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ALICE Recommendations to H2020 Work Programs 2016-2017
December 2014

ALICE, Alliance for Logistics Innovation through Collaboration in Europe, is the European Technology Platform for Logistics, launched on June 11, 2013, and receiving official recognition from the EC in July 2013. It has been set-up to develop a comprehensive strategy for research, innovation and market deployment of logistics and supply chain management innovation in Europe. Following its mandate, ALICE is providing recommendations for the next Work Program 2016-2017.

Content

[1] These topics may also be partially implemented through section "*socio-economic and behavioural research and forward looking activities for policy making*" withinSmart, Green and Integrated Transport

[2] These topics could be implemented through or with the collaboration of the *Information and Communication Technologies* section of Horizon 2020.

Context and Background

The EU is the world's largest exporter and biggest trader in goods[1]. It is estimated that in the next 10-15 years, 90% of the world's growth will come from outside the EU, so the EU has every interest in making sure that its companies remain very competitive and are able to access new markets and benefit from these sources of growth. Globalisation is not just about facilitating trade and exchanges. It is about joining global value chains and delivering products, services and technologies that no individual country would be able to produce on its own. In this context, logistics is a key aspect to lead value chains and access these new markets in competitive way. E-commerce is also rapidly and drastically changing mobility patterns and last mile logistics.

Estimates put the share of the logistics industry in the GDP of Europe at close to 14%[2]. According to the World Bank, the best 4 logistics performers are from the EU and out of the global top-10, 7 of them are from the EU in 2014[3]. According to experts, the long-term annual growth rate of the logistics industry is between 4% and 8% and exceeds on average 2.5 times the GDP growth rate of the EU[4]. However, some EU countries are exhibiting a decoupling of GDP and freight tonne-km growth due to increased efficiency and therefore saving energy and reducing environmental impacts. In addition, the competitiveness of other sectors (such as the automotive and the food industries) relies heavily on the performance of the logistics sector, as logistics provides the glue between the various parts of the supply chain (suppliers, manufacturers, markets).

[1] *Strategic approach for Horizon 2020 - a contribution from foresight. Ref. Ares(2014)1202380*
[2] COM(2007) 607 final. "*Freight Transport Logistics Action Plan*" European Commission, Brussels, 18.10.2007
[3] World Bank "*Connecting to Compete 2014*". http://www.worldbank.org/content/dam/Worldbank/document/Trade/LPI2014.pdf
[4] Prof. Dr. Dieter W. Rebitzer (University of Nürtingen-Gieslingen), "*The European Logistics Market*".

Logistics is a cross-sectorial activity impacting all productive sectors. It is estimated that logistics account for 10 to 15% of the final cost of finished goods[5]. A 10% to 30% improvement in efficiency in the EU logistics sector would potentially equal a € 100 – 300 billion cost relief for the European industry[6]. Efficiency in logistics, therefore, is a key element for the further growth of industrial activity and trade on a global scale.

Transportation is responsible for around a quarter of the EU greenhouse gas emissions[7]. Eurostat surveys estimate that 24% of good vehicles in the EU are running empty and the average loading of the rest is 57% giving an overall efficiency: of 43%. Flow imbalances can explain only half of this loss. The total cost burden of road freight transport inefficiency is estimated as €160 billion and 1.3% of EU27 CO_2 footprint [8].

While emissions from other sectors are generally falling, those from transport (still primarily based on fossil fuels, i.e. oil and gas) have increased by 36% since 1990[7] due to the linkage between transport and economic growth. The European Union[9] has identified as one of its objectives the decoupling of economic growth and the use of resources, by a shift towards a low-carbon and energy-efficient economy, and by modernization of the transport sector. The European Commission has established a 60% reduction of Green House Emissions as the target to be reached by 2050 compared to 1990 figures[10]. Concerning the freight logistics sector, similar targets have been established for the reduction of CO_2 emissions[11]. Sustainable economic growth is a fundamental challenge for Europe. Improved and more efficient logistics is a major enabler for sustainable growth

According to the Strategic approach for Horizon 2020 - a contribution from fore*sight*[1] "*A huge disruption in manufacturing supply chains is expected to come from the diffusion of 3D printers, irrespective of whether they are able to print food or organs. In the longer-run the convergence between nanotechnology, biology, neuroscience, and ICT can take transversality different levels through for example, intelligent self-organising artefacts combining biological and synthetic elements."* The development of such disruptive technologies will soon make available capabilities that will facilitate the implementation of ALICE vision of a Physical Internet[12] (PI). This vision addresses the biggest challenge in logistics: the development of new solutions and business models that leverage knowledge and technology to create more efficient supply networks and logistics operations.

PI has potentials to streamline an open global logistic system founded on physical, digital, and operational interconnectivity, through encapsulation of goods, interfaces and protocols design, aiming to move, store, realize, supply and use physical objects throughout the world in a manner that is economically, environmentally and socially efficient and sustainable.

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[5] COM(2006) 336 final. "*Freight Transport Logistics in Europe – the key to sustainable mobility*". Brussels, 28.6.2006

[6] *A Technology Roadmap for Logistics*. Alliance for European Logistics. (2010)

[7] **http://ec.europa.eu/clima/policies/transport/index_en.htm**

[8] World Economic Forum-2009

[9] COM(2010) 546 final "*Europe 2020 Flagship Initiative – Innovation Union*", European Commission, Brussels, 06.10.2010

[10] COM(2011) 112 final. "*A Roadmap for moving to a competitive low carbon economy in 2050*" European Commission, Brussels, 8.3.2011

[11] COM (2011) 144 final "*Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system"* European Commission, Brussels, 28.3.2011

[12] Montreuil, Benoit. "*Physical Internet Manifesto, version 1.11.1*", CIRRELT Interuniversity Research Center on Enterprise Networks, Logistics and Transportation, Quebec, 28 November 2012. Retrieved on 6 February 2013.

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

- Increasing service levels to the consumer of products and services, in the most efficient and sustainable way.
- Lowering the barriers for industries to enter new markets and to access the products for consumers.

