TRANSPORT CHALLENGE IN HORIZON 2020

ECTRI SUGGESTIONS FOR THE SECOND WORK PROGRAMME (2016-2017)
in the field of
"FREIGHT AND LOGISTICS"

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1. Introduction

ECTRI launched its Thematic Groups in September 2007 as a means to facilitate exchanges among its researchers interested in similar research fields and in order to promote joint initiatives and positions. One of the groups is the Thematic Group on Freight and Logistics (TG-Freight and Logistics). The main objectives of this group are to define research topics of interest for supporting EC policies and programmes, to increase successful participation in EU projects and to provide a platform for networking and scientific exchanges. The group consists of 46 experts from 16 Transport Research Institutes and Universities representing 15 countries. Most of the institutes are working in the field of freight transport and logistics. Members are: AIT, CDV, CENIT, DLR, Fraunhofer, HIT, IFSTTAR, ITS, KTI, TØI, TRL (TTR), TTI, UNEW, UNIZA, UPM, UVEG, VGTU, VTI and VTT.

Integrated freight transport system: designing the freight social and technical systems in tandem
TG-Freight and Logistics is addressing the smart and integrated freight transport topic.
Freight transport faces a dual challenge. It must satisfy the demands of globalised trade on one hand and meet environmental requirements on the other. Our purpose is to show that technological and infrastructural innovations are a necessary, but not sufficient, condition for achieving efficient logistics and transport chains. Smart and integrated freight transport can be achieved through designing the freight social and technical systems in tandem so that they work together smoothly.

Considering the freight transport system as a sociotechnical system
TG-Freight and Logistics considers the freight transport system as a sociotechnical system, referring to the *interactions between stakeholders, technologies and infrastructures*. Socio-technical systems consist of a cluster of elements, including technology, regulation, user practices and markets, cultural meaning, infrastructure, maintenance networks and supply networks.
In this framework, *smart and integrated freight transport is the result of the joint optimization of the social and technical factors*. The corollary of this is that optimization of each aspect alone (socio or technical) tends to decrease the system's performance. Then, research should be conducted to design the social system and technical system in tandem. The transitions from one sociotechnical system to another should also be considered, as well as the systems' resilience, in the context of economic crisis and climate changes.

Smart infrastructures (hubs and corridors) to promote door-to-door freight transport systems
From an infrastructure perspective, sea ports, airports, inland ports, rail terminals and logistics hubs-contribute to the functioning and competitiveness of territories, particularly metropolitan areas and more diffuse city regions. These gateways to the metropolis are essential nodes in international systems of door-to-door transport. They are essential for the geographical areas they serve and help to make them competitive, particularly in the case of metropolitan areas. The key elements in the explanation of the domination of road transport in the "last mile" problem lie with: the issues of door-to-door trips and of transhipment; access/egress to the distribution from/to freight terminals; and of their connection to each other. So, some improvements are needed, in particular for decreasing the number of bottlenecks and problems that freight transportation is facing such as organizational, technical, infrastructural, operational, financial and economic as well as political. Solutions are possible for improving the infrastructure and services in terminals and for improving the networks and their interconnectivity.

Technological innovations according to the stakeholders needs
Innovation is a traditional lever of sustainable transport policy. The innovation policy explicitly promotes technical innovations to enable the transition of the current transportation system into a sustainable transportation system. Telematics, safe logistic systems and new vehicle concepts, electric mobility and others are the subject of the current innovation policy. If this current policy is mainly focused on technological innovation, innovation is a multifaceted subject. Non-technological innovation covers at least three dimensions: innovation supply, process innovation and business model innovation that should also be considered. Another important topic is the definition of relevant technological innovations, according to the stakeholders' needs. Innovations must take account of the

possibilities of adoption by the social system of transport. The deployment of innovation requires a change in the organization of the system and the relationships between industry, state players, operators and users that has to be studied and supported.

