EARPA Position Paper

Task Force Logistics

March, 2019

About EARPA

Founded in 2002, EARPA is the association of automotive R&D organisations. It brings together the most prominent independent R&D providers in the automotive sector throughout Europe. At present its membership numbers 49, ranging from large and small commercial organisations to national institutes and universities.

Introduction to the Task Force Logistics Position Paper

Transport and logistics support economic development: the demand for these services is growing and this is expected to continue. At the same time as transport contributes to the fulfilment of several of UN's Sustainability Development Goals, it is also causing negative environmental impact[1], which has to be significantly reduced and ultimately eliminated.

The demand for logistics is changing, for instance due to the increase of e-commerce. Yet road transport will remain the predominant mode of freight transport, currently accounting for more than three-quarters of EU-28 freight transport[2] (expressed in tonne-kilometres), with heavy-duty vehicles (HDVs) and light-duty vehicles (LDVs) representing 26% and 12% of the road transport share of CO_{2eq}[3] emissions respectively (Eurostat, 2017).[4] Between 1990 and 2015, the growth rate of CO_{2eq} emissions from LDVs exceeded those of passenger cars in the EU. As greenhouse gas emissions from transport will need to be at least 60% lower in 2050 compared to 1990 levels and be firmly on the path towards zero emissions, a radical decarbonisation of logistics and the road freight transport sector is necessary, the development of more sustainable solutions essential.

Logistics, with its system and process view, is an enabler that could facilitate the fulfilment of several different types of missions that need to be addressed in the future. Logistics is defined as the process of designing, planning and controlling the forward and reverse flow and storage of materials, finished goods and related information, from the point of origin to that of consumption, with the aim to meet customers' requirements. In this context, the challenge is to make the European industry economically, environmentally and socially more sustainable, contributing to both competitiveness and societal needs. Nevertheless, logistics, and the transport industry in particular, has special needs: the low profit margins of the service providers hinders investment in efficiency improvements, and the small size of most transport firms makes it difficult to innovate and implement new solutions.

[1] In the EU, transport is responsible for more than half of all NOx emissions and contributes significantly (around 13 % or more) to the total emissions of the other pollutants such as PM, NMVOC, CO, SOx (European Environment Agency, 2017)

[22] Eurostat 2018 https://ec.europa.eu/eurostat/statistics-explained/index.php/Freight_transport_statistics_-_modal_split#Modal_split_in_the_EU

[3] Carbon dioxide equivalent is a measure used to compare the emissions from various greenhouse gases based upon their global warming potential. For example, the global warming potential for methane over 100 years is 21. This means that emissions of one million metric tons of methane is equivalent to emissions of 21 million metric tons of carbon dioxide.

[4] Total greenhouse gas (GHG) emissions in EU-28 accumulated to 4.451,8 mio tonnes CO2eq, with a share of transport of 23,5%. With regards to transport GHG emissions, road transport has by far the largest share with 72,9%.

A number of drivers will, in addition to the necessary decarbonization, influence the development of logistics and goods transport in the coming years. The following developments need to be considered: societal trends (e.g. changing demographics, urbanisation and the sharing economy), business developments (digitalization, new actors and business models), consumer demands (increased demands on service and sustainability), and technical developments. Technology developments in the following areas, all related to EARPA, will function as accelerators for new logistics systems: electrification, autonomous vehicles and automation in general, as well as connected vehicles.

Position of the Task Force Logistics

Research by the partners within the EARPA Task Force (TF) Logistics contributes to system transformations and system innovations, through a systemic use of technologies spanning several disciplines and applying them in both business to business (B2B) and business to consumer (B2C) contexts. It supports the cooperation between industry and academia, taking into account and combining different perspectives and competences. It also keeps a dialogue with governmental authorities in order to influence both research and policy. The partners within the TF Logistics support European service providers and shippers, making them more competitive and sustainable by contributing to the development of more efficient and effective logistics, including improved service, reduced resources usage, increased recyclability and, last but not least, a substantial reduction of the CO_2 footprint of the logistics sector. This is accomplished by mobilizing automotive R&D resources to develop new transport and logistics concepts, and processes related to road transport focusing on two areas: automated vehicles within automated transport; vehicle data for strategic and operational decision making within the logistics system.

Automated transport systems

A fundamental issue is to know what effects of Automated Road Transport (ART) will have on logistics and what are the prerequisites of ART? Linked to this are questions of how shippers may influence automated transport systems and how these will provide logistics new scenarios, applications and services.

There is a need for research on how to deal with the changes to the vehicles, e.g. when moving from long distance to local distribution. The impact of automation on multimodal transport systems is of special interest. The goods transfer process will be changed when automated vehicles are used and the benefits from automation could be lost if this aspect is not addressed. Automated vehicles open up possibilities for much more complicated operating patterns. This in turn implies differences in maintenance requirements and changes in the role of the stakeholders involved. This also relates to how to use vehicle data to improve maintenance processes.