The efficiency and sustainability driver corresponds to the key message of the Physical Internet vision, that is: by opening the logistic networks and sharing resources, the highest levels of efficiency can be achieved, levels unattainable by any individual company. Nevertheless, a company will be reluctant to and not yet ready to share assets/services in the supply chain if they are essential for its strategic position, i.e., if the logistic service-level is a differentiator against competitors. The challenge will be to develop new business models that reconcile societal and industrial objectives.

To that end, the market driver is of key importance, in the eye of the industry. The Physical Internet opens up new markets by multiplying the sources of supply. New products that were previously unavailable or too expensive to reach a certain market can be matched with new sources of demand, i.e., new retail models and the rising demand from on-line sales.

Besides coordination and collaboration, two other important enablers and drivers call for the transformation process leading to the Physical Internet:

- **Internet-of-Things and Big Data infrastructure**. Both elements represent the technological and informational basis enabling future coordination and collaboration in supply chains; potentially levering a Physical Internet.
- **New manufacturing paradigms**. Future supply chains are networks of "Smart Factories". Emphasis should be laid on the integration of the Smart Factory (see Factory-of-the-Future) in supply network collaboration and coordination processes. It is expected that the combination of Industry 4.0, Physical Internet and Internet-of-Things will lead to fundamentally new business models in manufacturing, retailing and customer services.

ALICE recommendations are pursuing the Low-hanging fruits implementation elements towards the Physical Internet while leveraging the outcomes and results of past innovation and research projects.

Process to build consensus on ALICE recommendations

These recommendations are based on the research and innovation needs identified within ALICE Working Groups and included in the Research and Innovation Roadmaps in the field of logistics recently approved by ALICE Steering Group (November 2014). The process for the definition of these recommendations started already in June. After a consultation within the Working Groups the document: *"Response of ETP ALICE on the consultation request to define the WP 2016 -2017"* was

issued to the European Commission and has been the basic document to continue elaboration of the recommended topics. ALICE organized a workshop in Brussels on the 3rd and 4th of September where the topics were presented and discussed with the members and additional recommended topics identified. The document was shared with ALICE Mirror Group composed of Member States representatives, clusters and national platforms and presented in ALICE Mirror Group meeting on the 13th of October. The recommendations were further reviewed by the Working Groups and approved by the Steering Group on the 17th of November 2014 meeting. The Steering Group proceeded with the prioritization of the topics and the priority is included after each topic title. Topics which do not include the priority level were gathered after the prioritization process.

Recommendations

Program Section: Smart, Green and Integrated Transport

Logistics

1. Identifying opportunities of the Physical Internet (2016). Very High Priority.

Specific challenge: Many of the changes observed in the transport sector are incremental reflecting a gradual uptake of improvements in technology and management practice. However, the Transport Advisory Group has identified a series of potential game-changers for the transport sector, such as (quote TAG):

- *Crowd sourcing of vehicle-based traffic data for congestion management and navigation.*
- *Application of internet principles to the movement of freight in the so-called 'physical internet'.*
- *New business models for sharing cars, vans and bicycles in urban areas (for both people and goods)*
- *Application of new gain-sharing techniques to promote logistics collaboration across the supply chain*

These game-changers are not realized by technical research alone, the business and industry adoption and the mental shift are of high importance challenges to reach these new paradigms in logistics.

Physical Internet (PI) concept embodies many innovative concepts that are on the agenda of the various ALICE Research Roadmaps. Moreover, a number of initiatives (TEN-T, e-freight) and technologies (Big data, IoT, Future Internet, Industry 4.0, automated driving, ITS) are either supporting potential implementation of the Physical Internet or requiring a substantial breakthrough in logistics operations. To reach this breakthrough, creating awareness on the vision of Physical Internet is needed. The key challenge is the design of individual components and their integration towards Physical Internet: Understanding the feasibility and impact of collaboration concepts required for PI (business models, governance), of ICT systems (connectivity, applications), of network

architectures (hubs and corridors, federated or centralized approaches), of technological concepts (modularity and encapsulation). The challenge is therefore, to create a fully operationalized Physical Internet vision which will be endorsed by industry and other stakeholders.

Scope and content: The proposals need to:

- Identify and promote through conference, events, etc.) already in place demo-cases and components towards a sound development of the Physical Internet: horizontal collaboration sharing logistics assets and networks, e-booking systems for freight, postal end-to-end logistics chains, utilization of modular load units, end-to-- end visibility, synchromodal transport solutions, etc.

- Developing simulation and modelling tools measuring the impacts of the Physical Internet implementation. While the concept of a Physical Internet underlies the vision of ALICE, no proven comprehensive model of what such an approach would mean to the transport of goods within the EU, and globally, exists. Such a model should be developed so that issue areas can be surfaced early and research and development projects developed accordingly. The model would provide the validation of the vision as well as assist in setting the agenda for future research and innovation.

- Identify and pursue opportunities and low-hanging fruits (first implementation sectors, etc.) as well as medium and long term milestones to achieve the Physical Internet.

- Exchange and building consensus between stakeholders: research and industry on further steps, barriers to overcome (anti-trust law compliance) and drivers including business continuity towards the Physical Internet. Define research and innovation agendas and implementation plans with clear references to the change needed both in industry and policy.

- Ensure compatibility of the Physical Internet with the implementation of ALICE´s research and innovation agenda and roadmap and considering other related industry research and innovation roadmaps: Manufacturing, Robotics and Transport ETP's.

- Developing links and coordination strategies between related initiatives at the international level (US, Canada, Hong Kong and Member States and Associated Countries level) in order to ensure synergies and convergence.

Expected Impact

- Realizing a broad awareness rising and promoting debate and consensus building between key industry players and research in order to accelerate the game-change to PI. This means increased service levels for the consumer in most efficient and sustainable way and improved access to new products for end consumers.

- Improved asset and service utilization.

- Reduce energy consumption, traffic congestion and emissions.

