborative networks

Research on this theme will deal with tools and approaches for tactical and operational optimization of collaboration, including event management, maximizing resources utilization. The focus should be on adaptation and integration of current logistics management approaches and systems, conceived for internal supply chain optimization, to meet the requirements of open collaborative supply networks.

Resilience capabilities and risk management of collaborative networks

Research in this area will deal with the challenge of ensuring that shared collaborative networks meet the resiliency and security standards expected in traditional Supply Chains. This will require the alignment of proactive and reactive risk management approaches among the different stakeholders (in the supply chain and involving the collaborating partners as well as entities such as emergency authorities, customs, banks, governments, etc.).

Business models and change management for collaborative services

The challenge is to find economically sustainable business models for the provision of logistic services in open and collaborative supply networks. The new models will enable logistic services providers to meet the requirements of collaborating shippers, as well as to develop collaborations with other providers. The goal is to preserve profitability for services providers in collaborative networks, ensuring a smooth transition to the new business ecosystem based on shared resources and services.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Tactical planning and execution of collaborative networks	• **E-save:** Collaboration platform and management tools to support decisions and every day operations for reducing energy consumption and carbon emissions

	• **I-cargo:** open affordable information architecture that allows real world objects, existing systems, and new applications to efficiently co-operate, across all transport modes. • **SHARE-box:** Development of a ICT platform for the flexible management of shared resources with other companies • **Efficiensea 2:** Development of the Maritime Cloud – a communication framework for both e-maritime and e-navigation - enabling efficient sharing of information between all maritime stakeholders
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Resilience capabilities and risk management of collaborative networks	• **Floue:** Network design decision-aid software for network design with uncertainties • **Citrimacc:** Information exchange platform that can reduce screening costs and eliminate tampering risks, web-based software for data storage and a 24/7 fully redundant communication systems for continuous real-time visibility. • **REFERENCE:** Development of a collaborative safety assessment framework
Business models and change management for collaborative services	• **CO3:** Business strategy enabling companies throughout the supply chain to set up and maintain initiatives to manage and optimize their logistics and transport operations through Horizontal Collaboration between industry partners. • **HUBWAYS:** Cooperative Model for Green Hubs enabling low-carbon, resource-efficient and secure transportation services • **NOVELOG:** Stakeholder collaboration and the development, field testing and transfer of best governance and business models in city logistics • **NEXTRUST:** To develop an innovative business model with interconnected, trusted, collaborative networks along the entire supply chain. • **SMART-RAIL:** Development of working business models for cooperation of different stakeholders. • **SUCCESS:** To identify business model among construction supply chain actors for urban logistics. • Topic SFS-34-2017: *Innovative agro-food chains: unlocking the competitiveness and sustainability potential (RIA),* Understand the distribution of risk and added value along the entire food chain. • ALICE Implementation Plan Topic: *Create Business Models for Synchro-modality* • ALICE Implementation Plan Topic: *Connected Services for Horizontal Collaboration* • ALICE Implementation Plan Topic: *Dynamic models, dynamic roles and coordination for migrating to PI.* • ALICE Implementation Plan Topic: *Business roles of SMEs and (end) Customers in the PI*

Strategic collaborative logistic network design	• **CaxMAN:** Cloud Portal in form of a market place - of Cloud application and services addressing the design, analysis, production chain for additive manufacturing. • **CO3:** The project demonstrated several cases of strategic collaborative network design. Including efficiency gains. • **EPOS:** gain cross-sectorial knowledge and investigate cluster opportunities using an innovative Industrial Symbiosis platform to be developed and validated during the project. • **FIspace**: Multi-domain Business Collaboration Space that employs FI technologies for enabling seamless collaboration in open, cross-organizational business networks • **SMART-RAIL**: Develop a methodology and architecture for exchange of data/information required for the optimization process between stakeholders**.** • **SYMBIONICA:** Supply chain distributed co-engineering platform for advanced design and full personalization involving all relevant stakeholders, design and engineering of the products and through-life services. • **SYMBIOPTIMA:** Development of a cross-sectorial energy & resource management platform for intra- and inter-cluster streams, characterized by a holistic model for the definition, life-cycle assessment and business management of a human-mimetic symbiotic cluster. • **SUCCESS**: To identify an integrated collaborative approach among construction supply chain actors. • **U-turn:** Will suggest innovative collaboration practices and tools towards achieving more efficient operations from both an environmental and cost perspectives for food and urban deliveries. • ALICE Implementation Plan Topic: *Development of a Strategic European Industry Supply Network Design towards TEN-M (Manufacturing)* This was recently discussed in the social and economic committee together with the European Parliament Transport Committee. • ALICE Implementation Plan Topic: *Dynamic models, dynamic roles and coordination for migrating to PI***.** • ALICE Implementation Plan Topic: *Business roles of SMEs and (end) customers in the PI*
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	

6.1.2. Supply network coordination

The following research themes have been identified as strategic:

Coordinated planning of supply chain and logistic services

Research in this area will deal with integration of traditional supply chain planning approaches with transport and logistics services planning bringing control towers to the next operation level. The aim is to maximise resources utilisation through information exchange along the open supply network (several control towers), by matching forecast demand and stock allocation plans with logistics services availability.

Synchronization and dynamic update of logistics operations in open networks

Research in this area is aimed at ensuring that shippers and services providers operating in open global networks are able to align and synchronize their operations in case of changes and deviations from plans. A number of initiatives have pursued similar objectives in the past, always within the boundaries of a single supply chain or in a restricted portion of the network (e.g., a port or inland terminal). The challenge is to achieve a high level of automated alignment in open networks, where many parties collaborate, even occasionally, covering the entire door-to-door chain.

Overcoming data-sharing barriers in collaborative networks

Supply network collaboration and coordination rely on capabilities to share, transform and use data among all the collaborating partners. A number of standards and ICT solutions are available to this purpose, yet these are far from being widespread in the logistics industry community. The challenge in this area is to understand the non-technological barriers that prevent data sharing, and to develop adequate countermeasures and approaches all this in coordination with the efforts and themes identified in ALICE roadmap on Information Systems for Interconnected Logistics.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale	
Challenges	Specific contributions justifying DoI 4
Coordinated planning of supply chain and logistic services	• **BONBOYAGE:** To develop and test a platform optimizing multimodal door-to-door transport of passengers and goods. • **C2NET:** Creation of cloud-enabled tools for supporting the supply network optimization of manufacturing and logistic assets based on collaborative demand, production and delivery plans • **MODULUSHCA:** Physical aspects of combining loads through usage of iso-modular loading units through the entire SC. • **SMART-RAIL:** Living Lab 2: Managing connectivity of rail with other transport modes; Control tower for long distance rail freight transport.
Synchronization and dynamic update of logistics operations in open networks	• **I-Cargo:** Supply chain composition linking and synchronising logistic services along the entire multi-modal chain. • **INTRASYS:** Cloud-based application to optimize transport-related operations.

	• **CLEV:** Create international information infrastructure for automated delivery • **SYNCHRONET:** Software for real-time synchro-modal logistics optimization • ALICE Implementation Plan Topic: *Dynamic models, dynamic roles and coordination for migrating to PI***.** • Relation with MG-5.4-2017. Potential of the Physical Internet
DoI 3: Some research activities and small scale pilots *(No challenges in this category)*	
DoI 2: Potentially foreseen in forthcoming calls for proposals *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Overcoming data-sharing barriers in collaborative networks	• **CO3:** The role of the trustee was very well described in the project CO3. This role enables data sharing between partners in a collaborative network. • **I-Cargo:** Access-point based infrastructure for sharing logistic services in a logistic business ecosystem. • ALICE Implementation Plan Topic: *Business roles of SMEs and (end) Customers in the PI***,** • Relation with: MG-5.4-2017. Potential of the Physical Internet. • Topic MG.6.3-2015. *Common communication and navigation platforms for pan-European logistics applications*

6.1.3. Drivers and enablers for collaboration and coordination

The following research themes have been identified as strategic:

1. Favouring the transition to the new collaborative environment.
2. Understanding the impact of collaborative logistics.

Favouring the transition to the new collaborative environment

Innovation support is needed to favour the transition to new logistic networks based on collaboration, and to implement the necessary changes on current processes and systems. The activities in this area should be aimed at removing in-company barriers to collaboration, through proper change-management approaches, as well as at creating awareness and promote the diffusion of collaborative logistics approaches in the logistics community at large.

Understanding the impact of collaborative logistics

Strategic drivers to collaboration in logistic networks have to be understood and quantified, internally within each partner but also across partners, to align the individual strategic visions for a successful

long-term collaboration. Forward-looking KPIs are needed, supported where necessary by modelling and simulation techniques, to enable local as well as global strategic planning decisions, also supporting public authorities in policy planning and assessment.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Understanding the impact of collaborative logistics	• **CO3:** The trustee game enables understanding of the different actors of Horizontal Collaboration. • **CITRIMAC:** Develop a 'Framework for Action' model that is based on strategic agreements across all stages of the supply chain delivered through collaborative working and supported by evidence-based tools to allow targeted, cost effective interventions. • **LOCIMAP:** Understanding of implications for communities & regional/national policy to achieve benefits. • **REFRESH:** Develop a 'Framework for Action' model that is based on strategic agreements across all stages of the supply chain delivered through collaborative working and supported by evidence-based tools to allow targeted, cost effective interventions. • **SYNCHRONET:** Demonstration that slow steaming, coupled with synchro-modal logistics optimisation delivers amazing benefits to all stakeholders in the supply chain. • ALICE Implementation Plan Topic*: Connected Services for Horizontal Collaboration* • ALICE Implementation Plan Topic*: Business roles of SMEs and (end) Customers in the PI*
DoI 2: Potentially foreseen in forthcoming calls for proposals	
Challenges	Specific contributions justifying DoI 2
Favouring the transition to the new collaborative environment	• **COOPS:** Create managerial insights that will help the practitioners to form sustainable collaboration by devising tools and rules for stable and fair allocation of benefits. • **ENRICH:** Create a platform for research training and transfer of knowledge activities on Integrated Container SCs.

	• **FINISH:** Provide grants to develop new and innovative collaboration applications in perishable products SC. • **HUBWAYS:** Ecosystem for electronically connecting multimodal terminal network stakeholders and amplifying their joint capabilities when using the Cooperative Model, Best practices dissemination. • **I-Cargo:** Lowering barriers for information sharing in a business ecosystem of logistic services clients and providers. • *Topic MG.6.3-2015. Common communication and navigation platforms for pan-European logistics applications* Application of collaborative systems and services (legal and business aspects, recommendations made as to how to split the costs of collaboration and make it attractive for users to buy into the proposed collaborative system)
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	

6.2. Integration of manufacturing and logistics

Research in this area deals with the planning of collaborative supply networks, on strategic, tactical and operational level, also including flexible manufacturing nodes relying on new technologies, such as micro-processing, on-site repairs, additive manufacturing, containerization of manufacturing, re-shoring manufacturing, etc.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed at a large scale *(No challenges in this category)*	
DoI 3: Some research activities and small scale pilots	
Challenges	Specific contributions justifying DoI 3
Integration of manufacturing and logistics	• **CASSAMOBILE:** Mobile, flexible, modular, small-footprint manufacturing system in a 20' ISO-container that can be easily configured for different products and processes. The container format allows transport to provide on-site manufacturing anywhere, enabling the benefits of localised service delivery without duplication of equipment at multiple locations. The integrated modular manufacturing system with standard interfaces allows an easy exchange of process modules. • **LOCIMAP:** Synergistic operation of large & small manufacturing units on and around fully integrated industry parks.

	• **OpenMOS:** intelligent modular plug-and-produce equipment. • **PLANTCOCKPIT:** Optimized production and logistics processes through an integrating model of production management systems. • **FlexLogiC:** Production and packaging processes modular and integrated self-contained 'factory in a box'. • **DISCO:** Optimisation of the overall supply chain performance by connecting with supply chain partners. • **SC-MC-S:** Define and research sustainable mass customization. • **SYMBIOPTIMA:** Resources (materials, energy, waste and by-products) coordinated among multiple autonomous Production Units organized in industrial clusters. • Topic MG-5.1-2016. *Networked and efficient Logistics Clusters.* • Topic FOF-11-2016: *Digital automation. Collaborative manufacturing and logistics.* • ALICE Implementation Plan Topic*: Sustainable Integration of new manufacturing developments: Industry 4.0 in Agile Supply and Logistics Networks* • ALICE Implementation Plan Topic: *Development of a Strategic European Industry Supply Network Design towards TEN-M (Manufacturing)* • ALICE Implementation Plan Topic: *Dynamic models, dynamic roles and coordination for migrating to PI.*
DoI 2: Potentially foreseen in forthcoming calls for proposals (No challenges in this category)	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	

7. Benchmarking Urban Logistics

The five areas of intervention in the ERTRAC-ALICE 2014 Urban Freight Research Roadmap that are benchmarked in this section include:

1. Identifying and assessing opportunities in urban freight.
2. Towards a more efficient integration of urban freight in the urban transport system.
3. Business models and innovative services.
4. Cleaner and more efficient vehicles (focus on trucks as 3.5 ton).
5. Safety and security in urban freight.

7.1. Identifying and assessing opportunities in urban freight

Nowadays, there is still no satisfactory and comprehensive qualitative and quantitative evaluation of the impact Urban Freight Transport (UFT) has on the life of cities. Recently, however, new trends are emerging as regards the identification and assessment of new opportunities for UFT. Collaborative transportation systems, for instance, have become an increasingly popular practice due to the crisis. However, the concept of cooperation and competition and data-sharing still requires further development. There is a strong need to acquire targeted consistent and homogeneous data in order to properly assess the problem and identify the most suitable solutions. It is expected that better data, knowledge and information will make it easier to identify opportunities for improvement. Although cities have proven to be almost unique and solutions very difficult to replicate, Key Performance Indicators (KPIs) can show the real impact of these new solutions and the extent to which they can be replicated in other cities.

DoI 5: Sufficient evidences of implementation	
Challenges	Specific contributions justifying DoI 3
Assessing urban logistics in cities: KPIs, benchmarking tools, governance models & identify urban freight actors. Framework data collection to analyse freight movements, impacts and identify opportunities.	Wide coverage through EU projects as such as **CITY LAB**, **C-LIEGE**, **ECOSTARS**, **NOVELOG**, **FREVUE**, **LAMILO, MODULUSCHA**, **SMARTFUSION**, **SMILE**, **STRAIGHTSOL**, **SUCCESS (on-going)**, **DOROTHY,** etc. In France, "National Urban Goods Movements Surveys" since the 90's, and FRETURB software Other examples: Mines Paristech (FR), CIRRELT (Canada)
Understanding the potential for stakeholder cooperation, stakeholder's awareness and involvement • New collaboration formulas (cooperative decision-making and cooperative planning processes), financing and governance structures. • New methodological frameworks to support participatory policy making	**Wide coverage through EU projects as such as BESTFACT cases**: Binnenstadservice**,** Cityporto Padova**,** Stadsleveransen in Gothenburg, Consolidation centre, LOGeco – eco-friendly logistics in Rome. **CITYLAB**, **C-LIEGE**, **CYCLELOGISTICS, ECOMPASS**, **ECOSTARS, LAMILO, MODULUSHCA**, **NOVELOG**, **SMARTFUSION,** **SMILE, STRAIGHTSOL, SPIDERPLUS, SUCCESS (on-going)**, **TRAILBLAZER**, **DOROTHY**, **CIVITAS**, etc. Forthcoming topics:

accounting for agent-specific preferences and their dynamic interactions • New policies and regulation measures that benefit public and private parties. • Assessing the impact of policy regulations and frameworks	Topic MG-4.1-2017 *Increasing the take up and scale-up of innovative solutions to achieve sustainable mobility in urban areas* • New governance models for freight and passenger transport: better coordination and cooperation; synergies between passenger and freight transport; stakeholder engagement; public consultation and participation; education and training, policy transfer. Topic MG-4.5-2016 *New ways of supporting development and implementation of neighborhood-level and urban-district-level transport innovations.*
DoI 4: Experiences but not deployed a large scale *(No challenges in this category)*	
DoI 3: Some research activities exist *(No challenges in this category)*	
DoI 2: Potentially foreseen in forthcoming topics	
Challenges	Specific contributions justifying DoI 2
Assessing the potential of new services in last mile operations associated to available data (big data). Assessing the potential of new distribution schemes in urban areas (e.g. 3D printing, crowd-shipping)	**GALENA** H2020 project: To adapt an existing logistics information system by taking into account the trusted PVT and authentication data. Forthcoming topics: MG-5.2-2017: *Innovative ICT solutions for future logistics operations*
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	

7.2. Towards a more efficient integration of urban freight in the urban transport system

Achieving a cleaner and more efficient urban logistics system requires a better integration of urban freight in both the transport system and city. Other transport activities within the city transport system may have an influence and be influenced by urban freight transport.

There is a relationship between the demand for passenger transport for certain type of activities, in particular commuting to work, and the demand for goods transport. Waste is another fundamental part of city transport. Waste removal processes could be integrated with the delivery or, more likely, the return of certain product categories. Additionally, it is important to consider the relationship between tourism and urban freight.

7.2.1. Optimizing the use of the road infrastructure in space and time for urban freight activities

When it comes to the integration of different activities on the road infrastructure, research should aim to enable their integrated management at the strategic, tactical and real-time level. While work is required to enable this joint use of the infrastructure, it should be supported by activities to build support for this among stakeholders. It should therefore be supported by work on public acceptance and the involvement of the different actors, in particular the freight operators. The extent and conditions of some forms of public-private partnerships (PPPs) to enable this should be investigated.

Significant research is still needed to ensure that the best is made of the integration of urban freight in the urban mobility system, the development of tools and methods, including scenario planning and models, for fully taking urban freight into consideration at all stages of the sustainable urban mobility planning process. This should identify opportunities to also assess the potential for using other modes and infrastructures than road for improving the urban freight system.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed a large scale	
Challenges	Specific contributions justifying DoI 4
Dynamic use of dedicated lanes and lane prioritizing	Some experiences: • **BESTFACT Case:** Multiuse lanes for freight distribution in Bilbao • Also cases in Lyon, Barcelona, and San-Sebastian
Integration of urban freight with public transport on the infrastructure but also at the level of the vehicles and at public transport interchanges.	Some cases regarding the use of vehicles for passengers and freight in combined way have been found. • **BESTFACT Case**: Parcel and small cargo delivery using interurban coach system between Lithuanian urban areas • **BESTFACT Case: Combipakt** – combined passenger and goods transport in Nijmegen, the Netherlands. • **Dencity project** (Sweden, funded by Swedish VINNOVA) - cases in Gothenburg and Stockholm. Aim to address passenger and goods mobility for development and planning of dense cities with high demands on accessibility and sustainability.
DoI3: Some research activities exist *(No challenges in this category)*	
DoI2: Potentially foreseen in forthcoming topics	
Challenges	Specific contributions justifying DoI 2
Assess how road infrastructure can be best used for freight activities.	Some experiences available: • Extensive work in the SPECTRUM project on using suburban rail networks for urban freight deliveries.
Differentiate the use of road space in time	

Explore the potential of private infrastructures. public private partnerships possibilities	• The Monoprix service in Paris using RATP lines at night to deliver to stores. Topic MG-4.1-2017: *Increasing the take up and scale-up of innovative solutions to achieve sustainable mobility in urban areas* • Optimizing the use of existing infrastructure and vehicles • Integration between urban freight and passengers transport networks within appropriate city and transport planning governance • Use of multi-modals hubs and terminals for passengers and freight • Multi-purpose use of space for vehicles • Synergies between passenger and freight transport
Development of tools and methods for fully taking urban freight into consideration at all stages of the sustainable urban mobility planning process	• ***C-LIEGE***. Creation of the City Logistics Manager. • ***ENCLOSE***. Releasing a specific SULP (Sustainable Urban Logistics Plan) and integrating it into the SUMP. • ***NOVELOG***: New Cooperative business models and guidance for sustainable City Logistics • **Dencity project** (see above) • **SMARTFUSION** developed the *Smart Urban Freight Designer* which is an interactive planning tool for clean urban logistics integrated with PTV routing tools. • **SMP** ITC Software The tool integrates methods and calculations of the benefits of creating environmental zones, using low emission vehicles for urban distribution, bundling of goods, night distribution, reducing road capacity, etc. • Topic MG.5.4-2015. *Strengthening the knowledge and capacities of local authorities*
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls (No challenges in this category)	

7.2.2. Better understanding of the impact of land use on urban logistics activities

Research and innovation on this topic should help to increase the knowledge related to spatial patterns and urban freight facilities. It should lead to tools for measuring the role, location and impacts of warehouse, freight terminals and urban logistics platforms in metropolitan areas. On this topic, it is also necessary to assess and map locational trends and the impacts of "logistics sprawl" on freight flows, CO2, local pollutants and congestion.

The location of logistics activities may also have an impact on the social cohesion of the territory and should be better understood.

Finally, some research should be carried out on measuring the accessibility of networks and terminals for various types of actors.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*

DoI 4: Experiences but not deployed a large scale *(No challenges in this category)*	
DoI 3: Some research activities exist	
Challenges	Specific contributions justifying DoI 3
Knowledge related to spatial patterns, location and impacts of warehouse, freight terminals and urban logistics platforms in metropolitan areas Assess and map locational trends and the impacts of «logistics sprawl» on freight flows, CO2, local pollutants and congestion	• **CITY LAB:** City Logistics in Living Laboratories • **PLUME**: decision-making tool to estimate the best position of urban distribution platforms • **ANNONA** and **SILOGUES** projects include work on location of warehouses • **LAMILO, SUCCESS** • **CITYFREIGHT:** LUTP (land use and transport planning) project. Much land use and freight work was done in Brussels and Helsinki. • **Laetitia Dablanc's (IFSTTAR)** work in this field is extensive: - The impacts of logistics sprawl in Paris - Atlanta: a mega logistics center in the Piedmont Atlantic Megaregion (PAM) - How can we Bring Logistics Back into Cities? The Case of Paris Metropolitan Area.
DoI 2: Potentially foreseen in forthcoming calls for proposals (No challenges in this category)	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Specific contributions justifying DoI 1
Measuring the accessibility of networks and terminals, for various types of actors.	No clear evidence it has been addressed

7.2.3. Enabling a more efficient management of goods: ITS to better manage the movement of goods

ITS can be used to better manage the movement of goods. The key focus of any research is to identify appropriate business models for technology adoption and market deployment.

The integration of urban freight into urban network management can rely on new improved traffic management operations and a better use of data on urban freight. To support this approach, research work should be carried out on data definition/identification/collection/accessibility for planning and policy and urban freight plans.

The potential of e-Freight should be explored to accelerate this development towards a more efficient management of the network.

In-vehicle systems and connectivity should also be explored as means to enabling a more efficient management of goods. The limit of the scope of the roadmap towards vehicles is defined by the scope of the European Green Vehicles Initiative (EGVI).

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed a large scale	
Challenges	Specific contributions justifying DoI 4
Management of loading and unloading areas.	Some experiences on load/unload management system, but not deployed at large scale • **BESTFACT Case**: i-Ladezone: Intelligent monitoring of loading bays in Vienna. • **BESTFACT Case:** New loading/unloading regulation and parking meter/loading bay surveillance technology in Lisbon • **FREILOT:** only affiliated users were allowed to use established loading zones, which could be pre-booked. However, the Pilot Test run in an unreal situation, due to the close universe of users involved, and the pre-booking system did not work" (Bilbao city traffic manager). Bilbao is trying to improve this service in the framework of the CO-GISTICS project. • **CO-GISTICS,** instead, will provide real-time information about the occupancy of the loading zones, and the loading zones will be available for every driver whether he is participating or not in the project" • **ALF** project
DoI 3: Some research activities exist	
Challenges	Specific contributions justifying DoI 3
Explore the potential of more exchange of data on urban freight Data definition, identification, collection, accessibility, for planning and policy and for urban freight plans. Models for data sharing and cost efficient data collection on urban freight.	• **GALENA:** To develop innovative and trusted PVT solutions with a hybrid system GALILEO / ZigBee enabling a seamless, robust and continuous handover indoor/outdoor localization of freight and enabling the various carrier operators to take over the liability of the goods they are responsible for. • **COMCIS**: interoperability between e-freight systems that have been developed in previous EU projects as well as in commercial undertakings. • **SMARTIE** project investigates and develops novel technologies to securely gather information from the real world e.g. from citizens, traffic control systems etc. and store it in the platform in a privacy-preserving way. • **Lindhomen Science Park**: workshop series in Sweden as a basis for understanding the data need to better support freight planning in urban area. • **E-freight projects:** - Use of multi-modals hubs and terminals for passengers and freight - Freightwise - e-freight - the relevant ISO and GS1 standards This has been well explored and the Common Framework covers operational work well. However, there is more to be done, pilots in urban freight are missing.
DoI2: Potentially foreseen in forthcoming topics	

Challenges	Specific contributions justifying DoI 2
Appropriate business models for technology adoption and market deployment e.g.: - Access control and privileges granted to specific vehicles (low noise, low or zero emissions...) - Dynamic routing - Lane sharing - Load index control - Information on other road users - Delivery spaces availability or information related to logistics	• **ALF** (ANR project): future generation delivery areas • **SMP** ITC Software The tool integrates methods and calculations of the benefits of creating environmental zones, using low emission vehicles for urban distribution, bundling of goods, night distribution, reducing road capacity, etc • Topic MG-6.3-2016: *Roadmap, new business models, awareness raising, support and incentives for the roll-out of ITS*
Deployment of C-ITS, in particular V2I.	• **ECOMOVE**: it developed core technologies and applications based on vehicle-to-vehicle and vehicle-to-infrastructure communication or so called "cooperative systems". • **Compass4D:** it focused on three services: The Energy Efficient Intersection (EEI), the Road Hazard Warning (RHW) and the Red Light Violation Warning (RLVW). • Topic MG-6.2-2016: *Large-scale demonstration(s) of cooperative ITS*. Enable services based on appropriate access and sharing of data leveraging in-vehicle resources and 2-way V2V, V2I, I2I and vulnerable road user's connectivity in complex urban environments • Topic MG-5.2-2017: *Innovative ICT solutions for future logistics operations*. Need to match the increased need for real-time and open data to plan and track shared freight with guarantees that the exploitation of this data is both safe and secure
Development of communication interface to manage all information related to vehicle operation, data exchange with infrastructure, data exchange with logistics operations, load management and mission profile.	• **CO-GISTICS:** Deploy cooperative ITS services for logistics: - Intelligent parking and delivery areas - Eco-drive support - Priority and Speed advice • **GET SERVICE:** platform provides transportation planners with the means to plan transportation routes more efficiently and to respond quickly to unexpected events during transportation. The service will be launched in 2016. • **OPTICITIES:** ITS solutions to optimize urban logistics operations: urban traffic regulation tools and integration into traffic management systems; freight delivery optimisation tools and fleet management services • **ECO-FEV**: Integration of the FEV in the cooperative transport infrastructure. Integrated IT platform that enables the connection and information exchanges between multiple infrastructure systems that are relevant to the FEV such as road IT infrastructure. • **SMARTIE** project build the advanced and secure IoT platform to provide enhanced services to the citizens • **E-freight projects** (see above): cover data exchange with logistics operations.

	• Topic MG-6.2-2016: *Large-scale demonstration(s) of cooperative ITS* Enable services based on appropriate access and sharing of data leveraging in-vehicle resources and 2-way V2V, V2I, I2I and vulnerable road user's connectivity in complex urban environments • Topic MG-5.2-2017: *Innovative ICT solutions for future logistics operations*
DoI 1: No clear evidences of implementation. none foreseen in current calls (No challenges in this category)	

7.2.4. Improving the interaction between long distance freight transport and urban freight

This challenge should address the interface and interactions with long distance freight transport services and infrastructures, and other modes (airports, seaports, intermodal terminals, dry ports, logistics platforms, etc.).

A major issue is the coordination of very different trends in long distance freight transport (increase efficiency by vehicle scale increases) and city distribution (increase efficiency by downscaling of transport modes used for urban deliveries).

The Physical Internet concept, in which logistics and supply chain networks are open and integrated, including warehouses and hubs, should be further investigated, to enable the proper consolidation of freight transport in the last mile delivery in urban areas. The design of freight corridors in cities/regions should be improved, to provide a better management of long distance freight transport through the urban transport network (urban nodes).

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed a large scale *(No challenges in this category)*	
DoI3: Some research activities exist *(No challenges in this category)*	
DoI2: Potentially foreseen in forthcoming topics	
Challenges	Specific contributions justifying DoI 2
Studies on land use and freight transport/logistic operations interaction, and the impact of the multiplicity of logistics hubs and networks. Design of freight corridors in cities.	• **STRAIGHTSOL**: One of the case studies deals with the link between long distance transport and urban freight: how will a more reliable management of long distance haulage help improving final delivery? • **SMARTFUSION** freight corridor pilot in Berlin to assess how to meet the needs in terms of air quality. • Land use and transport planning (see above). • Topic MG-4.3-2017: *Innovative approaches for integrating urban nodes in the TEN-T core network corridors.* Approaches for linking long-distance with last-mile freight delivery in urban areas.
DoI 1: No clear evidences of implementation. none foreseen in current calls	

(No challenges in this category)

7.2.5. Better adapting the vehicles to innovative urban freight delivery systems

The better integration of urban freight activities in the urban transport system requires the development of innovative vehicle solutions that are better fitted to innovative urban freight delivery systems, due to flexibility and modularity. There needs to be a decrease in the unwanted miles driven, unnecessary stops and time wasted in order to improve the overall efficiency of the system and decrease its impact on congestion.