Towards collaboration: promoting changes in the freight transport social system
From a stakeholder perspective, collaboration has become a critical ingredient for the smooth functioning of supply chains, in several domains and practices. In sustainable supply chain management, collaboration is the key driver to face the challenges of integration among the actors in order to achieve economic, environmental and social goals. Establishing effective and sustainable collective actions is easier said than done. Competitive interests, dissimilar organizational cultures, and conflicting objectives are just a few factors that can undermine success. Although the main thrust in supply chain collaboration is to achieve a win-win solution for all participating members, there is often a large disparity between the potentials and the practice. “Collaboration” often manifests as a power game amongst the chain members. Such behavior has the potential to result in “win-lose” rather than “win-win” outcomes. On the other hand the topic of co-opetition, which sees organisations both co-operating and competing, has been raised as a normal commercial activity in many sectors, and its deployment in logistics has been evidenced but needs facilitation.

TG-Freight and Logistics has tried to reflect the various suggested topics in the form of research priorities, aiming to highlight their significance for inclusion in the upcoming calls of Horizon 2020.

Furthermore, it proposes the following four “Challenges” that can be used, in order to map proposed research topics and ensure that all research activities will collectively contribute to them throughout the course of the next programming period.

INTEGRATED FREIGHT TRANSPORT SYSTEM: DESIGNING THE FREIGHT SOCIAL, TECHNICAL AND INFRASTRUCTURAL SYSTEMS IN TANDEM

- **Challenge 1: smart infrastructures (hubs and corridors) to promote door-to-door freight transport systems**

Research topics under this challenge shall address the infrastructures’ improvement associated to integrated freight transport systems. Focus will be made on the major nodes in international systems of door-to-door transport, in particular multimodal terminals and small and medium size ports and airports.

- **Challenge 2: relevant technological innovations and conditions for their deployment**

Research topics under this challenge shall precise the stakeholders needs for technological innovations (ITS, electric vehicles…) and the conditions for their deployment. Physical internet as well as e-freight, and the conditions for their acceptance, are in the scope of this challenge. The research topics have to define the relevant technological developments for the design and the management of smart integrated supply chains.

- **Challenge 3: collaboration between stakeholders and new regulations of the freight transport social system**

The deployment of innovation requires a change in the organization of the system and the relationships between industry, state players, operators and users that has to be studied and supported. In addition, the topics under this challenge shall address the public policies and regulations: what roles can the state and local authorities play to bring convergence between policy goals with regard to co-modality, the management of networks and the environment, and the needs of transport undertakings, logisticians and shippers.

- **Challenge 4: resilient freight transport systems**

Research topics under this challenge consider the dynamics of the freight transport system. It shall assess the system's reluctance to different kind of changes: macro changes such as climate changes or economic crisis, but also micro changes such as stakeholder's new strategies. Assessing the impact of these changes also needs harmonized calculation tools.

2. Suggested research topics

TG-Freight and Logistics suggest seven research topics based on our conviction that increased knowledge will be important for improving the efficiency of multimodal supply chains.

2.1 Analysing the key drivers for the location, design and management of efficient multimodal terminals

Motivation

Multimodal terminals are essential nodes of multimodal transport chains. Nodal points canalize long-distance freight-flows on ecologically and economically sustainable modes of transport with high mass handling capacity. Currently, it remains open how efficient multimodal corridors can be created and how new types of services can be created answering on the requirements of modern logistics systems. Efficient and seamlessly working terminals enable the selection of most suitable transport modes and lower the threshold of using greenest possible logistic chains.

Different types of terminals have to be taken into account: sea port terminals, dry port terminals, inland waterways, air cargo terminals, railports, city distribution centers, and private logistics hubs.

Regarding these nodal facilities, many stakeholders have to be considered and coordinated: terminals managers, investors, carriers, shippers, logistics service providers, technology suppliers, spatial planners, regional and national authorities.