Type of Action: Coordination Action €2-3 Million and Research and Innovation Actions

2. Improved Transhipment Points (terminals, city--hubs, ports) (2016). Very high Priority.

Specific Challenge: The EU objective is to shift 30% of road flows above 300 km. to alternative modes by 2030, and 50% by 2050. A key challenge recognized by different ETPs and advisory groups (ALICE, ERTRAC, Horizon 2020 Transport Advisory Group) is the need for integration of transport subsystems. For the EU freight network, hubs or transhipment points play this pivotal role. Hubs are the multimodal connectors between the TEN-T freight corridors, defining the options for transport through Europe. They are important crystallization points for employment in locally embedded, smartly specialized logistics clusters. Also, they drive the implementation of advanced multimodal transport and ICT technologies, together with the transport modalities.

Scope and Content:

- **Hub technology:** automating loading/unloading systems allowing terminals and hubs (including yard management) to operate different modular cargo units automatically. Progress on automation of the load/upload process for small load units by using enhanced robotized machines that perform the process more efficiently. In addition, an interaction between these machines and AGV vehicles will increase the performance of both technologies and reduce one of the barriers to progress to a more co-modal freight transport. Local traffic management and monitoring (to reduce congestion, unnecessary idling, parking, and local environmental impact) also needs to be implemented.
- **Network integration:** hubs integrated into the TEN-T core freight network, allowing efficient connections between corridors and last mile access to users. At the moment the position and role of hubs with the TEN-T network is unclear. A definition of performance profiles at different positions in the network is needed, including requirements for basic transport interoperability, a clarification of the European added value of individual hubs (to what extent do benefits of investments land in other member states?), including their importance for maritime and continental transport, both for long distance and local aces purposes.
- **Logistics cluster formation and governance** from mere transhipment points to value-added hubs, combining transhipment, various value added activities (storage, handling, packaging, bundling, cleaning etc.) as well as postponed manufacturing and logistics orchestration services. Transhipment points can act as local attractors of employment but have specific business models that rest on a synergetic balance between manufacturing, advanced logistics services, auxiliary services (e.g. finance, insurance) and transportation. Linking to the idea of smart specialization of clusters, hubs need to be empowered to combine an international “connection” function with the local “place” function. Questions concerning the governance of hubs to allow the strategic management of this wide scope and important function in a network must be addressed as well.
- Development of tools to be offered to the hub community. Development of dynamic tools allowing terminals and hubs to be an active part of the transport chain. In addition, the tools can

be offered as added-value services to the SMEs that have not the possibility to develop such IT systems internally / by themselves. The use of such tools can increase the SMEs' competitiveness while minimizing their expenses. Furthermore, barriers to access the intermodal market can be lowered, thus paving the path to a more co-modal freight transport.

Expected Impacts:

- Improved door-to-door logistics performance via TEN-T network
- Added value of hubs increased; local economic integration
- Efficiency of goods and cargo handling in specific sites
- Less local congestion and emissions, CO2, harmful emissions and noise
- Less use of land and traffic infrastructure
- Increase SMEs competitiveness in intermodal operations market

Type of Actions: Research and Innovation Actions and 1 Coordination Actions.

Note: This topic has been agreed together with ERTRAC ETP.

3. Towards the Physical Internet: Corridors and hubs (2017). High Priority.

Specific Challenge: Corridors and hubs play a key role in logistics and supply chains. The network has grown organically, i.e. their evolution so far has been guided by different stakeholders in an uncoordinated manner. The PI, however, will place strict demands on location, equipment, capacities of hubs and corridors, including their capabilities to manage movements. At the same time, the fast developments in ICT force the logistics industry to re-think services and operational approaches. Due to the diversity of the industry, however, the definition and implementation of EU-wide systems is an enormous challenge. This calls for an international R&D effort to operationalize the PI and work towards coherent EU wide implementations of technologies that will bring the PI closer.

In order for the PI concept to be operationalized, the development of co-modality with Europe has to be concretized and focused on seamless, flexible and robust connections between corridors of different modes of transport, which makes full use of the new possibilities in information and communication technology. Recent concepts such as synchromodality are an important step towards such a freight transport system. By analogy with the tremendous impact that the container had on production and inventory control, the PI will transform the design of supply chains and the actual transportation flows. It is vital that the consequences for the demand for infrastructure (i.e. hubs, corridors and ICT) are properly understood. The PI will require many new technologies and organization concepts to be developed. R&D will need to go beyond systems currently in place and design new architectures for planning, booking and transport execution systems.

Scope and Content: Standardized vertical transaction and specialized horizontal operations are key factors for achieving optimization in freight transports leveraging on novel business model schemas. Hubs can be crucial in brining efficiency in the Physical Internet hierarchy on both lower level interactions (smart positioning of inventories in warehouses) and upper level operations (added

value node operations, such as real time exception management, flexible network management in cooperation with other nodes); these features will enable faster traffic reconfiguration, better network exploitation and finally more efficiency in logistics operations. Systems such as: booking systems that finds the best mode or combination of modes options in an end-to-end transport giving end users real time information on shipments and global coverage of the supply chain (from order placement to the final delivery). Understanding and mapping shippers' demands from within their supply chain is a prerequisite for EU-wide deployment of Synchromodal services. Solutions need to ensure that modal and corridor available services are accessible. Solutions and systems should advance in the implementation of harmonized/digitized freight paperwork across chains. Solutions should provide stakeholders with appropriate and reliable information concerning: reconciliation of loading times (for planning and performance purposes), frequencies of services (for planning), quality and capacity of services of freight transport owners to optimize assets utilization. Solutions need to incorporate flexibility to allow alternative choices/ plans in case of network failure.

Expected Impacts:

- Strengthening digital and physical flows (systems' interoperability and operation standardization)
- Defining novel governance, with market oriented dynamics able to equilibrate supply and demand and then de-stress supply chains at global level.
- Seamless management of freight transport execution across member states and modes of transport, including planning, booking and freight ITS
- Increase of reliability and reduction of transit times by rail, waterways and intermodal transport
- Increased attractiveness of Europe for global supply chains due to high quality logistics

Type of Actions: Research and Innovation Action and 1 CSA.

4. Network of flexible and collaborative supply chains integrating the opportunities of manufacturing technologies (2017). High Priority.