DoI 5: Sufficient evidences of implementation	
Challenges	Specific contributions justifying DoI 5
Develop technologies to transfer loads between vehicles (large and smalls) as well as with other transport modes (architecture of vehicles, load units...) to allow a decoupling of the delivery processes between mass transport and last mile operations.	• Some solutions have been already introduced in the market. • **I.LOG City Logistics** system, for integrating intermodal transport with the "last mile" with micro-swap bodies. • Extensive work in transshipment: see **SPECTRUM** and **INHOTRA** for rail-road-sea systems. See also **CITYLOG**. • **BESTFACT Case**: Electric freight vehicle with trailers: Cargohopper in Utrecht: multi-trailer, 16-metre long but narrow road train. It is powered by a solar & battery-electric motor • **BESTFACT Case**: Citylog EMF (efficient, modular, flexibel) – Electro-Multifunction-Transportation vehicle: modular built vehicle, series of 'self-driven' vehicles and 'trailers' that can be coupled to a train, and un-coupled for loading and unloading operations • **CITY MOVE**: Optimization of the vehicle capacity and vehicle weight ratio. The vehicle responds to an urban and modular architecture, so it contributes to modular logistics units for a better load factor. • **CITYLAB:** Amsterdam case: floating depot and clean vehicles • **STRAIGHTSOL**: Mobile depot TNT • **VANECK GROUP:** Solution of several boxes on trailer ready for urban distribution. • **Other projects** on containers for urban logistics as PART, URBANCITY BOX or Transformer
DoI 4: Experiences but not deployed a large scale	
Challenges	Specific contributions justifying DoI 4
Lowering the noise related to handling, loading and unloading of the goods to enable night deliveries	• **PIEK** project: funded by the Dutch government. It published a handbook on how to silence almost every part of loading, unloading and driving in cities at night. • No recent examples from European research projects. National projects and tests in several countries (e.g. UK, Belgium, France, etc.) • **CERTIBRUIT** standard: considers global noise from a delivery, from truck to shop material, including delivery operations
DoI3: Some research activities exist	

Challenges	Specific contributions justifying DoI 3
Define future optimal urban freight vehicle sizes and architectures from multi-stakeholder perspective.	• **FURBOT**: it proposed novel concept architectures of light-duty, full-electrical vehicles for efficient sustainable UFT and developed FURBOT, a vehicle prototype, to factually demonstrate the performances expected. • **V-FEATHER:** it presented a complete electric vehicle architecture vision on how urban light duty vehicles will be designed, built and run in the near future.
DoI2: Potentially foreseen in forthcoming topics	
Challenges	Specific contributions justifying DoI 2
Develop standardized and modular logistics units (compatible with regular containers) for a better load factor and interoperability among different transport systems and modes	• **MODULUSHCA** • **TELLISYS:** modular set of volume-optimised and traceable MegaSwapBoxes (MSB) • *See Challenge: New material flow technologies and intelligent load carriers, standardized ULD's, page14.* • *Topic MG-5.1-2016: Networked and efficient logistics clusters*: Development of prototype Modular Load Units, optimised for automated handling and high load factors in all transport modes.
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Implementation status
Develop loading rate measurement systems (weight, volume...), to be linked with overall city access control and network management.	

7.3. Business models and innovative services

Research and development on new business models associated to the smart urban logistics needs to tackle economic, environmental and social aspects that allow growth, and industry to run businesses, and at the same time guarantee well-being for citizens.

Traditionally, the last mile delivery has been outsourced to specialised companies (mail or express companies, local agents, etc.), and somehow the direct control of the physical operations gets lost or at least handed over to someone else. The shift in consumer trends towards e-commerce and the current demand for better environmental conditions in cities call for a closer look into this part of the supply chain.

E-commerce is becoming the new paradigm in retailing. Beyond being a new channel of sales for retailers, the internet gives the consumer new powers to influence what is sold and how. The problem with e-commerce is that it multiplies the number of deliveries, since trips saved by consumers have to be done by the commercial vehicles.

Reverse logistics focuses on the analysis of niches and opportunities to integrate direct and reverse flows, in order to increase the global efficiency. Reverse logistics associated to e-commerce also have to be considered for this potential flow integration.

Finally, there is a need to better understanding how to best build and manage infrastructures dedicated to freight delivery in the urban environment.

DoI 5: Sufficient evidences of implementation *(No challenges in this category)*	
DoI 4: Experiences but not deployed a large scale	
Challenges	Specific contributions justifying DoI 4
Business models for consolidation schemes, including fleet and freight sharing and pooling. New concepts for distribution centres, optimal utilization of infrastructure	• **SMILE**, Valencia and Barcelona pilots • **SMARTFUSION**: Newcastle University working on consolidation scheme. • **LAMILO, LBCC** in London, Freight Cycle in Nijmegen and Consolidation Centre in Brussels • **SUCCESS**, living labs to identify new business models
Collaboration models for small businesses, e.g. out –of-office hour deliveries to retail and for specific logistics chains such as Hotel/Restaurant/Café (HORECA)	▪ **CITYLAB** Brussels case • Other examples: Bubble post Ben Hubble, Barcelona
Packaging in last mile distribution for fresh, refrigerated and frozen goods. Optimisation, modularization and standardization of packaging and load units.	• Refer also to sub-challenge 'better adapting the vehicles to innovative urban freight delivery services'- develop standardized & modular logistics units'
DoI3: Some research activities exist *(No challenges in this category)*	
DoI2: Potentially foreseen in forthcoming topics	
Challenges	Specific contributions justifying DoI 2
ICT tools to enable sharing and integration of data. Potential of Internet of Things (IoT) and Future Internet for logistics. Better integration of urban freight in main traffic models. C-ITS as support system.	Refer also to sub-challenge 'enabling a more efficient management of goods: ITS to better manage movement the movements of goods' • Topic MG-5.2-2017: *Innovative ICT solutions for future logistics operations*
Reverse logistics and transport of waste and recycling material Direct and reverse volume trends: waste, recycling and e-commerce. Current vs. new paradigms and business models of direct and reverse flows (recycling and returns) Direct and reverse logistics models, integration and cargo pooling Beyond reverse logistics: urban freight for circular economy and service functionality economy	• **FREVUE** Stockholm case study • **CITYLAB** Rome case • **SUCCESS:** reverse logistics aim to collect construction waste, demolition debris, packaging waste, etc., recycle and sort material; to organize and perform unused and unsuitable material exit and return to sub-contractor or supplier. • Topic CIRC-01-2016/2017: *Systemic, eco-innovative approaches for the circular economy: large-scale demonstration* • Topic CIRC-04-2016: *New models and economic incentives for circular economy business*
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls	
Challenges	Implementation status

E-commerce implications for cities: • Assessing the impact of e-commerce on urban freight delivery and the urban transport system. • Logistics for home deliveries. Decoupling delivery and reception. Service quality (requirements, perception, traceability) Integration of click-and-mortar distribution channels	• **CITYLAB**: The Observatory of Strategic Developments Impacting Urban Logistics provides data and analyses on E-commerce. • **WS 5.2 Mines Paristech:** The idea is to use taxis, as an available under-utilised transport capacities, to bring back unwanted products (bought through e-commerce) from the customer to the shop. Taxi drivers would receive an additional revenue, while congestion as well as energy consumption and emissions would diminish.
Designing and operating urban freight delivery infrastructures • Design and building of dedicated infrastructure, including vertical exploitation of space (storage and transport. Integration of infrastructure into other types of infrastructure and buildings • Financing the operation of dedicated infrastructure.	• **Chapelle International project** from SOGARIS mixing a rail-connected urban distribution center with, offices, a data center, restaurant, urban gardens. • **Connecting Europe Facility (CEF) urban nodes calls**: Actions implementing transport infrastructure in nodes of the core network, including urban nodes.
Implication of Physical Internet on the first and last mile: infrastructure, governance and business model	**MG-5.4-2017**. Potential of the Physical Internet

7.4. Cleaner and more efficient vehicles (*focus on trucks as 3.5 ton*)

More efficient organisation can lead to a decrease in the number of kilometers driven. But cleaner and more efficient vehicles can further enhance the positive trend to fuel consumption reduction and an improved urban environment. Besides air pollutants, the reduction of vehicle noise is an important research priority. The reduction of vehicle noise is also a condition for shifting deliveries to off-hours.

DoI 5: Sufficient evidences of implementation	
Challenges	Specific contributions justifying DoI 5
Reduction of vehicle noise • Definition of a EU standard methodology for noise measurement for the overall delivery process. • Development of 'affordable' low noise solutions, including full vehicle equipment.	• **PIEK standard** • **GREEN POST**. (IEE, 2008-2010) Studying the reduction of noise and air pollution emissions produced in the urban environment by the proposed vehicles.
DoI 4: Experiences but not deployed a large scale	
Challenges	Specific contributions justifying DoI 4
Definition of a common European standard, based on existing ones, and a common, shared framework for evaluating and changing the standard	• Italian national project on "*Active control devices for noise reduction of diesel shunting locomotives*" carried out by CIRIAF and TRENITALIA.

Business and deployment models for alternative fuels • Develop alternative fuel proposals (including electricity). Residual value of vehicles. Integrate management of vehicle auxiliaries for a wider scope of implementation. Develop alternative fuel proposals for autonomous body modules (e.g. refrigerated units). Reduction of particulates from brakes and tyres. • Address fuel availability and distribution, including the deployment of charging infrastructure for electric freight vehicles. • Address the potential choice determinants for alternative fuels fleet composition.	• **SMARTFUSION, SMARTSET** and **FREVUE pilots** • **FURBOT** • Topic GV-08-2017: *Electrified urban commercial vehicles integration with fast charging infrastructure*.
DoI3: Some research activities exist *(No challenges in this category)*	
DoI2: Potentially foreseen in forthcoming topics *(No challenges in this category)*	
DoI 1: No clear evidences of implementation (pilots, etc.) none foreseen in current calls *(No challenges in this category)*	

7.5. Safety and security in urban freight

A significant number of goods are lost following security breaches. It is important to identify solutions to guarantee a safe urban delivery system which minimises the risk for the freight operators, in order to achieve the objective of reducing the number of goods lost or stolen by 90%.

The delivery of goods in cities may lead to safety concerns for both Vulnerable Road Users (VRUs) and the drivers. There is indeed a high share of accidents of VRUs involving commercial vehicles in the urban environment. This is due, among other things, to the lack of visibility of VRUs in the urban environment when driving and manoeuvring. Moreover, it is risky for the driver to leave the vehicle and manipulate packages and pallets close to heavy traffic.

DoI 5: Sufficient evidences of implementation	
Challenges	Specific contributions justifying DoI 5
Locks and seals to guarantee vehicle integrity.	• There exist commercial solutions in place.
Secure and reliable automated parcels lockers and delivery units.	• There exist lots of commercial solutions (e.g. DHL packstations), e.g. lockers for residential buildings, integrated with traditional post-boxes. • **BESTFACT Case**: Urban distribution of small parcels using self-service terminals in Lithuanian towns and cities (LP EXPRESS 24). In market.

	• **BESTFACT Case**: Post Receiving Box by Austrian Post AG. The "receiving box" has proved successful and proceeded to a roll-out-phase – it is available and has been implemented in all major urban areas in Austria: Vienna, St. Pölten, Graz, Linz, Salzburg, Klagenfurt, Villach, Innsbruck, Bregenz, Dornbirn, Feldkirch and rural areas bordering these cities
Driver support and visibility equipment for a 360° safety around the vehicle when driving and maneuvering.	• This is commercially available
DoI 4: Experiences but not deployed a large scale	
Challenges	Specific contributions justifying DoI 4
Increasing and ensuring integrity of goods (perishable, electronic, high value) to avoid manipulation	
DoI3: Some research activities exist *(No challenges in this category)*	
DoI2: Potentially foreseen in forthcoming topics	
Challenges	Specific contributions justifying DoI 2
Include messages to vulnerable users, communication via lights, beeping sounds when backing up as in heavy duty vehicles, also when operating tail lifts...	• **SMARTFUSION**: The first two aspects are commercially available, fitted to trucks in the project trials. We just rung up and ordered them. • **SENIORS -** Safety-ENhancing Innovations for Older Road userS • **InDeV** - Depth understanding of accident causation for Vulnerable road users • **PROSPECT** - PROactive Safety for PEdestrians and CyclisTs • **XCYCLE-** Advanced measures to reduce cyclists' fatalities and increase comfort in the interaction with motorised vehicles • **SafetyCube** - Safety CaUsation, Benefits and Efficiency • Topic MG.3.4-2014. *Traffic safety analysis and integrated approach towards the safety of Vulnerable Road Users.* Advanced safety measures involving vehicles, infrastructure and its environment, protective systems, training and development of behavioural knowledge to reduce the number and severity of accidents involving Vulnerable Road Users. • Topic ART-04-2016: Safety and end-user acceptance aspects of road automation in the transition period.

ANNEX 1: PROJECTS & INITIATIVES CONTRIBUTING TO ALICE ROADMAPS IMPLEMENTATION (LINK)

ANNEX 2: HORIZON 2020 WP2016-2017 CALLS_RELEVANT FOR ALICE ROADMAPS (LINK)

Document 2: ALICE Research and Innovation Roadmaps Implementation Plan

This document is the *ALICE Research and Innovation Roadmap Implementation Plan as part of Deliverable 3.2 in SETRIS project.*

Contents

1. Executive summary

The European Technology Platform, Alliance for Logistics Innovation through Collaboration in Europe (ALICE), was launched on 11 June 2013, and received official recognition from the European Commission in July 2013. ALICE was established to develop a comprehensive strategy for research, innovation and market deployment of logistics and supply chain management innovations in Europe with the mission: "*to contribute to a 30% improvement of end to end logistics performance by 2030".* The mission is addressed with a societal, environmental and economic approach and is based on the concept of the "triple bottom line." Therefore, the strategy will positively impact People, Planet and Profit.

In December 2014, ALICE delivered five Research and Innovation roadmaps in key areas to achieve this Mission:

1. Sustainable Safe and Secure Supply Chains
2. Corridors, Hubs and Synchromodality
3. Information Systems for Interconnected Logistics
4. Global Supply Networks Coordination and Collaboration
5. Urban Logistics

These roadmaps included research and innovation gaps and challenges that needed to be addressed to drive the process from the current situation to the desired one, including milestones for 2020 and 2030. On top, several enablers and opportunities where identified in those roadmaps.

This implementation plan, aims to set the agenda on concrete topics that need to be addressed in the short and medium term according to the roadmaps to progress to a new paradigm for logistics. The implementation plan is targeting industry as main audience so consensus is established in the path forward for the sector, but also the European Commission as well as the Member States and Regions that may support this process with their policies and programs, especially those addressing research and innovation such as Horizon 2020.

These are the headings of the topics identified within this process and the relevant to implement Research and Innovation roadmaps above:

Table 1 ALICE Implementation plan topics relevance to ALICE roadmaps.

Identified topics to be addressed in ALICE implementation plan	Relevant Roadmaps addressed				
	1	2	3	4	5
1. Secure data exchange and access to build trust	✓	✓	✓	✓	✓
2. Effective trade facilitation	✓				
3. Logistics in the full circular economy: New business models for horizontal and vertical collaboration	✓			✓	✓

4.	Effective assessment and management of the triple-bottom line (*People, Planet and Profit*) logistics performance	✓				
5.	Scenarios for logistics developments	✓	✓	✓	✓	✓
6.	Synchromodal Hubs collaborative processes empowered by digitalization		✓	✓	✓	
7.	An adaptive synchromodal European freight network strategy		✓			
8.	Integration of information systems for cargo, transport and traffic		✓	✓		
9.	Development of a Synchromodal Network of Networks		✓	✓		
10.	Green logistics networks: Carbon and Beyond	✓	✓			
11.	Sustainable Integration of new manufacturing developments: Industry 4.0 in agile supply and logistics networks			✓	✓	
12.	Open system of systems for self-organizing logistics			✓		
13.	Collaborative data analytics for logistics and supply networks			✓		
14.	Affordable Cooperative Intelligent Transport Systems (C-ITS) solutions for end to end logistics applications		✓	✓		
15.	Logistics operations automation: The Matrix for Logistics		✓	✓		
16.	IoT large scale pilots in the field of logistics		✓	✓	✓	
17.	Development of a strategic European industry supply network design towards TEN-M (Manufacturing)		✓		✓	
18.	Horizontal collaboration cases and best practices		✓		✓	
19.	Connected services for horizontal collaboration			✓	✓	
20.	Physical Internet business cases demonstration	✓	✓	✓	✓	✓
21.	Mapping models, roles and coordination for migrating to PI	✓	✓	✓	✓	✓
22.	Business role of SME's and (end) customers in the PI	✓	✓	✓	✓	✓
23.	Integrated data framework and Big Data analytics assisting decision-making in urban freight transport			✓		✓
24.	Exploring new opportunities for achieving effective integration of urban freight and personal mobility services and networks					✓
25.	Improving the link between urban and long distance freight transport services and infrastructures		✓			✓
26.	New business models for logistics services based on disruptive sharing economy					✓
27.	Bringing Logistics into urban planning					✓
28.	Interoperable standard modular urban loading units operation in the urban context: autonomous deliveries		✓	✓		✓
29.	Safety and security in urban freight					✓

✓ Main Roadmaps addressed; ✓ Other Roadmaps addressed

2. Introduction

The European Technology Platform, Alliance for Logistics Innovation through Collaboration in Europe (ALICE), was launched on 11 June 2013, and received official recognition from the European Commission in July 2013. ALICE was established to develop a comprehensive strategy for research, innovation and market deployment of logistics and supply chain management innovations in Europe with the mission: *"to contribute to a 30% improvement of end to end logistics performance by 2030".*

2.1. ALICE Vision and Mission

ALICE is based on the recognition of the need for an overarching view on logistics and supply chain planning and control, in which shippers and logistics service providers are indispensable and should closely collaborate to reach sustainable and efficient logistics and supply chain operations.

The key idea behind the logistics and supply chain planning and control concept is the recognition that decisions on a supply chain level may have effects on transportation that far outweigh decisions made in the transport area solely. At the same time, these effects can only be reached if shippers and logistics service providers join hands. An example is the decision to transport components instead of full products and postpone final product configuration until close to the customer which serves sustainability (people, planet, profit) in a broad sense because of both less inventory investments due to uncertainty reduction, and increased loads of the transport means used due to a far higher packing density. Many shippers start to realize that efficient and sustainable logistics (referring to energy usage and environmental footprint) are two sides of the same coin. However, the decision to redesign the supply chain accordingly is typically a manufacturer/shipper decision, not a decision taken by the transport sector itself being a key challenge to overcome in today´s logistics.

Enlarging the scope to fully include decisions made in the shipper's boardrooms means considering not only *"how to transport"* but also *"what, when and where to transport".* That is, we do not only view (multimodal) transport as such but also strategic decisions on a logistics and supply chain level that strongly influence economic, ecological and social effects of transportation.

One of the key elements identified by ALICE as the Vision to achieve *a 30% improvement of end to end logistics performance by 2030* is The Physical Internet (PI) Concept[9]. The PI Concept is based on an open global logistic system founded on physical, digital, and operational interconnectivity, enabled through encapsulation of goods, standard interfaces and protocols, with the aim to move, store, produce, supply and use physical objects throughout the world in a manner that is economically, environmentally and socially efficient and sustainable.

The mission of ALICE is to contribute to the development of new logistics and supply chain concepts and innovation for a more competitive and sustainable industry. ALICE aims to accelerate the deployment of more efficient, competitive and sustainable logistics networks at the service of today´s

[9] Ballot, E., B. Montreuil, and R.D. Meller, The Physical Internet: the network of logistics network. PREDIT. 2014: La Documentation Française. 271p.

and future supply chains. To accomplish this mission, ALICE brings together as primary stakeholders: shippers and logistics service providers, as well as other relevant stakeholders including but not limited to: transport companies, terminal operators, support industry (Finance, ICT, Equipment/vehicle/vessel manufacturers, infrastructure providers, inspections) and research and education institutions to:

- Define research and innovation strategies, roadmaps and priorities agreed by all stakeholders to achieve ALICE Logistics vision.
- Foster innovation in logistics and supply chains, stimulating and accelerating innovation adoption in order to make possible the growth of the European economy through competitive and sustainable logistics.
- Raise the profile and understanding of new logistics technologies and business processes, monitoring progress and adjusting research and innovation roadmaps accordingly.
- Contribute to a better alignment and coordination of European, national, regional innovation programs in logistics.
- Provide a network for interdisciplinary collaborative research involving industry, academia and public institutions.

2.2. ALICE Research and Innovation Roadmaps, Milestones and Expected Impacts

ALICE Working Groups, composed of industry, academia and public bodies analyse and define research and innovation strategies, roadmaps and priorities to achieve ALICE Vision and Mission. These Working Groups are:

2. Sustainable safe and Secure Supply Chains
3. Corridors, Hubs and Synchromodality
4. Information Systems for Interconnected Logistics
5. Global Supply Networks Coordination and Collaboration
6. Urban Logistics

In December 2014, each of these working groups delivered a research and innovation roadmap[10] including research and innovation gaps and challenges that need to be addressed to drive the process from current situation to achieve ALICE Vision and Mission.

Different milestones were identified as core elements to achieve the vision in each of the areas as shown in Figure 1. This implementation plan is specially targeting to achieve milestones set for 2020 and also paving the way to achieve 2030 milestones, while 2040 and 2050 are more about functionalities enhancement and wide deployment.

[10] ALICE Research and Innovation Roadmaps (www.etp-logistics.eu/?page_id=13)

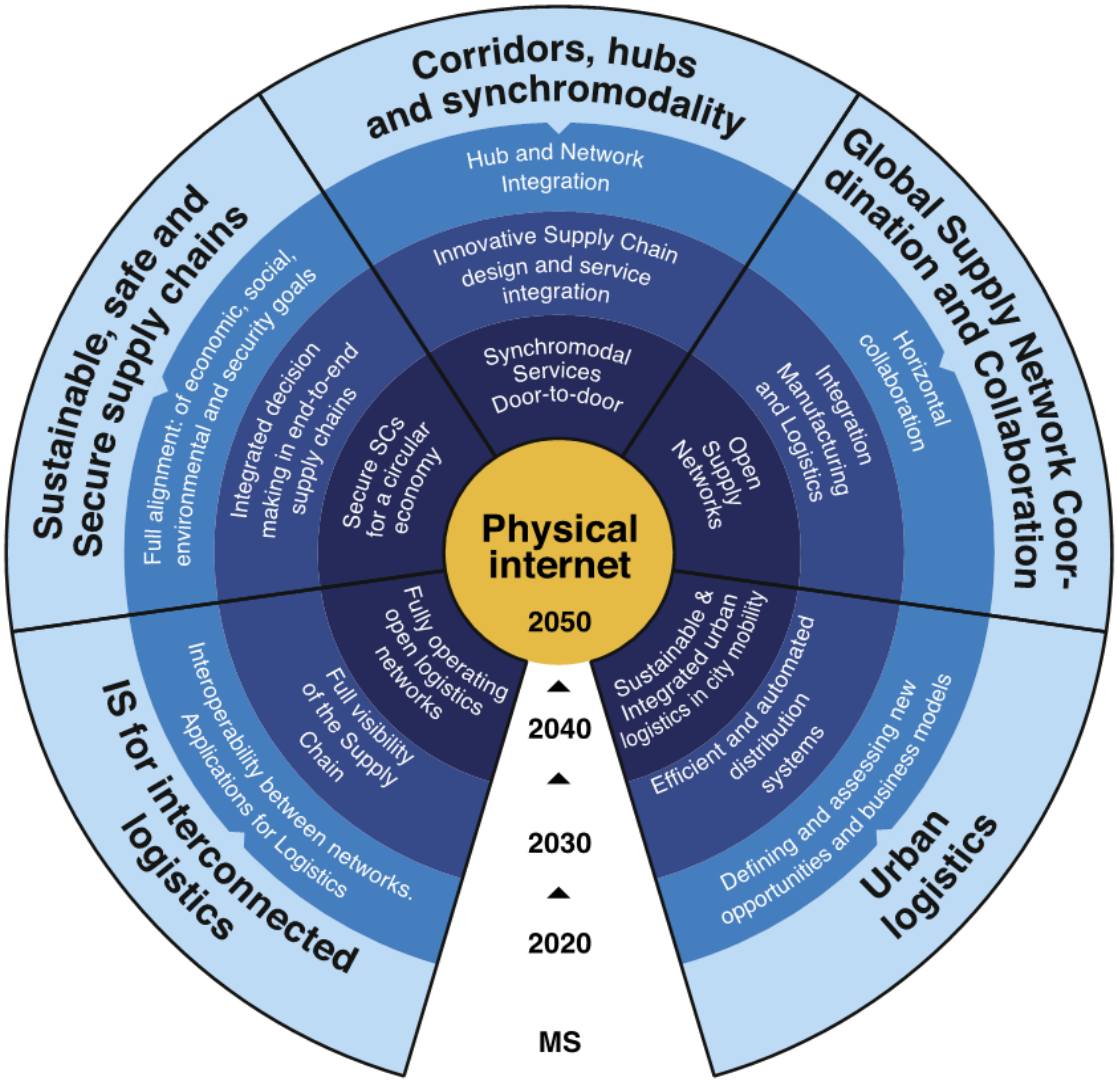

Figure 1 Milestones towards the Physical Internet

ALICE roadmaps identified expected impacts that should be addressed in order to "*contribute to a 30% improvement of end to end logistics performance by 2030".* These impacts should have a societal, environmental and economic approach based on the concept of the "triple bottom line." Therefore, expected impacts were identified in three dimensions: People, Planet and Profit.

The impacts discussed below are separated into one of these three categories for a more intuitive understanding by stakeholders.

The impacts were divided into primary and secondary impacts (Table 2). While primary impacts are the ultimate expected impacts, the secondary impacts will have a positive influence on the primary ones. For example, Energy Consumption is a primary impact while increasing load factors of vehicles is a secondary impact that positively influences energy consumption as well as other indicators such as emissions reduction.

Table 2 Expected impacts from the implementation of ALICE roadmaps proposed actions.

	Primary Impacts	Secondary impacts
People	+ Increase customer satisfaction + Products availability + Secure societies	+ Load factors: weight and cube fill of vehicles - Empty Running Kilometres + Volume flexibility (Time to +/- capacity) + % Synchromodal + Asset utilization + Supply Chain Visibility + Reliability of transport schedules + Perfect order fulfilment + Transport routes optimization (reducing Kms) + Transport actors using automatic data exchange + Cargo and logistics units integrated in the automatic data exchange + Upstream/Downstream Supply Chain Adaptability and Flexibility + Decoupling logistics intensity from GDP - Waiting time in terminals - Risk factor reduction - End-to-end transportation time - Travel distance to reach the market - Lead times
Planet	- Energy consumption (kWh Logistics/GDP) + Renewable energy sources share - CO2 Emissions	
Profit	+ Return on assets and working capital - Cargo lost to theft or damage - Total supply chain costs	

2.3. The Physical Internet Concept

The Physical Internet (PI) is based on the universal interconnection of logistics services, where goods travel in modular containers for the sake of interconnection in global and open networks of transport and logistic assets, hubs and resources. The system will be based on physical, digital, and operational hyper connectivity, enabled through modularization as well as standardisation interfaces and protocols.

The PI offers a new way to look at the consolidation problem and logistics at large, aiming to achieve an order of magnitude improvement of efficiency and sustainability of freight transport and logistics with its full implementation. This approach aims to universally interconnect logistic networks as the Internet does with computer networks. It can be seen as a generalisation of pooling and bundling where coordination complexity is addressed by standardisation and protocols. The concept involves generalising the use of modular handling containers in inland logistics in addition to swap bodies to give shippers a private space in open networks and routing them like 'packets' similar to information in the Digital Internet, yet in a manner adapted to the needs of logistics that has to harness the distinct characteristics of information and goods flow. As a first consequence, the PI does not deal with goods of various shapes, sizes and materials. But rather it will use a set of smart and secured containers,

namely PI-containers, with modular dimensions and standardised interfaces for handling improvement and communication. This allows the integration of all kind of services into PI supply chains. Furthermore, the PI enables the interconnection of different existing networks, thus developing a global meshed network with plenty of transport services as well as storage facilities available for every shipper making logistics services more accessible to all kind of companies. Such a network will be more efficient, more sustainable and also much more resilient. Furthermore, it offers an opportunity to develop new services to consumers, such as enhanced data management and coordination of supply chain processes (i.e. manufacturing, logistics, etc.).

The Physical Internet therefore is the fundamental background concept that should drive collaboration and coordination initiatives in logistics. For the industry stakeholders, the most important strategic drivers towards the PI are:

- Improving the efficiency and sustainability of the supply chains in agreement with the targets of industry and consumers.
- Lowering the barriers to enter new markets.
- Enabling consumers to gain access to (new) products.
- Increasing the service level of logistics.

The efficiency and sustainability driver corresponds to the core message of the Physical Internet vision so far, that is: by opening the logistic networks and sharing resources, highest levels of efficiency can be achieved, unattainable by any individual company. However, a company will probably not share assets/services in the supply chain if they are unique for its strategic position, i.e., if the logistic service level is a differentiator against competitors, unless a new improved model is in place. But Logistics Service Providers (LSPs) will be more than interested to attract new flows to be managed by their underutilized assets. The maritime container is a good illustration in a particular case of what it could be.

As far as the driver “new markets” is concerned, the Physical Internet opens up new markets by multiplying the sources of supply. New products that were previously unavailable or too expensive to get to a certain market can be matched with new sources of demand, i.e., new retail models and the raising demand from on-line sales and omni-channel.

Full realization of the Physical Internet concept means that logistic assets and services cease to be a differentiator, as they are fully standardized, integrated and shared on a global level. In other words, they will become a commodity available to any sender and receiver and operated according to different service levels requirements and needs. In this final scenario, competition will be no longer based on owned and individually optimized supply chains. Higher-level logistic functions, such as demand-driven network planning, after-sales services and advanced stock allocation, will drive the competition among supply chain leaders.

In our vision, the Physical Internet will be realised in a gradual process where global supply networks evolve organically through three main stages, in chronological order:

1. Fully owned supply chains, where the assets and services are key constituents of the company products/services, as differentiators for the customer. This is the current situation.

2. Horizontal collaboration and vertical coordination in a defined limited network of companies, sharing what are considered “commodity” assets and services.
3. Physical Internet for most goods are moved through PI-container, in a full collaborative network involving multi parties, who are unaware of collaborating, with the lowest costs and maximum availability and service level.

2.4. Scope and purpose of the Implementation Plan

The Implementation Plan focusses on end to end logistics including an overarching view on logistics and supply chain planning and control, in which shippers and logistics service providers are indispensable and should closely collaborate to reach efficient logistics and supply chain operations.

Figure 2 shows the view on supply chain logistics addressed in ALICE.

