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RESEARCH FOR TRAN COMMITTEE – SELF-PILOTED CARS: THE FUTURE OF ROAD TRANSPORT?

EXECUTIVE SUMMARY

Abstract

The study provides an analysis of the development of automated vehicles inside and outside the EU, including both the technologies which are already on the market and those under testing and research. The EU is giving increasing attention to automated and connected vehicles as they could have huge impacts on road safety, travel behaviour and urban development. The study reports on state of the art key research projects and large scale testing in this area and discusses future pathways and potential impacts of increasing vehicle automation. It concludes with recommendations on aspects that should be considered when shaping policies to sustain the research and development, and bringing to market, of highly automated and connected vehicles.

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EXECUTIVE SUMMARY

EXISTING IMPLEMENTATION

A variety of driving assistance systems of Level 0 (no automation), Level 1 (driver assistance) and a smaller number of Level 2 (part automation) technologies are currently available on the market, mainly implemented on passenger cars to support driving on motorways or for parking. Vehicle manufacturers are investing in R&D of more advanced automation systems up to Level 3 (conditional automation), which are expected to further improve the driving safety and comfort of private vehicles. Concurrently, research and testing of higher automated systems (level 4 – high automation and level 5 – full automation) is already underway. The concept of "self-driving vehicle" represents the pinnacle of vehicle automation, although, at the moment, the implementation of fully automated vehicles still requires a considerable amount of research and technological advancement.

In the EU a number of countries – namely the UK, Sweden, Germany, France and The Netherland - are taking significant steps to be at the forefront of research in this sector; in many cases actions in this area are led by vehicle manufacturers. Outside Europe, the United States is arguably the country where most has been done in the research and testing of automated vehicles, especially on the part of technology companies such as Google. In that regard, a remarkable difference can be retraced in the approaches adopted respectively by car manufacturers – which are generally taking an *evolutionary approach* in developing increasingly automated systems with a driver-centric approach – and technology companies – which are generally taking a *revolutionary approach* in testing self-driving vehicles whose diffusion would revolutionise the current mobility paradigm.

FUTURE PATHWAYS

Different stakeholders and experts have different views on the timescale for the diffusion of automated passenger vehicles in the market. However, a scenario is broadly shared according to which increasingly automated systems (level 2 to 4) are likely to be introduced in the short (next 5-10 years) and middle term (10-20 years), while full automation is expected to be feasible on a large scale in a farther time horizon (more than 20 years) as it requires more advanced technological systems, as well as greater modification to the current international and national regulatory frameworks and available infrastructure.

As for freight transport, truck platooning is expected to follow an incremental pathway consisting in the progressive reduction of the responsibilities of the drivers until full replacement would ultimately occur. Urban mobility and public transport is expected to follow a different pathway towards full automation – i.e. the *everything somewhere* approach, consisting in the development of highly automated vehicles initially bound to circulate in specific restricted environments and then gradually opening up to less protected circumstances.

POTENTIAL IMPACTS

Road safety is expected to significantly improve as automated vehicles should reduce accidents due to human errors. However, the effective safety performance of automated systems has yet to be demonstrated and several technical challenges still need to be addressed, and little evidence is available on the potential emergence of new risky situations. The extent to which automated systems could contribute to improve safety will

also depend on their rate of market penetration – which is likely to be a relatively long process.

Automated vehicles are expected to improve mobility for young, elderly and disabled people. Also, they would allow for the possibility of undertaking tasks and activities other than driving – thus reducing the opportunity cost of the time spent in the vehicle and the labour cost by respectively increasing comfort and productivity while travelling. Moreover, vehicle automation and connection are expected to generate new jobs in the automotive, technology, telecommunication and freight transport industry. Increasing driving automation would also have an impact on professional drivers, which would be required to be trained to use the new technologies and might face a lower labour demand over the long term.

The likely net impact of automated vehicles on road congestion and emission levels is hard to establish. On the one hand, the diffusion of automated vehicles and traffic management optimisation systems is expected to determine a reduction in fuel consumption and a significant increase in infrastructure capacity, thus reducing emissions and congestion. Environmental benefits are also expected from automated systems regulating both acceleration and braking and route choice. On the other hand, an overall increase in private transport demand is likely to be spurred by the availability of the new automated transport technologies, therefore environmental gains could be counter balanced by increased demand for road transport.

CONCLUSIONS

Automated cars are likely to sustain the shift towards a new mobility scenario where more sustainable transport solutions can replace the traditional car ownership/car usage paradigm. However, unfavourable scenarios could also occur – e.g. where the diffusion of automated vehicles would end in spurring private transport demand and the negative externalities related thereto. In that regard, European, national and local authorities should support and/or coordinate the development of automated transport systems to guide the development of connected and highly automated vehicles toward the goal of a reduction of road transport externalities.

Further research is needed to investigate full impacts of increased vehicle automation. A thorough assessment of the safety implications of automated systems should be conducted in order to estimate their likely effects on traffic accident frequency and severity, and identify potential risks from human behaviour. The findings from such assessments should, in turn, inform regulatory actions to mitigate the identified risks and accompany the introduction of this technology to guarantee that the overall effect of vehicle automation on road safety will be positive. Additional research is needed also in the field of environmental issues – e.g. to better quantify the potential for fuel consumption and emissions reductions.

The outcomes of research programmes should inform autonomous vehicle regulation to ensure safety standards are met and accompany technological developments preventing possible market failures. To date, there seems to be little coordination across the actions taken by different jurisdictions to allow for prototype testing on public roads. To some extent, different countries are competing to create the most favourable conditions for testing and attracting investment in this area. At present there is also little evidence of regulatory actions addressing the potential usage of autonomous vehicles on a large scale. Indeed this is a difficult task given the existing level of uncertainty on future pathways. Yet, amendments to existing international, European, and national regulations concerning both areas of vehicle operation/design and driver behaviour will be required in order to permit a

wide implementation of a number of automated systems. A coordinated approach – which could be effectively led by UNECE - is recommended to tackle existing international and national rules that are creating barriers against the global market launch of automation Levels 3, 4 and 5 and, in some cases, also challenge the use of Level 2.

Accident liability is also an issue that needs to be addressed opportunely. Although we believe that existing legislative provisions on product liabilities can effectively guide the shift towards new insurance and liability agreements that will accompany increasing vehicle automation, actions would be needed to avoid incurring in too high litigation costs. While for current tests liability lies solely with manufactures, it is more difficult to say who will be liable when private automated vehicles are allowed to circulate on public infrastructure. Regulators would need to provide clear guidance to establish the boundaries of liability for the different levels of automation and allow for the identification of the responsible of the accident and limit litigation.

As for the potential impacts on the labour market, we believe that driving automation could deliver significant productivity gains to the freight and logistic sector, however monitoring would be needed to verify that this gains are passed to consumers through reduced product prices. Moreover, education and training will have a crucial role either to train professional drivers and to prepare the new generations to work in a more technological society where new professions might replace ones that might no longer be needed.

Finally, as higher levels of automation and vehicle connection come to the market, the role of software will also become increasingly important. It would be necessary that completely reliable and up-to-date software and IT infrastructure would be available. Requirements about data and data transmission standards, quality, security and content must also be established in order to guarantee data security and protection. When establishing such measures, particular attention must be paid to privacy concerns due to the fact that vehicle automation and connection require the use and analysis of an enormous amount of data.