Specific Challenge: Future supply chains are networks of "Smart Factory". Emphasis should be laid on the integration of the Smart Factory (see Factory-of-the-Future) in supply network collaboration and coordination processes. The aim is to explore the potential of smart factories to improve flexibility and efficiency of production by intelligent coordination on the supply chain level. Further, the aim is to create new business processes and models based on the smart factory being integrated in intelligent supply chains. It is expected that the combination of Industry 4.0, Physical Internet and internet-of-things will lead to fundamentally new business models in manufacturing, retailing and customer services. This will lead to fundamental changes on how logistics and transport will be arranged. Research in this area will deal 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.

Further analysis is required to better understand the implications of the following concepts:

1. Holistic Supply Chain view
2. Manufacturing villages for collaboration and sharing of non-unique resources that are integrated in European supply networks (e.g. Pharma industry)
3. Agile, modular and distributed manufacturing: requirements, implications and opportunities for logistics in smart, collaborative transport and storage systems.

Scope and content: Establish and extend business cases to facilitate the emersion of specialized industrial clusters around modular manufacturing concepts by adding supply chain management and new physical logistics systems to cover the whole value chain. New concepts will leverage already developed solutions from previous and ongoing research projects on modular logistics units, i.e. Modulushca.

The core of the research will focus on developing:

- Enabling technologies, e.g. modular logistics units for storage and/or transport for specialized goods.
- Business models for shared manufacturing services, enabling to share services such as facility management, IT, security and safety services, training centres and non- core manufacturing facilities (e.g. printing services, packaging, etc.)
- Joint manufacturing and logistics hubs and transhipment points.

The verification of new models will happen in a living lab environment by setting up a collaborative demo project on National/ European level, where various industries will be involved. By experimenting in practice with new business models next steps will be found out that will lead to the integration of new Logistics and Supply Chain concepts and the Factory of the Future.

Expected Impact:

Realizing the full potential of the Industry 4.0 will lead to an improved competitive position of Industry and Logistics in Europe, better customer responsiveness and satisfaction, a better use of resources and increase of sustainability.

The business cases will lead to the next steps to exploit the full potential of modular manufacturing and integrated logistics processes.

Type of action: Research and Innovation action. Estimated budget € 3-5 Million.

5. Information Systems Supporting cost and environmental impact reduction* (2016). High Priority.

Specific Challenge: The use of information and communication systems to improve productivity in all segments of business has been demonstrated by numerous research efforts as well as through case studies. In order to achieve the efficiency improvement targets established by the EU for the transport and logistics sector, a step function advance in the use of current and emerging

information, computing and communication technologies is required. Currently, the integration of the transport and logistics processes of supply chain participants is limited by the complexity of existing systems technologies, the lack of communications and information standards, the dominance of proprietary systems, high costs, conflicting regulatory requirements, incompatible business processes, and outdated business practices. A number of projects have been developed, or are in the process of being executed, dealing with this critical aspect in the supply chain: CASSANDRA, COGISTICS, COMCIS, CONTAIN, CORE, DISCWISE, e-Feight, FINEST, FI-SPACE, iCARGO, INTEGRITY, LOGICON, RISING, SMART CM, etc. Moreover, a number of policy initiatives are under development, or in place, focusing on this issue: eMaritime, Inland Waterways RIS, e-customs and e-freight initiatives. Industry is also developing and using communications standards such as those developed by GS1, Odette, UN/EDIFACT, ANSI, and others. The challenge is to develop a vision matching ICT with business needs in the future given the following trends: increasing requirements for collaboration and cooperation, flexible and agile supply chains, increasing requirements for Synchromodality, the need for increased efficiency in cost, energy and environmental impact reduction, new manufacturing technologies (Industry 4.0) and ICT advancements: Big Data, IoT, ITS or the Future Internet.

Scope and Content: The action should deliver a vision matching ICT with business needs in the future considering the following scope:

a. Large scale harmonized interoperability between supply chain partners that facilitates the rapid and simple connection of all partners including governmental agencies, customs authorities, shippers, third party service providers and any other entity required to ensure the proper functioning of the supply chain;

b. Simple connection and integration tools to facilitate usage by non-technical personnel software utilities that allow SMEs to properly manage their portions of a supply chain without having to invest capital and resources that they do not have;

c. Simple and cost effective sensors or smart devices (IoT, ITS) that integrate into supply chains in a simple and low cost manner;

d. Open and standardized visibility and event management systems, including the strong demand from customers for visibility and "transparency" (i.e., traceability and performance), that enable supply chains to be managed efficiently and effectively;

e. Data governance processes that facilitate secure and trustworthy data management, privacy, identification, authentication and authorization;

f. Auditing and built-in controls that facilitate tracking of societally important factors such as carbon emissions, fuel consumption, safety, security of goods shipments, and trusted trader certificates. Auditing tools should be system and risk based in concept and design.

g. Analysis of how current and future technology developments (3D printing, Industry 4.0, IoT, ITS, Big Data, Robotics, Future Internet, autonomous logistics operations, etc.) will impact logistics and enable the efficient implementation of the Physical Internet vision.

is the action should also create a broader consensus on the vision based on a deep analysis of developments and lessons learnt from past projects and initiatives, and considering both industry and policy requirements for the successful pursuit of the ALICE ETP research and innovation agenda. The coordination action needs to demonstrate the capacity to reach a broad industry and policy audience and to raise awareness in the sector.

Expected Impacts:

- Better, more flexible integration of ICT and operational processes.
- Definition of appropriate conditions, policy, industry, etc., to speed market takes up.
- Foundation development and understanding of requirements for the achievement of the Physical Internet vision.

Type of Actions: 1 Coordination and Support Actions (2Million €) Research and Innovation Actions (5-8 M€).

* This topic could be implemented through or with the collaboration of the Information and Communication Technologies section of Horizon 2020.

6. Harmonized and accessible data for competitive and sustainable supply chains* (2017). Medium Priority.

Motivation/Challenge: The requirements to more efficiently and sustainably utilize assets creates the need for a more collaborative approach to operations and, therefore, to the more open sharing of data (shipments, statuses, plans, etc.) between supply chain partners. In addition, the data generated through supply chain operations provides considerable potential for operational improvements if it can be properly analysed. Both of these opportunities require work in the areas of cloud or open data services that are secure, scalable, accessible and analysable by authorized supply chain partners. However, 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 needed to achieve both industry and EC targets on competitiveness and sustainability**.**

Scope and Content:

- **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. Therefore, the following confidentiality, integrity and authentication areas need to be addressed:
  - Access and authentication services;
  - Data Integrity and recovery, roll back and resumption services (non-repudiation services); and
  - Data privacy and security.