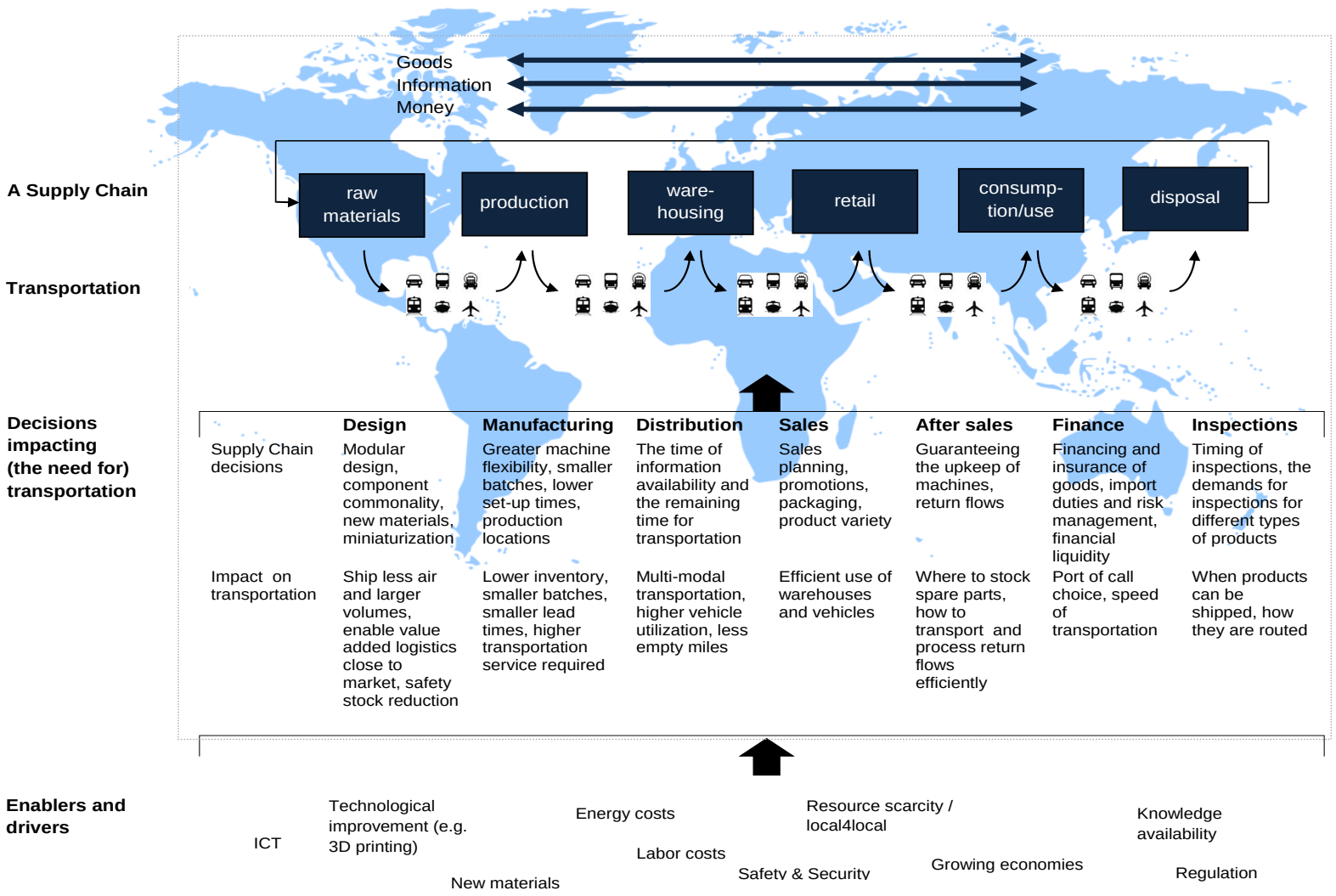

Figure 2 Logistics and transportation flows in supply chains

LOGISTICS & SUPPLY CHAIN MANAGEMENT

Effectively and efficiently design, organize, plan and perform logistical activities including: the management of flows, information and money across multiple chains from sourcing to the final customer including reverse flows.

The aim is to maximize the value of a product or service with sustainable use of required resources.

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2.5. Methodology

Several workshops have been performed in order to gather input, ideas and build consensus among industry, research and policy makers on the topics included in this Implementation Plan following a bottom up approach. The process has been developed in 4 phases:

Phase1: ALICE Working Groups small focussed workshops:

WG1. Sustainable Safe and Secure Supply Chains. Brussels, 30.10.2015 (15+ attendees)

WG2. Corridors, Hubs and Synchromodality. Rotterdam, 03.11.2015 (15+ attendees)

WG3. Information Systems for Interconnected Logistics. Berlin, 27.10.2015 (12 attendees)

WG4. Global Supply Networks Coordination and Collaboration. Brussels, 03.11.2015 (25+ attendees)

WG5. Urban Logistics. 26.01.2016 (25+ Attendees)

The sessions addressing the Implementation Plan (Agendas in the annexes) were structured in the following way:

- Short introduction of ALICE related roadmap and background.
- Individuals were given 10 Minutes to think 3 major issues/opportunities that should be worked on in projects.
- The major issues and opportunities were afterwards shared by the individuals and grouped in themes.
- Smaller groups of 3-4 people were appointed to work on each of the themes for 30 minutes to define:
    - Title
    - Identification of the problem and opportunity.
        - What needs to change and into what needs to change.
    - Scope:
    - Expected impact and expected results
- Smaller groups reported the outcomes to the whole group. The rapporteur was in charge to elaborate a draft after the meeting consolidating additional inputs from present and non-present members.
- In total, 38 topics were identified during the 5 workshops

Phase2: ALICE Executive and Steering Group Sessions:

- The outcomes of the meetings and the identified topics were discussed with the members of the Executive and Steering Group in a meeting on the 15th of November 2015 in Brussels.
- SETRIS partners prepared a revised version of the topics to include Steering Group Comments and shared broadly with ALICE Members.
- As a result, some of the topics were combined and merged resulting in a list of 32 topics.

Phase 3: Consolidation of topics and broader discussion. Vienna Workshop.

- A major Workshop was organized in Vienna with more than 100 attendees.

- A survey was launched among workshop participants and prior to the workshop to prioritize topics to be discussed out of the 32 identified so far. The result served to structure the workshop, giving more time for discussion to those topics with higher priority.
- The 100 attendees were divided in groups of 12-14 people before the start of the workshop.
- Each of the groups participated in one of the 8 "corners". In each corner one of the 28 prioritized topics was addressed. The following questions were addressed with input of each individual:
    - What are the key elements regarding this topic? (maximum 3)
    - What is missing (in your opinion).
    - What would you expect to get out of this as an outcome?
- The process was repeated 9 times, so we have 72 specific sessions. Some of the topics were discussed by different groups of people (up to 4) depending on the prioritization and voting.
- The organization of the workshop was evaluated very positively among participants as it allowed a lot of engagement and sharing of ideas.

Phase 4: Consolidation and finalization

- Setris partners consolidated the input received during the workshop in Vienna including a revision of the participants in the different workshops.
- The resulting description of the topics was broaden enormously, therefore the topics included a very well detailed and comprehensive identification of the challenges. See chapter 3.
- Moreover, additional topics were identified and other were merged resulting in a list of 30 topics.
- ALICE Executive Group proceed to an internal synthesis of the major aspects and challenges in the topics as included in chapter 2.
- A meeting of ALICE Mirror Group took place in July 2016, 6th and 7th in Milton Keynes were the topics were presented and discussed.
- A new round of comments was opened among ALICE members and the Mirror Group until the 15th of September.
- As a final stage of this analysis, the topics were presented in ALICE plenary meeting on the 14th of October and a prioritization process was developed.

3. Implementation Plan: Topics in a Nutshell

As a result of the activities performed, 29 differentiated topics have been identified as the key logical steps in the implementation of ALICE Research and Innovation Roadmaps

- Sustainable Safe and Secure Supply Chains.
- Corridors, Hubs and Synchromodality.
- Information Systems for Interconnected Logistics.
- Global Supply Networks Coordination and Collaboration.
- Urban Logistics

These 29 topics contribute to achieve the milestones in Figure 1. A summary on how the topics impact the roadmaps as well and contribute to achieve milestones in Figure 1 can be found in Table 1.

Some of them are partially addressed by running projects or potentially by future projects in open calls. Others are brand new and should be addressed in the upcoming 3 to 5 years through a common effort

at European, Member Stage and Regional level with the leadership of industry and research stakeholders,.

In this chapter, an overview of all topics identified is included. For further details and information, please refer to chapter 3.

3.1. Secure data exchange and access to build trust

Challenge: One of the major barriers preventing stakeholders to enter in automated data exchange in B2B and B2Platforms interaction concerns data confidentiality and unauthorized intrusion and usage, specially of sensitive (commercial) data. The challenge is to ensure the '*trusted*' and '*seamless'* access for supply chain stakeholders. Projects should focus on ensuring **data exchange and access in a secure, controllable and trusted way** by stakeholders but at the same time, providing **easy many to many connectivity, facilitating generic data exchange**. It also requires that supply chain data and information is visible and standardised on an international scale.

Outcome:

- **Mapping and addressing real issues and barriers** preventing data sharing and exchange on top of privacy, security and trust such as behavioural aspects and perception on sharing data and associated business models.
- **Provide safe and secure access to supply chain information**. The scope covers B2G, G2G, B2B, B2Platform and B2C information flows including reverse flow of information in order to accompany truly closed loop supply chains reducing administrative burden.
- Provide an **international governance structure, including legislative issues and standardisation** in order to ensure the development and implementation of seamless and trusted mechanisms. This includes B2G, G2G, B2B, B2Platform and B2C exchange of information in order to ensure common governance throughout the EU (and beyond).
- **Facilitate sustainable and secure data networks enabling new business models to emerge**. This means designing and testing of these data networks and preparation of demonstrations in practical applications. It should be taken into account that new networks need certification to ensure trust between users.

Impacts & Targets:

- Clear path to secure and trusted digital supply chains resulting in reducing risk, loss and damages.
- Reduced total costs in seamless supply chains.
- Increased efficiency and sustainability in supply chains.

3.2. Effective trade facilitation

Challenge: **The challenge is to improve interaction between business and border agencies.** Based on the experience of ongoing, such as CORE, and previous projects in the area the ultimate goal is to **smooth supply chain flows across borders** (all modes) **and identify innovative approaches and processes to comply with regulation in a more seamless way**. The topic should build on the Digital Transport and Logistics Forum launched by DG MOVE and the actions included there to move current

paradigm to e-freight implementation. The scope should be broader in order to capture not only customs' benefits but also the incentives of businesses involved in cross-border trade.

Outcome:

- **To propose harmonized AEO auditing schemes in Europe.**
- **To develop tools to store and maintain track of compliance of operators in a rated list** (compared to credit rating). As part of this compliance tracking, there is a need to understand and explore what sanctions need to be applied and how to apply them.
- **To identify and address hinders and barriers of simplified procedures**. A potential study could explore how heterogeneously trade facilitation procedures are being applied by customs administrations, how they impact the supply chain business, ending with recommendations/best practices. The study should lead to discover and quantify the impacts of the simplified procedures.

Impacts & Targets:

- Societal security.
- Faster customs clearance implies improved customer satisfaction, products availability and multiple savings for different stakeholders in supply chains.
- Total supply chain costs, especially considering delays at the borders, may be significantly reduced

3.3. Logistics in the full circular economy: New business models for horizontal and vertical collaboration

Challenge: Logistics is a key enabler to ensure sustainability of circular economy by providing smart and sustainable logistics networks and services. This requires to **develop new business models, including bundled services, after-market and reverse supply chains**, addressed with an integral approach not only in the **geographical sense** (urban versus rural and combined) but also integration of **end-to-end supply chain processes addressing scarce resources management**. The challenge is to integrate supply networks, including the reverse part of the chains, to make full utilization of resources within and across supply chains. This also requires the integration and adaptation of supporting supply chain tools.

Outcome:

- **New (business) models and use cases** demonstrating a substantial increase of supply network efficiency and sustainability of **direct and reverse flows management**, that currently are operated separately but could be integrated seamlessly. Determine costs and economic values of such integration and collaboration.
- **Overcome regulation barriers and definition of incentive schemes** for sustainable businesses cases in the circular economy**.**
- **Demonstrators** of hub operations, transport, packaging systems, containerization, handling technologies management, monitoring and tracing of resources throughout supply cycles for direct and reverse flows integration.
- **Better understanding of relationships within and across sectorial supply chains**, identification of material flows, and barriers and opportunities for synergies in the circular economy paradigm.

- **Measure the impact of logistics in the sustainability of circular economy in supply cycles.** Measuring and modelling the logistics performance of different circular economy value chains. Building on existing research on indicators, this requires new sets of widely supported KPI's especially addressing rebound effects, and recognised labelling and certification in value chains**.**

Impacts & Targets:

- Energy efficiency gains by 20%
- Reduction of environmental impact and continuous reintegration of resources by 20%
- Reduction of logistics costs thanks to opportunities of synergic flows by 20%
- Saving resources and materials thanks to reusing and recycling strategies by 30%
- Increase asset availability and quality. Upscaling of existing circular economy approaches by providing standardised logistics systems
- (real time) transparency on freight flows and demand
- Increasing customer and market acceptance of more circular business models.

3.4. Effective assessment and management of the triple-bottom line (People, Planet and Profit) logistics performance

Challenge: **Provide a broadly agreed framework to calculate, report and improve of logistics operations and networks based on the triple-bottom line performance** (people, planet and profit). This means addressing energy use and emissions (including air pollutants and noise with CO_2 equivalent), socio-economic factors (accidents, fatalities) alongside the traditional logistics KPIs that quantify costs, service performance and effectiveness.

Outcome:

- **Develop mechanisms to include other environmental impacts of transport** (not only CO_2), such as noise, black carbon and other pollutants into environmental performance assessment of logistics (if not already achieved by that point) as well as other socio economic factors;
- **Finalise the eco-label design and implementation**, alongside the widespread, detailed industrial testing of the recommended data collection, calculation, reporting and certification processes including certification governance;
- **Test and then promote widespread application of the accounting standard and eco-label scheme in industrial practice** (e.g. within existing management systems as part of a continuous improvement cycle) and policy design to prove its potential contribution to the identification of environmental improvement opportunities that can be incorporated into transport and logistics planning alongside traditional metrics related to cost, quality, safety, etc.;
- **Development of a continuous improvement process** that allows users of the approach to identify areas for improvement and which supports the drive to change;

Impacts & Targets:

- Reduced energy consumption (kWh Logistics/GDP)
- Increased renewable energy sources share.
- Reduced CO2 Emissions (kg CO2/tKm)

3.5. Scenarios for logistics developments

Challenge: A number of policies, socio-economic trends, new and developing technologies are seen as main influencers and potential game changers for certain logistics operations and/or logistics as a whole. The challenge is to **understand how trends, policies and technologies may impact logistics operation and therefore socio-economic aspects such as environment, energy, safety and security, employment and growth.** Projects are expected to identify and assess possible scenarios as well as to build modelling and simulation tools with that purpose.

Outcome:

- **Develop modelling and simulation tools** allowing during and after the project to 1) create different potential scenarios depending on the evolution of the trends, technologies and policies, including cross relation between the different aspects considered and 2) assess the expected socio-economic impact according to those scenarios and considering potential disruptions
- **Simulation of the scenarios** developed by means of modeling tools.
- **Develop recommendations and guidelines** according to analysis of scenarios for governments, industry and other stakeholder groups. Special attention should be given to business models and the opportunity to create socially safer and more secure jobs within the transport business.

Impacts & Targets:

- The project is expected to contribute to logistics scenario building to make optimal utilization of the opportunities of trends, policies and technologies in order to maximize the positive socio-economic impact.

3.6. Synchromodal Hubs collaborative processes empowered by digitalization

Challenge: **Leveraging the potential of hubs,** in particular inland hubs**, through innovative ICT and Digitalization** *(e.g. apps or information brokers)*. Developing ICT architectures and customized solutions enabling collaboration among different stakeholders and ensuring confidentiality based on common business rules. Providing consistent hub applications and transport applications in terms of data governance and technology standards. Improving service quality of multimodal freight hubs with improved data quality and availability following the example of Port Community Systems.

Outcome:

- **Open, service-oriented ICT architectures for hubs**.
- Improved **collaboration among all stakeholders**, including better access of SMEs to the logistics market through an easy and secure access to information.
- New hub-specific functionalities, like **waiting and handling time prediction, incident management, pre-notification, slots management and workflow management**.
- Shared **situational awareness** through enhanced reality applications allowing real time disruption management.
- **Smart synchromodal hubs** enabling dynamic flexibility at the shipper's end, allowing each node to reallocate materials (shipments) in terms of time (reliability, speed) and space (location).

- Contracting arrangements from public to private actors for the usage of shipment, carrier and loading unit data for optimization of processes.

Impacts & Targets:

- Decrease of terminal transport and inventory costs, increased flexibility and resilience of the transport system, and a higher percentage of synchromodal flows,
- Optimization of utilization of resources (available infrastructure, equipment, human resources, etc.),
- Interoperability with existing systems of hubs enabling multimodality,
- Verified business models and collaboration rules as well as data and solution ownership,
- Creation of a blueprint concept of a hub with generic ICT requirements framework

3.7. An adaptive synchromodal European freight network strategy

Challenge: Achieving an adaptive multimodal European freight infrastructure network of networks defining a public/private roadmap for action, including public investments and policies. **Develop the framework conditions for a European freight network that is transparent, robust and resilient to traffic incidents, geopolitical changes and other external factors like climate change.** Network analyses and optimization to nominate key inland freight hubs and service corridors of European importance and introduce a network strategy to allow Pan-European traffic by all modes of transport. Pull together current hub and corridor developments into one coherent framework serving the manufacturing and logistics industry.

Outcome:

- A **strategy for synchromodal European freight network integrating core and comprehensive networks**, including inland waterways network and city networks. Creation of a blueprint concept of a network with generic organisational, technological and infrastructural requirements framework.
- **Alignment of innovative technologies** supporting different processes along the network e.g. mode-free planning, booking and trip management.
- Research on flow development, shipment preferences and transport customer choice behaviour including definition of **synchromodal KPIs**. Develop a booking system for multimodal transport on top of TEN-T Corridors.
- **Guidance for the development of the TEN-T for freight transport in connection to global corridors** (e.g. China's One Belt) considering the core network for long distances and Comprehensive network for last-mile access.

Impacts & Targets:

- Decrease of transport and inventory costs, increased flexibility and resilience of the transport system, and a higher percentage of synchromodal flows.
- Optimization of utilization of resources (available infrastructure, services, equipment, human resources, etc.)
- Additional impacts on greening of transport through modal shift away from road transport.

3.8. Development of a Synchromodal Network of Networks

Challenge: While the previous topic is more directed to policy makers and infrastructure managers in order to define appropriate strategy for public infrastructure management and development, this topic is targeting synchromodal operators and hubs to **develop synchromodality and enlarging current synchromodal networks** by improving and developing (new) **business models**. Visualize and demonstrate the potential of creating a network of synchromodal networks in Europe. Demonstrate overall business model, including the governance and operational model that would make it sustainable. Propose a roadmap for transition to the future situation.

Outcome:

- **New business models to deliver transport services between different hubs** with (almost) full asset utilization of different transport modes.
- **Expansion of synchromodal services** towards continental freight transport for all sectors and all goods, including pallet cargo of the manufacturing and retail industries and bulk cargo.
- **Demonstration and pilots of collaborative-multi-stakeholders synchromodal networks** to achieve end-to-end efficient, sustainable and effective logistics solutions.
- **Identify and create new added value** within the logistics network(s) with the aim to enable smooth **transition to the Physical Internet** and support the necessary **change management**.

Impacts & Targets:

- Achieve overall 70 % load factors in synchromodal operations and 15% increase on modal shift.
- Reduction of energy consumption and CO_2 emissions by 20% transport operations
- Increased efficiency and effectiveness of infrastructure use.

3.9. Integration of information systems for cargo, transport and traffic

Challenge: **Overcoming fragmentation of information and systems between 3 silos - cargo information, service information and traffic information**. Achieving technological and organisational integration of information as well as between public and private actors allowing visibility and transparency in the supply chain. Appropriate business models and mind shift of transportation providers, LSPs and shippers together, towards more integrated and connected logistics allowing to achieve exchange of loads across service providers, transport modes and networks.

Outcome:

- Creation of an interoperable environment for a collaborative network with generic organisational, technological and infrastructural requirements for **cargo, transport and traffic system integration**:

- **Technological Integration** between platforms through interfaces based on data structure standards,
- **Organizational Integration** through identification of legal and administrative barriers and recommendations on how to reduce them, trust building and introduction of business models and collaboration rules,
- Integration between **Public and Private Actors**/Information.

- **Trust-building** for **collaborative IT systems between shippers, service providers, carriers and infrastructure providers/traffic managers** allowing dynamic planning and booking of freight services. *(in coordination with topic Nr. 1)*
- Verification of **business models and collaboration rules**.

Impacts & Targets:

- Increased flexibility and resilience of the transport system, and a higher percentage of synchromodal flows.
- Optimization of utilization of resources (available infrastructure, services, equipment, human resources, etc.).

3.10. Green logistics networks: Carbon and Beyond

Challenge: Adopt **systemic approach for Green Logistics, extending the design of green hubs and corridors into green networks able to support the achievement of EU sustainability goals** and favouring the coordination among transport corridors and enabling the interoperability among smart logistics networks. Establish standardised **multi-Criteria evaluation methodologies (including cost analysis)** for ex-ante and ex-post evaluation towards the establishment of virtuous circle of Green Certification for Companies and Consumers' increased awareness, exploiting IoT potential as complementary to topics 4, 6, 8 and 9.

Outcome:

- Development of required network performance (green hubs and corridors) measured through standardised KPIs to achieve sustainability objectives.
- Development of system-based energy optimization for logistics, possibly including reverse flows / circularity from a PI perspective.
- Hubs re-design requirements as linking hinge in a EU logistics system greening strategy.
- New business models for achieving green logistics.
- Education for all supply chain actors to increase better use of assets and Consumer awareness.

Impacts & Targets:

- Reduction of Energy consumption (kWh Logistics/GDP)
- Reduction of CO2 Emissions (kg CO2/tKm)

3.11. Sustainable Integration of new manufacturing developments: Industry 4.0 in supply and logistics networks

Challenge: Industry 4.0 is impacting supply and logistics chains. The challenge is to define **business models and demonstration cases** to develop and adapt **new functionality of the logistics system** to take the **full potential** out of the **new production models** in a **sustainable** way**.** Dematerialization and additive manufacturing, mass customization, on-site production, agile, cloud- and IoT-based manufacturing or manufacturing farms and associated services like quality controls, assembly and spare part management will affect the way products are produced, transported, stored and distributed hence impacting transport and logistics demands in terms of volume and new service requirements.

Outcome:

- **Evaluation of potential impact of manufacturing and Industry 4.0 innovations on transportation and logistics**: business and operational models, logistics and transportation process, cost-benefit and how to prepare the business environment to cope with these changes.
- **New value-adding services and expected roll out**, e.g. concepts for manufacturing farms/clusters, dematerialization and new value added services: quality control, assembly, spare part management in industry 4.0 paradigm.
- Agile Network of Factories of the Future: **Demonstration actions and pilots on new logistics services and systems enhancing industry 4.0.**
- Synchronization of end-to-end supply chains to real customer/consumer needs, by **merging Physical Internet and Manufacturing 4.0**

Impacts & Targets:

- Increase of product availability and customer satisfaction.
- Reduction of transportation cost, energy consumption and GHG emissions by creating more efficient networks of manufacturing and logistics
- Decoupling growth of Transport from GDP

3.12. Open system of systems for self-organizing logistics

Challenge: Logistics services and resources are more and more openly available and accessible by the users through market places, booking platforms and other online resources. The challenge is to **get end to end solutions for a specific transport/logistics demand**. Therefore, emerging architecture of intelligent, complex systems should be used in supply and logistics to enable **emerging behaviour in self-organizing logistics** (i.e. logistics systems providing solutions for a certain need or demand). These emerging architectures should support privacy, commercial sensitivity, liability, and (compliance) legislation. Interoperability is a basic feature of the architectures, enabling organizations to register, connect and be able to perform business.

Outcome:

- **Self-learning, self-adjustable and self-organizing systems for supply chain composition** based on available services, including a new broad range of connected devices, hardware and software.
- **Impact analysis on organizational aspect, governance, business continuity, value models and mind shift of the supply chain planners.**

Impacts & Targets:

- Optimizing resource utilization: load factor, assets, contribution to reduction of infrastructure – and hub congestions, etc.
- Reducing customer supply time.
- Increase flexibility and agility contributing to resiliency.

3.13. Collaborative data analytics for logistics and supply networks

Challenge: **Leverage the potential of data analytics to increase supply networks performance**, resiliency, improved forecasting and planning flexibility, reduction of inventory and identifying bundling opportunities increasing load factors and asset utilization. The challenge is to **realize**

opportunities in terms of efficiency, energy utilization and emissions in the area of logistics related to big data.

Outcome:

- **Applying (existing) data analytics algorithms for pattern detection**. It should result in **multi-tier collaboration in open supply – and logistics networks**.
- **Machine learning, predictive analytics and pattern recognition/detection applications** based on all relevant data. Downstream predictive analytics data for upstream optimization in the supply chain.
- **Demonstration of environment and supporting facilities for proof-of-concepts**. Address aspects like trust and data governance. Investigate any potential barriers and triggers for change.

Impacts & Targets:

- Reduced energy consumption (kWh Logistics/GDP)
- Reduced CO2 Emissions (kg CO2/tKm)
- Reduced total supply chain costs

3.14. Affordable Collaborative Intelligent Transport Systems solutions (C-ITS) for end to end logistics applications

Challenge: **Leverage C-ITS potential for end to end logistics applications** including real time optimisation of delivery schedules and routes, corridors and hubs management reducing empty trips, waiting time in terminals, optimizing transport (e.g. thanks to automation), ensuring integrity of the cargo and protection against damage and theft. Develop and showcase viable innovative (shared) business models in order to incorporate the while taking into account the specific needs of the logistics sector.

Outcome:

- **Develop and demonstrate C-ITS applications and business cases for logistics**, including **corridors management**, end-to-end, first and last mile delivery, trucks platooning, **transportation routing optimization, delivery execution, and terminals management:** loading and unloading reducing the waiting time in terminals.
- **Measure performance, impact and potential of deployment** of the tested business cases through specific quality indicators.
- Build on the ITS directive (2010/40/EU), **identifying good practices and lessons learnt** potentially transferred from the transportation of people to the transportation of goods.

Impacts and expected Targets:

- Increase energy efficiency by 10 % and increase traffic safety.
- Minimize waiting time in terminals increasing at the same time management capacity of terminals with already available infrastructure.
- Demonstrate business cases achieving an increase in load factors from 50 to 70 % and reducing empty trips by 20 %.

3.15. Logistics operations automation: The Matrix for Logistics

Challenge: **Show the value** of consistent, low cost, sustainable, collaborative, dependable, reliable, scalable, flexible and **automated supply chain (physical) operations** based on developments in the area of robotics, drones, augmented and/or mixed reality, autonomous transport, modular packaging and comprehensive automation.

Outcome:

- **Demonstration of improved performance in real human-machine cooperative systems** for applications and **use cases development** in transport automation, transhipment, last-mile deliveries, port and airport operations, terminals connection to warehouses and hubs, warehouse movements and operations, inbounding to manufacturing lines, etc. Explore modularity as an enabler**.**
- **Novel business and financial models** including a **roadmap and plan for broad deployment** identifying small initiatives and realizable projects but should fit together contributing to this end. **Feasibility study** of how current infrastructure can be used as an (basic) asset to deploy automated supply chain operations.
- **Socio economic and legal aspects** including, human-robotics environments user acceptance, employment and new skills required. Develop a socio-economic impact analysis.

Impacts & Targets:

- Reduce transhipment costs promoting co-modality and multimodality.
- Faster and more efficient goods and container consolidation and de-consolidation.
- Recommendations for regulatory and legal changes to realize fully automated and autonomous logistics operations.

3.16. IoT large scale pilots in the field of logistics

Challenge: Logistics is a domain that can truly benefit by an interconnected world, addressing issues such as goods shortage, overstocking and perishable goods management. IoT is an enabling technology that has been incorporated in a limited set of applications and scale in logistics systems and supply networks. The challenge is to **leverage the value of The Internet of Things as one of the key enablers to realise the vision of the Physical Internet** (i.e. Distribution of functions among objects in the PI).

Outcome:

- **Large scale pilots of IoT in logistics**, covering the whole value chain and addressing the following topics among others:
  - Logistics in the full circular economy: New business models for horizontal and vertical collaboration.
  - Integration of information from cargo, transport and traffic for enhanced efficiency and sustainability.
  - System of systems for self-organized logistics.
  - Logistics operations automation.
- **Governance and business models** for the **operation of such networks with shared assets and shared information**. Security, privacy and trust between network partners.

- **Linkage of Physical Internet** concept and logistics with IoT existing initiatives: like the European Technology Platform on Smart Systems Integration (**EPoSS**), the IoT-Forum or the Alliance for Internet of Things Innovation (**AIOTI**).

Impacts & Targets:

- Decrease of (human) errors within the supply chains
- Increase asset utilization and load factors.
- Increase Supply Chain Visibility.
- Reduce cargo lost to theft or damage.

3.17. Development of a strategic European industry supply network design towards TEN-M (Manufacturing)

Challenge: **Strengthen the value of TEN-T (**corridors, hubs and associated transport services) **for manufacturing industry.** To that end, **Strategic Supply Network design based on demand and supply concentrations of European Manufacturing industries.** Supply chain infrastructures and services utilization might be close to optimal from an individual company's perspective, but considering aggregated supply and demand from many companies, many more opportunities for bundling, back loading, modal shift, increase in frequency of deliveries and smaller quantities etc. are opened up. **The challenge is to overcome and ensure shippers collaboration requirements to stablish the industry supply networks.**

Outcome:

- A **shipper industry-driven approach creating rationalized transport and logistics networks** benefitting from the intra-industry and public-private synergies of joint customer locations, conditions, load carriers etc.
- **Creating shared manufacturing services for late product differentiation/ customisation/ personalisation in existing open regional Logistics Hubs**.
- Assessment of current cost and footprint, and **demonstrated value of an optimized collaborative network in various scenarios of collaboration**.

Impacts & Targets:

- Increase of product availability through a smarter network and response time.
- Reduction of energy and GHG emissions by 30% increased load factor and 20% less physical transport.
- Supply chain costs are expected to decrease by 15-20% through optimal supply network use.

3.18. Horizontal collaboration cases and best practices

Challenge: Identification and analysis of **innovative business models and cases towards open and collaborative markets pursuing asset sharing and collaboration**. Specially identifying enablers and barriers for those cases as well as the tools used to put them in place. Define paths and roadmaps for transferability and ample deployment after the success of CO3 and new market generated. Assessing human factors and organizational behaviours.

Outcome:

- **Best practices and business cases** should be identified, analysed and further exploited addressing shippers and logistics service providers.
- Advanced **business models for shipper's horizontal collaboration cases assessing different roles and governance**, as well as **legal** aspects.
- Advanced understanding of the **impact of human factors and organizational behaviours towards trust and adoption of open collaborative systems**.

Impacts & Targets:

- Increase asset utilization in the selected cases up to 80% load factor and achieve 15 % of modal shift.
- **Clear path for transferability and promotion of cases should be addressed**

3.19. Connected services for horizontal collaboration

Challenge: **The main goal of this topic is to prove the viability of the concept where the groups of horizontally collaborating shippers are connected to collaborating transport providers via systems** including standardised and transparent (legal) frameworks for participants to enter and exit in efficient combinations of collaborating networks. **Demonstrate how independent Control Towers** (coordination and management of networks of different supply chains) **and/or freight exchange platforms** could be linked, merged and/or work collaboratively to further exploit their potential.

Outcome:

- Interoperable systems that can be trusted as an **open platform of platforms to implement new collaborative business models** such as interconnected transport market places, control towers, booking systems, supply chain composition, etc. An increase in connectivity of different platforms already providing horizontal collaboration services and/or control towers is expected.
- **Motivation for different parties, minimum set of rules, regional differences etc**., Stimulating behaviour of logistics decision makers in expanding networks as a tool that helps companies to increase their, and the whole supply network, efficiency and sustainability.
- **Frameworks and systems to connect different networks of horizontally collaborating shippers as well as collaborating transport providers**; these will serve as a big step towards PI.

