European Parliament

Research for TRAN Committee – The impact of emerging technologies on the transport system

Mobility is in transition. The combined development of different emerging technologies (e.g. smart sensors, blockchain, artificial intelligence) boost innovations in Smart Mobility. The increasing pressure on achieving societal goals within the transport sector (e.g. decarbonisation, improving traffic safety, reducing congestion) will be another driver for the developments in Smart Mobility.

There are, however, still many challenges to implement Smart Mobility applications in a way that maximises the benefits for Europe and at the same time minimises any negative impacts. Lack of harmonisation in national legislation and lack of social acceptance are just two examples of issues that may hamper their large-scale deployment.

This study provides an overview of the most relevant Smart Mobility applications and their underlying emerging technologies for all transport modes (i.e. road, rail, shipping and aviation) for the period up to 2030. Their impacts on the transport system and society are assessed. Additionally, the main challenges for their development and deployment are identified, and actions that could be taken to address these challenges are discussed.

The present document is the executive summary of the study on The impact of emerging technologies on the transport system. The full study, which is available in English can be downloaded at: https://bit.ly/32hJzpH
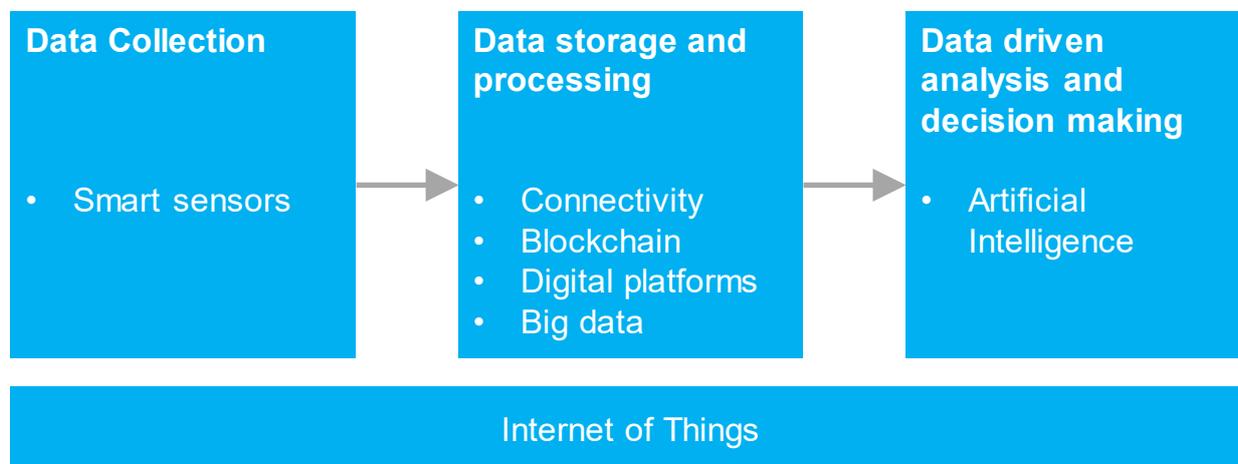
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Overview of emerging technologies and their applications in the transport sector

Collection, storage, processing and analysis of data are the main building blocks of Smart Mobility applications. The main emerging technologies supporting these steps in the data supply chain are given by Figure 1.

Figure 1: Overview of key emerging technologies

Data Collection	Data storage and processing	Data driven analysis and decision making
• Smart sensors	• Connectivity • Blockchain • Digital platforms • Big data	• Artificial Intelligence

Internet of Things

The level of maturity of the various emerging technologies varies greatly. Some are already widely applied (e.g. smart sensors, connectivity technologies), although further development is expected in the next decade. Other technologies (e.g. Artificial Intelligence) are in potential ground-breaking, but applications are only just starting to use them, discovering what is already possible and what still needs to be developed.

The emerging technologies mentioned above are key drivers of developments in Smart Mobility applications. The most promising applications are:

- **Cooperative Intelligent Transport Systems (C-ITS)** are applications where Intelligent Transport Systems (e.g. vehicles, infrastructure equipment, traffic control centres) communicate and share information in order to improve road safety, traffic efficiency, sustainability, etc.
- **Connected Cooperative Automated Mobility (CCAM)** comprises different levels of assisted and automated driving. It ranges from driver assisting features like automated cruise control to fully automated vehicles.
- **Mobility as a Service (MaaS)** is the integration of various forms of transport services into a single mobility service accessible on demand. It offers transport users access to plan, book and pay for a range of transport services, which can be easily accessed by an app.
- **Self-organising Logistics (SoL)** refers to decentral coordination of logistic chains, meaning that individual agents in the chain (e.g. companies, vehicles, containers) make autonomous decisions based on local intelligence and local data.

