ECTRI POSITION PAPER

"Horizon Europe mobility research needs: Bringing together knowledge and trends towards economic, environmental and social sustainability in transportation"

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The European Conference of Transport Research Institutes (ECTRI) is an international non-profit association officially founded in April 2003. It is the first attempt to unite the forces of the foremost multimodal transport research centres across Europe and to thereby promote the excellence of European transport research.

Today, it includes 28 major transport research institutes or universities from 21 European countries. Together, they account for more than 4000 European scientific and research staff in the field of transport. ECTRI, as the leading European research association for sustainable and multimodal mobility, is committed to provide the scientifically based competence, knowledge and advice to move towards a green, safe,

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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 in order to propose and influence EC policies and programmes, to create consortia for EU projects and to provide a platform for networking and scientific knowledge. The Freight and Logistics group consists of 54 experts from 16 Transport Research Institutes and Universities representing 15 countries. A speciality of the institutes is that freight transport and logistics is elaborated in a wide range of disciplines such as economics, management science, transport engineering, sociology, geography and spatial planning. Members are: DLR, IFSTTAR, Fraunhofer, AIT, BME, CDV, CENIT, DEUSTO, HIT, ITS, KTI, TOI, TTR, TTI, UNIZA, UPM, UVEG, VGTU, VTI, VTT and UNEW.

Capable, reliable and cost-efficient freight-transport services are essential for trade, production, and consumption. Moreover today, the transport and logistics service industry constitutes an important economic sector in European economy. Logistics is a highly innovative sector with a high share of R&D expenditures that levers the innovation capacity of the transport sector and beyond this sector.

However, increasing (i) digitization, (ii) need for sustainability, (iii) urbanization and (iv) individualism are challenging socio-economic trends affecting this sector.

The present position paper focusses on research topics towards a capable, reliable and resource-efficient freight transport services to address these socio-economic challenges. The key for this goal is the innovative capacity of logistics and transport industry as market leaders taking part in a worldwide competition.

Socio-economic challenges for logistics and transportation

The socio-economic conditions for freight transport and logistics services are continuously changing dramatically since nearly two decades. This puts some pressure on the sector. The pressure can be categorized into four domains of challenges:

(1) Digitization: the high socio-economic dynamics created by information and communication technologies implied a new paradigm with tremendous consequences for the whole economy including freight transport and logistics: On the supply side, there is a need to exploit technological opportunities in production methods, service design and business models, and companies have to adapt to changing market rules, new working skills and new powerful companies mainly funded in Silicon Valley. Digitization creates challenges on the demand side, too, where new requirements on products, services, time-space pattern and cost efficiency emerge – which also has an impact on logistics. Most observable is this dynamics created by the digitization in the E-commerce market, with impacts on parcel deliveries and on last mile logistics.
(2) Sustainability: there is increasing requirement and pressure to reduce external effects and resource consumption of the automotive mobility. An increasing implementation of driving bans in cities, the implementation of green zones and an intensified debate on emission standards can be observed. Although notable technological progresses have been made in

the past, a truly sustainable transport is far from being achieved. There is an obvious requirement and an invisible barrier at the same time for the transition towards sustainable freight transport and logistics.

(3) Urbanization: the agglomeration of people in cities and large agglomeration areas in connection with a rural exodus is a worldwide trend. This implies high pressure in urban residential area development, density of cities, rental prices, demand for goods and good's disposal and, corresponding transport services. The urbanization becomes an even more increasing challenge as far as transport services are mainly based on road vehicles with internal combustion engines.

(4) Individualization: this fourth major challenge is that collective expectations and behaviors turns into individualism not only in terms of transportation related choices but also in terms of good's heterogeneity, goods consumption pattern, personal development and lifestyle. The more developed a society is the more complex, flexible and variable demand becomes. This however has direct influence on logistic chains and transport fulfillment requirements including mode choice.

We think that innovation is the key to address these four challenges. Companies, actors and public bodies should be able to adapt in changing environment by innovation activities. It is important to note that innovation is not only of technical nature but comprises process and organizational innovations as well. Often, these innovations go hand in hand and a systemic transition is needed. However, the logistics and transportation sectors – network industries – are characterized by some structural barriers for innovations. It is an important task for public policies to reduce these barriers.