- **Data ownership.** To be able to identify any opportunities and/or barriers in sharing data and events across the boundaries of an organization. For example:
  - IPR management services;
  - Data rights management services;
  - Data location reporting and management; and
  - Liability and commercial sensitivity.

- **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.

- **Supportive legal and regulatory practices.** Legal/Policy frameworks (e.g., Union Customs Code, SAFE Framework of Standards, AEO, C-TPAT, e-freight) that support both collaboration and asset sharing.

The proposal should include business models and cases for data sharing demonstration including the elements above and enabling increased efficiency and sustainability of the supply chain.

Expected Impacts:

- Development of business cases demonstrating the benefits for both industry and policy of data sharing; e.g., reduced costs, energy consumption and emissions, increased load factors and vehicle utilization, increased visibility, transport optimization, automated data exchange, reduced empty kilometres and waiting times in terminals.

- Development of security, privacy and trust frameworks enabling continuation and scale up of the business cases.

- Development of appropriate policy recommendations to support further implementations.

Type of Actions: Research and Innovation actions. Budget: 6-8 Million €

* This topic could be implemented through or with the collaboration of the Information and Communication Technologies section of Horizon 2020.

7. Tools supporting broader and harmonized carbon footprint measurement in logistics and supply chains. (2016). Medium Priority.

Specific Challenge: the Global Logistics Emission Council (GLEC), World Resources Institute (WRI) and ISO are taking the work of COFRET and other research initiatives from round the world further through a combination of harmonisation practical application in global, multimodal logistics chains and supply chains and incorporation in existing calculation tools. The aim is that, through GLEC, by end of 2017 there will be a common approach in the main calculation tools embedded within the market.

Not addressed so far is the need to improve decision making within the global logistics sector as applied by shippers, LSPs and carriers for specific supply chains, transport chains, and logistics networks, leading to improvements in overall efficiency. To achieve this a harmonised approach such as that being developed by the GLEC, that brings together the needs of shippers, LSPs and carriers in a series of consistent steps, must be validated and widely adopted.

The challenge is to develop a model to demonstrate how supply chain and logistics managers´ decisions directly impact the sustainability of their supply chains and logistics networks. A further challenge is to take into account real-time accounting of external costs. The focus should be on holistic end-to-end logistics performance measurement, incorporating all external costs in the total costs of the chain.

Scope and Content: the following topics are envisioned:

- Specification, refinement, testing and evaluation of CO2 calculation methods for specific Transport and logistics chain elements within supply chains, in close cooperation with industry partners.
- Mechanisms to facilitate data collection using new technology by individual actors within the supply chain to improve coverage of 'real' data.
- The mechanisms necessary to transmit and share the required for full supply chain and logistics chain calculations.
- Ensuring compatibility and alignment of the transport elements with carbon footprint reporting from other elements of the supply chain within a product's life-cycle
- Clear and consistent reporting templates for the cumulative carbon footprint for the end user, depending on the nature of the transaction (B2B or B2C; intensity or total at product or service level).
- Incorporation of the transport carbon elements into tools used by manufacturers at the design stage to consider the life-cycle impact of products.
- Real-time monitoring of carbon footprint vs fuel consumption and costs to support effective and profitable actions for GHG mitigation from logistics (act before the emission happens). These monitoring systems should be based in a "learn by experience" scheme to take the right decision to minimize GHG emissions in transport and logistics.
- Definition of technical mechanisms as well as data quality requirements necessary to transmit and share the required data for full supply chain calculations.
- Education and implementation guidance for SMEs and others not familiar with the requirements for simple and effective carbon reporting in the logistics chain; e.g. data suitability, collection and awareness of appropriate methods and use of industry-backed data sources for reliable default values in the case where operator data does not exist.

Expected Impacts: The tools envisioned may serve in particular to speed up changes in the behaviour of companies, through a balanced focus on the three dimensions of sustainability, i.e. social, environmental and economical, i.e. <people, planet, profit>. Change management including behavioural aspects are so far not sufficiently address in previous R&D programs. In particular, the interplay between private and public stakeholders (companies and governmental organisations) deserves further attention. Expected impacts include:

- Improved decision making based on better comparability and reduced barriers to global trade
- Ensuring compatibility and alignment of the transport elements with carbon footprint reporting from other elements of the supply chain within a product's life-cycle
- Clear and consistent reporting templates for the cumulative carbon footprint for the end user, depending on the nature of the transaction (B2B or B2C; intensity or total at product or service level).
- Incorporation of the transport carbon elements into tools used by manufacturers at the design stage to consider the life-cycle impact of products.

Type of Actions: research and innovation action, co-ordination and support action

8. A research, simulation and testing infrastructure for supply chains in Europe (2017). Priority not discussed by Steering Group

Specific Challenge: Supply Chain Management is a mature research area in many research organisations and universities across Europe, and the rest of the world. Much of this research is funded by national research foundations and results in algorithms, heuristics, and conceptual frameworks to address supply chain challenges of businesses. These challenges are often complex planning problems in production and materials handling, or the integration of external requirements on the environment, corporate social responsibility, or security.

To support this research, there is a need for a standardized underlying research infrastructure, in which data on supply chains, results of other researchers, and comprehensive visibility and dashboard tools are available for supply chain researchers in Europe. Such an infrastructure will save time for researchers in collecting suitable data themselves, developing algorithm testing software, and developing standard dashboards, and spend this saved time on developing better algorithms, comparing their results to the results of others, and align the development of new supply chain solutions and insights across Europe. In particular it may help to test a variety of approaches and policies related to aspects of a Physical Internet based logistics infrastructure.

