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Response of ETP ALICE to the "*STAKEHOLDER CONSULTATION ON POTENTIAL PRIORITIES FOR RESEARCH AND INNOVATION IN THE 2018-2020 WORK PROGRAMME OF HORIZON 2020 SOCIETAL CHALLENGE 4 'SMART, GREEN AND INTEGRATED TRANSPORT*"

Context and Background

ALICE 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. ALICE has been asked to provide input for the next Work Program (2018-2020) in the area of 'Smart, green and integrated transport' within HORIZON 2020, following the question list below. Before addressing the questions context and background is included.

Estimates put the share of the logistics industry in the GDP of Europe at close to 14%[1]. 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[2]. 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[3]. Some countries are however already showing a positive decoupling between economic growth and transport.

Keeping current European world leadership in logistics is key for European citizens' future. The EU is the world's largest exporter and biggest trader in goods[4]. However, 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. Transport and logistics is a key aspect to lead value chains and access these new markets in a competitive way). It is estimated that logistics account for 10 to 15% of the final cost of finished goods[5] hence competitiveness of industry sectors (such as the automotive and the food industries) relies heavily on the performance of the logistics. In this sense, 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 and competitiveness of European industrial activity and trade on a global scale.

At the same time, transportation is responsible for around a quarter of the EU greenhouse gas emissions[7] (data from 2012). The European Union[8] 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

[1] COM(2007) 607 final. "*Freight Transport Logistics Action Plan*" European Commission, Brussels, 18.10.2007
[2] World Bank "*Connecting to Compete 2014*". http://www.worldbank.org/content/dam/Worldbank/document/Trade/LPI2014.pdf
[3] Prof. Dr. Dieter W. Rebitzer (University of Nürtingen-Gieslingen), "*The European Logistics Market*".
[4] *Strategic approach for Horizon 2020 - a contribution from foresight. Ref. Ares(2014)1202380*
[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] COM (2010) 546 final "*Europe 2020 Flagship Initiative – Innovation Union*", European Commission, Brussels, 06.10.2010

figures[9]. Concerning the freight transport and logistics sector, similar targets have been established for the reduction of CO2 emissions[10]. Sustainable economic growth is a fundamental challenge for Europe. However, according to the conclusions of the COP21 in Paris, shared in the Public hearing on COP 21 impact on European transport policy, Brussels, 04 April 2016, Transport Emissions are increasing in absolute. They represent 30% of all GHG emissions (24% if you exclude aviation and maritime), 32% of energy consumption and 94% of the oil import of the Union. Importantly 90% of the mobility related emissions (people) are for trips below 50Km and at least 60% of freight are linked to movement below 300 KM being the "last mile" an important contributor to the problem.

In the perspective of ALICE, there is no way for Europe to achieve the COP21/Transport White Paper targets if this issue does not attract more attention from a system/logistics perspective. Clear and certain opportunities for improvement are identified. For example, 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 [11]. Moreover, modal split in Europe is not growing at the desired rate due to lack of adequate infrastructure, regulations, efficiency, available services and reliability hence not meeting market requirements for a faster modal shift.

1) **What are the challenges in the field of Societal Challenge 4 ' *Smart, Green and Integrated Transport*' that require action under the Work Programme 2018-2020? Would they require an integrated approach across the societal challenges and leadership in enabling and industrial technologies?**

These are the key challenges that deserve attention in the Work Programme 2018-2020:

- According to "*Strategic Foresight: Towards the 3rd Strategic Programme of Horizon 2020"* Hyper-connectivity and Big Data will drive accelerated change and innovation: "*It is expected to find early major uses in environmental monitoring and supply chain logistics…"* and in relation to energy in this same report the following is foreseen: "*There will be a move to radically different vehicles and more rational systems for the movement of goods, through the development of the physical internet to underpin the later"*[12]. Indeed, Hyper connected transportation amalgamated in the concept of Physical Internet[13] is showing huge potential for change towards more efficient and sustainable transport and logistics. According to recent studies[14] results from a simulation experiment with top retailers Carrefour and Casino in France and their 100 top suppliers showed a potential economical benefit of 32%, 60% reduction of greenhouse gas emissions and 50 % of volume shifted from road to rail. Proof of concepts are starting to be tested in the field. However, a lot of further research is needed in

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

[10] 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

[11] World Economic Forum-2009

[12] Strategic Foresight: Towards the 3rd Strategic Programme of Horizon 2020. ISBN 978-92-79-53672-4

[13] 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.