Structural barriers of innovations in logistics and transportation

Europe's transport industry and logistics service providers are among the world's leading. Hence, the capacity to innovate can be pre-assumed as very high. However, the transportation sector has some particularities in terms of innovation capacity that need to be considered when designing answers to the challenges digitalization, sustainability, urbanization and individualization. These particularities are:

(1) The path-interdependency

Innovation studies revealed that technology is not separated from the social, economic, cultural and political context. The term 'socio-technical system' expresses a co-evolution and alignment of activities in the domains technology, industries, infrastructure, law, policy, user behavior, and culture. Through this convergence socio-technical systems stabilize their development and innovations are thus incremental rather than disruptive. Disruptive innovation steps could potentially destabilize a socio-technical system, because disrupting one or two elements disconnects the others from this development. Hence changing the innovation orientation of a regime is a greater challenge than purely technology engineering such as to produce battery electric vehicles.

(2) Product innovation competition and changing market conditions

The socio-technical system 'logistics' is matured nowadays with a high level of standardization of technologies, processes and products. At this stage, three implications become relevant for future innovation activity:

- Firstly, during the product innovation competition of the last decades the complexity of the socio-technical increased. The optimization level is very high what means that marginal improvements of innovations become smaller, while investments for these improvements increase.
- Secondly, standard products are subject of price competition because they are substitutive goods. In the price competition the market becomes saturated because it lacks in genuine innovations that can drive increase in demand.
- Thirdly, no or very low margins can be achieved in a prize driven market. This means that there is a lack of profitability of investments and thus of capital for reinvestments in innovations.

Taking all three issues together, a scenario can be a stalemate for innovation activities: no increasing demand and low profitability of market activity implies no incentive for innovation investments – and in turn, no innovation investments imply no market dynamic with the consequences of no increasing demand and hence no increasing profitability. One of the main barriers for modal shift from road to rail in freight transport is based such a stalemate in freight rail market. Hence, market-driven innovation activities need growing markets and margins in the markets. In such conditions the incentive to invest in innovation is high because a return of investment can be achieved at a low level of risk.

(3) The dilemma of social benefits and external costs in individual strategies

Congestion, pollution, greenhouse gas emissions, oil consumption etc. are external costs implying welfare losses. Because of following reasons, the internalization of social beneficial innovations by firms in transport and logistics is difficult:

- Firstly, if external costs become a challenge means that the incremental innovation pathway of the socio-technical system provokes the external costs. Hence, to internalize external costs in the innovation pathway implies to disruptively change of the socio-technical system's core (technology, market rules, routines etc.).
- Secondly, to include disruptive innovations is linked to high risks, sunk costs and new, uncertain investments. They will devaluate patents, knowledge, user behavior, markets and even market player (by new market entrants) and are linked with misguided investments, technology failing, learning costs. Moreover, the first strategic moves towards incorporating social benefits are the most risky, most expensive and most uncertain because a suited alternative is in the beginning of being explored.
- Thirdly, a free rider problem arises: following a first successful alternative pathway is economically much more efficient than being the pioneer. Hence, in economic-strategic orientation of a company within collusive forces the incremental intensification of the socio-technical system's pathway is much more attractive than its disruption. This mechanism is crucial for the tackle external costs of transportation.

(4) Dependency on external technology and knowledge

In the 'automotive age' (1930/40 to 1980/90), economic growth and efficiency for users of cars and trucks where directly linked to knowledge and innovation developed in the automotive sector itself. However, most innovations in the automotive sector within the last three or four decades were based on ICT or ICT related knowledge (hardware, software, data and algorithms). Generally spoken, transportation is not a sector which develops ICT or ICT-related knowledge rather than uses this 'external technology and knowledge'. Thus, the innovation

capacity is closely related to the ability of incorporating external technologies and knowledge. It is therefore crucial for market leadership in transportation and logistics to access external technologies and knowledge efficiently and instant, for example big data techniques or artificial intelligence methods. Moreover, it is easier to include highly standardized transport technologies and services into ICT-sector than to include novel ICT-technologies and knowledge in transport sector. That gives an advantage to ICT-related companies for entering the transport market and a disadvantage to established transport companies.