Research needs / aspects to consider

- The location of the multimodal terminal is a major issue. For instance, it needs to be better understood what the best location of the terminal within the road and rail network or near an airport will be, considering all the stakeholders: carriers, shippers, customers, policy makers, residents in surrounding areas.
- The design of the terminal, in terms of size and expandability, is an important element of its efficiency. The parameters of an efficient terminal and their dependency to size needs to be known. These parameters are different for each stakeholder and have to be coordinated.
- The management of the terminal, and its human and technical resources, have to be optimized. It means optimizing the different operations at the terminals, as well as the process transparency and the “external” processes management and control. Multimodal terminals represent complex systems with highly dynamic interactions among the various processes taking place inside them, which affect the efficiency and productivity of the overall multimodal chains they serve. As such, optimizing the operations inside the terminals, besides improving terminal productivity, may improve the overall productivity and efficiency of the supply chains. Collaborative use of terminals should be facilitated without harming incentives for innovation and investments.
- The potential of new technologies should be exploited: ITS solutions for an efficient management of the terminal should be assessed. An essential issue would also be on automated or semi-automated loading and un-loading to/from vehicles and between different transport modes. The effects of the sensorisation of cargo, vehicles and infrastructure, to ensure a seamless and transparent flow of goods have to be analyzed. Further there exists a strong link to e-freight (see below) to organize a seamless information flow between the different stakeholders.
- Coherent freight transport policies should be implemented: access and price regulation can reduce network operators’ and hob operators’ market powers. Though regulation eases market entrance of new operators into multi-modal corridors, it might negatively affect innovation and investment activity. The demand for openness and multi-actor capability might inhibit the exploitation of economies of scale by new technological solutions. Also, there is a difference in public support between intermodal terminals and other types of multi-modal transshipment facilities. Thus, there is a need to identify legal barriers and to develop coherent transport policies fostering the development of multi-modal corridors.
- New terminal service concepts should be probed and tested. Haulers and operators of line cargo have each their needs which might vary considerably. New services, new types of facilities, new concepts that serve the different actors along the logistics chains helping to enhance the profitability of logistics service providers and increase customer value must be tried and accompanied with reliable impact assessment, taking into account distributional effects of costs and benefits.

Expected impacts

The knowledge regarding the location of the multimodal terminals considering all the stakeholders would be helpful to develop an integrated planning or the relevant legal facilitation schemes. The final objective could be an “Efficiency Labeling” initiatives for intermodal corridors and terminals that serve the needs of all actors, or a certification scheme.

The design of the terminals could be improved using tools that coordinate the different parameters of efficiency, for all the stakeholders.

Optimization algorithms during operation could be proposed to promote a better management of the terminal, as well as ICT solutions for the process transparency (automatic localization and identification (process) and the “external” processes management and control. Capacity shared models for terminals operation could also make the collaborative use of the terminal easier.

New types of business models are developed. Possibilities for public funding are analyzed; legal barriers are identified.

Funding level and instrument

CSA/CA or STREP

2.2 Governance, efficiency and networks of small and medium-sized ports and hubs

Motivation

The way the maritime and inland/coastal ports as well as airports and rail terminals are operated and governed has a major effect on the logistics artery that supports mobility for growth. In the networks of ports, small and medium sized ports and terminals play an important role in linking local and regional economies to the global economy through feeder traffic (hub-and-spoke port systems).

Congestion in deep-sea ports contribute to inefficient cargo handling, and hence, the deep-sea ports depend on well-functioning small and medium sized port and hub networks serving pan European logistics. To improve well-functioning freight movements Europe freight need a networks of efficient and environmentally friendly small and medium-sized ports and hubs to serve rail, road, short sea and inland waterway freight services. This will require among others, an improved knowledge and understanding of the role small and medium sized nodal networks are playing in linking local and regional economies with the global economy through feeder and inland waterways traffic serving deep-sea ports and the development of best practice guidance on innovative approaches and how to replicate them.

Research needs / aspects to consider

Proposals should address one or several of the following aspects:

Improving basic knowledge and understanding on the services offered by small and medium sized ports, hubs or freight villages in Short Sea Shipping, rail freight, or sustainable road haulage.

Assessing and demonstrating logistics efficiency in small and medium sized ports to better manage regional freight flows and to reduce environmental impacts from freight flows between regional ports and deep-sea ports. Focus will be on competition and cooperation among small and medium sized port networks and deep-sea ports.