Scope and Content: A common European supply chain research infrastructure should contain of three components: a data repository, in which several European supply chain owners can feed recent and comprehensive operational data on their supply chains; a library in which researchers can store their algorithms, and gain access to the algorithms and heuristics of others; and a standardized visualisation toolbox, in which data, performance of the algorithms and the outcomes can be

visualized. Involvement of both supply chain companies, as well as software developers is of paramount importance in this research. The ideas in this research build on projects such as CONCOORD, in which such a platform is developed for vehicle routing problems in urban environments.

An important element in the scope of this project should be the development of an effective dissemination process that will connect the research tools and output of the supply chain research infrastructure with the needs of businesses in Europe, both large and small. This element has to be an explicit part of the project.

Expected Impacts: The expected impact of this research is the effective facilitation on ongoing research in advanced supply chain solutions, through the development of a common underlying research infrastructure. This will make the ongoing research more effective and applied, and will help businesses adopt research results in an earlier stage, since the outcome and impact of research results is measurable and clearly communicated. For that reason, the platform should be easily accessible for a variety of stakeholders, in particular SME's which need quick tools to identify and assess new business opportunities. More general, the platform should also help to identify how potential (local, regional, national of European) governance rules affect policies of private companies and vice-versa, in order to arrive at mutually acceptable solutions.

Type of Actions: Research and Innovation Action.

Urban Mobility/Freight

Note: Topics developed in coordination with ERTRAC

9. New governance models for urban logistics and improving synergies between urban freight and passengers transport services (2016). High Priority

Specific challenge: Urban logistics is largely operated by private companies, but increasing its efficiency has direct and indirect positive "public" impacts in terms of reduced congestion, air quality, noise, energy use and more in general quality of life in cities. In today's competitive environment, logistics operations are one of the key value-added business activities. However, the needs of freight logistics are often neglected in favour of passenger transport services in urban planning and management, and opportunities offered by more integration between both are not properly investigated. As demonstrated in many city trials, and recommended in EU policy documents (White Paper on Transport, Action Plan on Urban Mobility Initiative 33, UMP, Urban Mobility Package, etc.), involving the private sector is instrumental for effective local planning and policy making, as freight transport and logistics operators are the ones responsible for the majority of the movement of goods and services in urban areas, whereas the public sector is responsible for governing and regulating.

In order to bring about a paradigm shift, national and local authorities are encouraged to ensure that urban logistics frameworks are given proper consideration in their approaches to urban mobility and

in Sustainable Urban Mobility Plans and to establish platforms streamlining cooperation, exchange of data and information, training, etc., for all stakeholders, to achieve cost-effective and CO2-free city logistics in major urban centres by 2030. In order to reduce the negative impacts of freight transport, a better coordination between passenger and freight transportation is needed.

Furthermore, owing to the complex nature of urban logistics operations, 'new urban logistic governance models' are required, to stimulate active engagement of all stakeholders and thus optimise logistics operations in urban areas, considering resource positions, transaction costs, land use and network relationship.

Scope: New governance models (models in which institutions, structures of authority and collaboration are used to coordinate logistic activities in cities) are needed for a better coordination and exploitation of synergies between urban freight and passenger transport services as well as to develop novel concepts for transporting freight by using the passenger transportation system. Governance models should serve as the 'interface' between long distance and the last/first mile, where the previous freight systems are decoupled and integrated with the passenger system. This decoupling should take place in physical, ICT and financial terms. Governance models have to ensure that there are incentives for private operators to invest in new technologies, services and solutions. They should also facilitate co-operation between actors, capacity building at the local level, encourage the transfer of good practice, facilitate interoperability of ITS solutions, and stimulate proper integration with national frameworks. Mutual understanding between public and private stakeholders is a key factor for implementing sound strategic freight and urban mobility plans, based on robust data sharing and impact assessment. Active stakeholder involvement in the decision making process will enhance the take up and acceptance of urban logistics policy measures.

A new governance model on city logistics could support 'neutral' infrastructure and protocols for all packages going from A to B ensuring the cooperation of all stakeholders along the chain.

Proposals have to address one or more of the following aspects:

- Developing and/or testing innovative urban logistics services and business models for private stakeholders in order to encourage new investments and achieve overall efficiency in urban logistics sectors;
- Developing and assessing new governance models, supporting a holistic view of the urban mobility system, taking both freight and passenger transport into consideration; development of innovative ways for stakeholder cooperation and behavioural models; design of new legislation or policy supporting the establishment of new governance models; and priority issues should be taken into proper consideration;

Expected impact:

- Decoupling the supply chain to and from cities
- Improvements in infrastructures and network utilization
- Reduction of number of small volume freight movements (and traffic congestion)

- Increasing overall efficiency of logistics operations in terms of performance and affordability of delivery systems as key drivers for sustainable business models
- Decreasing GHG emissions, noise, energy use and particulates
- Improvements of vertical and horizontal cooperation between private and public stakeholders, including citizens

Type of Actions: Research and Innovation Actions

10. Better adapting vehicles and load units (standardization and modularization) for urban distribution (2016). High Priority.

Specific challenge: Proper interfaces between long distance and last mile transport are required for logistics efficiency. Previous experiences showed that these interfaces have to face important cost pressures. The need for efficient handling operations is therefore critical. In that context, the development of standardized load units is a driver for making urban distribution more efficient. The better integration of urban freight activities in the urban transport system also requires developing innovative vehicle solutions better fitted, through flexibility and modularity, to innovative urban freight delivery systems.

The introduction of containers in the 1950's was a revolution in the transport industry. It significantly improved the handling of goods for transhipment operations. It also brought a solution in terms of stocking and security of the goods. Hence, it was quickly adopted as a standard load unit. Ports and boats started to be designed around the container. The convenience of the standardization that way improved the efficiency of transport. It contributed to reducing the costs of long haul transport significantly.

The success of the container inspired other segments of the supply chain. However, the last mile of the supply chain is still lagging behind in terms of efficiency. For example, pick-up and delivery operations are estimated to be responsible for 40% of the costs in combined transport (PORTAL, 2003). As a result, distribution is receiving increasing attention today. In cities, parcels are mostly used nowadays for distribution. Still, this load unit is raising a number of issues. First, in terms of security and safety: parcels cannot be used for any kind of goods. Secondly, in terms of resources: boxes used for parcels deliveries become expensive and are barely reused. Finally, we can see that vehicles have not changed much with the adoption of parcels by the industry. Parcels appear therefore as a good solution, but optimisation is necessary.