Conclusion towards research topics

The domains of challenges – digitization, sustainability, urbanization and individualization – require innovation in freight transport and logistics. But the mentioned structural barriers for innovation activities weaken the market mechanism for innovation activities. Hence, some questions about the role of the public sector and of efficient and effective public measures emerge. In this context, research can provide orientation and decision support in several ways:

- Research can provide context analysis of ongoing and expected future developments
- Research can access and evaluate knowledge dealing with the opportunities from digitalisation, sustainability, urbanization and individualization
- Research can forecast cross-impacts on socio-technical systems by external trends
- Research can contribute to find, evaluate and develop innovative solutions
- Research can evaluate upcoming business models and organizational changes
- Research can contribute to disruptive innovations towards future markets
- Research can support experimental implementations of new technologies and logistics organisations, where the different stakeholders can readjust their roles and their interaction (competition “vs.” collaboration)
- Research can evaluate options of measures and assess their impact for a target system and hence prepare decision making

Therefore, research contributes significantly to the innovation capacity for freight transport and logistics services within increasingly challenging socio-economic conditions.

2. Suggested research topics

The digital revolution, sustainability, urbanization and individualization are not new phenomenon, but the pressure to provide adequate solutions for the future has increased recently. Solutions are essential for trade, production, and consumption and thus, for economic and social development as a whole. Moreover, competition for new technologies and services has become a global competition. Thus, the research topics shall lever the innovation capacity for freight transport and logistics services to ensure that European companies remains among global market leaders.

Several public measures have already been implemented to support the innovation capacity. This includes measures on electrification and alternative fuels, measures for automated connected driving and measures for new business models in freight transport and logistics. However, these activities have not yet led to the achievement of the objectives and further efforts are therefore required. Efficient and effective public measures require utilizing latest scientific knowledge and methods. For this purpose following research topics are proposed:

Research Topic 1: Automated and connected freight transport

Motivation:

The logistics industry has integrated automation technology in most of its processes such as intra-logistics, warehouse storage and packaging. However, the driving task is still done by humans. Automated and connected driving has however high potential to increase efficiency of logistics services due to an increasing lack of drivers, low margins in the market for standard driving tasks and increasing process costs. In future, logistic networks can be optimized under circumstances of driverless transport due to, for example, the absence of driver rest restrictions and new cost conditions.

Over the last years there has been a lot of research on connected and automated vehicles (CAVs) operations indicating many new possibilities for managing both passenger and freight movements and transport systems. In freight transport, services delivered by automated vehicles could take many forms and be connected to different modes like: trains, ships, barges, trucks and vehicles used for last mile deliveries.

Hence, automated and connected freight transport is highly likely part of future freight transport on the one hand side. On the other, many questions are crucial future challenges to unleash the potential of automated vehicles in freight transport and logistics services.

Research needs / aspects to consider

Connected and automated vehicles (CAV), new waterborne transport systems based on CAV technology with reduced manning or fully unmanned operation including automation of cargo loading and discharge, will result in lower costs. Inland waterway freight transport and vessel platooning can deliver increased efficiency and safety. But costs for information technology and other costs may rise, so it is challenging to calculate or assess the costs and benefits from introducing the new technology.

Impacts of connected and automated vehicles on freight and goods movement should be studied in logistic companies because they own their vehicle fleets and they are early adopters of connected and automated vehicles. Potential impacts of CAVs on freight transportations in the long-range planning process are important. In this context the use of drones for first and last mile pickup and delivery services will be a relevant issue. Drones bring significant challenges in terms of social aspects (e.g. changes in roles and responsibility).

Use of connected and autonomous vehicles must be integrated in logistics and supply chain system that allows improved speed optimization and shorter stays in terminals and port. This must be integrated with future logistics and traffic management systems. With better integration of modes including automated vehicles there is a need for a new functionality of interchange locations. To realize improved connectivity and automation, it is necessary to define technical specifications that can enable Internet of Things type applications over variable quality of service data networks. Another issue is to work close to vehicle manufacturers and logistic service providers to optimize vehicle load capacity to existing load carrying units or to adapt load carrying units to the vehicles capacity.