Vehicle data for strategic and operational decision making within the logistics system

A question is, how to take advantage of digitalization, data sharing enabling efficient and sustainable freight transport and logistics? The necessary research should focus on questions related to how increased availability of high-quality data from vehicles can contribute to improving logistics systems. For instance: how to use real-time operational data, such as position, load carriers, transport units etc., in the decision making? Alternatively, how to use vehicle data for strategic planning purposes? There is also a need for more research about the role of vehicles as data providers in logistics, and what and to whom vehicles may provide data. This is relevant from a "dynamic risk assessment and early warning" perspective. More knowledge is also needed regarding the consequences of data access for the role of service provider and different types of back-office systems. For example, how can reliability and maintenance performance, including spare parts distribution, be improved by means of better information management?

Automation and the use of data for decision making

New technology will enable new services, for instance the development of Logistics as a Service (LaaS), and other solutions based on a sharing economy model, where digital tools are used to match a long supply tail with a similarly long tail of demand, perhaps even in real-time. It is anticipated that a central part of the future development in this area relates to the use of Artificial Intelligence and machine learning. In order to take advantage of the technical developments and opportunities in data sharing, a number of non-technological barriers need to be overcome: this relates to how to build trust among operators, in the technology and in new business models.

Expected impact of the work in Task Force Logistics

Logistics will contribute to managing the challenge of decarbonisation and other aspects of sustainability, supporting a competitive Europe. Automation of freight transport may have potential to reduce CO_2 emissions, but it should be observed that it also may result in increased use of vehicles. Automated vehicles and equipment, with integrated control will require as well as facilitate new types of services. Automation will require real time coordination of the individual transport units and their routes. These issues need to be solved once those with driving vehicles in platoons have been solved. In addition to traffic management issues, this includes planning and scheduling services, and creating the demand for platoons by loading goods together that have to be transported in the same direction.

Digitalisation and information systems for interconnected logistics and transport systems are crucial for the future development of sustainable logistics and transport systems. Flexible information management is key to implementing transport solutions that can support sustainable logistics systems. A reduction of communication bottlenecks between actors in the system will improve the potential for collaboration, the utilization of resources along the supply chain and, thereby, reduce the environmental impact of logistics.

There is a huge potential in the exploitation of large or otherwise complex datasets produced by sensors, in terms of the possibility to extract useful information on the behaviour of users and actors, on the operations of logistics service providers, and on the possibility to monitor them. Based on these, information optimization algorithms can be developed to facilitate the increased efficiency of the transport system as a whole.

A commitment to supporting companies that are interested in deploying data science to optimize logistics operations and freight distribution is fundamental to increase the efficiency of transport systems and to reduce their impact on the environment. Matching academic and industrial interests relies on the possibility to deploy, amongst other things, machine learning techniques and to combine them into optimization algorithms. In this framework, Decision Support Systems (DSS) have a major role in creating competitive advantages for transport and logistics companies by supporting them in the selection of the most optimal choices.

The TF Logistics supports realising the target of a 60% reduction of CO_2 emissions by 2050 (compared to 1990 levels) by enabling advancements in the following areas:

- Improved logistics and vehicle utilization, where a distinction can be made between measures to improve systems efficiency with low implementation barriers (such as improvement of load factors, longer-heavy vehicles (LHVs), the use of ICT for internal load matching (combining heavy and volume products or reducing empty trips, rational routing etc) and high implementation barriers (physical internet, external co-loading, crowd-shipping, autonomous vehicles etc).

- Intelligent transport systems (ITS) such as driver assistance (fuel efficient route choice), advanced traffic management (such as slot management) and cooperative systems (such as congestion assistant, platooning and cooperative traffic lights).
- Synchromodality and modal shift, which not only involves shifts from road to rail or barge for part of trajectories, but also from short-haul air to road.

Relation to other roadmaps

The greening of EU freight transportation and logistics is specified in the goals of existing roadmaps from, amongst others, ERTRAC (the European Roadmap "Sustainable Freight Systems for Europe"), ALICE, EUCAR, iMobility on Logistics, ACEA and the Green Freight Europe Program. The TF Logistics is positioned in the intersection of the ETPs ALICE and ERTRAC. The two research areas focused in TF Logistics position paper are closely related to two topics in the ERTRAC long distance transport. The first is 'Automation' including aspects such as social acceptance, business model, automation of the terminal process, the loading and handling, and impacts of automation of freight vehicles also related to human factors. The second topic 'Connected Services for long-distance freight' focusses on data management and related services. Including storage and management of data plus information protection and security is necessary and there is naturally a strong link to regulation.

Conclusion

Identifying key research themes, as outlined above, is essential in order to prepare for the dramatic changes that will be brought about by societal, business and technology developments, including use of information technology and automation, in freight transport.

The themes identified call for a combined approach involving researchers, industry and policy-makers. If action is taken then there will be significant advantages for many stakeholders concerned with the automotive industry and the logistics systems that rely on road freight transport.

For further information, please contact our contact persons of the Task Force:

TF Logistics Chairman
Dan Andersson
E: dan.andersson@chalmers.se
T: +46 31 772 1339

TF Logistics Secretary
Anders Johnson
E: anders.johnson@ri.se
T: +46 70 625 8696

More information at our website: www.earpa.eu