[14] Ballot É., B. Montreuil, R. Meller (2015), The Physical Internet: The Network of Logistics Networks, Documentation Française.

different levels to get pan-european expansion of the concept and benefits. ALICE is currently developing a comprehensive implementation plan of the roadmaps towards achieving the desired effects of this foresight and concrete topics will be proposed in a later stage to contribute to work program preparation. Isolated use cases of the Physical Internet concept are in place at the moment but not working as pieces and or components of a broader system. The challenge is to speed up the process and transition towards the new paradigm but also frame the process in a way that physical internet allows a play field in which companies will compete to deliver the services, therefore, moving the concept from the "Big Brother" scenario in the foresight to other scenarios close to market competition.

- Also included in foresight: *In transport, the move towards automatic vehicles and smarter logistics will all lead to major changes in the transport infrastructure. Demand for goods will continue, so innovation will focus to a great extent on ways of meeting demand, whilst ensuring cleaner and more efficient systems*[12]. This statement complements the need towards a different paradigm. The figures shared in the introduction show the potential of increasing load factors in transport in terms of efficiency and sustainability, however, no significant advances have been achieved in the last decade mainly due to sector fragmentation, lack of appropriate indicators to measure progress in this area and required advance in business models and above all behavioral change. Some initiatives are running currently in order to increase consolidation of freight flows through horizontal collaboration then reducing overall emissions and energy. Identifying best practices and cases and sharing the benefits to further deploy them is seen as a great potential opportunity for improvement. One of the key targets of the Transport White paper is that 30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50 % by 2050, facilitated by efficient and green freight corridors. A substantial growth in modal shift is not achieved yet. The challenge is to smooth transshipment operations between transport modes, warehouses and infrastructure increasing end to end efficiency. Further modularization should contribute to improve current situation. Moreover, building decentralized Manufacturing networks, empowered by Industry 4.0 and technological enablers such as 3D printing, that could collaborate (vertically and horizontally) in order to increase efficiency of transport on top of TEN-T could support this process providing the hubs with a higher role in the whole network. This fact would open new opportunities for the hubs, offering innovative value added services that do not belong to the traditional supply chain, such as palletization, labelling, customization, assembly/repair, reverse logistics.

- e-commerce is growing at double-digit rate and accounts for up to 25 % of returns. This combined with smaller shipment sizes is increasing freight trips. According to research in UK, in 2013, products ordered online generated just over one billion deliveries. By 2018, this number is expected to grow by 28.8% to 1.35 billion[15]. Fastest growth rate will occur typically in rural areas then creating increased need for professional transport and rural last mile transport services. In the urban environment, the growth in deliveries may have an impact in increasing traffic. However, current load factors for delivery vehicles in cities are very low (e.g.

[15] The last Mile, Exploring the online purchasing and delivery journey. Report produced by Columino for Barclays. September 2014

38% for vans in London), therefore, this increase in deliveries may not directly result in increasing trips as long as more efficiency is achieved and load factors are increased. Urban freight delivery model should be reviewed for example, including direct and return trips, higher efficiency of reverse logistics and/or achieving increased consolidation of goods. Consumer trip (transport between home & store) account for around 20 % of the total CO2 emitted by supermarket shopping[16]. Therefore, new delivery patterns coupled with innovations in automation and electromobility may reduce the CO2 emitted in shopping trips. The challenge is therefore to find appropriate delivery models to match growing demand in a sustainable and efficient way without increasing vehicle movements.

- Energy, decarbonization and trade policies, socio-economic trends, digitalization, new and developing technologies are seen as main influencers and potential game changers for certain logistics operations and transport as a whole. We mean 1) development of technologies such as: robotization, human machine interfaces, automation of transport and drones, autonomous delivery vehicles, Internet of Things (IoT), augmented reality, Big Data, Industry 4.0 and 3D printing, machine visualization and machine learning algorithms, fifth generations smartphones (5G), enhanced system interoperability, etc. 2) socio-economic trends such as: ageing, demographic changes, oil price volatility, crowdsourcing and crowd shipping, sharing economy, urbanization, globalization and localization, consumer needs and behaviors and growth of e-commerce, 3) transport, environmental and energy policies 4) Physical Internet paradigm and integration with manufacturing: off and near shoring, cloud manufacturing, etc. There is a clear need to understand and achieve the best potential benefits out of these trends in a socio-economic context in terms of environment, energy, safety and security, employment and growth.

An integrated approach across the societal challenges and leadership in enabling industrial technologies is required to meet these challenges in a comprehensive way. According to Commissioner Bulc´s opening speech in TRA2016, the user (people) should be at the center. In terms of goods, people need to have full access to goods and services at a reduced cost and in a sustainable way. Approaching the challenge from the user perspective implies a systemic approach that can only be achieved through integrated approaches that address the transport system as a whole and focus on forward looking benefits for people and society.