Automated vehicles will interact with other vehicles, drivers the infrastructure, pedestrians and bicyclists. This fact fosters many issues like need for acceptance criteria for autonomy. Will it be necessary to develop acceptance criteria for operation of different types of automated vehicles? This includes technical and operational risks as well as societal acceptance. Lacking criteria, both design and approval, will be difficult and costly as no common standard exist. There will also be a need for development of procedures to qualify people to use automated vehicles including those who are not currently licensed drivers because of age, disease, or other disabilities. Suited training and education on the capabilities and limitations of automated vehicles and the relative roles and responsibilities of the manufacturer, dealer, and public regulators is thus a research field.

Another issue is, whether public agencies are agile enough to respond to autonomous vehicles deployment needs and possible approaches for public agencies given the uncertainty about automated vehicles performance, functionality and market growth.

Other topics to be addressed are associated with security including cyber security, physical security infrastructure security, spectrum security and individual security. Systems and standards for transparent, trusted and secure data transmission within and between modes, including Internet of Things are related to this.

Based on available research and literature on automated vehicles the focus research ideas for further studies should be on: 1. Data, assumptions and analysis of costs and benefits from implementations of autonomous vehicles in different freight solutions. 2. Effects and long term strategies for changes in land use, urban design and solutions for livable cities as a result of vehicle automation. 3. Evolving strategies, solutions to avoid negative impacts of adoption and use of automated vehicles i.e. rising congestion, mixed traffic confusion and less aware pedestrians. 4. The entire transportation system will be connected in a way that transforms how people live, work and interact. Achieving this vision requires research, development and testing on how vehicles users, telematics and infrastructure all work together via vehicle-to-infrastructure or infrastructure-to-vehicle communication.

Expected impacts:

The research proposed shall directly contribute to the real world implementation of automated and connected vehicles. Expected benefits are related to market leadership in technology development with export advantages, technology prices and advantages in market structuring and in standardization. On user side improvement in efficiency of logistics operation can be expected. Moreover new cost and time efficiencies of logistic chains in terms of requirements by digitalization, urbanization and individualization are addressed by automation and connectivity technologies. At least sustainability impacts are possible at a high degree of automation by increased infrastructure capacity utilization, lower fuel consumption and less to zero fatalities.

Funding level and instrument

RIA and CSA

Research Topic 2: Alternative fuels/new energy

Motivation:

Among the main levers to reduce the impacts of greenhouse gas emissions and local pollution generated by freight transport, shifting from internal combustion engines to more environmentally virtuous energy carriers should be considered as one of the main priorities, together with modal shift and demand management. Long-term trends such as globalization, just-in-time logistics or e-commerce have increased the importance of road freight transport, and it is probable that these trends will be difficult to mitigate in the future. In addition, particularly in the context of urban logistics, the perspective for mode shift is limited, and local pollution due to road freight transport causes very important impacts.

However, replacing fossil fuels with other energy carriers is a complex undertaking considering the maturity of established vehicle technology, market rules, user culture and infrastructure. Beyond, several options compete: electricity, compressed or liquefied gas, hydrogen, pressurized air, biofuels, etc. Opting for one or a mix of these options is a complicated issue, for several reasons.

Research needs / aspects to consider

On the supply side, energy has to be supplied to vehicles. This implies the implementation of an energy distribution network, with capacities and a spatial density consistent with the demand. It also requires that the production and transport capacities of mentioned energies are able to cope with the demand generated by road freight transport, in addition to other uses. On the demand side, two costs should be taken into account: the (total) out-of-pocket cost for carriers to acquire and operate the energy and vehicles; and the potential opportunity costs caused by the reorganization implied by using vehicles with different loading capacities and/or autonomies than conventional ones. This raises questions such as the optimal autonomy, market offer, and fleet and batteries management. Finally, a global life-cycle assessment of the true environmental impacts (both global and local) is required and the analysis of the impact for supply chains as well. An expected result would be the definition of domains of relevance of various energy carriers and vehicle layouts, depending on markets and geographical areas.

