Artificial intelligence in road transport

Cost of non-Europe report

IN-DEPTH ANALYSIS

EPRS | European Parliamentary Research Service

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Cost of non-Europe reports analyse possibilities for gains and realisation of a public common good through action at EU level. They attempt to identify areas that are expected to benefit from deepest EU integration and for which the EU's added value is potentially significant.

Artificial intelligence (AI) deployment in road transport is one of the most mature examples of AI in the various economic sectors and one of the most promising in terms of potential added value that could be brought to the EU economy and society.

This report tries to establish what would be the lost economic benefit in terms of gross domestic product (GDP) and jobs not generated if no action were undertaken at EU level to address the existing gaps relating to liability and protection of users of AI systems in road transport. For these two aspects alone, the cost of non-Europe ranges between €231 097 and €275 287 million. This might have been even higher, however, had the scope of the quantitative analysis been broader.

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Executive summary

Transport is one of the sectors in which artificial intelligence (AI) technologies are seeing rapid uptake. AI systems can detect patterns in a large volume of data and model complex solutions that enable increased efficiency in decision making and better resource allocation. The biggest transformation in the sector, yet to come, would be the deployment and uptake of highly autonomous vehicles and enhanced traffic management systems.

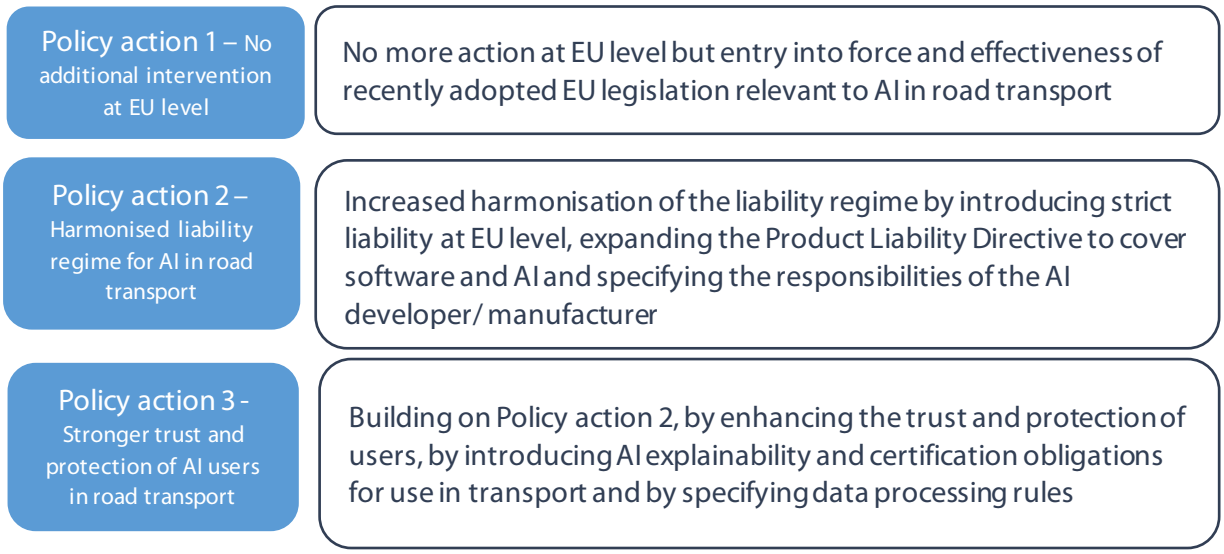
Many estimations show that the application of AI systems in the transport sector can bring some important benefits to the economy and create jobs, which could help balance out the negative effects that automation brings, such as loss of low-skilled jobs (Chapter 1).

For several years now, the European Parliament has been indicating that the transport sector is key for AI and has been advocating the harmonisation of rules to enhance the cross-border development of connected and autonomous vehicles (CAVs). This could fully exploit their economic potential and enable the EU to benefit from the positive effects of technological trends. In 2021, the European Commission is planning to address the current legal vacuum and will make a number of horizontal legislative proposals addressing AI (Chapter 1.2).

Against this backdrop this report analyses enablers for the development and deployment of AI in road transport. These are: (i) infrastructure, (ii) technology, (iii) investment, (iv) ethics, (v) the legal and policy framework and (vi) social acceptance. Next it identifies the gaps and barriers that still persist and hamper the potentially beneficial development of AI (Chapter 2).

Finally, the report estimates the cost of non-Europe (CoNE) – the cost of not acting at EU level – for AI in road transport (Chapter 3). This calculation is based on the study that underpins this report (see Annex 1). For this purpose, the report analyses in detail only selected AI enablers (EU policies and legislation, and how they could increase social acceptance of AI with regulatory rules). The report presents three sets of EU policy actions ranging from least ambitious – no additional intervention at EU level – to most ambitious, which addresses current weaknesses in the liability regime and strengthens the trust and safety of AI users in road transport.