Benchmarking of efficiency in freight handling and freight flows in coherence with the level and type of services offered, use of load carrying units, handling equipment etc. Development and use of KPI's. Assessment the impact of ownership and governance and financing model (PPP) of small and medium sized nodal infrastructure on efficacy and efficiency.

Identifying and offering selection methodologies between optimal business and operational models of competition, cooperation and co-opetition between small and medium sized ports and hubs, logistics networks and between these and deep-sea ports and land based intermodal transport solutions and freight terminals.

Expected impacts

Actions will result in a clear understanding of competition and cooperation models among small and medium sized ports and hubs in EU regions and between these and deep-sea ports. Particular attention will be paid to governance models improving efficiency, reduced costs and emission benefits from freight handling and freight flows passing through networks of small and medium sized nodes. Practical guidance will result in better integration of small and medium sized ports and port networks with deep-sea ports. Clear commitment from participants, and leadership for an ambitious Europe – wide take up and roll out of results during and following the project(s) are expected. The impacts will support *A Deeper and Fairer Internal Market with a Strengthened Industrial Base through:*

- Increased performance of supply chains involving Short Sea Shipping, small and medium sized ports.
- Improvement of network and spatial planning integrating European and regional transport networks with focus on intermodal and sea transport

The results will support government planners, port authorities and market players in planning of port infrastructure and superstructure.

Funding level and instrument

CSA/CA or STREP

2.3 Efficient green freight corridors

Motivation

The White Paper 2011 clearly differentiates freight into a hub and spoke model that split last mile and city logistics away from the 300km + long haul freight, with a short haul between the two. The target is for cities with only clean vehicles and a 50% modal shift for freight over 300km to rail/sea/waterborne. This raises a variety of challenges to support mobility for growth, notably enhancing safety and reducing transport's dependency on fossil fuels, whilst promoting co-modal logistics services that deliver attractive solutions that improving the efficiency and resilience of logistics chains, and allowing greater sustainable choice to shippers, operators and pro-active receivers of goods.

Research needs / aspects to consider

Proposals should address one or several of the following aspects:

- Railfreight research needs to meet the huge increase in rail freight this corridor would need, road haulage research needs to address the need to reduce the dis-benefits of road haulage, inland waterways needs to find business models that connect the many fragmented players. All need to develop optimization techniques, systems and competition, collaboration and co-opetition businesses to address the co-modal challenges of the interfaces from and to backbone long distance corridors and the more diffuse short legs before connection to last mile city logistics.
- Efficient green corridor should be implemented through integrated systems for freight. The conditions for fully integrated rail, water and road networks and services for freight (e.g. co-modality) should be analysed. The role of technological developments, as well as ITS, should be assessed. Innovative freight services (e.g. Transportation of air cargo by rail, development of premium rail freight offerings, use of barges as slow moving storage in kanban systems, horizontal integration between shippers) and radical new freight vehicle concepts (e.g. electrification of motorways, shorter faster trains, longer heavier trains, cleaner barge propulsion, self-organising non-hierarchical unplanned logistics systems, intelligent cargo) are also expected.
- Rail freight terminal arrangements are a significant barrier to achieving modal shift targets. At present the rail terminal network lacks sufficient density to ensure that the rail leg of the journey transports goods close to the end consumer and the suitable aggregation of goods transported in smaller volumes.
- A truly, fully integrated network must ensure the seamless handling of goods between modes. Until this is achieved, the aspiration to capture new markets will remain extremely challenging. Testing Intelligent Hubs concept by achieving information and capacity sharing among modal terminals in defined geographical areas along corridors can realistically support co-modal solutions provision to customers and end users.Technology should act as an enabler to efficient green freight corridors and business models but on its own will not capture new markets. Technological solutions should help to facilitate freight transport integration by providing a one-stop shop for potential customers and seamless peer to peer data interoperability that recognises and can adapt to the changing contractual nature of client-supplier, a relationship that can change from contract to contract as well as over time.