Impacts:

- Transport routes of connected networks show a further 15- 20 % increase in load factors and decrease in supply chain cost.
- Energy use and GHG emissions are reduced with a further 20 %.

3.20. Physical Internet business cases demonstrations

Challenge: **Speed up the process and transition towards the new physical internet paradigm** demonstrating how different technologies, business use cases and standards come together to create the basis for deploying Physical Internet in real-world applications delivering value to its users and positive impacts in terms of emissions and energy consumption.

Outcome:

- Collect and analyse already running or established single projects/initiatives that could be seen as puzzle part of PI and **propose and implement business use cases of Physical Internet** to increase asset and energy utilization minimizing environmental impacts.
- Develop **novel business models** (including sharing policies) and their feasibility to be smoothly integrated into the existing logistics ecosystem **transitioning from current paradigm to Physical Internet one.** Roll-out and deployment strategies for the use case/s at European/Worldwide level.
- **Address socio-economic impacts, policy, regulatory and standardization recommendations** to speed up the process.

Impacts & Targets:

- Achieve overall 80 % load factors in the selected use cases and 20% modal shift.
- Reduction of energy consumption and CO2 emissions by 30% in the network.

3.21. Mapping models, roles, behaviours and coordination for migrating to PI

Challenge: **Strategy for the transition of the existing logistics service market into open configurable and collaborative networks of the Physical Internet.** Is this strategy supporting the business dynamics of tomorrow's supply chains?

Outcome:

- A proven **analytical economic model to evaluate the necessary investments of the different actors into Physical Internet**, that includes all possible streams of revenue and cost of utilized and shared resources.
- The appropriate **business model including governance and legal structures** for the Physical Internet.

Impacts:

- Stakeholders in open collaborative networks can calculate the economic effects on their business model
- Demonstration of the economic and environmental effect of the transition to PI for stakeholders.

3.22. Business role of SMEs and (end) customers in the PI

Challenge: **Develop, test and validate, through real life pilots, new business models for SMEs that can safeguard their agility and leanness in the Physical Internet paradigm**. The new business models definition shall include and address technology requirements, know-how and rules to participate in PI.

Outcome:

- **Pilots involving SME's as part of a diversified community/cluster formed by more actors of the PI**, demonstrating: (i) Cooperative organization and collaboration between big and small companies; (ii) Different approaches for different types of SMEs; (iii) Inclusive PI, involving companies of any size and geographical location.
- **Concrete examples of business models for SMEs** and their interacting partners, **demonstrating the advantages of participating in the establishment of PI.**

- **Finding ways to reach SME's and communicate to them, the PI opportunity**

Impacts:

- Business models, including requirements and roles, to make PI attractive not only for bigger companies but also for SMEs, so they can play an active and profitable role.
- Demonstration cases that PI will lead to cooperative organization and collaboration between big and small companies.
- Process innovations providing measurable benefits (benchmarks) for SME's on the marketplace (e.g., ROI, jobs creation).

3.23. Integrated data framework and Big Data analytics assisting decision-making in urban freight transport

Challenge: **Smarter and holistic data collection and management** need to be taken in proper consideration according to two perspectives, jointly affecting decision-making and overall efficiency of the urban transport system: **business outlook and freight mobility planning / network management**. Big data analytics will offer greater opportunities to **link freight operator's decision making with city planners decision making** (e.g. urban network planning) in order to achieve **resilient, optimised, sustainable and cost-effective governance of the city and more competitive position of business actors.**

Outcome:

- **Structured knowledge base on current applications of Big Data in urban freight transport.** Identification of good practices of value added applications of Big Data management and linked KPIs to elicit the potential and added value of such applications **to improve decision making in urban freight transport** (both private and public sectors);
- **Development and testing of evidence-based business cases**, achieving **positive impacts on energy use, environment and resilience of cities** in facing megatrends impacts (e.g. sharing economy – crowd-sourcing; social and demographic evolutions; e-commerce, etc.).
- **Roadmap of research to mitigate gaps between private & public decision-making** and improve the adoption of suitable methods. Incentive schemes will be supporting optimal and integrated use of big data in freight transport decision making for both private and public sectors.

Impacts & Targets:

- Better use of predictive analysis to achieve economies of scale in accessing data (accessibility of public sector to private data - lower cost than 20% - 30% and lower time);
- Faster development of big data program and regulation frameworks in public sector and reduced procurement time frame for the use of private big data;
- Resilient use of city transport network (optimal network capacity with increased use of 15-20%);
- Engage with the public sector to profit from potential collaboration / dialogue with private sector.

3.24. Exploring new opportunities for achieving effective integration of urban freight and personal mobility services and networks

Challenge: Further **exploitation of the potential of integration between urban freight and passengers transport systems and networks** is needed to optimize the use of the road, rail and inland waterways infrastructures in space and time, contribution to get healthier cities in terms of less traffic and congestion. This requires a change of paradigm towards a **freight/passenger integrated mobility planning** and explore more opportunities and new business **models for integration of urban freight with private or public transport at infrastructure and transport vehicle levels**.

Outcome:

- **Tools, methods and data sources** to identify and assess **opportunities of flows integration** and support the development of **integrated mobility plans.**
- **Evaluation of different measures for freight and passenger integration** and define **resilient governance models and incentives/enforcement system.** Evaluation in terms of environmental and social impact, level of traffic decongestion, job creation, economic impacts, through pilot testing at different type and size of cities is needed
- **New concepts and technologies contributing to a better integration of freight and passenger flows** including: IT, vehicle architecture, containers and logistics unit design and operation, transhipment and handling technologies.
- Development of **business models offering and extending mobility as a service (MaaS) to connect people and goods movements.**

Impacts & Targets:

- Increased use of assets and infrastructures by 10%
- Reduction of congestion and CO2 emissions by 15% through use of public transport network for freight deliveries.

3.25. Improving the link between urban and long distance freight transport services and infrastructures

Challenge: A major challenge to **reduce freight transport movements, congestion** and to increase the load factor in urban areas is the **optimization of the links between urban and long distance transport**. This suggest the exploration of **new delivery models where connected hubs at different levels are shared by different retailers/suppliers to enter the city, and green vehicles are used for the last mile.** A number of **soft barriers including business models and collaboration** need to be tackled to achieve a full realization.

Outcome:

- **Analytic models and tools for urban planners to decide on optimal location and size of connected urban hubs and transport means** taking into consideration current and future flow demand, demography, etc. for different city segments and scenarios.

- Pilot solutions for optimising the use of **Urban Consolidation Centers and micro platforms exploiting horizontal and vertical collaboration**, supported by IT solutions which enables visibility of flow data for all actors.
- Pilot and **evaluate different business and governance models** by defining roles and responsibilities for all actors, rules for hubs, ownership of the services and interactions between actors

Impacts & Targets:

- Increased use of assets and infrastructures by 30%.
- Reduction of congestion and CO2 emissions by 30% through optimization of traffic between hubs and urban areas, improvement of load factor and use of green vehicles.

3.26. New business models for logistics services based on sharing economy

Challenge: Consumers and other stakeholders are showing a strong interest in the sharing-based economy. Re-thinking the value of "*ownership*" and "*use*" is the new disruption, especially in urban logistics. There is the need to **find new approaches to unexplored potentials or emerging peer-to-peer (P2P) business / business – to – consumers (B2C) opportunities in freight market**, making them attractive and widely accepted. This lead to solutions to increase reliability, trust in transactions, higher investments and assets / payoffs sharing, in order to find new multi-stakeholders metrics for urban logistics sector sustainability.

Outcome:

- **Truly innovative, sustainable and long lasting forms of cooperation, business and social models for urban logistics services** (vehicles and fleet sharing and pooling, infrastructures and networks sharing) that are adequate to new market evolutions and trends.
- New **multi-actor assessment framework** able to evaluate safety, economic and financial sustainability, societal acceptance, operational efficiency, level of innovation, labour and environmental impacts.
- New **governance models and related marketplace rules** of the game - affecting all stakeholders – enabling a **win-win collaboration** able to remove barriers and eliminate any possible conflicts; instead, this models will encourage cross-sectorial cooperation among competing services and they will enable to capitalise previously underutilized assets.
- **Business-led roadmaps** ensuring a seamless and significant **market take up and roll out of collaborative meta-business models** in different frameworks with measures and incentives.

Impacts & Targets:

- Increased load factors (20%)
- Operational cost reduction (10-15%)
- Reduction of lead-time (5-10%)
- better infrastructures capacity use (better capacity 20%)

3.27. Bringing Logistics into urban planning

Challenge: Today, a general transport infrastructure plan for both people and logistics is missing in the city plan. It is necessary to **define conditions towards proper consideration of urban logistics infrastructure needs and urban design aspects in Sustainable Urban Logistics Plans integrated in overall mobility plans.** The involvement of all key stakeholders: business actors, local administration and local politicians is crucial to achieve awareness and consensus on urban design decisions. Business models for building and operating facilities, how to get financial support and how to get greater efficiency in the management of the infrastructure are the main challenges of this topic.

Outcome:

- Recommendations on architectural design and **integration of logistic facilities in urban areas**, as well as the business models supporting them. This means understanding of how to best build and manage – in an optimal and resilient way – logistics city infrastructures (loading/unloading areas, consolidation centres, pick up points, warehouses, etc.) and urban design adequate for the (evolving) dynamics of urban delivery services.
- **Analytical economic models to support stakeholder analysis, balancing logistic efficiency and life quality.**
- **Large-scale demonstrators on logistics planning for urban city planners showing the impact of concepts, tools and innovations.**

Impacts & Targets:

- Increased use of assets and infrastructures by 20%.
- **Reduction of congestion and CO2 emissions by 20% through optimization of traffic and better vehicle utilisation.**

3.28. Interoperable standard modular loading units' operation in the urban context: autonomous deliveries

Challenge: **Modularization of logistic (smaller) units suggests similar benefits at urban level to those ISO-container has already demonstrated**: improved load factor and interoperability among different transport systems and modes, less logistics costs and handling times, more secure and safe cargo, etc. M**odular loading units used in the urban context will seek for interconnectivity, optimization and last mile cost efficiency.** However, these units need to be designed and tested for different urban scenarios and demonstrate the full advantages to industry and society. Additionally, it is necessary to pave the way towards a global standardisation to realize full benefits.

Outcome:

- **Development of modular urban load units compatible with regular containers and vehicles,** as well as new proposal for vehicle architectures and sizes compatible to urban load units (i.e. small van with capacity optimized for multiple or submultiple of palet-size/modular box).
- **Development of technologies to transfer standard loads between vehicles** (large and small) as well as with other transport modes at urban level. Enabling distributed self-control of objects through networks, as well as, cooperation and consolidation among various LSP and LSC.

- **Large scale pilot project** (including various business cases), together with an impact assessment (economical and environmental) will be demonstrated.

Impacts & Targets:

- Improvement of load factors and vehicle utilization by 15%
- Reduction of CO2 emission thanks to traffic reduction by 15%
- Reduction of handling costs and time in last mile operations thanks to standardization of load units and interoperability by 30%
- Increase safety and security of cargo by 30%

3.29. Safety and security in urban freight

Challenge: A significant number of goods is loss following security breaches specially in cities. It is therefore important to **identify solutions to guarantee a safe urban delivery system minimizing the risk for the freight operators and ensuring peoples' privacy and security at the same time**. Research efforts should be extended to systems enabling the **decoupling of the delivery and the collection of the goods** with efficient, reliable and safe solutions. Logistics providers, carriers and receivers need to work together in order to improve the security (mainly data and information, loss or damage of goods), the safety for workers (health) and the environment (dangerous goods) by introducing state-of-the-art technologies and further developments.

Outcome:

- **Efficient, reliable and safe solutions enabling the decoupling of the delivery and the collection of the goods**.
- Solutions to **improve security and safety** by assessing the potentials of improvements of **human machine interfaces**, policies, vehicles and information and ICT.
- Innovative solutions to ensure the **resiliency and robustness of urban freight systems.**
- **Impact assessment and roadmap** with mitigation measures to ensure safer and more secure urban mobility and logistics.

Impacts & Targets:

- Increased customer satisfaction by 30%
- Reductions of failed deliveries by 30%
- Reduction of cargo loss due to theft or damage by 30%
- Improvement of resilience and robustness of urban freight systems by 30%

4. Topics full descriptions

In this section, a detailed description of the topics is included as well as the summary from chapter 3 (blue box).

4.1. Secure data exchange and access to build trust

Challenge: One of the major barriers preventing stakeholders to enter in automated data exchange in B2B and B2Platforms interaction concerns data confidentiality and unauthorized intrusion and usage, specially of sensitive (commercial) data. The challenge is to ensure the '*trusted*' and '*seamless'* access for supply chain stakeholders. Projects should focus on ensuring **data exchange and access in a secure, controllable and trusted way** by stakeholders but at the same time, providing **easy many to many connectivity, facilitating generic data exchange**. It also requires that supply chain data and information is visible and standardised on an international scale.

Outcome:

- **Mapping and addressing real issues and barriers** preventing data sharing and exchange on top of privacy, security and trust such as behavioural aspects and perception on sharing data and associated business models.
- **Provide safe and secure access to supply chain information**. The scope covers B2G, G2G, B2B, B2Platform and B2C information flows including reverse flow of information in order to accompany truly closed loop supply chains reducing administrative burden.
- Provide an **international governance structure, including legislative issues and standardisation** in order to ensure the development and implementation of seamless and trusted mechanisms. This includes B2G, G2G, B2B, B2Platform and B2C exchange of information in order to ensure common governance throughout the EU (and beyond).
- **Facilitate sustainable and secure data networks enabling new business models to emerge**. This means designing and testing of these data networks and preparation of demonstrations in practical applications. It should be taken into account that new networks need certification to ensure trust between users.

Impacts & Targets:

- Clear path to secure and trusted digital supply chains resulting in reducing risk, loss and damages.
- Reduced total costs in seamless supply chains.
- Increased efficiency and sustainability in supply chains.

Motivation/Challenge:

A trusted and seamless integrated system is a requirement for supply chain visibility which in turn leads to safe and secure controlled logistics systems in the Physical Internet. The challenge is to ensure the 'trusted' and 'seamless' access for supply chain stakeholders. Stakeholders need to be sure that data exchange can be under their control. The way stakeholders provide data (remain the owner, no owner or other models) and setting the conditions for use is key. This will be a prerequisite for stakeholders

to 'trust' any IT solution developed for supply chains. It requires solid models for data ownership and sharing.

The other challenge is to organise the flow of information throughout supply chains in a seamless manner. This requires new ways of making use of existing data and providing tools to use data that is not per se uniform. Creating resilient supply chains based on integrated use of information (ex. RFID, sensor technology, open data, etc.) is required in a secure manner.

The seamless and trusted exchange of data is to be governed and monitored to avoid misuse (and mistrust). National and international standards and legislation may prevent the development of global standards as they are different and no with common focus. It will be a challenge to provide a governance and monitoring framework for secure data exchange in international supply chain environments developing the appropriate standards.

Scope and Content:

Provide safe and secure access to supply chain information. The scope covers B2G, G2G, B2B, B2Platform and B2C information flows including reverse flow of information in order to accompany truly closed loop supply chains.

- Provide an international governance structure, including legislative issues and standardisation in order to ensure the seamless and trusted mechanisms for secure data exchange to exist. This includes G2G (Government) exchange of information in order to ensure common governance throughout the EU (and beyond).
- Addressing the issue of data ownership in integrated supply chain solutions. New models are required which take into account individual ownership versus collective use.
- Facilitate sustainable and secure data networks in order for business models to emerge. This means design and testing of these data networks and prepare demonstrations in practical applications. It should be taken into account that new networks need certification to ensure trust between users.
- Generic data exchange models and plug & play (low-cost) interfacing in order to reach out to wide scope of supply chain stakeholders including SMEs. The use of new technology should be an aspect taken into account when designing these models, for instance the use of block chain technology.
- Enhance the maturity of Supply chain management monitoring capabilities (of governments) by providing research on the monitoring itself. This includes also a system based monitoring organised on a European level, an independent authority needs to guarantee the secure use of data and information throughout supply chain operations. This requires real-time capabilities for data exchange monitoring.
- Enhancing supply chain risk management models to address risk from a supply chain broad perspective. Moving towards integration of risk management and supply chain management throughout companies and networks.
- Eventually enable the Physical Internet and seamless supply chains to exist. By testing and realizing proof of concepts in the use and sharing of data in a secure fashion first steps will be taken in this process. Provide open and interoperable systems that can be trusted as open platform of platforms to implement new business models such as interconnected transport market places, booking systems, supply chain composition, etc. to offer new trusted logistics services.

ALICE milestone/s the areas is contributing to

The actions addressed in this document contribute to the following milestones:

- 2020 Full alignment of economics, environmental, social and security goals
- 2020 Interoperability between networks and IT applications for logistics
- 2020 Horizontal Collaboration
- 2030 Integrated decision making in end-to-end supply chain
- 2030 Full visibility throughout the supply chain
- 2040 Safe and secure supply chains for circular economy

Expected Impacts:

Primary

- Reduce total costs in seamless supply chains.
- More secure and trusted supply chains resulting in reducing risk, loss and damages
- Secure societies

Secondary

- Increased supply chain transparency and visibility
- Increase transport actors using automatic data exchange.
- Supply Chain Adaptability and Flexibility
- Efficient supply chains and thus more energy efficient operations, reducing a.o. CO2 emissions
- More reliable execution of transport
- Cargo and logistics units integrated in the automatic data exchange
- Risk factor reduction.

4.2. Effective Trade Facilitation

Challenge: **The challenge is to improve interaction between business and border agencies.** Based on the experience of ongoing, such as CORE, and previous projects in the area the ultimate goal is to **smooth supply chain flows across borders** (all modes) **and identify innovative approaches and processes to comply with regulation in a more seamless way**. The topic should build on the Digital Transport and Logistics Forum launched by DG MOVE and the actions included there to move current paradigm to e-freight implementation. The scope should be broader in order to capture not only customs' benefits but also the incentives of businesses involved in cross-border trade.

Outcome:

- **To propose harmonized AEO auditing schemes in Europe.**
- **To develop tools to store and maintain track of compliance of operators in a rated list** (compared to credit rating). As part of this compliance tracking, there is a need to understand and explore what sanctions need to be applied and how to apply them.
- **To identify and address hinders and barriers of simplified procedures**. A potential study could explore how heterogeneously trade facilitation procedures are being applied by customs

administrations, how they impact the supply chain business, ending with recommendations/best practices. The study should lead to discover and quantify the impacts of the simplified procedures.

Impacts & Targets:

- Societal security.
- Faster customs clearance implies improved customer satisfaction, products availability and multiple savings for different stakeholders in supply chains.
- Total supply chain costs, especially considering delays at the borders, may be significantly reduced

Motivation/Challenge:

In the past, logistics and supply chain operators have perceived border-controls as an administrative burden or nuisance for their operations. For these reasons governments are fostering trade facilitation procedures in order to guarantee expedite clearance to all complying operators. In addition, recent research related to advanced risk management approaches as well as automated systems to simplify regulatory compliance are reshaping the landscape and revolutionizing the way companies look at governmental agencies. Despite this, there are still some challenges to be overcome and that need further research.

First of all, supply chains in Europe that want to become AEO compliant could be differently evaluated in different European countries. Hence, it seems that different auditing schemes and procedures are being used. Next, it needs to be understood how to handle companies that while following simplified procedures are caught faulty by agencies. Should a rated list be issued? Should there be sanctions, which and how should they be applied?

Another typical challenge encountered by practitioners is the implementation of simplified procedures. Operators claim major bottlenecks that are resulting in additional time delays and costs. Information exchange still remains an important topic for operators in order to facilitate seamless compliance in combination with *topic 1 on secure data exchange.*

Corruption of customs officers is unfortunately still a major issue in some countries, yet there is very little visibility on where it happens and how. Enhancing knowledge about the issue may bring to light the problem and lead to potential solutions and recommendations.

Finally, there is still much to be done in terms of concrete benefits offered to complying companies. For instance, the AEO programme promises several benefits to complying companies, however few of them fully materialize. It can be argued that future IT development should move toward this goal, i.e. developing platforms that can help supply chain companies in planning transport and logistics operations and thereby optimizing the processes and requirements to clear goods entering a country.

Scope and Content:

- To propose harmonized AEO auditing schemes in Europe.
- To develop tools to store and maintain a black list of not complying operators. As part of the blacklist there is a need to understand and explore what sanctions need to be produced and how to apply them.
- To identify hinders of simplified procedures. A potential study could explore how trade facilitation procedures are being applied by customs administrations, how they impact the supply chain

business, ending with recommendations/best practices. The study should lead to discover and quantify the impacts of the simplified procedures.

- Discover and report cases of customs corruption → analysis of current levels of corruptions. Or mechanisms to *detect* fraud and corruption at customs borders.
- To develop tools for monitoring, improving and simplifying green lane schemes offered by customs administrations.
- Improve coordination and management of customs post, including training and providing tools in order to make sure harmonised regulations and simplified procedures are applied equally.

ALICE milestone/s the areas is contributing to

- 2020 Full alignment of economics, environmental, social and security goals
- 2020 Interoperability between networks and IT applications for logistics.
- 2030 Full visibility throughout the supply chain.

Expected Impacts:

This topic aims to improve cross-border controls by both enhancing security as well as performance. First of all, impacts are expected in terms of societal security. Next, faster customs clearance imply improved customer satisfaction and products availability. Likewise, total supply chain costs, especially considering delays at the borders, may be significantly reduced.

Primary:

- Increase customer satisfaction
- Products availability
- Secure society
- Total supply chain costs
- Cargo lost to theft or damage

Secondary:

- Supply Chain Visibility
- Reliability of transport schedules
- Perfect order fulfilment
- Transport actors using automatic data exchange
- Cargo and logistics units integrated in the automatic data exchange
- Waiting time in terminals
- Risk factor reduction
- end-to-end transportation time
- Travel distance to reach the market
- Lead times

4.3. Logistics in the full circular economy: New business models for horizontal and vertical collaboration

Challenge: Logistics is a key enabler to ensure sustainability of circular economy by providing smart and sustainable logistics networks and services. This requires to **develop new business models, including bundled services, after-market and reverse supply chains**, addressed with an integral approach not only in the **geographical sense** (urban versus rural and combined) but also integration of **end-to-end supply chain processes addressing scarce resources management**. The challenge is to integrate supply networks, including the reverse part of the chains, to make full utilization of resources within and across supply chains. This also requires the integration and adaptation of supporting supply chain tools.

Outcome:

- **New (business) models and use cases** demonstrating a substantial increase of supply network efficiency and sustainability of **direct and reverse flows management**, that currently are operated separately but could be integrated seamlessly. Determine costs and economic values of such integration and collaboration.
- **Overcome regulation barriers and definition of incentive schemes** for sustainable businesses cases in the circular economy**.**
- **Demonstrators** of hub operations, transport, packaging systems, containerization, handling technologies management, monitoring and tracing of resources throughout supply cycles for direct and reverse flows integration.
- **Better understanding of relationships within and across sectorial supply chains**, identification of material flows, and barriers and opportunities for synergies in the circular economy paradigm.
- **Measure the impact of logistics in the sustainability of circular economy in supply cycles.** Measuring and modelling the logistics performance of different circular economy value chains. Building on existing research on indicators, this requires new sets of widely supported KPI's especially addressing rebound effects, and recognised labelling and certification in value chains**.**

Impacts & Targets:

- Energy efficiency gains by 20%
- Reduction of environmental impact and continuous reintegration of resources by 20%
- Reduction of logistics costs thanks to opportunities of synergic flows by 20%
- Saving resources and materials thanks to reusing and recycling strategies by 30%
- Increase asset availability and quality. Upscaling of existing circular economy approaches by providing standardised logistics systems
- (real time) transparency on freight flows and demand
- Increasing customer and market acceptance of more circular business models.

Motivation/Challenge:

Economy is slowly moving to be circular, i.e. that the raw materials in products at the end of life or that by-products and or residuals in manufacturing processes are used again and keeping all resources into

a new value chain[11]. This includes the use of water, energy, biotic and abiotic materials used within the scope of supply cycles.

In that paradigm, logistics is a key enabler to ensure sustainability of circular economy by providing smart logistics networks. This leads to the development of new business models, including bundled services, after-market solutions and reverse supply chains. Projects should focus on enabling these networks, supply cycles and business models by providing IT integration and monitoring tools. Logistics and supply chain management are enablers for supply cycles and the right IT infrastructure and supply chain processes in an integral approach will support the uptake.

Perishable distribution in urban areas is a major challenge where the collection of food waste outlets must be added, potential stakeholders on this challenge are: distribution platforms, shops, catering and foodservice sector, hotels, restaurants and markets. The percentage of not consumed products in this sector is high and it is necessary solve this problem to manage effectively forward and reverse logistics. In this sense, supply chain planning and control are essential elements to ensure availability of recycled materials as a primary resource for industrial use, to lower the supply uncertainty of such materials and making it competitive in relation to virgin materials.

The circular economy allows making a better (re-)use of resources. In order to bring these resources, back in the loop, reverse logistics is often seen as a not directly pertinent and separate part of the supply chain. The challenge is on how to integrate the concept of circular economy in the supply chain (*including the reverse part of the chain*) and how to stimulate and improve vertical collaboration between all actors to facilitate this integration. The aim is to realise the paradigm shift: "*From supply chain management to supply cycle management*".

In the last few years, successful supply cycles have been developed and product design is turning more and more towards circular thinking. However, the scope and scale of initiatives should be increased in order to realise sufficient impact. Besides the upscaling aspects it is necessary to not only look at product design, including packaging design and information design. Information design is key to ensure traceability of resources in supply cycles.

Logistics structures for the re-circulation of end of life products (*container systems, information flows, organisational structures*) are often incompatible with the supply logistics of manufacturing companies as they are not designed to meet SCM requirements. But to improve the utilisation rate of secondary materials (coming from industry or from final consumers), and to even make these available as primary sources of supply to manufacturing industries, the necessary prerequisites must be created both in terms of processing technology and of logistics structures.

Moreover, setting the right regulatory context to allow waste to become a material for one or more production processes needs to be developed

[11] https://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/calls/h2020-ind-ce-2016-17.html#c,topics=callIdentifier/t/H2020-IND-CE-2016-17/1/1/1/default-group&callStatus/t/Forthcoming/1/1/0/default-group&callStatus/t/Open/1/1/0/default-group&callStatus/t/Closed/1/1/0/default-group&+identifier/desc

Scope and Content:

Building on and being complementary to *TOPIC: CIRC-04*-2016 new models and economic incentives for circular economy business, this research starts from the need to identify and build models that increase the global efficiency of supply chains and understand how flows, that currently operate separately, could be managed in an integrated seamless way. This research applies to waste streams from producers to recycling, as well as repairs, returns, garbage, recycling waste from final consumers such private households or businesses.

A proper understanding of relationships within sectorial supply chains and opportunities for synergies between supply chains and supply chain stakeholders for the same or for different sectors should be part of this research, and new models to integrate direct and reverse logistics.

The research should cover all the following issues:

- Understanding the streams and material flows and links within and across supply chains, considering direct flows and the different types of reverse flows: repairs, returns, garbage, recycling waste.
- Develop new approaches to eventually reintegrate goods (and waste) into the circular loop (e.g. recycling, reverse logistics) and effective after-market supply chains that ensure prolonged 'life-time' of products in-use.
- Developments of integrated IT-systems improving sustainable networks (supply cycles) taking into account the different characteristics of regions and industry segments. These systems need to be dynamic in order to cope with ever faster changing environment supply chains deal with. These systems should allow to monitor and trace resources throughout supply cycles. Standardisation and design of information models within supply chains is required to achieve full transparency of flow of resources and the uptake of supply cycles.
- Understand who are the right actors and the possible interrelations among their roles in the chain and in the cycle. Trust issues and possible actions to unlock barriers and change behaviour should be considered. Determine and give full visibility of real costs for manufacturers, retailers, distributors and other stakeholders. Develop meta business models associated to the efficiency gains thanks to integration of existing separated flows and determine costs and economic values of collaboration. Define incentive schemes for sustainable businesses cases
- Address legal issues and restrictions, e.g. restrictions when mixing different cargo or tagging materials as a waste (food with non-food items)
- Demonstrators of design of hub operations, transport, packaging systems and handling technologies to efficiently integrate direct and reverse flows specially addressing food supply chain in cities.
- Increasing the impact of logistics in the circular economy by [1] upscaling of current successful initiatives, [2] engagement of new entrants for the circular economy, including SME involvement and [3] incorporate social aspects like quality of life, health and working conditions.
- Define KPI's that can be used to measure impact of logistics in the sustainability of circular economy and identify KPI´s in circular supply chains that are supported/used throughout the industry. This may be implemented through a recognised labelling and certification in the supply chain. A lot of work has already been done on the academic research point of view to achieve

widely accepted concepts for supply cycles. This will be the starting point for projects more focussed on implementation in industry.

- Process design for clear closed loop supply chains based on resource requirements for products and its potential for renewable product life cycles. Not only referring to product design, but also including packaging concepts which potentially require circular supply chains on their own.

Contribution to Milestones:

- 2020 Full alignment of economics, environmental, social and security goals
- 2020 Urban logistics: Defining and assessing new opportunities and business models
- 2020 Horizontal collaboration
- 2030 Integrated decision making in end-to-end supply chain
- 2030 Integration Manufacturing Logistics
- 2040 Safe and secure supply chains for circular economy.
- 2040 Open Supply networks
- 2040 Sustainable and integrated urban logistics in the city mobility system

Expected Impacts:

- Energy efficiency gains by 20%
- Reduction of environmental impact and continuous reintegration of resources by 20%
- Reduction of logistics costs thanks to opportunities of synergic flows by 20%
- Saving resources and materials thanks to reusing and recycling strategies by 30%
- Increase asset availability and quality. Upscaling of existing circular economy approaches by providing standardised logistics systems.
- (real time) transparency on freight flows and demand
- Increasing customer and market acceptance of more circular business models

4.4. Effective assessment and management of the triple-bottom line (People, Planet and Profit) logistics performance

Challenge: **Provide a broadly agreed framework to calculate, report and improve of logistics operations and networks based on the triple-bottom line performance** (people, planet and profit). This means addressing energy use and emissions (including air pollutants and noise with CO_2 equivalent), socio-economic factors (accidents, fatalities) alongside the traditional logistics KPIs that quantify costs, service performance and effectiveness.