An additional level of complexity in this issue is the irreversibility of implementing an energy supply infrastructure, even more so when taking into account the economies of density in energy distribution: a higher market share means a higher density of stations, thus an improved level of service for carriers and likely lower costs. This makes a pure demand-based definition of domains of validity irrelevant: synergies in energy provision must be accounted for. Irreversibility is not an issue in itself: it is an issue because of the current uncertainty regarding the expected technical and economic perspectives of the various energy carrier alternatives, their relative energy prices and efficiencies, autonomy, etc. This uncertainty can be aggravated by the financing scheme for the energy distribution network, and the way variability returns on investment can be a risk regarding fixed costs. New business models may help circumventing this issue. The heterogeneity of freight transport activity should be taken into account. In addition, the technical difficulty to implement (possibly multi-energy) stations should also be assessed and accounted for, especially in dense urban areas and long distance transport axes. Finally, the need to combine implementation strategies with consistent, complementary transport policy instruments needs to be considered.

Expected impacts:

We expect from the proposed research that to one or two alternatives fuels/energy carrier a market alignment begins and speeds up in freight transport. The step from field trials to daily business is the impact to be achieved.

Funding level and instrument

RIA and CSA

Research Topic 3: New business models for logistics

Motivation:

To develop new or progress in existing business models and related company structures is in a stressed field by an increased pressure to be innovative, sustainable and profitable. Digitalization, urbanization, sustainability and individualization are going to challenge established business procedures and business models. Platform economy, digitization of processes and connected logistics, artificial intelligence, blockchain technology, circular economy and environmental friendly vehicle technologies are some of the novelties that established companies have to act on. Moreover, new player enter the market whose business models are specialized on one or another of those novelties. To be competitive and innovative towards reliable business models and effective investments for established and new players it needs orientation and support.

Research needs / aspects to consider

Logistics and freight transport is a function of economic activity such as trading, production based on division of labor and consumption pattern. However established freight transport services with vehicle technology, just in time processes and market rules imply not only positive but also negative impacts on society such as pollution, greenhouse gas emission, labor

conditions, accidents and others. In a highly competitive and price sensitive market a great challenge is to implement incentives for green technologies and green processes (green logistics). This not only a question of alternative fuels or propulsion technologies but also a question of higher inclusion of rail in logistics processes and transport services and moreover, incentives to reduce physical transports. Research in this field needs to consider the perspective of logistic and freight operators, of the demand side (production and trade) and end consumers and their awareness of consequences of consumption pattern. It needs research to identify mechanism and measures to encourage the acting of companies on a sustainable society.

Another issue is that the incorporation of novelties in processes and technologies needs investments. Investments are not only capital but includes human capital and knowledge as well. Taking for example the blockchain technology or circular economy processes - it needs knowledge to understand the market potential, to create a business model, to test applications, to plan the implementation in existing processes, technologies and organizational structures and to educate workers in their skills. Research needs are seen in the support in orientation for companies in the stream of novelties, their potential and specific requirements for future investments. Knowledge transfer from science to industry is an important lever to achieve this. It further needs open test fields and test infrastructures which enable companies to make experiments with the plenty of novelties on the one hand side but on the other which brings progresses in robustness, standardization and deployment specification.

It is obviously that market leading companies are able to make investments and take the risk of investments easier than small and medium sized companies (SMEs) or companies who newly enter the market. Hence, the opportunities of the novelties tend to the risk of market and power concentration. However, SMEs, market entering and market leading companies together are important to obtain an innovative and competitive market environment. It therefore needs research on mechanism and related measures on how to support SMEs and company funding effectively towards market oriented business models and investments. In the speed of technology development and decision making nowadays projects should implement and evaluate technologies and business models that at least we can learn on the significance of measures per technology concerned and company type.

Most of novelties today have to do with new data und data amounts, new data collection and processing methods and new economic exploitation of data. Data are the valuable resource for business models in future on the one hand side. On the other, data rise questions of privacy concerns, security requirements and protectionism by owners. It is a topic where in the past, the practice where dominated by only few companies in the world. It is however a topic of public concern and a topic with high relevance for the development of business models in freight transport and logistics. Hence, it needs research on a concept of data in freight transportation. The concept of data in freight transportation should address data privacy, security and accessibility and should include issues of private, commercial and public data owners, providers and operators.