Expected impacts

- Capacity enhancement e.g. Integrated optimisation of system capacity for freight networks (e.g. traffic volume, vehicle occupancy, revenue flow, load factors);
- the reduction of emissions from diesel rolling stock e.g: Hybridisation of diesel power trains; Technology transfer from automotive sector and systems integration;
- intelligent automated traffic management systems;
- information management (databases, customer access, etc.) and "one-stop-shop" open platforms for info and service; provision at level of Hubs;
- integration of freight planning and execution between modes;
- Innovative freight services addressing lost markets of higher value for rail and waterways;

- Innovative freight services incorporating new freight vehicle concepts and advancing them from technology development to service innovation;
- Integrated freight network synchronising water, road and rail modes at terminals or where goods are transferred;
- One stop shop providing complete supply chain visibility for potential freight customers;
- Radical new austere terminal designs incorporating fully joined up thinking with the entire supply chain and between interfaces.

Funding level and instrument
RIA and CSA

2.4 Innovative solutions to optimize the last mile at the urban scale: propositions and assessment

Motivation

Urban logistics is a current subject in many cities across the world due to the pressure to become more sustainable in noise, air quality, congestion, and carbon emissions.

Urban areas represent particular challenges for national and international freight transport, both in terms of logistical performance and environmental impacts. Goods, waste and service trips in urban areas impose negative traffic and environmental impacts and take place in space shared with many other actors including public transport operators, private car users, taxis, cyclists and pedestrians. The European Commission pointed out several key challenges of urban logistics:

- A lack of focus and strategy on urban logistics as part of urban mobility, and few cities have an individual in authority responsible for urban logistics;
- A lack of co-ordination among actors involved in urban logistics, and in many cases insufficient dialogue between city authorities and private actors who operate there;
- A lack of data and information which makes it difficult to improve operational efficiency and long-term planning.

Classically defined top down integrated city logistics schemes have failed across Europe. To face the urban freight challenges, and taking into account the lessons from the previous experiments, new co-operative and fully sustainable innovative solutions have to be developed.

Research needs / aspects to consider

As part of sustainable urban mobility, a sustainable urban logistic plan should present measures to improve the efficiency of urban logistics, including urban freight delivery, while reducing related externalities like emissions of GHG, pollutants and noise. The plan should aim at optimising the use of existing road, freight terminals and consolidation centres infrastructure and improving the situation in the identified 'hot-spots' and overall. In addition the plan should include actions to foster a change towards more sustainable logistics patterns. Co-operative models as developed in projects such as SMARTFUSION should be adopted, even when developing mandatory interventions. Logistic service providers, transporters, retailers, shops, municipalities, citizens, and other relevant actors should be engaged. Proposals should address one or several of the following aspects:

- <u>The different implemented solutions should be assessed</u>. If many of the top-down solutions are flawed, we should also point to the few successes, in niche applications, where top-down command works, such as airport franchises and some shopping centers. We can also draw lessons from the experiments of the use of non-road modes for urban deliveries by the carriers and the shippers, or the different urban consolidation experiments. The lack of success in the area of urban freight also shows the need for a clear customer-supplier model of urban access and information concerning the market mechanisms to allocate the scarce resource of urban access. It is important to understand the drivers and business models of different stakeholders involved in urban freight.
- <u>Financial viability of proposed solutions</u> has to be addressed and an understanding of the requirements for profitable operations is needed to study the potential for further roll-out of promising solutions. Business models and supportive measures should be analysed using toolsets such as CANVAS or those developed in the STRAIGHTSOL project to estimate the potential impact of the new and innovative solutions.
- <u>We need to better understand the impacts of the ongoing changes</u> for urban freight: e commerce, increase in the home delivery demand, and relocation of the points of sales or the urban hubs for the deliveries.
- Goods and services are purchased, and <u>the role of sustainable procurement</u> in better defining the method of delivery, the role of operator recognition schemes in driving logistics to sustainable solutions should be explored.