Outcome:

- **Develop mechanisms to include other environmental impacts of transport** (not only CO_2), such as noise, black carbon and other pollutants into environmental performance assessment of logistics (if not already achieved by that point) as well as other socio economic factors;
- **Finalise the eco-label design and implementation**, alongside the widespread, detailed industrial testing of the recommended data collection, calculation, reporting and certification processes including certification governance;
- **Test and then promote widespread application of the accounting standard and eco-label scheme in industrial practice** (e.g. within existing management systems as part of a continuous

improvement cycle) and policy design to prove its potential contribution to the identification of environmental improvement opportunities that can be incorporated into transport and logistics planning alongside traditional metrics related to cost, quality, safety, etc.;

- **Development of a continuous improvement process** that allows users of the approach to identify areas for improvement and which supports the drive to change;

Impacts & Targets:

- Reduced energy consumption (kWh Logistics/GDP)
- Increased renewable energy sources share.
- Reduced CO2 Emissions (kg CO2/tKm)

Motivation/Challenge:

A wide range of emission accounting standards (inc. EN 16258), calculation methodologies and tools, emission factor databases and even legislation have been developed (geographically, sector-specific solutions, company level…) for certain aspects, such as CO2. These developments have been achieved without coordination. As a consequence, they are not fully compatible, with wide differences in approach between them. This situation is acknowledged as a significant barrier to establish and compare the true environmental performance of different logistics operations. Therefore, it is currently not possible for stakeholders, whether individually or collectively, to make rational decisions that include environmental performance alongside traditional logistics KPIs.

Research into harmonisation of calculation methodologies has already been conducted in COFRET (as well as in the US). Development of a harmonised methodological approach is continuing, led by the Global Logistics Emissions Council (GLEC), with a view to developing practical logistics sector guidance for the Greenhouse Gas Protocol. Further development is anticipated through 2017/18 as a result of the topic *MG 5.3. Promoting the deployment of green transport towards Eco-labels for logistics* (LEARN Project), with a focus on first stage development, testing and consensus-building around the data flows and verification mechanisms in order to take the approach to the next level. The process needs to be supported by a transparent verification mechanism that leads to a simple and reliable indication of overall environmental performance. At the same time the approach needs to be easy to apply to ensure stakeholders' acceptance and use. In this way it will be easier to identify and incorporate improvement opportunities into logistics and supply chain planning, operational optimization, designing policy support interventions and purchasing decisions (B2B and B2C), creating additional value for users.

Scope and Content:

- Based on the current and further-developed GLEC baseline, and outcomes of LEARN project, environmental performance indicators (EPIs) need to be agreed, tested and applied in order to properly incorporate environmental impact into logistics planning and optimisation. The eco-label concept developed by LEARN project shall be stress-tested in practical application and implemented in cooperation with industry and standards bodies.
- These EPI's as well as the tests shall indicate areas for developing new technologies, the scale of potential improvements and fields of actions to overall establish renewable logistics leading to a decision support toolkit for environmental logistics at all levels.

- Develop mechanisms to include other environmental impacts of transport, such as noise, black carbon and other pollutants into environmental performance assessment of logistics (if not already achieved by that point) as well as other socio-economic aspects such as accidents;

- Development of data collection and reporting standards and a toolkit for monitoring. Perform a widespread, detailed industrial testing of the recommended data collection, calculation, reporting and certification processes.

ALICE milestone/s the areas is contributing to:

- 2020 Full alignment of economics, environmental, social and security goals

Expected Impacts:

- Reduced energy consumption (kWh Logistics/GDP)
- Increased renewable energy sources share
- Reduced CO2 Emissions (kg CO2/tKm)
- Reduced total supply chain costs
- Increased load factors: weight and cube fill of vehicles
- Less Empty Kilometres

4.5. Scenarios for Logistics Developments

Challenge: A number of policies, socio-economic trends, new and developing technologies are seen as main influencers and potential game changers for certain logistics operations and/or logistics as a whole. The challenge is to **understand how trends, policies and technologies may impact logistics operation and therefore related/linked socio-economic aspects such as environment, energy, safety and security, employment and growth.** Projects are expected to identify and assess possible scenarios as well as to build modelling and simulation tools with that purpose.

Outcome:

- **Develop modelling and simulation tools** allowing during and after the project to: 1) create different potential scenarios depending on the evolution of the trends, technologies and policies, including cross relation between the different aspects considered and 2) assess the expected socio-economic impact according to those scenarios and considering potential disruptions.
- **Simulation of the scenarios** developed by means of modeling tools.
- **Develop recommendations and guidelines** according to analysis of scenarios for governments, industry and other stakeholder groups. Special attention should be given to business models and the opportunity to create socially safer and more secure jobs within the transport and logistics business.

Impacts & Targets:

- Contribute to logistics scenario building to make optimal utilization of the opportunities of trends, policies and technologies in order to maximize the positive socio-economic impact.

Motivation/Challenge:

A number of policies, socio-economic trends, new and developing technologies are seen as main influencers and potential game changers for certain logistics operations and or logistics as a whole. In detail, they can be identified as: 1) development of technologies such as: robotization, human machine interfaces, automation of transport and drones, automated delivery vehicles, Internet of Things (IoT), augmented reality, big data, block chain, Industry 4.0 and 3D printing, machine visualization and learning, fifth generation smartphones (5G), enhanced system interoperability, etc; 2) socio-economic trends such as: ageing, demographic changes, oil price volatility, crowdsourcing and crowd shipping, shared economy, globalization and localization, consumer needs, changing behaviours and growth of e-commerce; 3) European and Member States transport, environmental and energy policies; 4) Physical Internet paradigm and integration with manufacturing: off and near shoring, cloud manufacturing. There is a clear need to understand how these trends, policies and technologies may impact logistics operation and therefore socio-economic aspects such as environment, energy, safety and security, employment and growth. Moreover, people behaviours influencing the system should also be addressed.

Special attention will be given to the expected impact on labour force and required skills. With the increase of automatization and digitalization, workers should acquire new skills to exploit new technologies and the related potentialities. Already today studies in the US, Germany and UK as well as industry statements claim a shortage in truck and locomotive drivers for logistics. A research by the World Bank (WORLDBANK 2016[12]) emphasizes the need of education to prepare for demands of the digitalized work environment in order to avoid a widening gap in society between low-skilled and high-skilled workers.

Little is known about the complex interrelations between trends, policies, technical developments in logistics and the mentioned socio-economic aspects. The development, simulation and analysis of scenarios for logistics can contribute to support policies and strategy developments in industries, government and in all stakeholders. They provide for a better understanding of current trends and future developments and help industry and government to reflect on possible adaptions and measures taken. Results and lessons learnt in previous projects like TRANSTOOLS, SPECTRUM, etc. should be taken into account.

The recent financial crisis and extreme major events that had a severe impact on logistics systems have taught us that policies need to consider uncertainty to an extent that the robustness of the system can be safeguarded under large disruptions and shocks. Such disruptions can include global economic or health crises, natural disasters and geopolitical or climate changes. Scenarios for logistics need to consider those disruptions that could be critical for the system.

Scope and Content:

[12] Worldbank (2016): DIGITAL DIVIDENDS, World development report 2016, download: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2016/01/13/090224b08405ea05/2_0/Rendered/PDF/World0developm0000digital0dividends.pdf

- Identify most important parameters and quantitative indicators to describe the logistics system and its development to assess the socio-economic impact of logistics developments in terms of economy, energy, environment, congestion, infrastructure required, value of transport, employment, education and skills, safety and security.
- Develop modelling and simulation tools allowing during and after the project duration to 1) create different potential scenarios depending on the evolution of the trends, technologies and policies, including cross relation between the different aspects considered and 2) asses the expected socio-economic impact according to those scenarios and considering potential disruptions and behaviours.
- Develop different scenarios for different justified time horizons, e.g. 2020, 2025, 2030 and 2050, which reflect possible different developments of the parameters identified as relevant for the logistics system. Scenarios should recognize the existence of deep uncertainty in the system and incorporate methods that go beyond conventional prediction approaches of continuous events.
- Simulation of the scenarios developed by means of the modelling tool. Specifically, analyse, evaluate and asses in detail the most likely and promising scenarios for society in terms of sustainability and efficiency including guidelines and roadmaps on how to transition from current to scenario paradigm, asses if fundamental changes in supply chains may be expected and identification of gaps, business models and new added value services required. Analyses and assessing implications for all kind of stakeholders in the desired scenario and how this may impact their business have to be developed as well.
- Develop recommendations and guidelines according to analysis of scenarios for governments, industry and other stakeholder groups. Special attention should be given to business models and the opportunity to create socially safer and more secure jobs within the transport business.
- The tool/s should propose themselves and serve as a monitoring tool for the assessment of the impact of the taken measures and the evolution of the different scenarios according to new trends, technologies and policies that may be in place.

ALICE milestone/s the areas is contributing to:

Contribute to provide input on the overall advance of ALICE roadmaps as well as to measure logistics sector evolution.

Expected Impacts:

The project is expected to contribute to logistics scenario building to make optimal utilization of the opportunities of trends, policies and technologies in order to maximize the positive socio-economic impact.

4.6. Synchromodal Hubs collaborative processes empowered by digitalization

Challenge: **Hubs and clusters leveraging the potential of hubs,** in particular inland hubs**, through innovative ICT and Digitalization** *(e.g. apps or information brokers)*. Developing ICT architectures and customized solutions enabling vertical and horizontal collaboration among different stakeholders and

ensuring confidentiality and data sharing based on common business rules. Providing consistent hub applications and transport applications in terms of data governance and technology standards. Improving service quality of multimodal freight hubs with improved data quality and availability following the example of Port Community Systems.

Outcome:

- **Open, service-oriented ICT architectures for hubs**.
- Improved vertical and horizontal **collaboration among all stakeholders**, including better access of SMEs to the logistics market enabled through an easy and secure access to information.
- New hub-specific functionalities, like **waiting and handling time prediction, incident management, pre-notification, slots management and workflow management, added value services provision**.
- Shared **situational awareness** through enhanced reality applications allowing real time disruption management.
- **Smart synchromodal hubs** enabling dynamic flexibility at the shipper's end, allowing each node to reallocate materials (shipments) in terms of time (reliability, speed) and space (location) also ensuring the best systemic exploitation of their resources.
- Arrangements for data access and user rights for public and private actors that stimulate the exchange and use of data on loads and vehicles for transport optimization.

Impacts & Targets:

- Decrease of terminal transport and inventory costs, increase flexibility and resilience of the transport system, enable the achievementof higher percentage of synchromodal flows,
- Optimization of utilization of hubs and clusters' resources (available infrastructure, equipment, human resources, etc.),
- Promote interoperability with existing systems of hubs enabling multimodality,
- Provide verified business models and collaboration rules as well as data and solution ownership,
- Create a blueprint concept of a hub with generic ICT requirements framework.

Motivation and challenge:

Hubs are gaining importance as value creators for supply chains and society in general. The service quality requirements of multimodal freight hubs in Europe will develop quickly in the future. The chances of success will depend highly on the capability of hubs to innovate in their ICT facilities and capabilities, digital infrastructure as well as to be connected to the physical infrastructure. In the larger maritime hubs, many new facilities are emerging *(e.g. apps from hackatons or information brokers)* that partly collaborate and partly compete with incumbent Port Community Systems. In contrast, many inland hubs are not yet well developed in terms of ICT, good connectivity to infrastructure, despite the fact that the amount of data that passes through is large and constantly growing. This creates a misalignment among hubs in the intermodal transport system and missed opportunities to build an EU network. Within ports, consistency between hub applications and transport applications in terms of data governance and technology standards is of importance. The challenge is to develop the needed ICT to leverage the full potential of hinterland hubs in terms of enabling collaboration, operational capacity and execution following the examples of Port Community Systems. Easy customized solutions

enabling vertical and horizontal collaboration among different stakeholders and ensuring confidentiality based on common business rules is needed. Focus should be put on real value added services that unlock the value in the hinterland network, also ensuring that there are feasible business models to take up such services. Replication of Port Community Systems for hinterland hubs strongly equipped with ICT services is necessary *to achieve the Physical Internet vision.*

Scope and content:

- Development of open, service-oriented ICT architectures for hubs as complex, dynamic system-of-systems, allowing applications to be developed and scaled quickly.
- Improve vertical and horizontal collaboration among all hub stakeholder, including better access of SMEs to the logistics market enabled through an easy and secure access to information.
- Development of hub-specific functionalities, like waiting and handling time prediction, incident management, pre-notification, slots management and workflow management.
- Use of ICT to increase shared situational awareness using gaming and/or enhanced reality applications, at the operational and tactical level of terminal operations to allow real time disruption management, added services
- Create smart synchromodal hubs enabled dynamic flexibility at the shippers end, allowing each node to reallocate materials (shipments) in terms of time (reliability, speed) and space (location).
- At the strategic level, arrangements for rights to access and to use data should be made so that data exchange and use is for optimization of processes.
- Provide business cases (and pilots) validating the developed ICT solution and applications involving strategically located hubs.

ALICE milestone/s the topic is contributing to:

- Hub and Network Integration
- Innovative Supply Chain design and service integration

Expected impacts:

- Decrease of terminal induced transport and inventory costs, increased flexibility and resilience of the transport system, enable the achievement of higher percentage of synchromodal flows.
- Optimization of utilization of hubs and clusters´ resources (available infrastructure, equipment, human resources, etc.) reflecting in development of new services.
- Development of open, accessible and service oriented system allowing interoperability with existing systems and enabling multimodality, also guaranteeing the access of SMEs to the logistics market.
- Support in decision making process based on data analytics.
- Verification of business models and collaboration rules as well as data and solution ownership.
- Creation of a blueprint concept of a hub with generic ICT requirements framework.

4.7. An Adaptive Synchromodal European Freight Network Strategy

Challenge: Achieving an adaptive multimodal European freight infrastructure network of networks defining a public/private roadmap for action, including public investments and policies. **Develop the framework conditions for a European freight network that is transparent, robust and resilient to**

traffic incidents, geopolitical changes and other external factors like climate change. Network analyses and optimization to nominate key inland freight hubs and service corridors of European importance and introduce a network strategy to allow Pan-European traffic by all modes of transport. Pull together current hub and corridor developments into one coherent framework serving the manufacturing and logistics industry.

Outcome:

- A **strategy for synchromodal European freight network integrating core and comprehensive networks**, including inland waterways network and city networks. Creation of a blueprint concept of a network with generic organisational, technological and infrastructural requirements framework.
- **Alignment of innovative technologies** supporting different processes along the network e.g. mode-free planning, booking and trip management.
- Research on flow development, shipment preferences and transport customer choice behaviour including definition of **synchromodal KPIs**. Develop a booking system for multimodal transport on top of TEN-T Corridors.
- **Guidance for the development of the TEN-T for freight transport in connection to global corridors** (e.g. China's One Belt) considering the core network for long distances and Comprehensive network for last-mile access.

Impacts & Targets:

- Decrease of transport and inventory costs, increased flexibility and resilience of the transport system, and a higher percentage of synchromodal flows.
- Optimization of utilization of resources (available infrastructure, services, equipment, human resources, etc.)
- Additional impacts on greening of transport through modal shift away from road transport.

Motivation and challenge:

Creation of an adaptive multimodal European freight infrastructure network: a public/private strategic roadmap for action identifying the missing link between current infrastructure and the future targets, including public investments and policies all this aiming to achieve a full synchromodal paradigm for the long-term vision of the Physical Internet. It would pull together current hub and corridor developments into one coherent framework serving the manufacturing and logistics industry. A key challenge is to design a freight network that is transparent, robust and resilient to traffic incidents, geopolitical changes and other external factors like climate change. The infrastructure network strategy should nominate key inland freight hubs and service corridors of European importance and introduce a network strategy to allow pan-European traffic by all modes of transport and interoperability across corridors. Modern technologies, such as automated truck platooning, rail AGV's and autonomous navigation or other technologies supporting transhipment or providing decision-making system should be enabled and implemented operationally in the network. Stakeholders at the supply chain level (e.g. manufacturers) the transport service level (e.g. transport operators) and the infrastructure network level (e.g. public road / rail / IWW authorities, transport node authorities) would need to be brought together.

Scope and content:

- Development of a strategy for synchromodal European freight network integrating core and comprehensive networks, including city networks. A strategy should define new roles of hubs, collaboration rules reflected in business models as well as network requirements and recommendations for public/private investments within infrastructure and ICT. Check the elasticity of the business models and define the real Hubs/Terminals that are needed in the European network.
- Development and alignment of innovative technologies supporting different processes along the network, including decision-making system, transhipment, track and trace, identification of loading units as well as safety and security.
- Design of robust/ extended inland waterways network. Approaches to make the network more robust (including innovative infrastructures and ship design, traffic management, etc.) and resilient, including adaptations of the existing infrastructures to enable their full exploitation for the whole year (e.g. due to varying water levels, navigability is a continuous concern)..
- Research on flow development, shipment preferences and transport customer choice behaviour taking into account a supply chain level, transport service and infrastructure network level. Future freight network user requirements are still largely unknown. Research into the demand of freight transport as well as definition of measurable synchromodal KPIs is needed.
- Guidance for the development of the TEN-T for freight transport in connection to global corridors (e.g. China's One Belt), as part of CEF Programme and to be adopted by the corridors.
- Providing business cases (pilots) validating the network based on strategically located hubs and corridors and measuring social impacts (i.e. transport companies' evolution in a lower/higher demand for transportation).

ALICE milestone/s the topic is contributing to:

- 2020 Hub and Network Integration
- 2030 Innovative Supply Chain design and service integration

Expected impacts:

- Decrease of transport and inventory costs, increased flexibility and resilience of the transport system, and enabling of the achievement of a higher percentage of synchromodal flows.
- Optimization of utilization of network resources (available infrastructure, services, equipment, human resources, etc.)
- Development of open, robust and resilient freight network.
- Support in decision making processes at network level.
- Cerification of business models and collaboration rules at freight network level, targeting also the connection of EU network with global corridors.
- Creation of a blueprint concept of a network with generic organisational, technological and infrastructural requirements framework.
- Boost the greening of transport through co-modality.

4.8. Development of a Synchromodal Network of Networks

Challenge: In contrast to public infrastructure management and development addressed in other topics, this one is targeting synchromodal operators and hubs to **develop synchromodality and enlarging current synchromodal networks** by improving and developing their **business models**. Visualize and demonstrate the potential of creating a network of synchromodal networks in Europe. Demonstrate overall business models, that allow cooperation, including the governance and operational model that would make it sustainable. Propose a roadmap for transition to the future situation.

Outcome:

- **New business models to deliver transport services between different hubs** with the best combination of transport modes towards (almost) full asset utilization.
- **Expansion of synchromodal services** towards continental freight transport for all sectors and all goods, including pallet cargo of the manufacturing and retail industries and bulk cargo.
- **Demonstration and pilots of collaborative-multi-stakeholders synchromodal networks** to achieve end-to-end efficient, sustainable and effective logistics solutions.
- **Identify and create new added value** - **targeting also the establishment of new services -** within the logistics network(s) with the aim to enable smooth **transition to the Physical Internet** and support the necessary **change management**.

Impacts & Targets:

- Achieve overall 70 % load factors in synchromodal operations and 15% increase on modal shift.
- Reduce energy consumption and CO_2 emissions by 20% in relation to transport operations.
- Increased efficiency and effectiveness of infrastructure use.

Motivation/Challenge:

Connecting hubs with different modalities is an important step towards integration of networks, or PI. **The business models for the different modalities have to give an answer to existing stakeholders on: (i) what could be their future business model, and the corresponding operational models and organizational models; (ii) how to make the transition from the existing model to the new business model; (iii) how to link all the modalities in order to enable the full implementation of Synchromodality between the European Hubs and networks reducing empty back load trips.** The business models need to take into account the end-to-end supply chain and have to include postal services, e-commerce and food chains.

Scope and Content:

- Create the right framework for the expansion of synchromodal services towards continental freight transport for all sectors and all goods, including pallet cargo of the manufacturing and retail industries for different sectors (food, postal, e-commerce, automotive, etc.) and bulk cargo.
- Define the barriers in regulations and other aspects to be addressed in the development of the framework conditions to enable the implementation of the synchromodal network of networks .
- Visualize the network of networks in Europe, and the overall business model, including the governance and operational model, that would make it sustainable. Involve all stakeholders in the

governance model. Identify and develop new value enablers to achieve change and collaboration in the connections and in the hubs of synchromodal networks achieving mental shift towards mode-free booking.

- Create new business models[13] to deliver transport services between different hubs with (almost) full asset optimised utilization of different transport modes focusing on identifying appropriate frameworks for development of the synchromodal network of networks and analysing profits, risks, barriers and social aspects and how to create extra value, not just distribute efficiency and cost sharing. Feasibility analysis, network design and business modelling for continental synchromodal transport flows will be part of the whole framework. Identify and create new added value within the logistics network(s) with the aim to enable smooth transition to the Physical Internet and support the necessary change management.
- Develop prototypes, demonstrations and pilots of multi-stakeholders synchromodal networks and associated business models to achieve end-to-end efficient, sustainable and effective logistics solutions.

Contribution to Milestones:

- 2020 Hub and Network integration
- 2020 Horizontal Collaboration
- 2030 Integration of Manufacturing and Logistics

Expected Impacts:

Baseline business design, demonstrated feasibility and implementation roadmap for a synchromodal service network at the European scale. Clarification of infrastructural and regulatory preconditions for a EU level synchromodal network. Clarification of the expected contribution to the overall targets of the ALICE roadmap especially in the area of transport system efficiency (system utilization, energy consumption and emission reduction) and reliability. In particular to:

- Achieve overall 70 % load factors in synchromodal operations and 15% increase on modal shift.
- Reduce of energy consumption and CO2 emissions by 20% in relation to transport operations.
- Increased efficiency and effectiveness of infrastructure use.

4.9. Integration of Information Systems for Cargo, Transport and Traffic

Challenge: **Overcoming fragmentation of information and systems between the three silos: cargo information, service information and traffic information**. Achieving technological and organisational integration of information as well as between public and private actors allowing visibility and transparency in the supply chain. Boosting appropriate business models and mind shift of transportation providers, LSPs and shippers together, towards more integrated and connected logistics allowing to achieve exchange of loads across service providers, transport modes and networks and increased collaboration among all the stakeholders.

Outcome:

[13] The Osterwalder canvas business model could give a framework for the business models.

- Creation of an interoperable environment for a collaborative network with standardised organisational, technological and infrastructural requirements for **cargo, transport and traffic system integration, including**:
  - **Technological Integration** between platforms through interfaces based on data structure standards,
  - **Organizational Integration** through identification of legal and administrative barriers and recommendations on how to reduce them, trust building and introduction of business models and collaboration rules,
  - Integration between **Public and Private Actors**/Information.
- **Trust-building** for **collaborative IT systems between shippers, service providers, carriers and infrastructure providers/traffic managers** allowing dynamic planning and booking of freight services. *(in coordination with topic Nr. 1)*
- Verification of **business models and collaboration rules for an integrated freight transport system**.

Impacts & Targets:

- Increased flexibility and resilience of the transport system, and a higher percentage of synchromodal flows.
- Optimization of utilization of resources (available infrastructure, services, equipment, human resources, etc.).

Motivation and challenge:

Information systems in logistics are still developing in three silos of information: cargo information, service information and traffic information. **To achieve efficiencies in transportation through collaboration a proposal on how fragmentation of information and systems between these levels can be overcome is necessary.** Moreover, a mind shift of transportation providers, LSPs and shippers together, towards more integrated and connected logistics is needed to achieve exchange of loads across service providers, transport modes and networks. Current systems work too much in isolation so the potential of their combination cannot be unlocked, which will eventually hinder the introduction of the Physical Internet. Efforts in this area should build on SELIS and AEOLIX projects complemented by developments in projects under MG-5.1-2016. *Networked and efficient logistics clusters* and MG-5.2-2017. *Innovative ICT solutions for future logistics operations*. A key challenge is to provide technological integration, organisational integration and integration between public and private actors/information. Barriers for integration include risk averse behaviour (increased liability risk due of information availability), poor trust (link with topic Nr 1) and little practice in investment and gain sharing. At the same time companies – LSPs and LSCs are in need of solutions that provide visibility and transparency in the supply chain through these silos. R&D investment needs to be stimulated into collaboration in systems and data use across three layers of cargo, transport and traffic information and to foster implementation throughout Europe. The real-time information should promote optimization of production, transport & logistics processes through vertical and horizontal cooperation, assets sharing and global assets tracking based on simple costs rules.

Scope and content:

- Development of seamlessly integrated system through Interoperability among Information systems including:
  - Technological Integration between platforms through interfaces based on standards to assure security and to achieve supply chain visibility and transparency.
  - Organizational Integration through identification of legal and administrative barriers and recommendations on how to reduce them, trust building and introduction of business models and collaboration rules
  - Integration between Public and Private Actors/Information
- Large scale experiments/pilots with dynamic supply chain planning and flexible transport planning and booking, possibly accompanied by dynamic transport performance (e.g. congestion). Pilots with an involvement of LSPs, LSCc and local authorities. PPP approach is recommended in later stage to make the system acceptable.
- Business model of improved shared situational awareness between shipper and carrier based on e.g. time stamps of events, container location data, container content data.
- Trust-building campaign highlighting benefits for stakeholders including shippers in CSA combined with R&D effort to develop new, integrated transport/supply chain concepts that prevent sub-optimization on transport (shipment based transport network redesign). Assess impact of information systems on transport network performance (including resilience).

ALICE milestone/s the topic is contributing to:

- 2020 Hub and network integration.
- 2030 Innovative Supply Chain design and service integration.
- 2040 Synchromodal services door-to-door.

Expected impacts:

- Increase of flexibility and resilience of the transport system, and achievement of a higher percentage of synchromodal flows.
- Establishment of collaborative IT systems between shippers, service providers, carriers and infrastructure providers/traffic managers allowing dynamic planning and booking of freight under changing supply chain requirements and external conditions.
- Optimization of utilization of resources (available infrastructure, services, equipment, human resources, etc.).
- Verification of business models and collaboration rules to integrate Information Systems for Cargo, Transport and Traffic.
- Create an interoperable environment for a collaborative network with generic organisational, technological and infrastructural requirements framework.

4.10. Green Logistics Networks: Carbon and Beyond

Challenge: Adopt **systemic approach for Green Logistics, extending the design of green hubs and corridors into green networks able to support the achievement of EU sustainability goals** and

favouring the coordination among transport corridors, also enabling the interoperability among smart logistics networks.

Outcome:

- Development of required network performance reference (green hubs and corridors) measured through standardised KPIs and targets to achieve sustainability objectives.
- Development of system-based energy optimization for logistics, possibly including reverse flows / circularity from a PI perspective.
- Definition of hubs re-design requirements as linking hinge in a EU logistics system greening strategy.
- Proposal of new business models for achieving targets of green logistics.
- Foster education for all supply chain actors to increase better use of assets and Consumer awareness.

Impacts & Targets:

- Reduction of Energy consumption (kWh Logistics/GDP)
- Reduction of CO2 Emissions (kg CO2/tKm)

Motivation and challenge:

This topic follows up the COP21 and COP22 targets on deep Decarbonisation. Current logistics sustainability measures are mainly efficiency-focused, which does not allow building up a complete understanding and addressing of the Green Logistics Networks issue. In order to get a clearer picture of what is needed, an improved identification of network boundaries and the definition of last mile role in the logistics network are needed, thus allowing to establish and achieve coherent long-term objectives.

The Logistics Networks have significant rebound effects (i.e. increase demand), sub-optimise at the cost of the system and produce unwanted social and geographical distributive effects. **The achievement of objectives concerning global warming require measures that go beyond efficiency improvements in the transport subsystem**. These include systemic approaches for Green Logistics (joining technical and organizational re-design, linking levels in the supply chain, possibly allowing an increase in emissions in places for a stronger reduction overall), consumption-based internalisation of external costs, reduction of waste, green freight and cargo management approaches. This means also that it is necessary to establish proper certified methodologies for measuring emissions (e.g. noise, waste) along the supply chain, also exploiting the IoT potential).

Currently a target-based review of options for decarbonization are insufficiently known, consequences of alternative policies are not understood and, as a result, measures will be limited in scope and effectiveness. The design of green hubs and corridors can be extended into green networks/grids that support the realization of EU sustainability goals and minimize the risk of unwanted local effects of EU policies. A target-based approach to the optimization of Logistics Network/s should be adopted, at the same time favouring the coordination among transport corridors and enabling the interoperability among smart grids. The Shippers' role towards Green Networks optimization has to be better defined, considering also the optimization (and potential reduction) of transport demand and involving the Procurement Process aspects.

In this context, **the role of innovation paths towards Green Logistics Networks establishment has to be analysed, considering the impact of e-commerce (parcel's growth role in carbon emissions) and the need for optimisation of truck volume use (beside weight) and the C2C (Customer to Customer) interaction (besides the traditional B2C ones)**. The various ways to achieve a general reduction of emissions have to be taken into account (also through electric traction exploitation), without forgetting to consider the primary energy source.. Proper Policies able to encourage the Greening and Decarbonisation can be elaborated at EU level, after proper preliminary study able to simulate their impact through interactive modelling of the potential effects and promoting / incentivizing the Shippers' and LSPs' commitment towards Decarbonisation.

Scope and content:

- Development of required network performance (green hubs and corridors) to achieve sustainability objectives; definition of network attributes. Reconciliation between deep COP21 Decarbonisation pathways and ambitions in the area of economic, social and security goals. Assessment of impacts for/from industry and e-ecommerce. Study of realistically expected emission savings and uncertainties therein; measures to manage global emissions. Identification of a reasonable number or set of interoperable and standardised KPIs to: (i) measure impact, (ii) justify the adopted transport mode. Recognition of critical aspects and design of targeted Policies at EU level to set up green logistics networks
- Development of system-based energy optimization for logistics, possibly including reverse flows / circularity from a PI perspective.
- Hubs redesign greening strategy.
- New business models for achieving green logistics.
- Education for all supply chain actors to increase better use of assets and Consumer awareness.

ALICE milestone/s the topic is contributing to:

- 2020 Full alignment of economic, environment, social and security goals

Expected impacts:

Projects are expected to lead to decrease of CO2 emissions and improved alignment with other KPI's and increase opportunity for Synchromodality exploitation in the intra-European transport. The following ALICE impacts are expected to achieve:

- Reduced Energy consumption (kWh Logistics/GDP)
- Reduced CO2 Emissions (kg CO2/tKm)

4.11. Sustainable Integration of new manufacturing developments: Industry 4.0 in Supply and Logistics Networks.

Challenge: Industry 4.0 is impacting supply and logistics chains. The challenge is to define **business models and demonstration cases** to develop and adapt **new functionality of the logistics system** to take the **full potential** out of the **new production models** in a **sustainable** way**.** Dematerialization and additive manufacturing, mass customization, on-site production, agile, cloud- and IoT-based manufacturing or manufacturing farms and associated services like quality controls, assembly and

spare part management will affect the way products are produced, transported, stored and distributed hence impacting transport and logistics demands in terms of volume and new service requirements.

Outcome:

- **Evaluation of potential impact of manufacturing and Industry 4.0 innovations on transportation and logistics**: business and operational models, logistics and transportation process, cost-benefit and how to prepare the business environment to cope with these changes.
- **New value-adding services and expected roll out**, e.g. concepts for manufacturing farms/clusters, dematerialization and new value added services: quality control, assembly, spare part management in industry 4.0 paradigm.
- Agile Network of Factories of the Future: **Demonstration actions and pilots on new logistics services and systems enhancing industry 4.0.**
- Synchronization of end-to-end supply chains to real customer/consumer needs, by **merging Physical Internet and Manufacturing 4.0**

Impacts & Targets:

- Increase of product availability and customer satisfaction.
- Reduction of transportation cost, energy consumption and GHG emissions by creating more efficient networks of manufacturing and logistics
- Decoupling growth of Transport from GDP.