The development of disruptive technologies will make available capabilities that will facilitate the implementation of ALICE vision of a Physical Internet[13] in different phases moving towards a more efficient system, as addressed in H2020 foresight. However, this vision can only be developed with an integrated approach of many different technologies and stakeholders working on a common system or much better a system of systems. The Physical Internet vision addresses the biggest challenge in transport and logistics: the development of new solutions and business models that leverage knowledge and technology to create an order of magnitude more efficient and sustainable supply networks and logistics operations.

[16] LCA study, P. van Loon, J. Dewaele, L. Deketele - Heriot-Watt University / P&G 30 items/shopping basket - UK B&M supermarket - typical (average) travel behavior (distance, transport mode

2) What is the output / impact that could be foreseen? Which innovation aspects could reach market deployment within 5-7 years?

ALICE sees clear opportunities to achieve a more sustainable transport system: less energy use, less pollution, less noise, less congestion and higher efficiency. Higher freight carrier loads (i.e. higher asset utilization and fewer empty miles), intelligent combinations of loads across supply chains, smart consolidation and coordination of flows in supply networks (increasing modal shift), synchromodality having the Physical internet as the ultimate vision should result in all these benefits as long as the process is properly steered. Altogether, an efficiency increase of 15 % hence achieving total savings of €100 billion/year and 15% of EU27 transport CO2 footprint reduction could be expected as well as having positive effects on congestion. Several opportunities need to be pursued to achieve these gains:

- Developing an open market for collaborative logistics and developing appropriate supply Network design considering European Manufacturing industry developments on top of the TEN-T Network. Speed up the processes and implementation of shipper's horizontal collaboration.

- Leverage full potential of the Internet of Things, Big data, Machine/deep Learning, 5G and ITS. Experts estimate that the Internet of Things will consist of almost 50 billion objects by 2020[17]. Logistics is one of the major industries that will benefit from the intelligent conjunction of information and material flows[18]. Smart, integrated information and communication systems (e-market-places, e-booking platforms, supply chain composition, etc.) are an indispensable backbone to achieve true coordination and collaboration along and across supply chains. Moreover, C-ITS potential for freight transport and logistics is promising as well as deep learning algorithms[19], that are seen as an important enabler to leverage the full potential of integration of information looking forward to self-organizing logistics operations, optimizing routes, scheduling delivery times in real-time, reducing empty trips by sharing schemes, reducing waiting time in terminals, optimizing transport thanks to automation, ensuring integrity of the cargo and protection against damage and or theft. Innovation actions in this field should be expected.

- Smart and green distribution systems and freight transport in urban areas may significantly reduce the environmental and social burden for citizens. Examples include the development of city distribution (cross docking and/or consolidation) centers, allowing only fully, preferably electric, and partially autonomous vans/trucks to enter (parts of) cities, but also parcel delivery and collection stations or login boxes (fixed or dynamically allocated), all aiming at diminishing the number of transport movements, while increasing efficiency and maximize safety. This may imply new models in which there are middleware consolidation centers in city areas (freight is shipped in trough rail (as in Paris) or heavy/middle trucks) between hubs connecting to core Network of transport and very last mile Urban Delivery Centers. A number of soft barriers including business models and collaboration need to be tackled to achieve full realization.

- De-stressing the supply chain to reduce supply chain complexity by using the right mix of transportation modes to operate sustainably at lower cost with higher quality. For example, a

[17] http://www.iotsworldcongress.com/documents/4643185/0/IoT_IBSG_0411FINAL+Cisco.pdf
[18] DHL Logistics Trend Radar 2016.
[19] Algorithms that enable computers to automatically identify and extract high-level features of unstructured data

tactical transportation 'slow-down' can balance the supply chain, cut storage costs, and even reduce the carbon footprint by shifting loads from road carriers to rail, barge or (where appropriate) short sea transport, thereby increasing transport efficiency significantly. Synchromodality is more efficient and environmentally friendly than the use of fixed transportation modes with pre-defined routes and schedules. It is the process by which logistics providers ensure optimal, flexible, and sustainable deployment of different transportation modes and services to fit customer needs. It allows dynamic interchangeability of modes (road, rail, air, and ocean) at any point in the supply chain and at any time. However, its optimal function requires an increased confidence in predictions of the supply chain dynamics and the enabling technologies, such as predictive analytics. In this sense, development and implementing a strategy towards a synchromodal European freight network and operations is required.