- Simulation, planning and dynamic optimization could suggest developments for new hubs and vehicles/nodes/concepts for urban deliveries. An optimized planning should also consider the characteristics of these vehicles (limited range of electric vehicles, etc…).
- The potential role of ITS for urban freight should be assessed: development of cooperative route optimization, distributed sensor networks and data management, new information systems to improve visibility and access to data in order to promote the generation and use of multimodal routes for goods transport, development of Internet of Things (IoT) and affirmation of Service Oriented Architectures (SOA). The use of technological and management procedures and techniques applied for sustainable mobility of passengers to sustainable mobility of goods should also be tested. A cost-benefit analysis of these solutions should be conducted, considering the related organizational changes needed.
- New concepts of vehicles, including automated driving, in order to optimize energy consumption and efficiency could provide innovative solutions. We should identify the benefits and real needs of the vehicles, in order to reduce unnecessary systems and optimize the energy consumption, as well as study other transports modes, tram, ropeway, etc., as alternative to the present urban transport. Alternative propulsion for LDV and HDV is another possibility to realize lower or zero emissions transport in several areas. That includes e.g. the use of cargo-bicycles for distribution. It should be answered the question concerning the framework conditions to use new propulsion vehicles by efficient total costs of ownership
- Support stakeholders' governance including guidance for elaborating new governance schemes for sustainable city logistics, stakeholders training and coaching for being engaged in win-win flexible cooperation, evaluation of incentives schemes applicability and development of sustainable city logistics dashboards for supporting decision making and achievement of long lasting effects.

Expected impacts
This should result in sustainable urban logistics plans for city freight in the context of immediate and longer term urban planning and governance. It could mean regulations to enable multimodal transports of people and goods, on the way to optimize costs and energy consumption. Alternative tools could also be developed such as a customer-supplier model of urban access, concepts for reverse logistics, demand driven delivery optimization tools, or urban traffic dynamic models for optimizing physical distribution… ITS solutions could be proposed and assessed, as well as organizational changes towards more cooperative practices by the stakeholders. The development of ITS solutions also needs innovative intermediate, decentralised structures enabling neutral exchange and bundling of route and planning data necessary for successful cooperation and consequent optimisation of capacity usage. Results from the action should improve the methodology and give recommendations for development of sustainable urban logistic plans in an EU policy context and thus lay the ground for developing sustainable urban logistics plans in interested EU cities and regions. Development of best practices guidance on innovative approaches and how to replicate them. The action should bring together a set of motivated EU cities that seek support in planning and initiating sustainable urban logistic plans and facilitate the initiation of appropriate processes in involved cities and serve as a catalyst for sustainable urban logistics planning in any EU city.

Funding level and instrument
RIA and CSA

2.5 New concepts to enlarge the use of e-freight

Motivation

Further seamless transport in multimodal transport chains should be enabled to gain more energy efficiency for transport by higher load factors.

E freight is mainly based on the role of ICT to develop simple, paperless and harmonised procedures

Research needs / aspects to consider

- The impacts of ICT for innovative and efficient solutions should be assessed: How could these innovations promote new service concepts? How could these innovations promote radical changes in freight transport chains? We should focus on the influence of information quality on the process efficiency. The degree of information quality (at an early stage, in a complete and reliable way) influences the resource efficiency of logistics processes. This parameter has to be assessed: does higher information transparency towards one or multiple stakeholders pay off for the involved companies?
- A better knowledge of the innovation process is an important issue: very few is known concerning the preconditions for innovation in freight transportation as well as concerning the adoption process by logistics industry.
- Articulation between technological and organizational innovation should be developed. E-freight is often thought in terms of technological innovation only. But the implementation of e-freight also means associated organizational innovation.
- A framework towards standardization in logistics industry can be identified. This framework could be based on business partners cooperating in chains operation for pursuing standardization in information exchange and interoperability of Systems (ICT) operated by "*cooperating communities of actors*". A bottom up approach for systems interoperability and new organizational schemes aiming to the creation of shared and trusted environments should be followed.
- Large Freight Transport Harmonization has to be considered, to come to the harmonization of obtaining the necessary permits for the transport of abnormally large loads in the different European countries.
- E-Freight implementation in large and SME business. Support to logistics operations, (automated and harmonised) information exchange and new technologies. Solutions for small and medium sized enterprises are of special interest, also easy adaptation and transferability. Impacts to competitiveness and productivity.