Motivation/Challenge:

Industry 4.0 is impacting supply and logistics chains. This will become an opportunity for new logistics services enhancing industry 4.0 including dematerialization, manufacturing farms and associated services like quality controls, assembly and spare part management and at the same time, contributing to overall value chain energy consumption and emissions reduction. Integration of existing production and logistics concepts will leverage the full potential of Industry 4.0 and society.

Logistics Supply Networks are and will be further challenged by a number of developments and initiatives driven by manufacturing companies and machine tool suppliers (e.g. mass customization, on-site production, agile and digital manufacturing or additive manufacturing). These disruptive changes will affect transport and logistics demands and the way products are produced, transported, stored and distributed.

Traditional supply networks could disintegrate because 3D printing of parts and spare parts will make long distance transports redundant. Agile manufacturing processes with very fast planning and ramp-up phases need even faster supply networks with new governance models and open contracts. The connected world is creating a wealth of opportunities that will affect the way we produce things and the way we *"transfer"* them. The adaptation of current logistics operations to be able to react to these changes and the identification of value-adding services for logistics hubs and service providers is of high importance. A number of initiatives are already in place and will drive the future of Manufacturing and Supply Networks (e.g. EFFRA, ALICE).

Scope and Content:

- Evaluation of potential impact of manufacturing and Industry 4.0 on transportation and logistics: business and operational models, logistics and transportation process, cost-benefit and how to prepare the business environment to cope with these changes.
- Identification of new value-adding services and expected roll out, to support Industry 4.0. and provided by for example 5th-Party-Logistics-Providers (5PL) e.g. concepts for manufacturing farms/clusters sharing facilities and resources lead to providing new value added services: quality control, assembly, spare part management; evaluation of business models on dematerialization, including assets sharing, IPR and regulations, individualisation and co-creation (low volume but high variety).
- Agile Network of Factories of the Future: Demonstration actions and pilots on new logistics services and systems enhancing industry 4.0. These could be done by different sectors (Perishable, Non Perishable, Durable goods, Construction etc.) were value creation is maximized end-to-end and minimizing waste. This should be implemented in cooperation with manufacturing companies and LSPs.
- End-to-end supply chains be better synchronized to real customer/consumer needs, by merging Physical Internet and Manufacturing 4.0 can also best be done by sector (Perishable, Non Perishable, Durable goods, Construction etc.). Cooperation models taking into account the close relationship between manufacturing and logistics, supporting the realisation of mass customisation and the shift of the customer order decoupling point.

ALICE milestone/s the areas is contributing to:

- Horizontal Collaboration
- Integration of Manufacturing and Logistics

Expected Impacts:

Primary Impact:

- Increase products availability
- Energy consumption (kWh Logistics/GDP)
- Renewable energy sources share

Secondary Impacts and indicators:

- Reduction of transportation and value chain environmental and financial costs.
- Increase asset utilization
- New business opportunities for logistics companies.
- Decoupling logistics intensity from GDP

4.12. Open system of systems for self-organizing Logistics

Challenge: Logistics services and resources are more and more openly available and accessible by the users through market places, booking platforms and other online resources. The challenge is to **get end to end solutions for a specific transport/logistics demand**. Therefore, emerging architecture of intelligent, complex systems should be used in supply and logistics to enable **emerging behaviour in self-organizing logistics** (i.e. logistics systems providing solutions for a certain need or demand). These

emerging architectures should support privacy, commercial sensitivity, liability, and (compliance) legislation. Interoperability is a basic feature of the architectures, enabling organizations to register, connect and be able to perform business.

Outcome:

- **Self-learning, self-adjustable and self-organizing systems for supply chain composition** based on available services, including a new broad range of connected devices, hardware and software.
- **Impact analysis on organizational aspect, governance, business continuity, value models and mind shift of the supply chain planners.**

Impacts & Targets:

- Optimizing resource utilization: load factor, assets, contribution to reduction of infrastructure – and hub congestions, etc.
- Reducing customer supply time.
- Increase flexibility and agility contributing to resiliency.

Motivation/Challenge:

Supply and logistics are the artery of society. Suppliers, manufacturers, Logistic Service Providers and carriers are challenged to increase sustainability, resilience, safety, and security of production, distribution, and transport of an ever-increasing volume of goods with changing customer requirements and innovations in manufacturing. Logistics services and resources are more and more openly available and accessible by the users through market places, booking platforms and other online resources. The challenge is to get end to end solutions for a specific transport/logistics demand.

The Physical Internet in which cargo is expected to find its way from origin to destination requires a high degree of self-organization at several levels like package, transport means, human and organisation, leading to computational complexity that can be addressed as self-organized logistics.

The Internet of Things introduces real time visibility of the location of products, cargo, and transport means, and available logistics capacity in a global logistics system with the objective to optimize capacity utilization, improve process synchronisation by predictions, and improve risk analysis by anomaly detection based on logistic patterns. Machine-to-machine communication with smart sensors will improve operations based on goals and capabilities. Sales predictions via various direct and indirect channels supported by different solutions integrated with production – and logistics capacity of various stakeholders will create opportunities for more efficient and sustainable supply and logistics.

Open, dynamic, complex, and networked are the main characteristics of supply and logistics. A holistic architecture of complex inter-operation of multiple (semi-)autonomous systems (or systems of systems) with dynamic viewpoints due to ever changing states is necessary to infer fragility (e.g. lack of synchronization between availability of a terminal and of logistic services); identify the causes (e.g. in a sub-subsystem like an exchange of out-dated information, or in the external context like traffic delays); and ultimately adapt the overall system to ensure quality and timely decisions in the future (e.g. by continuous monitoring and adaptation). Quality and reliability of sharing and access to heterogeneous data sets of trusted - and known stakeholders is key in these complex systems. Data analytics for various objectives like anomaly detection for compliance and resilience and prediction for planning coordination of various stakeholders complements traditional planning algorithms. Emerging

architecture of various software services, components and algorithms construct a (federated) IT infrastructure functioning as a (global) virtual data store ('Internet of Data'). This architecture may impact the various IT solutions of all stakeholders and allows the public – and private sector to register, connect, and perform business in a secure and controlled way.

Scope and Content:

- Self-learning, self-adjustable and self-organizing systems for supply chain composition based on available services, including a new broad range of connected devices - from smartphones and tablets to wearables and vehicles. Emerging architecture of intelligent, complex systems in supply and logistics to enable emerging behaviour in self-organizing logistics. These emerging architectures should support privacy, commercial sensitivity, liability, and (compliance) legislation. Interoperability is a basic feature of the architecture, enabling organizations to register and connect and be able to perform business. Furthermore, the architecture needs to support the *Privacy by Design* concept and ensure cyber security of different solutions implementations.
- Application of data analytics in various ways (e.g. predictive and prescriptive) addressing dynamicity, resilience, and anomaly detection in logistics at various levels, like congestion in hubs, infrastructure congestion, incident and accident detection, etc., including humans in decision support.
- Real life demonstrators and living labs are expected to show what is possible, identifying barriers and enabler for change on top of technical functionalities of the systems
- Impact analysis on organizational aspect, governance, business continuity, value models and mind shift of the supply chain planners; how to get the best adoption of the new services that need to be utilized in the context of self-organizing logistics (i.e shared access to resources,). Considerations should be given to distribution of functionality related to sustainable business models as well as impact analysis for the changing the business model, logistics and transportation process and transition business environment to cope with these changes.
- Address multi-stakeholder aspects that clearly show how (which incentives) and what behaviour is and will be emerging. Whereas a total (sub) system can have a positive business case, it needs to be positive for all stakeholders involved, including humans. Illustrate the stability of the system by applying academic in for instance the area of complex ecological systems. Address regulatory barriers.

ALICE milestone/s the areas is contributing to:

- 2020 Interoperability between networks and IT applications for logistics
- 2030 Full visibility throughout the supply chain
- 2040 Fully functional and operating open logistics networks

Expected Impacts:

- Simplified monitoring by authorities and external bodies
- Illustrating the ROI (Return of Investment) of data collection by for instance:
    - Optimizing resource utilization: load factor, assets, contribution to reduction of infrastructure – and hub congestions, etc.

  - Reducing customer supply time
  - Increase flexibility and agility contributing to resiliency
- Data analytics available as a service.
- Interoperability standards, scalability, and cyber security of different solutions implementations.
- Creating mind shift of (supply chain) planners; how to get the best adoption of the new services
- Impact analysis for the changing the business model, logistics and transportation process and how to prepare the business environment to cope with these changes.
- Ability to serve the new paradigms in production (Industry 4.0) and the coming trends (3D printing etc.), a mind shift and demonstrating solutions

4.13. Collaborative Data Analytics for Logistics and Supply Networks

Challenge: **Leverage the potential of data analytics to increase supply networks performance**, resiliency, improved forecasting and planning flexibility, reduction of inventory and identifying bundling opportunities increasing load factors and asset utilization. The challenge is to **realize opportunities in terms of efficiency, energy utilization and emissions in the area of logistics related to big data**.

Outcome:

- **Applying (existing) data analytics algorithms for pattern detection**. It should result in **multi-tier collaboration in open supply – and logistics networks**.
- **Machine learning, predictive analytics and pattern recognition/detection applications** based on all relevant data. Downstream predictive analytics data for upstream optimization in the supply chain.
- **Demonstration of environment and supporting facilities for proof-of-concepts**. Address aspects like trust and data governance. Investigate any potential barriers and triggers for change.

Impacts & Targets:

- Reduced energy consumption (kWh Logistics/GDP)
- Reduced CO2 Emissions (kg CO2/tKm)
- Reduced total supply chain costs

Motivation/Challenge:

Available amount of data is growing tremendously being more and more the data available but at the same time increasingly difficult to handle in terms size, complexity and standards. There are many platforms, systems and standards, but interoperability is an issue that should be addressed in the project resulting from call MG 6.3 2015. **The objective is to demonstrate new cases of application of data analytics to increase supply networks performance, resiliency, improved forecasting, reduction of inventory and identifying bundling opportunities increasing load factors and asset utilization**. The challenge is to realize opportunities in terms of efficiency, energy utilization and emissions in the area of logistics related to big data.

Each stakeholder will try to improve its particular forecasts, based on analysis of real time behaviour of its customers, seasonal influences, product lifecycle, capacity constraints, and other relevant aspects (also known as 'advanced planning'). Behavioural patterns can be detected in large amounts of data that can potentially be input to production forecasts and resource planning. The predicted forecasts will have a level of uncertainty, where the uncertainty decreases over time. One can have a planning based on rolling horizon basis, which is updated by relevant events (event-driven planning). Actual operations based orders can be compared to predictions, detecting potential anomalies with mitigation actions. These types of predictions and prescriptions are expected to contribute to the agility of an organization and therefore to its business continuity.

Whereas traditionally, collaborative planning is based on subcontractors matching customer forecasts, the challenge of each stakeholder will be (1) to utilize the patterns generated by its (potential) customers as input to its own forecasts and (2) to utilize the patterns generated by similar stakeholders to enable bundling. Bundling takes two perspectives, namely order – and capacity bundling. The objective is to develop a multi-tier collaboration based on distributed pattern detection with flexible business relations. These can lead to innovative business models.

Scope and Content:

- Applying (existing) data analytics algorithms for pattern detection, related solutions and applications (multi-view clustering) based on all relevant data, considering its reliability, and including patterns of customers and (potential) competitors. It should result in multi-tier collaboration in open supply – and logistics networks. Select and demonstrate a market for this and its starting point of data generation (e.g. point of Sale data).
- Machine learning and inference engines for real time supply network optimization and interoperability including automatic matching based on patterns detection and recognition. Downstream predictive analytics data for upstream optimization in the supply chain
- Digital demonstration of environment and supporting facilities for proof-of-concept of new use cases exploiting analytic tools and available and new sources of data from the supply chains and transport capacity. Address aspects like trust and data governance for sharing of aggregate data, including the application of privacy enhanced technologies like homomorphic encryption and local instead of centralised data analytics. Investigate any potential barriers and triggers for change.

ALICE milestone/s the areas is contributing to:

- 2030 Innovative supply chain design and synchromodal service integration.
- 2030 Full visibility throughout the supply chain.
- 2020 Horizontal Collaboration.

Expected Impacts:

Primary Impacts:

- Products availability
- Energy consumption (kWh Logistics/GDP)
- CO2 Emissions (kg CO2/tKm)

- Total supply chain costs

Secondary Impacts:

- Improved forecasting with faster decision making, leading to increased supply network resiliency, stock reduction, and increased energy efficiency and emissions reduction.
- Community building support by platforms and infrastructure for trust
- Increasing asset utilization and load factors, reduce empty trips.
- Increase % synchromodal transport.
- Transport routes optimization (reducing Kms)

4.14. Affordable Collaborative Intelligent Transport Systems solutions (C-ITS) solutions for end to end logistics Applications

Challenge: **Leverage C-ITS potential for end to end logistics applications** including real time optimisation of delivery schedules and routes, corridors and hubs management reducing empty trips, waiting time in terminals, optimizing transport (e.g. thanks to automation), ensuring integrity of the cargo and protection against damage and theft. Develop and showcase viable innovative (shared) business models in order to incorporate the added value of C-ITS directly into the carriers and LSPs while taking into account the specific needs of the logistics sector.

Outcome:

- **Develop and demonstrate C-ITS applications and business cases for logistics**, including **corridors management**, end-to-end, first and last mile delivery, trucks platooning, **transportation routing optimization, delivery execution, and terminals management:** loading and unloading reducing the waiting time in terminals.
- **Measure performance, impact and potential of deployment** of the tested business cases through specific quality indicators.
- Build on the ITS directive (2010/40/EU), **identifying good practices and lessons learnt** potentially transferred from the transportation of people to the transportation of goods.

Impacts and expected Targets:

- Increase energy efficiency by 10 % and increase traffic safety.
- Minimize waiting time in terminals increasing at the same time management capacity of terminals with already available infrastructure.
- Demonstrate business cases achieving an increase in load factors from 50 to 70 % and reducing empty trips by 20 %.

Motivation/Challenge:

C-ITS is a well-established field of passengers transport with many applications already and an important development potential. While C-ITS potential for enabling people mobility has been adequately shown and supported in a variety of applications and conditions, the motivation of using C-ITS as a supply chain/logistics applications enabler remains still largely unrevealed.

The challenge Is to leverage C-ITS potential for end-to-end logistics applications including: real time optimisation of delivery schedules and routes, corridors and hubs management, reducing empty trips and increasing load factors, reducing waiting time in terminals, optimizing transport (e.g. thanks to automation), ensuring integrity of the cargo and protection against damage and or theft.

It is also important to show how state of the art C-ITS services and applications from the people mobility domain may be reused (upgraded) for freight transport and in a framework which is agnostic of the specific technology/application. Moreover, there is a need to develop and showcase viable innovative (shared) business models needed to create and incorporate the added value of C-ITS directly into the carriers and Logistics Service Providers taking into account the specific needs of the logistics sector. These should leverage full potential of C-ITS contributing to energy and emissions reductions.

Scope and Content:

- Develop and demonstrate C-ITS applications and business cases for logistics, including corridors, terminals and hubs management (loading and unloading processes reducing the waiting times), end-to-end logistics applications, real time optimisation of first and last mile delivery schedules, trucks platooning, transportation routing optimization, visibility of delivery execution. Implementation of C-ITS and e-freight solutions targeting interoperability & co-modality through corridor-hub based multimodal transport management systems. Development and showcase dynamic real time lane management concepts focusing on online servicing freight transport over the best available infrastructure in a manner that is compatible with the other road users (passenger transport). Demonstrate how C-ITS may increase security in supply chain applications in corridors, ensuring integrity of the cargo and protection against damage and or theft.
- Measure performance, impact and potential of deployment of the tested business cases through specific quality indicators. Examine how specific concepts like connectivity and automation and electro mobility can affect the supply chain and propose specific implementations.
- Investigate further applications building on the ITS directive (2010/40/EU). Identify good practices and lessons learned to be transferred from the transportation of people to the transport of goods.

ALICE milestone/s the areas is contributing to:

- 2020 Hub and network integration
- 2020 Horizontal Collaboration
- 2030 Efficient and automated distribution systems
- 2040 Sustainable and integrated urban logistics in the city mobility system

Expected Impacts:

- Show the correlation between specific C-ITS applications and their direct impact on the efficiency and environmental impact of the supply chain management.
- Increased energy efficiency by about 10% and increasing traffic safety.
- Higher traffic throughput due to more efficient utilisation of road capacity and terminals.

- Reduced waiting time in terminals increasing at the same time management capacity of terminals with the same infrastructure.
- More efficient first and last mile delivery within a city environment supporting the smart city concept and reducing the footprint of the transportation of goods to the city transport system
- Better load factor, especially for last mile/e-commerce.
- Improved end to end logistics due to the introduction of multimodality in conjunction with C-ITS

4.15. Logistics Operations Automation: The Matrix for Logistics

Challenge: **Show the value** of consistent, low cost, sustainable, collaborative, dependable, reliable, scalable, flexible and **automated supply chain (physical) operations** based on developments in the area of robotics, drones, augmented and/or mixed reality, autonomous transport, modular packaging and comprehensive automation.

Outcome:

- **Demonstration of improved performance in real human-machine cooperative systems** for applications such as transport automation, transhipment, last-mile deliveries, port and airport operations, terminals connection to warehouses and hubs, warehouse movements and operations, inbounding to manufacturing lines, etc. Explore modularity as an enabler. **Business and use cases development.**
- **Novel business and financial models** including a **roadmap and plan for broad deployment** identifying small initiatives and realizable projects but should fit together contributing to this end. **Feasibility study** of how current infrastructure can be used as an (basic) asset to deploy automated supply chain operations.
- **Socio economic and legal aspects** including, human-robotics environments user acceptance, employment and new skills required. Develop a socio-economic impact analysis.

Impacts & Targets:

- Reduce transhipment costs promoting co-modality and multimodality.
- Faster and more efficient goods and container consolidation and de-consolidation.
- Recommendations for regulatory and legal changes to realize fully automated and autonomous logistics operations.

Motivation/Challenge:

The main target of this area is to fully benefit from developments in the area of robotics, drones, augmented and/or mixed reality, autonomous transport, modular packaging and comprehensive automation for the benefit of logistics operations: transport, transshipment, last-mile deliveries, port and airport operations and connection to warehouses and hubs, warehouse movements and operations, inbounding to manufacturing lines, etc. The demonstration of benefits of automation for nodal points in the Physical Internet, such as airports, seaports, inland wet and dry ports, warehouses, distribution centres, cross dock operations, and production facilities, as well as the autonomous movement of goods between these facilities should pave the way for a more integrated and operationally effective and efficient Physical Internet. There are many issues to be addressed in the

areas of standards, safety, regulations, security, etc. for these benefits to be achieved. The expected result of this topic is to show the value of consistent, low cost, sustainable, collaborative, dependable, reliable, flexible and automated supply chain operations while ensuring safe human-machine interactions.

Scope and Content:

- Develop and demonstrate connected and automated applications building on the Internet of Things, new digital transportation Infrastructures, advances in autonomous vehicles, standardized packaging, etc. and novel business cases for logistics operations automation. Build on all different efforts and projects potentially contributing to this: Autonomous Transport Robotics, IoT, ITS, etc.
- Demonstration of improved performance in real human-machine cooperative systems for applications such as transport automation, transshipment, last-mile deliveries, port and airport operations, terminals connection to warehouses and hubs, warehouse movements and operations, inbounding to manufacturing lines, etc. Develop user interfaces enabling user acceptance, i.e. new forms of signs and messages to accommodate automated environments and enhance human awareness. Explore modularity as an enabler. Business and use cases development.
- Novel business and financial models including a roadmap and plan for broad deployment identifying small initiatives and realizable projects fitting together towards this end. Investigate and deploy security measurements to prevent and manage threats from cyber-attacks in an autonomous logistics and supply chain network. Feasibility study of how current infrastructure can be used as an (basic) asset to deploy automated supply chain operations.
- Socio economic and legal/regulatory aspects including, human-robotics environments user acceptance, ethical aspects, safety implications in interactions with autonomous and robotic systems. Develop a socio-economic impact analysis including employment and new skills required.

ALICE milestone/s the areas is contributing to:

- 2020 Interoperability between networks and IT applications for logistics
- 2030 Efficient and automated distribution systems

Expected Impacts:

- Reduce transhipment costs promoting co-modality and multimodality.
- Ensure safe and secure human-machine interactions in cooperative environments
- Faster and more efficient goods and container consolidation and de-consolidation.
- Proof of concept for the use of automation in logistics based on specific scenarios and applications.
- Demonstration of cost/benefit of autonomous operations in supply chains.
- Recommendations for regulatory and legal changes to realize fully automated and autonomous logistics operations.
- Identification of socio-economic impact of autonomous operations and recommendations for enhancing education and training for employment requirements.
- optimized modal shift, warehouses, last mile and long haul transportation transhipment.

4.16. IoT Large Scale Pilots in the Field of Logistics.

Challenge: Logistics is a domain that can truly benefit by an interconnected world, addressing issues such as goods shortage, overstocking and perishable goods management. IoT is an enabling technology that has been incorporated in a limited set of applications and scale in logistics systems and supply networks. The challenge is to **leverage the value of The Internet of Things as one of the key enablers** which are needed **to realise the vision of the Physical Internet** (i.e. Distribution of functions among objects in the PI).

Outcome:

- **Large scale pilots of IoT in logistics**, covering the whole value chain and addressing the following topics among others:
  - Logistics in the full circular economy: New business models for horizontal and vertical collaboration.
  - Integration of information from cargo, transport and traffic for enhanced efficiency and sustainability.
  - System of systems for self-organized logistics.
  - Logistics operations automation.
- **Governance and business models** for the **operation of such networks with shared assets and shared information**. Security, privacy and trust between network partners.
- **Linkage of Physical Internet** concept and logistics with IoT existing initiatives: like the European Technology Platform on Smart Systems Integration (**EPoSS**), the IoT-Forum or the Alliance for Internet of Things Innovation (**AIOTI**).

Impacts & Targets:

- Decrease of (human) errors within the supply chains
- Increase asset utilization and load factors.
- Increase Supply Chain Visibility.
- Reduce cargo lost to theft or damage.

Motivation/Challenge:

The Internet of Things aims for a network of smart objects which are able to collect, store and analyse environmental data through sensors. Currently the European Commission is promoting large scale pilots in different application fields:

https://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/2223-iot-01-2016.html.

Logistics, transport and supply chain management are promising fields of application for this kind of pilots. Logistics is per definition a cross-sectorial activity and can on the one hand benefit from communicating and interoperable smart objects helping to bridge media disruption between companies, e.g. events occurring in different actors' supply chains can be combined to meaningful information and enable a quick response. On the other hand, logistics can help to reach many different domains and connect the producer's side with the customer's side. Events occurred in different actors chains can be combined to meaningful events and respond to them as quickly as possible.

Logistics is a domain that can truly benefit by an interconnected world, addressing issues such as goods shortage, overstocking and perishable goods management. IoT is an enabling technological trend that has not been incorporated in Logistics systems. The Internet of Things is one of the key enablers which are needed to realise the vision of the Physical Internet.

Scope and Content:

- Large scale pilots of IoT in logistics, covering the whole value chain (for one product or one specific sector) to i)Raise visibility and transparency within supply networks based on smart objects**, ii**) Define cross-sectorial test beds including logistics, manufactures and customers in IoT-based supply networks and iii) Validate results regarding costs and benefits: easy to implement and low cost solutions for the use of IoT. The following topics may be addressed among others:
  - Logistics in the full circular economy: New business models for horizontal and vertical collaboration.
  - Integration of information from cargo, transport and traffic for enhanced efficiency and sustainability. Gathering of data and information from value chains, raising quality, usage and reliability of the collected data.
  - System of systems for self-organized logistics.
  - Logistics operations automation.
- Identify governance and business models for the operation of such networks with shared assets and shared information. Privacy and trust between network partners should be addressed. Identify and demonstrate scenarios covering innovative responses and risk management (opportunities, failures, etc.) that are derived from events occurred within the value chain or even external sources.
- Examine the connection of IoT to the Physical Internet concept by linkage to existing initiatives for the discussion of issues related to IoT, for the coordination of related actions for the logistics sector, for the exchange of best-practices and working solutions and for the promotion of logistics. Possible initiatives could be the European Technology Platform on Smart Systems Integration (EPoSS), the IoT-Forum or the Alliance for Internet of Things Innovation (AIOTI).

ALICE milestone/s the areas is contributing to:

- 2020 Interoperability between networks and IT applications for logistics
- 2030 Full visibility throughout the supply chain

Expected Impacts:

- Fully interoperable plug & Play concept for the harmonisation of material and information flow based on IoT devices and connectivity services
- Development of smart logistics objects, like smart packaging, allowing easy connectivity and monitoring of goods
- Algorithms for the collection and analyse of data and information (including checks for quality and reliability)
- Decrease of (human) errors within the supply chains
- Overview of benefits for all stakeholders

- Increase asset utilization and load factors.
- Increase Supply Chain Visibility.
- Reduce cargo lost to theft or damage

4.17. Development of a Strategic European Industry Supply Network(s) Design towards TEN-M (Manufacturing)

Challenge: **Strengthen the value of TEN-T (**corridors, hubs and associated transport services) **for manufacturing industry.** To that end, **Strategic Supply Network design based on demand and supply concentrations of European Manufacturing industries.** Supply chain infrastructures and services utilization might be close to optimal from an individual company's perspective, but considering aggregated supply and demand from many companies, many more opportunities for bundling, back loading, modal shift, increase in frequency of deliveries and smaller quantities etc. are opened up. **The challenge is to overcome and ensure shippers collaboration requirements to stablish the industry supply networks.**

Outcome:

- A **shipper industry-driven approach creating rationalized transport and logistics networks** benefitting from the intra-industry and public-private synergies of joint customer locations, conditions, load carriers, etc.
- **Creating shared manufacturing services** for late product differentiation/ customisation/ personalisation in existing open regional Logistics Hubs.
- Assessment of current cost and footprint, and **demonstrated value of an optimized collaborative network in various scenarios of collaboration**.

Impacts & Targets:

- Increase of product availability through a smarter network and response time.
- Reduction of energy and GHG emissions by 30% increased load factor and 20% less physical transport in the rationalized networks.
- Supply chain costs are expected to decrease by 15-20% through optimal supply network use.

Motivation/Challenge:

The challenge is to strengthen the value of TEN-T (corridors, hubs and associated transport services) **for manufacturing industry.** To that end, Strategic Supply Network design based on demand and supply concentrations of European Manufacturing industries. Supply chain infrastructures and services utilization might be close to optimal from an individual company's perspective, but considering aggregated supply and demand from many companies, many more opportunities for bundling, back loading, modal shift, increase in frequency of deliveries and smaller quantities etc. are opened up. The designed model should also be able to simulate how flexible these networks are in relation to changes in consumer patterns/ economic developments in Europe. Multimodal Terminals are the crucial nodes in this Supply Network, the model should give an answer to their ideal locations and roles. **The challenge is to overcome and ensure shippers collaboration requirements to establish the industry supply networks.**

Scope and Content:

It is essential to have a critical mass of participants cross-industry and cross Europe to create the right model, for which collaboration and fair gain sharing will be analysed and set up. The approach will be evidence- and data-driven, departing from the practical lessons that have been learned in related European projects and cases observed in practice. More specifically, the following is expected:

- A **shipper industry-driven approach creating rationalized transport and logistics networks** benefitting from the intra-industry and public-private synergies of joint customer locations, conditions, load carriers etc. The ambition is to: (i) analyse three/four initial industries (retail, medical, automotive, food and feed, …), represented by at least 5-10 important companies; (ii) assess current cost and footprint, and compare with demonstrated value of an optimized collaborative network in various scenarios of collaboration then (iii) a cross-industry assessment can also be made as a stepping stone to a true PI.
- **Creating shared manufacturing services** for late product differentiation/ customisation/ personalisation in existing open regional Logistics Hubs. This will be a step towards combined manufacturing and logistics "villages".

ALICE milestone/s the areas is contributing to:

- 2020 Horizontal Collaboration
- 2020 Hub and Network integration
- 2040 Open Supply Networks

Expected Impacts:

+ Supply network design pilot from origin to destination
+ Step towards the physical internet
+ Several success cases of network collaboration between shippers, hubs
+ Product availability
- CO2 Emissions (kg CO2/tKm)
- Total supply chain costs

4.18. Horizontal Collaboration cases and best practices

Challenge: Identification and analysis of **innovative business models and cases towards open and collaborative markets pursuing asset sharing and collaboration**. Specially identifying enablers and barriers for those cases as well as the tools used to put them in place. Define paths and roadmaps for transferability and ample deployment after the success of CO3. Assessing human factors and organizational behaviours.

Outcome:

- **Best practices and business cases** should be identified, analysed and further exploited addressing shippers and logistics service providers.
- Advanced **business models for shipper's horizontal collaboration cases assessing different roles and governance**, as well as **legal** aspects.
- Advanced understanding of the **impact of human factors and organizational behaviours towards trust and adoption of open collaborative systems**.

Impacts & Targets:

- **Increase asset utilization** in the selected cases up to 80% load factor and achieve 15 % of modal shift.
- **Clear path for transferability and promotion of cases should be addressed**

Motivation/Challenge:

Building on the results of CO3, NEXTRUST, SYNCHRONET and the resulting projects on MG 6.3-2015 this area should enable open and easy access to collaboration and synchronization of supply chains leveraging full potential of vertical and horizontal collaboration transferring business models to an open, secure, trustable ICT system(s). The challenge includes as well addressing human factors on open trusted systems and mental shift towards collaboration and openness.

Especially challenging is **the identification of innovative business models and deployable use cases to make open and collaborative markets viable for service providers beyond transport market places.**

Scope and Content:

- Analyses of best practices and business cases should be identified, analysed and further exploited addressing shippers and logistics service providers. Identify and analyse tools and interfaces exploring the creation of new services and apps that can be integrated or connected with open and collaborative platforms and markets
- Identification of barriers and opportunities and key success cases and advanced business models for horizontal collaboration and synchromodality should be used for a wider impact. Building on similar and improved strategies developed in CO3 project and experiences on trustee role/ governance and legislation aspects
- Understanding the impact of human factors and organizational behaviours towards trust and adoption of open collaborative systems.

ALICE milestone/s the areas is contributing to:

- Horizontal Collaboration

Expected Impacts:

- Increase load factors and asset utilization.
- Reduce energy consumption.
- Reduce emissions.
- Cost saving & faster adoption of innovation for SMEs.