Scope: The aim is to come to innovative distribution systems, in which the delivery operations are better adapted to the urban environment. Hence, research should investigate the constraints of the delivery operations. Important aspects to consider are the organisation of urban space and the time period where the delivery takes place, the nature of goods (different urban supply chains) and the legislation at stake. These considerations help in better understanding current delivery practices. Research should also propose innovative delivery practices that better meet the constraints of the urban environment. The focus here should be on improving vehicles and packaging of freight in terms of efficiency (i.e. increase load factor whereby attention is being paid to a trade-off between

weight and volume), security and safety of the type of parcels used. Cost of the packaging material and reuse of the parcels are also important to consider. Finally, noise is a rising problem in cities that should also be integrated in the solutions.

Involving relevant stakeholders in this process is vital as they all have to comply with possible changes. This includes the shippers since they are responsible for the packaging and the orders, logistics service providers who use specific vehicles and could collaborate horizontally (e.g. more efficient deliveries) and vertically (e.g. reuse material), receivers, and local authorities. Additionally, the role of vehicle manufacturers and producers of parcels is important.

Actions should include:

- Define future optimal urban freight vehicle sizes and architectures from multi-stakeholder perspective.
- Develop loading rate measurement systems (weight, volume...), to be linked with overall city access control and network management
- Develop standardized and modular logistics units (compatible with regular containers) for a better load factor and interoperability among different transport systems and modes.
- Testing innovative equipment supporting safe, secure and silent deliveries in urban distribution. Equipment should involve different modularization of load units. Attention should be focused here on the security of goods, the transfer efficiency of load units and their standardization.
- Equipment should involve different vehicles. Attention should be focused on the loading rate, the emissions and distance of the vehicles. The design of the vehicles should therefore be adapted to the load units considered in the demonstration in order to optimise the loading rate of vehicles. The drive train should also be adapted to the urban environment so that it generates low emissions and limited noise levels.
- GPS tools can support routing of heavy goods vehicles. The complexity of the regulations in cities can indeed affect distance driven of vehicles. Stakeholders are here again essential to include in the project for evaluating their support.

Expected Impact: Urban freight transport is a key sector for the sustainable development of cities. Indeed, freight is responsible for 25% of CO2 emissions and up to 50% of fine particles generated by transport in cities. However, they might have a higher impact if we consider double parking. It has indeed become common practice for urban deliveries, affecting congestion and emissions from cars. Improving the last mile through more efficient deliveries is therefore a priority for urban welfare. It is also a priority for supporting the economic development of the cities. Better deliveries mean a cheaper and better accessibility of the city. Standardized and Modular Logistics Units will results in a collaborative, highly distributed and leveraged logistics and urban distribution system. Modular Logistics Units improve security, reduce damages and losses and simultaneously allow urban freight to be transported faster through the physical hubs. The biggest impact will be that the entire system will gain efficiency. Finally, it can improve the work conditions which are particularly stressing at the moment in distribution. Human labour is a high cost factor and combined with unhealthy working conditions make automated solutions highly desirable.

Type of Actions: Research and Innovation Actions

11. Freight data collection for decision support in urban mobility planning (2017)

Specific challenge: The distribution of goods and servicing trips in cities represent a significant portion of urban traffic. Inefficient urban logistics may significantly harm citizens' quality of life. Today, there are no adequate quantified statistics about transport flows concerning light and heavy freight vehicles in cities. The number of registered vehicles increases, but little information is available about loading type, route, vehicle age/fuel/type, transport patterns or load factor, and if existing only on an aggregated level.

A multitude of data sources are available providing potential input data for freight distribution systems (e.g. almost all trucks are equipped with GPS devices).

While urban logistics and data collection have been the focus of several research activities, and good practices have been developed, clustered and ranked, a clear and sound understanding of factors influencing urban logistics demand and supply is still needed, also in order to evaluate how market principles, public needs, expectations and requirements of stakeholders are met when implementing urban logistics policies. In many cases, the necessary data set is existing but not publicly available. Proper and focused sets of data would contribute to a sound analysis of urban freight transport dynamics and overarching trends (drivers and trends of the sector, type of operations, vehicles, load factors, relative share of different type of freight: Retail, Ho.Re.Ca, parcel, construction, maintenance, waste, etc.). In addition to that, local authorities have few resources available for systematic data collection.

It is fundamental to have sound data able to generate “business as usual scenarios” and develop appropriate logistics scenarios measuring short/ long term effects and trends and take effective decisions. Provision of collected data and measurements towards the "crowd" could open new methods supporting dispatchers and truck drivers in optimising their freight distribution behaviour. Currently only (very) limited initiatives in this direction are performed.

Scope: Proposals have to focus on the development of smart, multi-stakeholder frameworks for urban freight transport data collection and on step-wise approaches to knowledge sharing.

Actions should significantly contribute to increasing levels of understanding on possible enablers in urban logistics optimisation and efficiency, increasing knowledge on market trends in different areas (urban distribution, waste and service trips, etc.) and on how to adopt the most appropriate transport and logistics solutions (for private actors) or take proper decisions (for local authorities).

A multi-stakeholder cooperation platform streamlining relationships and knowledge sharing should lead to the definition of guidelines for innovative solutions and options for data collection in urban logistics, including success factors and performance criteria on how to replicate good practices. Activities should include the state of the art of possible technologies, methodologies, ideas and action plans based on trials for cost benefits analysis on efficient urban logistics data collections methods. This Action Plan should focus on: understanding user’s needs, decision making and

stakeholders behaviour; assessment of how new data collection methods can bring significant improvements in terms of urban logistics overall operational efficiency and plan for the long term; investigating on policy implications, regulations, standards and governance models and interoperability along the whole supply chain; analysing market barriers in implementing new data collection methods (including the use of new and cost effective ICT technologies); exploring market opportunities; streamlining cooperation, public engagement and consensus building in order to encourage the transfer of good practices and adoption of innovative data collection methodologies for effective decision making in urban logistics.