Expected impacts

Incentives to support the innovation process in freight transportation will be suggested. In the same time, organizational innovations should be developed in association with technological innovations for e-freight.

Incentives, organizational schemes and processes reengineering are also expected to promote innovative communities of cooperating partners.

The elements for a unique permission over Europe for large freight in Europe could be proposed.

Funding level and instrument

CSA/CA or STREP

2.6 Enhancing resiliency of freight transport

Motivation

Resilience of international and inter-continental supply chains is a prerequisite for the EU competitiveness given that 40% of the intra-EU trade consist in intermediaries (such as parts, components, sub-systems and modules) which are processed at several European industrial locations and then brought to original producers as readymade merchandize suitable for retailer distribution. In some industries, such as automotive and civil aviation the share of the intra-EU geographically distributed intermediary processing reaches 60 % of sectors' output. Further, a large part of European industrial manufacturing depends on inputs from extra-European locations which are brought to Europe either as row materials and/or sub-systems for assembling and/or final aggregation, branding and consumer marketing. At the same time about 30 % of EU industrial production is totally dependent on extra-European imports. These simple facts underscore the immense importance of supply chain's ability to deliver goods in right conditions, to right locations and on-time. However, the recent high frequency of natural and man-made hazards combined with climatic variability and long-term climate change impacts affect both the physical and the virtual transport infrastructure and pose considerable threats of disruptions and breakdowns of international supply operations and services.

Besides, a survey of research on climate resilience building funded by the 6 and 7 FP revealed that out of 398 projects, 378 assessed preparedness needs of the well-established Western EU member countries. Only 20 project consortia working on these themes included one or two partners from Central and/or South Eastern Europe. Participation of the North Eastern countries was higher, but still at lesser degree than the core EU nations. As a result, the proposed adaptation measures were tailored for the established members' hazard types, and produced solutions, which the new EU member or candidate countries neither might need nor afford. Thus, the adaptation measures offered by the Climate-Adapt EU climate-change resilience database might not be directly applicable to climate hazards that the Central, South Eastern and North Eastern EU nations might be exposed to. As a result, knowledge of climate risk profiles and preparedness requirements in the underrepresented countries is lacking. In order to *increase the overall quality of European climate proofing*, much broader collaboration between the well-established and the most recent EU members need to take place as regards climate risk assessments, hazard projections, and recognition of the most severe socio-economic and physical adversities that need to be prevented. Furthermore, to improve *effectiveness of the EU climate change protection policy,* European legislators, regional authorities and national and local governments need to take into account the local specifics such as the financial, cultural, political and social conditions when deciding when and how to implement the European and when the local adaptation policies. When adversities trans-pass several national responsibility domains, knowledge of socio-environmental features of impacts surroundings may motivate the joint resource apportioning to speed up recovery, rebuilding and long-term resilience enhancement.

Research needs / aspects to consider

The disruptive impacts of climate change, extreme weather events and natural and man-made hazards on reliability of multimodal supply chains need to be analyzed, particularly those cutting across several countries, several climatic zones and continents.

These developments require a lot of new knowledge on how to build the capacity for preparedness to and management of the short-term disruptions and traffic stops, and also how to effectively use resources for long-term operational resilience.

In particular, safety and security of cargo going through terminals is a number one priority: the cargo system is a complex network that handles a vast amount of freight and is therefore vulnerable to several security threats (explosives, illegal shipments of hazardous materials and criminal activities). The complexity is further increased through the involvement of several actors.

In order to base their climate adaptation policies, strategies and investments on contextually validated understanding of climate change in the Central, South Eastern and North Eastern countries, these nations' public and private decision makers need to have better scientifically embedded insights.