Impacts on transport and the society

Smart Mobility applications are expected to provide significant benefits for transport users, particularly by increasing transport efficiency (e.g. more flexibility) and improving travel experience (e.g. higher feeling of comfort). Furthermore, Smart Mobility applications may also have the potential to significantly contribute to the achievement of societal goals, like less CO_2 emissions, improved traffic safety and less congestion. To what extent this potential will be materialised

depends on its design and management by public authorities (with actions such as legislation, funding, piloting and public-private cooperation). If not managed well, Smart Mobility applications' contribution to achieving societal goals will be less prominent, and may be even negative (e.g. if the additional transport demand expected to be generated by CCAM is not managed well, it may result in additional emissions which may undo any emission reduction at the vehicle level, ending up with higher total emissions levels).

The full impact of Smart Mobility will only be realised on the long-term. First, because most applications need a critical mass to become fully effective. Secondly, because Smart Mobility applications become more effective in the next decade due to technological improvements.

Finally, the evidence on the impacts of Smart Mobility applications is only available from small-scale pilots, scenario studies and stated preferences studies. Therefore, the uncertainty in these findings is high.

Impacts for transport infrastructure

The deployment of Smart Mobility applications requires a well-developed digital infrastructure. The development, availability, security and governance of the digital infrastructure need to be a key priority in Smart Mobility policies. As the lifetime and user-requirements of the digital infrastructure differs widely from the physical infrastructure and the development of the infrastructures is not congruent, specific (but integrated) strategies for the various levels of transport infrastructure are required. This asks for a close cooperation between different stakeholders, as the various infrastructure levels are managed by different parties, with shared responsibilities.

Challenges for the deployment of Smart Mobility

To facilitate and accelerate the deployment of Smart Mobility applications, many challenges have to be overcome. Although each individual application has its own challenges, some general challenges can be identified. These are technical, as well as economic and social and all seem to be equally important. Improving user and public acceptance, developing viable business cases, guaranteeing data privacy, providing a harmonised and secure data sharing infrastructure and ensuring interoperability between countries/regions and modes are some of the main challenges for the deployment of Smart Mobility applications.

Actions to accommodate the Smart Mobility applications

To overcome the various challenges, actions at different levels are needed. Not only by European policy makers, but also by a range of other stakeholders (e.g. Member States, cities, vehicle manufacturers, infrastructure managers, etc.). Each Smart Mobility application is in a different stage of development and the same is true for the underlying emerging technologies. Therefore, a targeted set of actions is required for each application.

In addition to specific actions, an overarching European strategy towards Smart Mobility is required as well because of the common challenges to the various Smart Mobility applications, the fact that they make use of the same technologies, and the increasing integration of the various applications in the future. The European Commission is currently working on a strategy for a Sustainable and Smart Mobility which could provide such an overarching perspective.

Policy recommendations

Based on the main findings summarised above, the following policy recommendations are formulated.

- *Develop an overarching strategy for Smart Mobility* with the view to coordinate effectively all initiatives on the various types of Smart Mobility applications.
- *Create base conditions for Smart Mobility,* e.g. by further investments in digital infrastructure.
- *Define targeted sets of policy actions for each Smart Mobility application*, stimulating and facilitating actions from all stakeholders. Policies include a consistent legal framework, large-scale pilots, and a good balance between public, public-private and private financing.
- *Ensure that policies are proactive, flexible and adaptive,* such that they can be quickly adapted when new technological concepts become available or user preferences are different than anticipated.
- *Improve the knowledge base on Smart Mobility applications* on issues like technical requirements, expectations and concerns related to these applications, and the impacts these applications can have on the transport sector and society.
- *Organise cooperation between all relevant stakeholders* (including end-users), by promoting and/or prolonging and/or extending cooperation and consultation bodies (like the CCAM Platform).

Further information

The study, which is available in English, can be downloaded at: https://bit.ly/32hJzpH

More information on Policy Department research for TRAN: https://research4committees.blog/tran/

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