A dedicated forum facilitating stakeholders' engagement should be established. Stakeholders from the sector should be actively involved and links and synergies with transport-related European Technology Platforms (ETPs) and the on-going research project would add significant value.

The maximum EU contribution cannot exceed EUR 3 million.

Expected Impact:

- Inclusive approach in providing a comprehensive overview of new forms of cost efficient data collection methods for urban freight transport and implications for business actors, society and policy makers;
- Enhance targeted urban logistics policies and research and enabling innovation priority setting in the sector;
- Better address freight transport market needs of specific groups and communities in urban areas (e.g. ecommerce);
- Promote innovative/alternative business models for data collection in urban logistics;
- Support the identification of additional data sources (e.g. Bluetooth, WiFi, mobile phone, etc.) and application of big data methods on the data sources to gain usage insights;
- Improve coordination of data collection efforts (in terms of data sources and data sets).

Expected smart results: Developing a sound framework for data collection supporting urban logistics overall efficiency.

Type of Action: CSA

Program Section: Secure societies

12. Compliance in global supply chains. High Priority

Specific Challenge: Supply chain partners face considerable challenges to be compliant with laws and regulation for their own operations in many different countries and in border crossing transport and logistics. Considerable research is already being conducted to provide new tools and solutions for information transparency in logistics chains (EU projects such as INTEGRITY, IT-AIDE, CASSANDRA and CORE). These solutions cover only part of the compliance challenge from a supply chain point of view and it is often difficult to integrate the different tools in a complete compliance management suite.

At the supply chain level, product related compliance requirements are important, but information on these is often not available at the logistics level. The research requirement is therefore to develop current and new compliance monitoring solutions for logistics chains and integrate them with product level compliance requirements at the supply chain level. A related challenge is to align expectations of compliance monitoring and control of government authorities with requirements and expectations of supply chain partners. The result of this alignment should be that government agencies can rely on the level of control supply chain partners have put in place.

Scope and Content: The scope of the research is to develop compliance management regimes in supply chains that are both comprehensive in their approach and that facilitate communication about the level of compliance with third parties. Part of this research is in assessing available commercial tools for compliance management, and evaluating the integration of these tools in comprehensive solutions. Another part of the research content should be about the possibilities to communicate about complex concepts such as compliance, and the level of objectivity that can be reached based on various methods such as KPI evaluation, multi-criteria analysis, and visual techniques. Another important element in the research is to develop insights in the way businesses can perform checks and verification actions on their internal transactions in such a way that this is acceptable for the risk assessment required by third parties. This research has an important link to the development of built in controls in enterprise resource planning systems.

Expected Impacts: The expected impact of this research is a development towards system based supervision, that is now hampered by a reluctance of authorities to rely more on system audits than on transaction based control. If businesses are able to develop their own reliable approach to transaction based controls, this shift is expected to take place quicker.

Type of Actions: research and innovation action.

13. Collaborative chain control strategies for advanced supply chain risk management and resilience. High Priority

Specific Challenge: Supply chain risk management portfolio is a combination of transfer, tolerate, terminate and treat risks. Today, most organisations apply well developed risk transfer measures as well as effective internal control measures treating the most crucial enterprise risks, but the potential of collaborative controls is underutilised. This not only leads to inefficiency in supply chain execution and suboptimal use and utilisation of assets and transport network infrastructures, it also exposes the European society with unneeded societal risks and makes us less resilient for systemic risks. Whereas building resilience for systemic risks was identified as one of the key societal challenges during the World Economic Forum in 2012, which was confirmed by a large number of studies afterwards (references). Many organisations only implicitly manage their supply chain risks, based on experience and without using structured analysis methods. The ones that apply more structured methods for supply chain risk management often consider only internal control measures as part of an enterprise control framework. But in a globalised economy with highly fragmented value chains, the effectiveness of internal control measures only is diminishing. Supply chain control towers provide an answer to operational risks by providing the visibility allowing to act accordingly.

But this visibility is not being used to control more tactical and strategic supply chain risks, such as capturing upstream supply chain data (such as packing list information) and validate the correctness and completeness at the source. Projects such as CASSANDRA have highlighted the economic rationale of collaborative chain controls resulting in highly positive business cases, but nevertheless the take up falls behind due to ignorance, lack of tools and instruments and perceived difficulties in developing collaborative approaches.

Scope and Content: What is proposed is an action that includes raising awareness among supply chain actors, inventorying possible chain control measures and their potential impact, identifying best practices, develop toolsets to assist supply chain actors in managing their risks, including risk monitoring tools.

Expected Impacts: Deliverables include awareness raising campaigns, best practice exchange interventions, easily accessible and applicable toolboxes and instruments to reconsider SCRM practises and implement chain controls and risk monitoring systems. Expected impacts include more reliable and predictable supply chains, resulting in better synchronisation of supply chain processes and considerable total landed cost reductions. As such it contributes directly to the competitiveness of the European economy. Additionally, it also makes our European supply chains more secure, more resilient and more sustainable, as a consequence of removing non-value added activities in the supply chain.

Type of Actions: Coordination action

Program Section: Climate Action, Environment, Resource Efficiency and Raw Materials/Waste

14. Efficient reverse logistics networks. High Priority

Specific Challenge: Improve the re-use of materials and components from packaging, disposed and return products by setting up efficient 'reverse logistics' networks, in order to come closer to the circular economy by means of closed loop supply chains. This is crucial taking into account that e-commerce is growing at a double digit rate and accounts for up to 25 % of returns.

Scope and Content: the following topics are envisioned:

- Design of 'closed-loop supply chains', with clear options for disposal (repair, re-use, remanufacturing, refurbishing, recycling, landfill).
- Define roles and responsibilities for all companies in the supply chain (manufacturer, shipper, logistics provider, user) the 'closed-loop supply chain'.
- Development of circular business models that help manufacturers, shippers, logistics providers and users to achieve their sustainability objectives.

- 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.

Expected Impacts: A strong improvement of the re-use of products, parts or materials and hence an equivalent reduction of the use of fresh raw materials, up to 50 %. In particular, new business models should make aware the various stakeholders of the opportunities for additional business. We envision a prominent role of serious gaming models to raise such awareness.

Type of Actions: Research and Innovation Action.