These should encompass a broad *inter-disciplinary knowledge* of the roles that the local geophysical, atmospheric, hydrological, economic, industrial and social factors play in the enhancing of climate risks, and expected adversities. Subsequently, assessments of the different socio-economic impacts with cross-boundary and time distributed consequence, need to be performed. Based on both outcomes, the integrated and highly targeted climate adaptation policies need to devised for not only tackling the hazards in the new target nations but also for collaborating with other member states on mitigation of hazards that span across several national and/or regional borders. Finally, these results should also provide input to much broader and better empirically embedded EU climate-adaptation policies and instruments applicable to different hazard/social context combinations.

Proposals under this topic should address the following:

- Experiences of and lessons learnt from previous disaster-events affecting freight transport and supply chains
- Analyses of the robustness and resilience of individual value adding networks
- Trade-off between stock-holding (preparation against interruptions) and flexibility/resilience (ability to reorganize processes) in logistics
- Vulnerability, criticality and redundancy analyses of infrastructure networks and multi-modal networks
- Identification of short term quick wins and medium to long term measures, strategies and policies for adapting freight transport and logistics to climate change, disasters and extreme weather events
- Increased network redundancy and decreased vulnerability (in particular: Eastern Europe, and: railway networks)
- Increased substitutability between modes in cases of disrupting events
- Understanding of roles and perspectives of multiple actors – (shippers, infrastructure operators, public sector) in setting up precaution measures and in disaster management
- Increased risk awareness and improved risk management at multi-actor level
- Increased preparedness for unexpected events – knowledge, training, awareness, institutions/legislations/exceptions from them
- Roadmaps for climate change adaptation of freight transport and supply chains

Expected impacts
Solutions to limit the disruptive impacts of climate change, extreme weather events and natural and man-made hazards on reliability of supply chains.
Enhancing resiliency of the freight transport system would allow it to “absorb” small scale disruptions and quickly recover from major ones. The scope is to minimize the impact of disruption to the system and the time required for the system to recover.

Funding level and instrument
CSA/CA or STREP

2.7 Requirements towards a further emission calculation standardisation development

Motivation

By end of 2017 there will be a common approach in the main calculation tools embedded within the market. However, even if this is achieved it is still likely that there will be debate as to fine tuning of the methodology in regards to the balance between transparency, usability and accuracy. Currently there is no organisation that can research, in depth, how to best optimise this balance.

Currently there are different issues that need further attention such as consistent treatment across modes of the allocation of CO2 emissions to shipments, auxiliary processes and refrigeration, the CO2 calculation of specific transport chain elements such as terminals and the calculation of emissions on cargo level. By the end of 2017 some of these will probably have been solved in the work conducted by GLEC, whereas others may remain (it must remembered that GLEC is an industry-led partnership, not a research organisation), in particular the following topics:

- The issue of data collection by individual actors within the supply chain
- The necessary sharing and processing mechanisms for specific supply chains
- The issue of defining sources for reliable default values in the case where operator data does not exist

These topics are of high importance and of value to shippers and carriers alike when trying to maximise the efficiency of transport chains, thus improving their sustainability.

Research needs / aspects to consider

In order to ensure the best balance between accuracy, usability and transparency of any calculation standard for transport chain emissions, detailed and further research is needed, accompanied by users or representatives of the industry at global level. It is important that any such further research involves real-life test cases which are analysed in detail, demonstrating emission computations for the transport chains, involving shippers, forwarders and service providers. These demonstrations would need to overcome two difficulties: first to compute transport chain element-level emissions, and then (second) to report them along the chain. The demonstrations could be also used as a tool for promotion (acceptance) of the emission computation practices. An important aspect directly related here is the standardisation of information exchange within the transport chain and reporting with clearly defined quality requirements.

Refinement, testing and evaluation of CO_2 calculation methods for specific Transport Chain Elements within supply chains in close cooperation with industry partners. Development of specifications for further emission standardisation efforts for transport chains and support to GLEC, World Resource Institute and ISO

Expected impacts

Research and validated inputs for further developments and improvements of emission calculation harmonisation. Output can be implemented in future versions of emission standards such as an ISO equivalent to EN16258.

Funding level and instrument

RIA and CSA

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