4.19. Connected Services for Horizontal Collaboration

Challenge: **The main goal of this topic is to prove the viability of the concept where the groups of horizontally collaborating shippers are connected to collaborating transport providers via systems** including standardised and transparent (legal) frameworks for participants to enter and exit in efficient combinations of collaborating networks. **Demonstrate how independent Control Towers**

(coordination and management of networks of different supply chains) **could be merged and/or work collaboratively.**

Outcome:

- Interoperable systems that can be trusted as an **open platform of platforms to implement new collaborative business models** such as interconnected transport market places, control towers, booking systems, supply chain composition, etc. An increase in connectivity of different platforms already providing horizontal collaboration services and/or control towers is expected.
- **Motivation for different parties, minimum set of rules, regional differences etc**., Stimulating behaviour of logistics decision makers in expanding networks as a tool that helps companies to increase their, and the whole supply network, efficiency and sustainability.
- **Frameworks and systems to connect different networks of horizontally collaborating shippers as well as collaborating transport providers**; these will serve as a big step towards PI.

Impacts:

- Transport routes of connected networks show a **further 15- 20 % increase in load factors and decrease in supply chain cost.**
- **Energy use and GHG emissions are reduced with a further 20 %.**

Motivation/Challenge

The main goal of this topic is to prove the viability of the concept where the groups of horizontally collaborating shippers are connected to collaborating transport providers via systems including standardised and transparent (legal) frameworks for participants to enter and exit in efficient combinations of collaborating networks. **Demonstrate how independent Control Towers** (coordination and management of networks of different supply chains) **could be merged and/or work collaboratively.**

An intriguing research question is the role of horizontal collaboration in the Physical Internet (PI). Some services in the PI will work as "*connected services*" where competing actors offer partial services of a super-ordinate task (e.g. services for the road freight leg within an intermodal transport). The goal is to create a feasible growth path from the current situation to the PI. This path might very well go along the way of horizontal collaboration, which works for groups of shippers that are still manageable and controllable (e.g. can draw up contract together, managing risk and benefit sharing, etc.). In order to facilitate the creations of this type of horizontal collaboration groups, transparent, standardized and easily accessible framework needs to be established to allow shippers enter and exit coalitions under established rules. After that, collaboration should become implicit rather than explicit. At the same time the 'system' of the PI should take care of efficient combinations. This can hardly be achieved in a planned way, the conditions should be right and from then on the market should take it up.

Scope and Content:

- Interoperable systems that can be trusted as open platform of platforms to implement new collaborative business models such as interconnected transport market places, control towers, booking systems, supply chain composition, etc. Increase connectivity of different platforms already providing horizontal collaboration services. In order to advance this innovative approach, project(s) under this topic should be based on 2 or more existing logistics and transport horizontal

collaboration platforms and/or control tower operations and study the possibility and eventually prove the case of merging/stablishing collaborations of independent control towers.

- Motivation for different parties, minimum set of rules, regional differences etc., to join. In this topic some laboratory research on simulating behaviour of logistics decision makers in expanding networks. An overall, the horizontal collaboration concept cannot be compulsory for shippers, this should be a tool that helps companies to increase their, and the whole supply network, efficiency and sustainability.
- Frameworks and systems to connect different networks of horizontally collaborating shippers as well as collaborating transport providers; these will serve as a big step towards PI. In general, this topic will include not only operations research or technical models, but also utilizing organizational theories and strategic management point of view. For example, theories of the firm, strategic alliances etc. could give valuable insights into the new models of collaboration in logistics.

ALICE milestone/s the areas is contributing to:

- 2020 Horizontal Collaboration
- 2040 Open Supply Networks

Expected Impacts:

Transport routes of connected networks show a further 15- 20 % increase in load factors and decrease in supply chain cost higher return on assets and working capital.

Energy use and GHG emissions are reduced with a further 20 %.

Moreover:

- Increased % of synchromodality
- Improved transport routes optimization (reducing kms)
- Increased number of transport actors using automatic data exchange
- Increased number of cargo and logistics units integrated in the automatic data exchange
- Reduced number of empty kilometres
- Improved end-to-end transportation time
- Improved lead time

4.20. Physical Internet Business Cases Demonstrations

Challenge: **Speed up the process and transition towards the new physical internet paradigm** demonstrating how different technologies, business use cases and standards come together to create the basis for deploying Physical Internet in real-world applications delivering value to its users and positive impacts in terms of emissions and energy consumption.

Outcome:

- Collect and analyse already running or established single projects/initiatives that could be seen as puzzle part of PI and **propose and implement business use cases of Physical Internet** to increase asset and energy utilization minimizing environmental impacts.

- Develop **novel business models** (including sharing policies) and their feasibility to be smoothly integrated into the existing logistics ecosystem **transitioning from current paradigm to Physical Internet one.** Roll-out and deployment strategies for the use case/s at European/Worldwide level.
- **Address socio-economic impacts, policy, regulatory and standardization recommendations** to speed up the process.

Impacts & Targets:

- Achieve overall at least 80 % load factors in the selected use cases and 20% modal shift.
- Reduction of energy consumption and CO2 emissions by 30% in the freight network.

Motivation/Challenge:

Physical Internet concept is getting importance and some isolated use cases are in place at the moment working as pieces and or components of a broader system. The challenge is to speed up the process and transition towards the new physical internet paradigm demonstrating how different technologies, business use cases and standards can come together to create the basis for deploying Physical Internet in real-world applications delivering value to its users and positive impacts in terms of emissions and energy consumption.

Different Business Cases applications of the Physical Internet concept in different levels need to be running in different areas such as: modularization of packaging and goods enabling bundling, digital service infrastructures, consolidation and deconsolidation, operative business models, transport and warehouses assets working in a network. It combines a number of different technologies including IoT, data analytics, advanced networking, robotics, autonomous operations and transport, etc.

Scope and Content:

- Collect and analyse already running or established single projects/initiatives that could be seen as contribution to PI and propose and implement business use cases of Physical Internet. Demonstration of first cases using existing technology and how different technologies come together to create the basis for deploying Physical Internet business cases in real-world applications**.** These specific aspects should be addressed:
  - Use cases demonstrating modularization's positive impacts for bundling of cargo and co-modality in terms of efficiency, energy consumption and emissions reduction.
  - Use cases for transhipment technologies that include automated vehicles, novel material handling concepts and mode shifting.
  - Use cases for shared infrastructure (e.g., warehouses, etc.) used in supply chain networks such as between retailers and suppliers, construction sites in cities, etc.
  - Use cases for collaboration and service provision in an open network of services between service providers and clients, considering extension across the different layers of the PI.
- Develop novel business models for open networks, allowing the new business approaches to transition from the existing logistics ecosystem into the Physical Internet.
- Address socio-economic impacts of the different use cases (e.g., training/retraining requirements, environmental impacts, etc.). Identify regulatory and cross mode inhibitors to the Physical Internet concept and develop potential solution approaches.

ALICE milestone/s the areas is contributing to:

- All

Expected Impacts:

- Achieve overall at least 80 % load factors in the selected use cases and 20% modal shift.
- Reduction of energy consumption and CO2 emissions by 30% in the freight network.

4.21. Mapping models, roles behaviours and coordination for migrating to PI

Challenge: **Strategy for the transition of the existing logistics service market into open configurable and collaborative networks of the Physical Internet.** Is this strategy supporting the business dynamics of tomorrow's supply chains?

Outcome:

- A proven **analytical economic model to evaluate the necessary investments of the different actors into Physical Internet**, that includes all possible streams of revenue and cost of utilized and shared resources.
- The appropriate **business model including governance and legal structures** for the Physical Internet.

Impacts:

- Stakeholders in open collaborative networks can calculate the economic effects on their business model.
- Demonstration of the economic and environmental effect of the transition to PI for stakeholders.

Motivation/Challenge:

There are different players that will play a significant role in the long term Physical Internet arena. The transition of these different and complementary roles needs to be coordinated in order to increase the overall efficiency by 30%.

How can the PI as an infrastructure for end-to-end logistics support the business dynamics of tomorrow's supply chains? In the frame of new business for the PI actors will take flexible roles; e.g., a retailer offers his stocks to a wholesaler and by this becomes a "virtual" warehouse; a company like Amazon offers warehouse space to producers and other sellers. How will the PI make use of dynamic adaptation of its resources? How and by what instruments, standards and tools for information and physical resource sharing, can coordination be achieved? Which strategies are useful to incrementally develop the PI from the existing logistics service market? Which market mechanism will drive actors to participate into the PI model initially? Can it be based on the dynamic synchronization of various horizontal collaboration networks?

Net present value analysis for the PI investments: Analytical economic models are required to evaluate the investments of actors for their participation in the PI; the approach should consider all possible streams of revenue from offering services/resources, utilizing or buying resources/services and sharing resources/services.

Scope and Content:

This action would require the development of the most suitable strategies to incrementally develop the PI from the existing logistics service market to open and configurable efficient networks. For this purpose, the value propositions (in the short and long run) of the different key roles need to be determined, as well as the incentives and KPIs for making this transition feasible, from the operational as well as the economic point of view, under specifications of increasing overall performance for efficiency and sustainability. For this purpose, a particular development of Net-Present-Value formulation is required for following a smooth, fair and sustainable transition along the long path to follow. This would imply the development of analytical economic models required to evaluate the investments of actors for their participation in the PI, the analysis of the risks taken by each of them, as well as their particular contribution to the overall value network. The approach should consider all possible streams of revenue from offering services/resources, utilizing or buying resources/services and sharing resources/services.

The investments should be categorized in private and public, who is investing in what. Besides the business model also the governance model should be developed. Who is responsible for the design and operations of the PI model? The process should be open, transparent and accessible is this role for the independent trustee and the Control Tower concept? What is the legal structure?

A country based analysis via associations would reveal requirement in various geographies. an awareness needs to be created about future and PI. than a roadmap will be available. IT infrastructure would be the most required element to improve.

The action would require the implication of the following profiles of partners:

- Omni-channel retailer, since their dynamic is very high and they integrate global with local logistics and supply chain strategies
- Global Manufacturers from FMCG or Electronics.
- LSPs, control tower providers, neutral trustees
- Institutes of Research and Technology

Contribution to ALICE Milestones:

- 2040 Open supply Networks
- 2030 Innovative Supply Chain design and service integration

Expected Impacts:

+ Increase customer satisfaction
+ Products availability
- Energy consumption (kWh Logistics/GDP)
+ Return on assets and working capital
- Total supply chain costs
+ Volume flexibility (Time to +/- capacity)
+ Asset utilization
+ Supply Chain Visibility
+ Transport routes optimization (reducing Kms)

+ Transport actors using automatic data exchange
+ Upside / Downside Supply Chain Adaptability and Flexibility
- Lead times

4.22. Business roles of SMEs and (end) Customers in the PI

Challenge: **Develop and validate through real life pilots to test new business models for SMEs that can safeguard their agility and leanness in the Physical Internet paradigm**. The new business models definition shall include and address technology requirements, know-how and rules to participate in PI.

Outcome:

- **Pilots involving SME's as part of a diversified community/cluster formed by more actors of the PI**, demonstrating: (i) Cooperative organization and collaboration between big and small companies; (ii) Different approaches for different types of SMEs; (iii) Inclusive PI, involving companies of any size and geographical location.
- **Concrete examples of business models for SMEs** and their interacting partners, **demonstrating the advantages of participating in the establishment of PI.**
- **Finding ways to reach SME's and communicate to them, the PI opportunity**

Impacts:

- Business models, including requirements and roles, to make PI attractive not only for bigger companies but also for SMEs, so they can play an active and profitable role.
- Demonstration cases that PI will lead to cooperative organization and collaboration between big and small companies.
- Process innovations providing measurable benefits (benchmarks) for SME's on the marketplace (e.g., ROI, jobs creation).

Motivation/Challenge:

Since the logistics sector consists of SME's for a large part, e.g. trucking companies, forwarders, the question is which role SME's will take in the PI, is of relevance. What are their business models? Which chances and risks are involved for SME's in the PI? Similar to SME's, it needs to be understood how do private households and consumers benefit from the PI? Will they experience a new sort of quality of service? Will the PI help to solve existing societal challenges? SME's are important as customers for logistic/postal services, given the e-commerce trend. They are important as providers, too, especially trucking companies. SME's are complementary to large LSP's, being able to offer a "tailored service". As such, they will play a specific role in the PI by executing an important part of the transport chain. Current challenges concern:

- Motivation for SME's to join, in terms of benefits for SME users. These should be expressed in economic terms, demonstrating that the PI offers sufficient margins for SME's to survive and prevent unemployment, as SME's play an essential social role.
- What technology/know-how requirements are placed on SMEs? How can they participate into an open and accessible architecture? Which are the information channels and standards? What are the rules for participation? Which resources are needed?

- SME's miss a joint voice to play a role in development and governance of future PI platforms.

Scope and Content:

Find the right approach for SME's to be able to connect and be part of the PI, or they will risk disappearing when PI gets mature:

- Pilots involving SME's as part of a diversified community/cluster formed by more actors of the PI, demonstrating: (i) Cooperative organization and collaboration between big and small companies; (ii) Different approaches for different types of SMEs; (iii) Inclusive PI, involving companies of any size and geographical location (iv) Connectivity for sharing data among SME's and between them and other players in the PI.
- Concrete examples of business models for SMEs and their interacting partners, demonstrating the advantages of participating in the establishment of PI. New business models based on aggregation (consortia). These will have to safeguard the SME's agility and leanness, which are the reasons why currently SMEs tend not to aggregate into larger enterprises. Such models could lead to a "uber for freight" but not dominated by a single intermediary, or "logistics as a cloud service" for the smaller suppliers
- Finding ways to reach SME's and communicate to them, the PI opportunity. This can be done through existing logistics SME communities on regional level as there are, for example, in Germany.

ALICE milestone/s the areas is contributing to:

- 2020 Interoperability between networks. Applications for Logistics
- 2020 Defining and assessing new opportunities and business models

Expected Impacts:

PI is an opportunity for SME's: to get more business from more clients, to make business with big companies, to innovate/disrupt current business models (exploiting the SME's higher flexibility), to have access to new and more sophisticated services, for SME shippers to access new and bigger markets worldwide.

- Business models, including requirements and roles, to make PI attractive not only for bigger companies but also for SMEs, so they can play an active and profitable role.
- Demonstration cases that PI will lead to cooperative organization and collaboration between big and small companies.
- Process innovations providing measurable benefits (benchmarks) for SME's on the marketplace (e.g., ROI, jobs creation).

4.23. Integrated data framework and Big Data analytics assisting decision-making in urban freight transport

Challenge: **Smarter and holistic data collection and management** need to be taken in proper consideration according to two perspectives, jointly affecting decision-making and overall efficiency of the urban transport system: **business outlook and freight mobility planning / network management**.

Big data analytics will offer greater opportunities to **link freight operator's decision making with city planners decision making** (e.g. urban network planning) in order to achieve **resilient, optimised, sustainable and cost-effective governance of the city and more competitive position of business actors.**

Outcome:

- **Structured knowledge base on current applications of Big Data in urban freight transport.** Identification of good practices of value added applications of Big Data management and linked KPIs to elicit the potential and added value of such applications **to improve decision making in urban freight transport** (both private and public sectors);
- **Development and testing of evidence-based business cases**, achieving **positive impacts on energy use, environment and resilience of cities** in facing megatrends impacts (e.g. sharing economy – crowd-sourcing; social and demographic evolutions; e-commerce, etc.).
- **Roadmap of research to mitigate gaps between private & public decision-making** and improve the adoption of suitable methods. Incentive schemes will be supporting optimal and integrated use of big data in freight transport decision making for both private and public sectors.

Impacts & Targets:

- Better use of predictive analysis to achieve economies of scale in accessing data (accessibility of public sector to private data - lower cost than 20% - 30% and lower time);
- Faster development of big data program and regulation frameworks in public sector and reduced procurement time frame for the use of private big data;
- Resilient use of city transport network (optimal network capacity with increased use of 15-20%);
- Engage with the public sector to profit from potential collaboration / dialogue with private sector.

Motivation/Challenge:

The impact of mega trends, such as e-commerce, sharing economy, fast demographic transformation of society and digital economy (connectivity everywhere, GALILEO, Social media, etc.) generate a disruptive evolution of changes in data availability (smartphones, GPS, Social Networks), requirements and opportunities leaving huge amount of unstructured data and information to process.

Better knowledge on how to management of data assets for holistic and seamless interactions between city transport planning and business sector can lead to unbiased forecast (better decision planning), higher production factors, stronger competitive position of operators (better routing, asset management, operational capacity, etc.).

Behavioural foundations (e.g. reluctance on data sharing), clear and seamless regulation, demand management and planning are the impact domains that could benefit from integrated urban freight data collection framework using big data. It will strongly support policy-making and concretely lead to new generation of decision making in urban areas.

Relations with the following initiatives should be established: MG 6.3-2016 Pan European logistics solutions, Urban Mobility KPIs identification (tender launched by DG MOVE in 2015), Digital Transport and Logistics Forum.

Scope and Content:

The following aspects have to be addresses by proposals targeting smart data management:

- Structured knowledge base on current applications of Big Data in urban freight transport. Identification of good practices of value added applications of Big Data management and linked KPIs to elicit the potential and added value of such applications to improve decision making in urban freight transport (both private and public sectors);
- Develop, test and analysis meaningful of use cases at different scales and market purposes (private and public) on: connectivity, procurement, pooling of assets, vehicles and fleet management, etc. These should have a positive impact (e.g. socio-economic, congestion, environment). Different data sources have to be identified, such as vehicles / fleets, private cars, open data platforms, crowdsourcing, social networks, etc. When looking at motivations to share the data and incentive schemes, new possible collaborative models could be investigated (e.g. PPP) and which market opportunities to match (e.g. sharing economy, e-commerce, circular economy – i.e. waste management and recycling). This will evidence main barriers, prospects and emerging requirements for resource-effective use of Big Data in urban freight.
- Roadmap for wide-scale deployment of R&I solutions for integrated knowledge and adoption of Big Data management in urban freight. They will be pathways towards "New generation" of Big Data management (intended as new business models on how to adopt freight Big Data not in silos). They need to improve: 1) freight demand management and overall efficiency of sustainable urban transport system (networks capacity, vehicles' / fleets optimisation); 2) value creation of companies' assets and new business opportunities generated by better decisions as lever for increasing competitive advantage; and 3) regulatory framework facilitating economies of scale in procurement and accessibility to big data at lower cost and time.

ALICE milestone/s the topic is contributing to:

- 2020 Defining and assessing new opportunities and Business Models
- 2040 Sustainable and integrated urban logistics in city mobility

Expected Impacts:

The main impacts will be validated recommendations for wide-scale deployment of research and innovation solutions in some urban areas leading to:

- Better use of predictive analysis to achieve economies of scale in accessing data (accessibility of public sector to private data - lower cost than 20% - 30% and lower time);
- Faster development of big data program and regulation frameworks in public sector and reduced procurement time frame for the use of private big data;
- Resilient use of city transport network (optimal network capacity with increased use of 15-20%);
- Engage with the public sector to profit from potential collaboration / dialogue with private sector.

4.24. Exploring new opportunities for achieving effective integration of urban freight and personal mobility services and networks

Challenge: Further **exploitation of the potential of integration between urban freight and passengers transport systems and networks** is needed to optimize the use of the road, rail and inland waterways infrastructures in space and time, contribution to get healthier cities in terms of less traffic and congestion. This requires a change of paradigm towards a **freight/passenger integrated mobility planning** and explore more opportunities and new business **models for integration of urban freight with private or public transport at infrastructure and transport vehicle levels**.

Outcome:

- **Tools, methods and data sources** to identify and assess **opportunities of flows integration** and support the development of **integrated mobility plans.**
- **Evaluation of different measures for freight and passenger integration** and define **resilient governance models and incentives/enforcement system.** Evaluation in terms of environmental and social impact, level of traffic decongestion, job creation, economic impacts, through pilot testing at different type and size of cities is needed
- **New concepts and technologies contributing to a better integration of freight and passenger flows** including: IT, vehicle architecture, containers and logistics unit design and operation, transhipment and handling technologies.
- Development of **business models offering and extending mobility as a service (MaaS) to connect people and goods movements.**

Impacts & Targets:

- Increased use of assets and infrastructures by 10%
- Reduction of congestion and CO2 emissions by 15% through use of public transport network for freight deliveries

Motivation/Challenge:

Urban mobility planning should take into proportioned consideration passenger and freight (deliveries and servicing plans) transport. Freight activity needs to be considered as part of the overall transport system in a city, but is often neglected or diminished. Freight is sometimes looked up only as a pure business (private) problem and not a social one. However, the increased number of (parcel) deliveries is more and more impacting transport in cities. It is thus necessary to **initiate a paradigm shift towards integrated planning between mobility management and logistics management.** Although some experiences have been implemented in some EU cities (e.g. multipurpose lanes for freight distribution, use of Public Transport for delivery of goods), there is still room for potentially more integration between urban freight and passengers transport networks optimizing the use of the road, rail and inland waterways infrastructures in space and time, contribution to get healthier cities in terms of less traffic and congestion. This requires to explore more opportunities and new business models for integration of urban freight with private or public transport at infrastructure and transport vehicle level (private cars, taxi, bus, rail, tramp, etc.).

The use of Public Procurement of Innovation solutions (PPI) or Pre-Commercial Procurement (PCP) to adopt solutions should be encouraged.

Scope and Content:

- Tools, methods and data sources to identify opportunities of flows integration and support the development of integrated mobility plans. This tools should:
  - Identify potential network capacity and technological / non technological constraints / enablers to multipurpose use for freight and passengers
  - Adopt probabilistic models to match demand and supply
  - Identify new methods for data visualization for different nature of traffic (e.g. services, goods, parcel, shopping trips)
  - Find effective stakeholders engagement (multi-actor) approach for accepted governance and mutual benefits
  - Design simulation tools to evaluate the potentialities of integration and prediction.
- Evaluate different measures for freight and passenger integration and define resilient governance models and incentives/enforcement system. Evaluation in terms of environmental and social impact, level of traffic decongestion achieved, job creation, economic impacts, through pilot testing at different type and size of cities is needed. Legal, security, privacy, and societal aspects should also be evaluated as well as governance and incentives/enforcement systems. Measures should involve solution at terminals or junction points between goods and people (e.g. locks in metro or bus stations), links with neighbourhoods and districts, control / monitoring systems of urban spaces, etc.
- New concepts and technologies contributing to a better integration of freight and passenger flows including: IT, vehicle architecture, containers and logistics unit design, transhipment and handling technologies.
- Development of business models offering mobility as a service (MaaS) to connect people and goods movements.

ALICE milestone/s the topic is contributing to:

2020. Urban logistics: Defining and assessing new opportunities and business models

Expected Impacts:

- Increased the use of assets and infrastructures by 15%
- Reduction of congestion and CO2 emissions by 15% through use of public transport network for freight deliveries

4.25. Improving the link between urban and long distance freight transport services and infrastructures

Challenge: A major challenge to **reduce freight transport movements, congestion** and to increase the load factor in urban areas is the **optimization of the links between urban and long distance transport**. This suggest the exploration of **new delivery models where connected hubs at different levels are shared by different retailers/suppliers to enter the city, and green vehicles are used for the last mile.** A number of **soft barriers including business models and collaboration** need to be tackled to achieve a full realization.

Outcome:

- **Analytic models and tools for urban planners to decide on optimal location and size of connected urban hubs and transport means** taking into consideration current and future flow demand, demography, etc. for different city segments and scenarios.
- Pilot solutions for optimising the use of **Urban Consolidation Centers and micro platforms exploiting horizontal and vertical collaboration**, supported by IT solutions which enables visibility of flow data for all actors.
- Pilot and **evaluate different business and governance models** by defining roles and responsibilities for all actors, rules for hubs, ownership of the services and interactions between actors

Impacts & Targets:

- Increased use of assets and infrastructures by 30%.
- Reduction of congestion and CO2 emissions by 30% through optimization of traffic between hubs and urban areas, improvement of load factor and use of green vehicles.

Motivation/Challenge:

A major challenge to reduce freight transport movements, congestion and to increase the load factor in urban areas is the optimization of the links between urban and long distance freight transport services and infrastructures (airports, seaports, intermodal terminals, dry ports, logistics platforms, etc.). A major challenge is the coordination and efficient link of two opposite flows towards and from the city. This suggest the exploration of new delivery models where facilities, transport means and logistic services to consolidate freight at different levels can be shared by different retailers or suppliers to enter the city. For example, linking hubs or logistics platform (which are connected to core network of transport) to urban consolidation centers (UCCs) through heavy/middle trucks. These UCCs could organize directly the final delivery or link to other urban micro platforms at district or neighbourhood level from where final delivery is made preferable with green vehicles i.e. small electric vans, e-bikes or by walking. A number of soft barriers including business models and collaboration need to be tackled to achieve a full realization.

Scope and Content:

- Analytics models and tools for urban planners to assess bottlenecks, existing infrastructures and constraints for optimal location and size of connected hubs taking into consideration current and future flow demand, demography, etc. for different city segments and scenarios.

Studies on land use and assessment of the impact of the multiplicity of logistics hubs and networks should be required.

- Pilot solutions for optimising the use of UCCs and micro platforms exploiting horizontal and vertical collaboration and supported by IT solutions enabling visibility of flow data for all actors with emphasis on the use of green vehicles for the last mile. Guides for decision on appropriate type of vehicles, vehicle architectures, sizes and weights limits to optimize efficiency and sustainability depending on different cases and characteristics of city/district/area and logistics traffic. New design concepts for containers, boxes, modular units and handling solutions to ease transhipment operations between long distance and last mile legs and both flows directions.
- Define measurement methods and KPIs to evaluate the performance of different solutions in terms of cost efficiency and environmental impacts
- Pilot and evaluate different business and governance models by defining roles and responsibilities for all actors, rules for hubs, ownership of the services and interactions between actors. Measures for public involvement and procurement strategies.

ALICE milestone/s the topic is contributing to:

2020. Urban logistics: Defining and assessing new opportunities and business models

Expected Impacts:

- Increased use of assets and infrastructures by 30%.
- Reduction of congestion and CO2 emissions by 30% through optimization of traffic between hubs and urban areas, improvement of load factor and use of green vehicles.
- Reduced transhipment and handling costs/times in hubs

4.26. New business models for logistics services based on sharing economy

Challenge: Consumers and other stakeholders are showing a strong interest in the sharing-based economy. Re-thinking the value of "*ownership*" and "*use*" is the new disruption, especially in urban logistics. There is the need to **find new approaches to unexplored potentials or emerging peer-to-peer (P2P) business / business – to – consumers (B2C) opportunities in freight market**, making them attractive and widely accepted. This lead to solutions to increase reliability, trust in transactions, higher investments and assets / payoffs sharing, in order to find new multi-stakeholders metrics for urban logistics sector sustainability.

Outcome:

- **Truly innovative, sustainable and long lasting forms of cooperation, business and social models for urban logistics services** (vehicles and fleet sharing and pooling, infrastructures and networks sharing) that are adequate to new market evolutions and trends.

- New **multi-actor assessment framework** able to evaluate safety, economic and financial sustainability, societal acceptance, operational efficiency, level of innovation, labour and environmental impacts.
- New **governance models and related marketplace rules** of the game - affecting all stakeholders – enabling a **win-win collaboration** able to remove barriers and eliminate any possible conflicts; instead, this models will encourage cross-sectorial cooperation among competing services and they will enable to capitalise previously underutilized assets.
- **Business-led roadmaps** ensuring a seamless and significant **market take up and roll out of collaborative meta-business models** in different frameworks with measures and incentives.

Impacts & Targets:

- Increased load factors (20%)
- Operational cost reduction (10-15%)
- Reduction of lead-time (5-10%)
- better infrastructures capacity use (better capacity 20%)

Motivation/Challenge:

European cities are growing and the dynamics of distribution of goods and services have led in the very recent years to an increasing interest for sharing assets (including infrastructure) towards cost-effective and sustainable logistics processes in urban areas. Consumers and other stakeholders are showing a strong interest in the sharing-based economy. The evolution of people lifestyles – i.e. new social and economic trends – will change significantly urban freight mobility patterns. Factors such as teleworking, ageing population, and especially the significant growth of e-commerce have a direct impact on mobility in cities. Re-thinking the value of "ownership" favoring the one of "use" is a consolidated trend. Shared mobility is definitely an economic mega-trend: public transport is no more the only collective transport mode but vehicles and infrastructures are now shared in urban context following peer-to-peer (P2P) and business to consumer (B2C) models. Very first/last mile transport is a key part of the supply chain, where sharing would be very effective and beneficial.

To be sustainable, business models needs to be adequately developed and tested in different market conditions and urban contexts. European cities to properly face mobility challenges and need to implement new collaborative systems and develop new mobility concepts with a proper involvement of all stakeholders.

Scope and Content:

- Truly, innovative, sustainable and long lasting forms of cooperation, business and social models (e.g. public-public, public-private, customer-customer, private-private and private-customer) for urban logistics services that are adequate to new market evolutions and trends. Truly, innovative, sustainable and long lasting business models for vehicles and fleet sharing and pooling, infrastructures and networks sharing.
- New multi-actor assessment framework able to evaluate safety, economic and financial sustainability, societal acceptance, operational efficiency, level of innovation, labour and environmental impacts. It will evidence implications on business and society, regulatory aspects/legal, reliability, security, insurance aspects and ethical issues.

- New governance models and related marketplace rules of the game - affecting all stakeholders – enabling a win-win collaboration able to remove barriers and eliminate any possible conflicts but rather encouraging cross-sectorial cooperation among competing services and capitalise all underutilized assets. Development of profit sharing and compensation / incentives schemes and tools to measure the effectiveness and sustainability of models. Governance models indicates priorities and accessibility conditions for sharing of public infrastructures.
- Business-led roadmaps ensuring a seamless and significant market take up and roll out of collaborative meta-business models in different frameworks with measures and incentives (especially for early adopters). Roadmaps may include communication action and participation to the public about the potential of business models in improving sustainability and foster the acceptance of the stakeholders across Europe

ALICE milestone/s the areas is contributing to:

- 2020 Defining and assessing new opportunities and Business Models
- 2030 Efficient and automated distribution systems
- 2040 Sustainable and integrated urban logistics in the city mobility system
- 2040 Open Supply networks

Expected Impacts:

To meet the challenge on cost- efficient and sustainable urban logistics, proposals are requested to evidence how the following impacts will be achieved:

- Increased sustainability generated by business models in the overall supply chain including cost-efficiency, financial, safety, policy and security aspects. Increased load factors (20%)
- Effects of new collaboration schemes and regimes or partnerships within the urban logistics ecosystem in terms of loading factors and operational efficiency, reduction of lead time and congestion, better use of resources and infrastructures, new jobs, better working condition, trust and investments
    - Operational cost reduction (10-15%)
    - Reduction of lead-time (5-10%)
    - better infrastructures capacity use (better capacity 20%)
- Communication and promotion to the public about the potential of business models in improving sustainability and foster the acceptance of the stakeholders across Europe

4.27. Bringing Logistics into Urban Planning

Challenge: Today, a general transport infrastructure plan for both people and logistics is missing in the city plan. It is necessary to **define conditions towards proper consideration of urban logistics infrastructure needs and urban design aspects in Sustainable Urban Logistics Plans integrated in overall mobility plans.** The involvement of all key stakeholders: business actors, local administration and local politicians is crucial to achieve awareness and consensus on urban design decisions. Business models for building and operating facilities, how to get financial support and how to get greater efficiency in the management of the infrastructure are the main challenges of this topic.