3) **Which gaps (science and technology, innovation, markets, policy) and potential game changers, including the role of the public sector in accelerating changes, need to be taken into account?**

This question has already been addressed in previous answers. The above outputs can only be reached through a concerted action of all stakeholders, in particular the private sector (shippers, logistic service providers, ports and hubs, and transport companies), infrastructural organizations, regional and national governments, and last but not least the European Union.

On top, market behavior can be influenced by defining either smart incentives (for instance, pricing and charging/taxation mechanisms) or via strict regulations. Incentives for industry towards full utilization of transport means increasing load factors, reducing empty trips, access to urban areas may help to change both company and consumer behavior. Examples include the introduction of city access rules for freight transport: access only with higher load factors, time zones for freight delivery, dedicated lines for Electric Vehicles. A similar question pertains with respect to so-called external (non-tangible) costs (due to emission, congestion) which are currently not charged to the polluter but eventually to the public (e.g. via local tax mechanisms). Pricing and charging of infrastructure use may present a remedy but again requires political will and agreement of all partners concerned (which often is not the case). The biggest risk as perceived by individual organisations is that, through participation, they ultimately subsidize their competitor.

Legal obstacles may preclude far-reaching collaboration between companies, since such collaboration may violate competition regulations. At a European level (and even more at an intercontinental level), smooth coordination is often hindered by non-attuned local regulations. On a smaller scale, the same phenomenon holds with respect to information systems. Too often, collaboration and coordination among different partners along the supply chain is hampered by non-geared legacy systems, while the investments needed to harmonize them are often substantial.

Game theory offers in principle a way to address these issues and in general provides an adequate tool to develop new, mutually attractive business models with gainsharing, however, simplified models need to be in place for day to day operations.

A further obstacle is more behavioral in nature; how to change the attitude of stakeholders looking forward to a new paradigm? A new paradigm will imply winners and losers so many players will prefer to maintain current status quo.

4) **Which areas could benefit from integration of horizontal aspects such as social sciences and humanities, responsible research and innovation, gender aspects, and climate and sustainable development?**

- Economy is slowly moving to be circular, i.e. that the raw materials in products at the end of life or that by-products and or residuals in manufacturing processes are used again and keeping all resources into a new value chain. This includes the use of water, energy, biotics and abiotics used within scope of supply cycles. In that paradigm, logistics is a key enabler to ensure sustainability of circular economy by providing smart logistics networks. This leads to the development of new business models, including bundled services, after-market and reverse supply chains.

- Measuring performance for effective transport and logistics towards a sustainable world. This area is focused on calculating, reporting and improving the social, environmental and economic performance of logistics operations and networks in terms of energy use and emissions (including air pollutants and noise with CO2 equivalent) alongside the traditional logistics KPIs that quantify costs, service performance and effectiveness.

- A number of policies, socio-economic trends, new and developing technologies are seen as main influencers and potential game changers for certain logistics operations and/or logistics as a whole. The challenge is to understand how these trends, policies and technologies may impact logistics operation and therefore socio-economic aspects such as environment, energy, safety and security, employment and growth. Assessing possible scenarios as well as build modelling and simulation tools with that purpose could also benefit from the integration of these horizontal aspects and reach mental shift to adopt change at the relevant stakeholders.

5) **Taking into account the current technological transformations (e.g. digitalisation), policy imperatives (e.g. decarbonisation) and socio-economic trends (e.g. on-demand economy), what areas of transport R&I should be prioritised in the short-medium term in order to reconcile economic efficiency, sustainability and user convenience?**

R&I addressing the challenges included in answer to point 1) as well as the aspects included in answer to point 2) should be prioritized.

It is already confirmed by stakeholders that policy imperatives such as energy targets and decarbonisation cannot be achieved by increasing vehicle efficiency only. Therefore, it is crucial that R&I addressing system level aspects, is considered as important as well. For example, the Physical Internet concept is systemic in its essence, meeting the requirements of end users of transport (whether for freight movement or for personal movement), primarily citizens and secondary industry that use transport to provide goods and services to people and is showing clearly breakthrough potential to achieve policy imperatives.

Addressing complex systems instead of specific aspects could be seen as being fuzzier or riskier but on the other hand, looking forward to a planned paradigm change in the transport system could be the only way to meet policy imperatives, considering socio-economic trends and benefiting from technological transformation.

Therefore, proper trade-offs need to be addressed in the investment for transport R&I ranging from incremental very specific potentialities to broader concepts looking forward to an order of magnitude increase on efficiency and sustainability. Related to the former, and following the arguments included in point 4) concerted public and private actions such as Research Public Private Partnerships should be explored to meet challenges at a system level.