Expected impacts:

From the research proposed we expect to strengthen companies in particular SMEs in freight transportation to use new technologies and create new business models and hence, contribute directly to GDP. We expect influence on economic sustainability issues in terms of awareness, willingness to pay and implementation. The competitive landscape will also be strengthening

by the research proposed with consequences on technology and knowledge investments and hence a higher level of innovativeness which is not decoupled from success stories in worldwide competition.

Funding level and instrument

RIA and CSA

Research Topic 4: Re-evaluating (sustainable) urban logistics as demand driven activity

Motivation:

A policy target is that city logistics become CO_2 free by 2030. However current trends are making this target very challenging to attain. First the trend of urbanisation with 80% of the European people living in urban, metropolitan and peri-urban areas by 2050. And more people means also more goods to be transported towards these areas (building materials, consumer goods etc.). Second, there is the trend of e-commerce. The increasing volume of e-commerce transactions has created an explosion of freight traffic for personal deliveries in residential areas and office districts previously dominated by personal shopping trips. The logistics of e-commerce by itself could become more sustainable than shopping of people at a retail store. If an efficient short milk run delivery with an electric vehicle or cargo bike can be organized towards a neighborhood, less emissions and congestion can be caused in theory than if all these people would take their car to the retail store. However, fragmentation in space and time caused by next day delivery and by the many delivery operators makes that current logistics operations are far from sustainable. This difficulty will be further emphasized due to the trend towards on-demand deliveries.

Research needs / aspects to consider

On-demand deliveries can be defined as B2C delivery services that allow end-consumers to receive their online purchases whenever and wherever they like. Delivery time is no longer solely determined by the contractual agreement between shipper and courier. Consumers can opt for extremely fast deliveries but can also delay deliveries if that suits them better. They can change date and time when parcels are already 'in-flight' or 'in-transit'. Consumers can also freely determine where they want to be delivered and can equally change it 'in-flight' or 'in-transit'. On-demand deliveries are facilitated by digital platforms that connect shippers, couriers and end-consumers (consignees), and are managed by both new/innovative players and traditional logistics service providers.

This trend makes that fragmentation will potentially become even more important, leading to less optimized routes and/or optimal filled vehicles. Returns of goods (sometimes in 50% of the deliveries), makes an efficient and sustainable operation extra difficult to organize.

These issues bring huge challenges towards the public sector, the private sector and at the same time changes the lives and behavior of consumers. Which measures have to be taken, to keep our cities livable? What role should authorities play or can they play? Which framework to set up? What is the impact on urban planning? Which urban space has to be foreseen or changed due to these trends?

For the logistics service providers, even if they face a huge increase in demand for their services, the pressure on margins has never been higher. New competing business models, not in the least from the e-retailers themselves, challenge them to even further lower their margins, while trying to keep up with the ever increasing demands of the consumers and their customers. This leads to high competition and less possible investments in sustainable solutions.

The consumers finally, are increasingly getting used to receiving online purchases when they want and where they want at no cost. They combine online and offline channels for their purchases (omni-channel retail), while not being aware of the most sustainable solutions.

What is needed is a better knowledge of the driving behaviors underneath these trends. Certainly the consumer and the consumer of the future has to be understood better in order to enable to prepare for the future but also to steer or nudge the behavior in a sustainable direction. Simulation models based on the behavior of the different actors are necessary to understand the long term impacts of these trends. These models will also help city authorities to make 'what-if' analyses and enable to analyze prospective scenarios.

New concepts that enable for sustainable solutions for the last mile have to be tested and transferred to other settings.

Expected impacts:

The expected impact by the research proposed is a clear contribution to clean and liveable cities. In particular in circumstances of a concentration of the major challenges (digitalization, sustainability, urbanization and individualization) in urban centers we expect high dynamic in innovation activities of technical, process and organizational nature. Moreover a stream of new companies and business models can be supported by the research proposed.

Funding level and instrument

RIA and CSA

Research Topic 5: New data: collection, usage and regulation/big data

Motivation:

Both private and public stakeholders need reliable data on the movement of freight. Without doubt, data are the base of business models, of public decision and scientific knowledge. EU legislations set minimum requirements to make the uni-modal statistics comparable between countries. The data collected from freight transport firms consist of mode-specific transport activity measures. The use of the nationality principle for road and the territoriality principle for the other modes leads to inconsistencies and a clearing of the road transports is needed.