Outcome:

- Recommendations on architectural design and **integration of logistic facilities in urban areas**, as well as the business models supporting them. This means understanding of how to best build and manage – in an optimal and resilient way – logistics city infrastructures (loading/unloading areas, consolidation centres, pick up points, warehouses, etc.) and urban design adequate for the (evolving) dynamics of urban delivery services.
- **Analytical economic models to support stakeholder analysis, balancing logistic efficiency and life quality.**
- **Large-scale demonstrators on logistics planning for urban city planners showing the impact of concepts, tools and innovations.**

Impacts & Targets:

- Increased use of assets and infrastructures by 20%.
- Reduction of congestion and CO2 emissions by 20% through optimization of traffic and better vehicle utilisation.

Motivation/Challenge:

Currently, consideration of urban logistics dynamics is neglected in urban planning (e.g. in SUMPs), as evidenced in the Urban Mobility Package. It is necessary to define conditions towards proper consideration of urban logistics infrastructure needs and urban design aspects in Sustainable Urban Logistics Plans, taking into account: traffic and emissions reduction objectives, citizens behaviour, modular design, waste collection services, reuse of existing facilities, sharing infrastructure between people and goods, how to make logistics invisible. This topic includes research activities on risk assessment, procurement, business models for building and operating facilities and how to get financial support and the research for greater efficiency in the management of the infrastructure, for different purposes, different logistics chains, at different times of the day.

Specific challenges to be addressed include:

- Involvement of all key stakeholders: business actors, local administration and citizens. Political representatives are particularly important to achieve awareness and consensus on urban design topics including logistics needs; so far they have not been involved in city logistics projects.
- Design of the infrastructure, including the distribution nodes network and logistic platforms serving the city and business models to make the infrastructure economically sustainable. Design should be based on strategic scenarios modelling and visualization, to demonstrate and test different scenarios and to help understand what is already being done well (best practices). Scenario evaluation criteria should include: use of infrastructure 24h a day, understanding total demand (in/outs), taking out what can be done outside the city, development of new infrastructure vs. use of existing infrastructure.

Scope and Content:

- Recommendations on architectural design and integration of logistic facilities in urban areas, as well as the business models supporting them. This means understanding of how to best build and manage – in an optimal and resilient way – logistics city infrastructures (loading/unloading areas,

consolidation centres, pick up points, warehouses, etc.) and urban design adequate to (evolving) dynamics of urban delivery services. This involves:

- Research on use of brown fields for urban freight deliveries, integration concepts for logistics and traffic planning, or the architectural design and integration of logistic facilities in urban areas, as well as the business models supporting them.
- Research on the vertical exploitation of space for goods storage and transport.
- Development of an adequate tool for simulating impacts / benchmarking and set use cases.
- Good practices handbook for decision makers, to allow understanding what has already been done well, for different typologies of cities, as there are very different urban situations..

- Analytical economic models to support stakeholder analysis, balancing logistic efficiency and life quality.
- Large-scale demonstrators on logistics planning for urban city planners showing the impact of concepts, tools and innovations. Providing the blueprint for optimal standardised developments (Best Practices) applied as case-by-case solutions to current planning problems of cities, demonstrating logistics planning importance for urban cities.
-

Contribution to Milestones:

- 2020 Full alignment of economics, environmental, social and security goals
- 2020 Hub and network integration
- 2040 Sustainable and integrated urban logistics in the city mobility system

Expected Impacts:

To meet the challenge on more efficient and sustainable urban logistics, proposals are requested to proof how the following will be achieved:

- early integration of logistics in spatial and urban design, less congestion.
- Increased use of assets and infrastructures by 20%
- Reduction of congestion and CO2 emissions by 20% through optimization of traffic and better vehicle utilisation

4.28. Interoperable standard modular loading unit's operations in the urban context: autonomous deliveries

Challenge: **Modularization of logistic (smaller) units suggests similar benefits at urban level to those ISO-container has already demonstrated**: improved load factor and interoperability among different transport systems and modes, less logistics costs and handling times, more secure and safe cargo, etc. M**odular loading units used in the urban context will seek for interconnectivity, optimization and last mile cost efficiency.** However, these units need to be designed and tested for different urban scenarios and demonstrate the full advantages to industry and society. Additionally, it is necessary to pave the way towards a global standardisation to realize full benefits.

Outcome:

- **Development of modular urban load units compatible with regular containers and vehicles,** as well as new proposal for vehicle architectures and sizes compatible to urban load units (i.e. small van with capacity optimized for multiple or submultiple of palet-size/modular box).
- **Development of technologies to transfer standard loads between vehicles** (large and small) as well as with other transport modes at urban level. Enabling distributed self-control of objects through networks, as well as, cooperation and consolidation among various LSP and LSC.
- **Large scale pilot project** (including various business cases), together with an impact assessment (economical and environmental) will be demonstrated.

Impacts & Targets:

- Improvement of load factors and vehicle utilization by 15%
- Reduction of CO2 emission thanks to traffic reduction by 15%
- Reduction of handling costs and time in last mile operations thanks to standardization of load units and interoperability by 30%
- Increase safety and security of cargo by 30%

Motivation/Challenge:

Modularization revolutionized our global transport system. The use of modularization of logistic units together with (semi) autonomous transport at urban level suggests similar benefits to those ISO-container has already demonstrated: improved load factor and interoperability among different transport systems and modes, less logistics costs and handling times, more secure and safe cargo, etc. Modular urban loading units will seek for interconnectivity, optimization and last mile cost efficiency. However, these logistics units, starting from the experience undertaken in the past research projects such as MODULUSHCA for fast moving consumer goods, need to be designed and tested for different urban scenarios and demonstrate the full advantages to industry and society. Additionally, it is necessary to pave the way towards a global standardisation to realize full benefits.

Scope and Content:

- Development of modular urban load unit compatible with regular containers and vehicles, as well as, new proposal for vehicle architectures and sizes compatible to urban load units (i.e. small van with capacity optimized for multiple or submultiple of palet-size/boxes). The scope of the research has to also cover market acceptance of modular urban load unit and the whole urban logistics system including tools and techniques for awareness rising. Recommendations for standardised modular urban load units will be developed together with standardisation implementation process.

- Develop technologies to transfer loads between vehicles (large and small) as well as with other transport modes (architecture of vehicles, load units...), to allow decoupling of the delivery processes between mass transport and last mile operations, and technologies for vehicle C-ITS connectivity. Technologies, algorithms and tools that allow better planning, tracking and tracing of embedded materials and components, which reduce costs and consequently increases the margin for recycling materials at the end of their current use.

- Develop loading rate measurement systems (weight, volume...), to be connected with city access control, and network management. Enabling distributed self-control of objects through networks, independently of the way they are actually transported (and generally handled) as well as, cooperation and consolidation among various LSP and LSC are considered important features for the development of interconnected networks using iso-modular units.
- Large scale pilot project (including various business cases), together with an impact assessment (economical and environmental) will be demonstrated. Developed modular urban load units need to be easily adapted and accepted by all actors in the urban logistics, including postal companies. There should be no significant increase on complexity or cost for the market players in order to ensure the success on the deployment of developed modular urban load units.

ALICE milestone/s the areas is contributing to:

- 2020 Defining and assessing new opportunities and Business Models
- 2030 Efficient and automated distribution systems
- 2040 Sustainable and integrated urban logistics in the city mobility system
- 2020 Horizontal Collaboration
- 2030 Integration Manufacturing Logistics
- 2040 Open Supply networks

Expected Impacts:

- Improvement of load factors and vehicle utilization by 15%
- Reduction of CO2 emission thanks to traffic reduction by 15%
- Reduction of handling costs and time in last mile operations thanks to standardization of load units and interoperability by 30%
- Increase safety and security of cargo by 30%

4.29. Safety and Security in Urban Freight

Challenge: A significant number of goods is loss following security breaches specially in cities. It is therefore important to **identify solutions to guarantee a safe urban delivery system minimizing the risk for the freight operators and ensuring peoples' privacy and security at the same time**. Research efforts should be extended to systems enabling the **decoupling of the delivery and the collection of the goods** with efficient, reliable and safe solutions. Logistics providers, carriers and receivers need to work together in order to improve the security (mainly data and information, loss or damage of goods), the safety for workers (health) and the environment (dangerous goods) by introducing state-of-the-art technologies and further developments.

Outcome:

- **Efficient, reliable and safe solutions enabling the decoupling of the delivery and the collection of the goods**.

- Solutions to **improve security and safety** by assessing the potentials of improvements of **human machine interfaces**, policies, vehicles and information and ICT.
- Innovative solutions to ensure the **resiliency and robustness of urban freight systems.**
- **Impact assessment and roadmap** with mitigation measures to ensure safer and more secure urban mobility and logistics.

Impacts & Targets:

- Increased customer satisfaction by 30%
- Reductions of failed deliveries by 30%
- Reduction of cargo loss due to theft or damage by 30%
- Improvement of resilience and robustness of urban freight systems by 30%

Motivation/Challenge:

The security of goods and freight operations in urban environments in terms of crime and terrorism remains a challenge. A significant amount of goods gets lost following security breaches. It is therefore important to identify solutions to guarantee a safe urban delivery system minimizing the risk for freight operators and ensuring peoples' privacy and convenience at the same time.

The first obvious challenge is to put even more effort in tracking and tracing consignments throughout the delivery process in order to avoid loss and damage of goods.

A second challenge is the high number of failed deliveries tempting the logistics service providers to leave consignments with neighbours or on doorsteps. From that time, the consignment is no longer tracked and traced but the final consignee does not have the parcel in his hands yet. Research efforts should focus on systems allowing that time of delivery does not necessarily has to coincide with the moment the consignee lays hold of his goods, e.g. deliveries in pack stations or in vehicles, autonomous vehicle deliveries, drone deliveries or other similar systems that will be developed in the near future. These systems will only deliver their full potential if they are proven as safe and reliable and are perceived like that by citizens.

Other challenges are health issues for people working in urban distribution and environmental risks linked to the transport of dangerous goods in cities. Introducing state-of-the-art technologies and further developing them can be an answer to that.

A final challenge is the resilience and robustness of urban freight systems under normal conditions and in times of disaster (natural and anthroposophical disasters, terrorist attacks, etc.) to guarantee the supply of goods to urban areas.

Scope and Content:

- Efficient, reliable and safe solutions enabling the decoupling of the delivery and the collection of the goods.
- Research on technological, societal and ecological impact of failures in supply chains and development of solutions to improve security and safety by assessing the potentials of

improvements of human machine interfaces, policies, vehicles and information and communication technologies.

- Innovative solutions to ensure the resiliency and robustness of urban freight systems. Induced traffic, by using smaller light duty vehicles in combination with UCCs (urban consolidation centres), can be expected.
- An impact assessment is needed to understand existing safety and security issues related to urban logistics today and tomorrow, followed by the roadmap with mitigation measures to ensure safer and more secure urban mobility.

ALICE milestone/s the areas is contributing to:

- 2020 Defining and assessing new opportunities and Business Models
- 2040 Safe and secure supply chains for circular economy

Expected Impacts:

- Increased customer satisfaction by 30%
- Reductions of failed deliveries by 30%
- Reduction of cargo loss due to theft or damage by 30%
- Improvement of resilience and robustness of urban freight systems by 30%

ANNEX I: WG 1: SUSTAINABLE, SAFE AND SECURE SUPPLY CHAINS MEETING, 30TH OF OCTOBER 2015

Agenda

30th of October 2015

Venue: CLECAT. Rue du Commerce 77. 1040 Brussels
Ground floor - meeting room

10:30–11:00 Welcome to participants

Work in groups of 4-5 pax, in each session after a short intro and then presentation of outcomes in the small groups

Session 1: Integrated End-to-End Logistics System

11:00-12:00 identify the following aspects related to Integrated End-to-End Logistics System

a. Components/Requirements
b. Enablers and barriers
c. Roles
d. Added value/ impact for the stakeholders

12:00-12:30 Presentation of results and group discussion

12:30–13:30 Lunch Break

Session 2: Implementation Plan for WG1 Roadmap

13.30-14:30 Implementation Plan for the WG1 Roadmap.

- Topics to be implemented in the calls 2018-2020
- Long-term implementation plan after 2020

14:30-15:00 Share and present outcomes

15:00–15:15 Coffee Break

Session 3: Time to imagine your future

15:15-16.15 How Logistics should look like in 2030?

- What will be the business requirements?
- Make a value proposition on how companies will react to 'new' conditions.

16:15-16.45 Discussion of results

16:45 End of the meeting

List of participants

Surname	Name	Organization
Baeyens	Alain	Solvay/ELUPEG
Baalsrud	Jannicke	BIBA
Boucheri	Karine	FM Logistic Corporate
Chevalier	Dominique	FM Logistic Corporate
Dachs-Wiesinger	Alfons	Magna Steyr
Dobers	Kerstin	Fraunhofer Institute for Material Flow and Logistics IML
Flanagan	Aidan	CLECAT
Halldorsson	Arni	Chalmer University of Technology
Jammernegg	Werner	LRA/WU Vienna (Vienna Univ. Of Economics and Business)
Liesa	Fernando	ALICE
Rudolph	Christian	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)
Shodi	Moham	CASS Business School
Urciuoli	Luca	Zaragoza Logistics Center
Van der Jagt	Nicolette	CLECAT
Veenstra	Albert	DINALOG
Wolters	Peter	European Shippers Council

ANNEX II: WG 2: CORRIDORS, HUBS AND SYNCHROMODALITY MEETING, 3RD OF NOVEMBER 2015

AGENDA

Venue: 3 November 2015, 10AM-4PM @ECT, Rotterdam (Maasvlakte 2)

1. Welcome

2. Introductions: Physical Internet and wG2 roadmap on "Corridors, Hubs and Synchromodality". Discussion on the subject of synchromodality. (30 min)

3. Work Session 1: Implementation Plan. Discuss current WP in H2020 (2016-2017); define topics to be implemented in the calls 2018-2020 and long-term vision after 2020.

- Individual assignment: ask each individual to think in 3 key areas that should be further investigated with projects in the next WP (Starting between 2018-2020) and 3 more after 2020 (15 min.)
- Group(s): Make a compilation of the ideas in up to 5 areas (topics); identify interrelations, steps towards completion and example industry use cases (45 min.)

4. Lunch 12:30-13:00

5. Work Session 2: Relations with other ALICE roadmaps. Present PI and other roadmaps and think of key relations (to/from). Consider Components/Requirements, Enablers and barriers, Roles, Added value/ impact for the stakeholders.

- Individual assignment: ask each individual to list critical interrelations with other roadmaps, ordered in importance (15 min.)
- Group(s): Make a compilation of the interrelations and identify consequences for different roadmaps. Revisit (3). (45 min.)

6. Synthesis. Discussion on state of logistics in 2030. (20 min)

7. Closing, any other matters

8. Excursion ECT MV2

List of participants

Surname	Name	Organisation
Ngo	Pernilla	Lindholmen Science Park /CLOSER - Swedish mobilization in logistics and transport
Sjögren	Jerker	Lindholmen Science Park /CLOSER - Swedish mobilization in logistics and transport
Islam	Dewan	NewRail, Newcastle University
Tavasszy	Lori	TNO / Tu Delft
Aulicino	Angelo	Interporto Bologna
Hajdul	Marcin	Institute ofLogistics and Warehousing
Kirchner	Malgorzata	Institute ofLogistics and Warehousing
Eidhammer	Olav	Institute of Transport Economics
Dachs-Wiesinger	Alfons	MAGNA STEYR AG & Co KG
Journee	Herman	ECO Sustainable Logistic Chain Foundation, ECOSLC
Adesiyun	Adewole	FEHRL – Europe's National Road Research Centres
RECAGNO	Valerio	D'Appolonia S.p.A.
Schauer	Oliver	LRA/Logistikum Steyr
Loli Herrero	Tomás	ITENE
Feyen	Eric	UIRR INTERNATIONAL UNION FOR ROAD-RAIL COMBINED TRANSPORT
Kraaijenhagen	Ben	MAN Truck & Bus AG
Knoors	Frank	LogitOne

ANNEX III: WG 3: INFORMATION SYSTEMS FOR INTERCONNECTED LOGISTICS WORKSHOP, 27TH OF OCTOBER 2015

Agenda

Venue: Fraunhofer-Forum Berlin. Anna- Louisa-Karsch-Straße, 2 10178

11:00–11:10 Welcome to participants

Session 1: Integrated End-to-End Logistics System

11:10-12:10 Work in groups of 4-5 pax to identify the following aspects:

e. Components/Requirements
f. Enablers and barriers
g. Roles
h. Added value/ impact for the stakeholders

12:10-12:40 Presentation of results and group discussion

12:40–13:30 Lunch Break

Session 2: Implementation Plan for WG3 Roadmap

13.30-14:30 Definition of the Implementation Plan for the WG3 Roadmap

- Topics to be implemented in the calls 2018-2020
- Long-term implementation plan after 2020

14:30-15:00 Share and present outcomes

15:00–15:15 Coffee Break

Session 3: Time to imagine your future

15:15-16.15 How Logistics should look like in 2030?

- What will be the business requirements?
- Make a value proposition on how companies will react to 'new' conditions

16:15-16.45 Discussion of results

16:45 End of the meeting

List of attendees:

Surname	Name	Organisation
Blobner	Christian	Fraunhofer IFF
Franklin	Rod	Kühne Logistics University
Georgiadis	Panagiotis	ICCS
Hofman	Wout	TNO
Ingram	John	Transport Systems Catapult
Liesa	Fernando	ALICE
Nettsträter	Andreas	Fraunhofer IML
Ozemre	Murat	Bimar
Persi	Stefano	ENIDE
Saleem Pathan	Saira	Fraunhofer IFF
ZAJICEK	Jurgen	Austrian Institute of Technology

ANNEX IV: WG 4: GLOBAL SUPPLY NETWORK COORDINATION AND COLLABORATION WORKSHOP, 3RD OF NOVEMBER 2015

Agenda

3rd of November 2015

Venue: Procter & Gamble (BIC), Temselaan 100,1853 Strombeek-Bever Belgium, meeting room M0117-M0118 (tbc)

The workshop is organised by ALICE within the framework of SETRIS[1] (Strengthening European Transport Research and Innovation Strategies) project financed by H2020.

10:00–10:10 Welcome to participants

Session 1: Definition of Integrated End-to-End Logistics System

10:10-11:10 Work in groups of 4-5 prs to define elements for the definition, i.e.:

a. Components/Requirements

b. Enablers and barriers

c. Roles

d. Added value/ impact for the stakeholders

11:10-12:00 Presentation of results and group discussion

Session 2: Time to imagine your future

12.00-12:30 How Logistics should look like in 2030?

☐ What will be the business requirements?

☐ Make a value proposition on how companies will react to 'new' conditions

12:30-13:00 Share and present outcomes

13:00–13:30 **Lunch Break**

Session 3: Implementation Plan for WG4 Roadmap (WG4 members only!)

13:30-14.15 Definition of the Implementation Plan for the WG4 Roadmap

☐ Topics to be implemented in the calls 2018-2020

☐ Long-term vision after 2020

14:15-15.00 Discussion of results

List of Attendees:

SURNAME	NAME	ORGANIZATION
Alcaraz	Juan	ITENE
Andersson	Dan	Chalmers
Andres	Irene	CNC-LOGISTICA
Baalsrud Hauge	Jannicke	BIBA
Barbarino	Sergio	Procter & Gamble
Bauwens	Marco	JDR
Brüll	Ludger	Bayer Technology Services GmbHBTS
Charrel Ernest	Albert	JDR
Cunningham	Petter	SKI
De Vito	Marco	Tecnoalimenti
Dowgielewicz	Timasz	ILIM
Dullaert	Wout	The VU Logistics Research group
Hegmanns	Tobias	Fraunhofer IML
`t Hooft	Dirk	ALICE / DINALOG
Konstantinopoulou	Lina	ERTICO
Liesa	Fernando	ENIDE / ALICE
Moesch	Emmanuelle	Cluster Paca - Logistique
Norbert	Peto	MDLZ
Paganelli	Paolo	Bluegreen
Prévot	Sylvain	Traxens
Prugger	Raffaello	Tecnoalimenti
Saenz	Maria Jesus	Zaragoza Logistics Center
Schumacher	Jens	FH Vorarlberg
Stumm	Patrick	Pastu
Treiblmaier	Horst	LRA/Logistikum
Van Amelsfort	Lieke	Argusi
Verstraelen	Tim	Ahlers
De Vries	Jelle	VU
Wolters	Peter	European Shippers Council

ANNEX V: ALICE-ETRAC WORKSHOP, BRUSSELS 26 JANUARY 2016

The workshop is organised by ALICE and ERTRAC within SETRIS (Strengthening European Transport Research and Innovation Strategies) project financed by H2020. Project Number 653739.

Urban freight working group
Agenda

26th of January 2016

Venue: POLIS. Rue du Trône 98, 1050 Brussels, Belgium

10:30–11:00 **Welcome to participants and agenda**. Dario Biggi (chair of WG5 ALICE)

11:00-11:30 **Presentation of "Integrated End-to-End Logistics System", a first relevant outcome from SETRIS project.** Fernando Liesa (ALICE)

11:30-12:00 **Presentation of initial conclusions of the benchmark analysis of the current UF roadmap to identify coverage of challenges by projects or WP topics between 2014 and 2017**. Gabriela Barrera (POLIS) and Emilio González (vice-chair of WG5 ALICE)

Working session: New challenges for UF Roadmap

Participants will be organized in groups of 4-5 max to identify new challenges for UF working group after a short intro.

12:00-12:30 **Introduction to the session**. Paola Cossu (vice-chair of WG5 ALICE)

12:30–13:30 **Lunch Break**

13:30-15:00 **Working session to identify new challenges before and beyond 2020.** All participants

15:00-16:15 **Share and present outcomes.** All participants

16:15-16:30 **Conclusions and next steps.** Dario Biggi (chair of WG5 ALICE)

16:30 **End of the meeting**

List of participants

Surname	Name	Organization
Aertsents	Xavier	ERTRAC
Andersen	Jardar	TOI
Barrera	Gabriela	POLIS
Biggi	Dario	Poste Italiane S.p.A.
Caldevilla	Andres	DENSO/CLEPA
Congiusta	Antonio	UNICAL
Cossu	Paola	FIT CONSULTING
González	Emilio	CNC-LOGISTICA/ITENE
Guerlain	Cindy	LIST
Johnson	Anders	SP
Kalev	Aleksandar	LIST
Kassyda	Christian	VWN (commercial vehicles
Konstantinopoulou	Lina	ERTICO
Kraaijenhagen	Ben	MAN
Rudolph	Christian	ECTRI/DLR
Liesa	Fernando	ENIDE / ALICE
Lozzi	Giacomo	POLIS
Macharis	Cathy	VUB
Moesch	Emmanuelle	Cluster Paca - Logistique
Rodrigues	Maria	PANTEIA
Schrampf	Juergen	LRA/Econsult Betriebsberatungsges.m.b.H.

Souhait	Patrick	Muses (Member of Cluster Paca Logistique)
Stephens	Julian	MJC[2]
Vancluysen	Karen	POLIS
Vennersten	Sofie	Lindholmen Science Park/EUCAR
Zunder	Tom	NewRail
Lapillonne	Gregoira	FN Logistics
Routhin	Clemence	LUTB
Gatta	Valerio	University of Roma
Val	Susana	Zaragoza Logistics Center
Catini	Giulia	IVECO (CNH Industrial)

ANNEX VI: ALICE WORKSHOP, VIENNA 2-3 FEBRUARY 2016

The Meeting will be organised by ALICE with the support of SETRIS (Strengthening European Transport Research and Innovation Strategies) project financed by H2020. Project Number 653739.

ALICE members and experts workshop

Date: February 2-3, 2016

Venue: Wirtschaftsuniversität Wien, Welthandelsplatz 1, 1020 Vienna, Austria

AGENDA for Day 1: 2nd of February

10:00-10:30	**Welcome coffee**
10:30-10:45	**Workshop overview: welcome, agenda, targets and expected results.**
10:45-11:30	**Definition of Truly Integrated Transport System for Efficient and Sustainable Logistics.** An updated document with comments received will be shared second half of January.
11:30-11:45	**Research and Innovation progress monitoring.** Fernando Liesa. ALICE Secretary General, Logistics Innovation Leader, ENIDE.
11:45-12:45	***Implementation Plan. Topics discussed with all attendees (1)*** ***All participants working in parallel on selected topics.***
12:45-13:45	**Lunch**
13:45-14:45	***Implementation Plan. Topics discussed with all attendees (2 Continuation)***
14:45-15:15	**Coffee Break**
15:15-16:00	**Plenary session to share outcomes**
16:00-18:30	**Public event organized with LRA**
18:30	**End of the day**
20:00	**Networking Dinner**

AGENDA for Day 1: 3rd of February

9:00-9:15	**Warm up and introduction to the day**
9:15-10:30	***Implementation Plan. Topics discussed in parallel session (1)***
10:30-11:00	**Coffee Break**
11:00-12:00	***Implementation Plan. Topics discussed in parallel session (2)***
12:00-13:00	**Lunch**
13:00-14:00	**Plenary session to share outcomes**
14:00-16:00	**ALICE Research and Innovation Roadmap on the Physical Internet**
16:00	**End of the workshop**

List of participants

First name	Last name	Company / Organisation
Waqas	Ahsen	PostEurop
Juan	Alcaraz	ITENE
Angelos	Amditis	ICCS
Corrado	Andrean	AJA REGISTRARS EUROPE
Angelo	Aulicino	Interporto Bologna SpA
Jannicke	Baalsrud Hauge	biba
Peter	Bachl	Industrie-Logistik-Linz GmbH
Eric	Ballot	Mines ParisTech
Sergio	Barbarino	P&G
Immacolata	Battaglia	Meware
Pierre	Beran	Jones Lang Lasalle
Jan	Bergstrand	Trafikverket
John	Berry	ELUPEG
Dario	Biggi	fondazione proPosta \ Poste Italiane SpA
Christian	Blobner	Fraunhofer IFF
Frédéric	Buyse	IFB
Franco	Castagnetti	NEWOPERA
Paola	Cossu	FIT CONSULTING
Frans	Cruijssen	ArgusI

Alfons	Dachs-Wiesinger	MAGNA STEYR AG & Co KG
Yves	David	COMACAS - CASINO
Lieven	Deketele	P&G Sevrices Company SA
JUAN MANUEL	DÍEZ OREJAS	AUTORIDAD PORTUARIA DE VALENCIA
Verena Charlotte	Ehrler	DLR Institute of Transport Research
Olav	Eidhammer	Institute of Transport Economics
Rikard	Engström	Swedish Transport Admin
Eric	Feyen	UIRR scrl
Fabiana	Fournier	IBM Research - Haifa
Jean Francois	Fusco	EALTH
Pierre	Gabaud	EUCAR
Lukas	Gerhold	Siemens
Emilio	Gonzales	ITENE
Marcin	Hajdul	ILiM
Arni	Halldorsson	Chalmers University of TEchnology
Maria Dolores	Herrero Tomás	ITENE
Wout	Hofman	TNO
Indrek	Ilves	ALICE/Interlogistics
John	Ingram	Transport Systems Catapult
Werner	Jammernegg	WU Vienna
Mats	Johansson	Chalmers University of Technology
Anders	Johnson	SP Technical Research institute of Sweden
Mats	Johnsson	Lund University
Herman	Journee	ECO Sustainable Logistic Chain Foundation
Christian	Kassyda	Volkswagen Commercial Vehicles
Panayotis	Katsoulakos	INLECOM
Ralph	Keck	Procter & Gamble Purchases
Christoph	Kern	Austrian Logistics Network
Gosia	Kirchner	Institute of Logistics and Warehousing
Ben	Kraaijenhagen	MAN Truck & Bus AG
Tobias	Kutzler	Fraunhofer IFF
Alessandra	Laghi	University of Bologna
Heikki	Lahtinen	LIMOWA

Jorge	Leon	ITENE
Chiara	Lepori	Consorzio IB Innovation
Alan	Lewis	Smart Freight Centre
Fernando	Liesa	ALICE/ENIDE
Edoardo	Marcucci	university of roma tre
Nils	Meyer-Larsen	ISL Institute of Shipping Economics and Logistics
Andreas	Nettsträter	Fraunhofer IML
Carina	Neveling	Fraunhofer IML
Pernilla	Ngo	Closer
Nico	Nuerbchen	HARTMANN Group
Murat	Ozemre	Bimar ARKAS
Paolo	Paganelli	Bluegreen Strategy
Alfonso	Pagliuca	AJA REGISTRARS EUROPE
Gianmarco	Pagliuca	AJA REGISTRARS EUROPE
Stefano	Persi	ENIDE
Norbert	Peto	Mondelez
Andreas	Pichler	Gebrüder Weiss GmbH
Matthias	Prandtstetter	AIT Austrian Institute of Technology GmbH
Sylvain	Prevot	TRAXENS
Katrin	Reschwamm	Verein Netzwerk Logistik Schweiz
Michael	Reske	duisport agency GmbH
Mar	Rodriguez	KALEIDO IDEAS & LOGISTICS
Emeline	Rousselet	CHEP Europe
Clémence	Routhiau	LUTB Transport and Mobility Systems
Oscar	Ruiz	ITENE
Maria Jesus	Saenz Gil De Gomez	Zaragoza Logistics Center
Oliver	Schauer	FH OÖ -LOGISTIKUM
Jürgen	Schrampf	ECONSULT
Antonino	Scribellito	PostEurop
Jerker	Sjögren	Jesjo Konsult
Julian	Stephens	MJC2
Dirk	t Hooft	ETP-ALICE
Horst	Treiblmaier	University of Applied Sciences, Upper Austria
Athanasia	Tsertou	ICCS
Nil	Tunasar	ASSOCIATION OF INTERNATIONAL FORWARDING AND LOGISTICS SERVICE PROVIDERS
Luca	Urciuoli	Zaragoza Logistics Center
Bas	van Bree	TKI Dinalog

Nicolette	van der Jagt	CLECAT
Robert	Vasenda	Advantech-DLoG
Alan	Waller	ELUPEG
Hans	Westerheim	SINTEF ICT
Henk	Zijm	Univ. of Twente / DINALOG
Marcel	Huschebeck	PTV Group
Lahtinen	Heikki	LIMOWA - Logistics Centre Cluster Finland
Dominik	Ruttke	ECTRI/DLR
Thomas	Zunder	ERTICO / NewRail, Newcastle University
Florian	Maurer	FH Vorarlberg