Research needs / aspects to consider

Some European countries (Sweden, Norway and France) carry out commodity flow surveys that provide information about the shippers' choice of transport chains. The transferability of the data and collections methods and possibility to carry out a European commodity flow survey should be analyzed.

There are wide-spread quality problems in freight statistics, discrepancies between data sources and a chronic lack of volumetric data (i.e. to describe load factors). An increased scope of the data collection (i.e. access to terminals) would increase the understanding of freight flows.

On top of the quality problems in the existing statistics, climate goals lead to requirements to monitor the emissions caused by transports in the national and international statistics. This has led to initiatives at the EU-level to disaggregate the energy consumption in transport (type and volume of consumed energy).

The overall challenge is to apply data collection methods that fulfil the requirements of the different stakeholders, have low or no quality problems are costs effective (including low response burden of firms). The technological development of communication systems and increasing spread of online and mobile data communication are promising in this regard. Traditional and new (big) data should be compared and combined.

Expected impacts:

The impacts expected by the research proposed is that better data contribute to decision making process in policy and industry at local, national and European level. It further will improve the capability of science to support policy and industry.

Funding level and instrument

RIA and CSA

Research Topic 6: Innovative production and consumption models and logistics

Motivation:

The ongoing digitalization, urbanization, individualization but also sustainability awareness are stimulating innovation in the established production pattern, business models and, logistics and transportation. However new technologies emerge at the same time such as 3D printing, quantum computers, artificial intelligence techniques, blockchain and airborne drones. Innovation is a process of sociotechnical change which can be incremental but also disruptive. New technologies such as the mentioned before have generally a disruptive character. Hence, if successful, they will have structural consequences on social and economic development. Structural consequences are far reaching including positive effects such as new jobs and economic growth, new markets, market spin offs and new giant companies and negative effects such as market cleaning and devaluating of job skills.

Research needs / aspects to consider

The monitoring of technology emergence and understanding of structural consequences related to transport demand and logistics are essential to create policies towards future capable, reliable and cost efficient freight transport. The research challenge is that disruptive technologies are only little comparable with established technologies. For example the truck in 1900 was only little comparative to railway – the traditional competitive factors such as mass transport capacity and related low costs per ton with railways were not relevant for the success and tremendous

impact on economic growth by trucks. It thus needs research on the suited data for the monitoring of technology emergence and suited evaluation methods for data on the one hand side. On the other hand side, maybe more important, it needs assessment methods for disruptive technologies for proper policy measure preparation. Assessment methods to be developed must be able to evaluate positive and negative effects distinct by stakeholder and sector and shall do research on the range of effects by disruptive innovations.

Related to this, it further needs context setting scenarios for possible futures under circumstances of distinguished disruptive technologies. Such scenarios should elaborate the consequences of, for example, an economy based on 3D printing for production pattern, consumption pattern, and possible business models. They further should reflect the implied changing requirements on logistics and transportation. This should be done not only in terms of transport technology but also in terms of changing generalized cost, spatial interaction and willingness to pay for transport services.

How to support relevant disruptive technologies best? To be market leader for future basic technologies is desirable objective for Europe's industries but for American and Asian as well. It is however important to note, that disruptive technologies have a tendency to be uncertain, costly, knowledge intense which necessarily implies sunk costs. The crucial point is, as desirable as it is to be market leader, as higher the investment is to be market leading in a pool of potential basic technologies. It thus needs efforts in the field in research policies and innovation policies to implement public measures on disruptive technologies best.

Future is likely not only dedicated to disruptive technologies but also incremental improvements. In circumstances of competing disruptive and established technologies it needs research in fields of transition management and strategic planning for both, public and industrial agencies.

Expected impacts:

The impact expected is that a long term orientation for investments is provided for logistic and freight transport companies but inter alia for their consumers as well. It is further expected that public resources are allocated effectively in support and development of new technologies and strategies for the creative transformation to exploit positive effects of new technologies and reduce negative effects. The research proposed is further expected to have an impact on global competition and a strengthening of Europe its logistics and freight transport industry.

Funding level and instrument

RIA and CSA

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