Figure 1 – Proposed policy actions at EU level that could address some of the identified gaps that hinder the development and deployment of AI in road transport in the EU



Source: Adapted from O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS (see Annex 1).

Calculations made as part of the study underpinning this CoNE report (Annex 1) point to a potential cost of non-Europe relating to AI in road transport. In 2030, the benefits lost if no further action is taken at EU level on liability in AI and on enhancing the trust of users of AI in road transport could amount to between €231 097 and €275 287 million, were none of the gaps and barriers analysed addressed. This EU action would be also beneficial for employment and could create between 5.181 and 6.147 million jobs.

Table 1 – Estimated direct cost of non-Europe, in 2030, EU-27

	Lower bound	Upper bound
GDP (millions of euros)	€231 097	€275 287
Employment (million persons)	5.181	6.147

Source: O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS (see Annex 1).

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1. Introduction

1.1. Cost of non-Europe reports

The European Added Value unit of the European Parliamentary Research Service analyses the potential impacts of further action at European Union (EU) level. One of the unit's main publication series are the **cost of non-Europe reports** that are designed to study the possibilities for gains and/or the realisation of a public common good through action at EU level. They attempt to identify areas that are expected to benefit from deeper EU integration and for which the EU's added value is potentially significant.

In 1983 Michel Albert and James Ball introduced the notion of the 'cost of non-Europe' as an impediment to an economic growth in a report commissioned by the European Parliament.[1] The 1988 Cecchini report further developed and applied the concept of non-Europe to single market policies. In 2014, the concept was re-visited and developed in a report on the cost of non-Europe in the single market.[2] The concept of non-Europe has been applied and quantified in a number of policy areas.[3]

In the 2016 Interinstitutional Agreement on Better Law-Making[4] it is agreed that analysis of the potential 'European added value' of any proposed Union action, as well as an assessment of the cost of non-Europe in the absence of action at Union level, should be taken fully into account when setting the legislative agenda.

1.2. Background

Transport is one of the economic sectors where artificial intelligence (AI) technologies are seeing rapid uptake. The growth trends are clear: 'In the future, the transport system will accommodate vehicles with ever growing computing power, high speed connectivity, deep learning algorithms for artificial intelligence, fast processing and decentralised data handling'.[5]

AI systems applied in the transport sector can already now detect patterns in a large volume of data and model complex solutions that enable increased efficiency in decision making and better resource allocation. For example, AI technologies are used for 'real-time or predictive matching of supply and demand for rides or goods, predicting traffic speeds or dangerous road segments and behaviours, and managing supply chains'.[6] The biggest AI-driven transformation and most

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1 M. Albert and R. Ball, Working Documents, Towards European Economic Recovery in the 1980s. Report presented to the European Parliament, 31 August 1983.

2 For the concept of the cost of non-Europe, see P. Cecchini, M. Catinat and A. Jacquemin, 1992 – the European Challenge: The Benefits of a Single Market, Wildwood House, 1988; as well as previous and recently completed cost of non-Europe studies, e.g. the Cost of Non-Europe in the Single Market (Cecchini revisited).

3 Between 2014 and 2019, 21 cost of non-Europe reports were prepared by the European Parliamentary Research Service, see https://epthinktank.eu/tag/cost-of-non-europe/.

4 Interinstitutional Agreement Between the European Parliament, the Council of the European Union and the European Commission on Better Law-Making, 13 April 2016.

5 European Partnership under Horizon Europe Connected, Cooperative and Automated Mobility (CCAM), Working Document, 2020.

6 For an overview of AI use cases in transport and an explanation of the significance of AI systems in the transport sector, see for instance: International Transport Forum, Governing Transport in the Algorithmic Age, 2019. For more on AI in urban mobility, see for instance: EIT Digital, A European Approach to Artificial Intelligence, 2020.

promising AI applications that expected in the sector, however, are yet to come: the deployment and uptake of highly autonomous vehicles and enhanced traffic management systems.

Considering the speed of development of AI technologies and their potentially significant impact on the economy and society EU policy debates have focused intensively on AI applications in the transport sector.[7] EU actions contributing to the development and uptake of AI in the transport sector are two-fold. First, the EU facilitates development of AI technologies through research funding and investment.[8] Second, building on its competencies related to the internal market, consumer protection, fundamental rights and safety legislation, the EU is in the process of developing a legislative framework for AI in general and AI in transport specifically.

1.2.1. Position of the European Parliament on AI in road transport

The European Parliament was the first EU institution to draw attention to the enormous potential of AI technologies for the economy, society and environment but also to the risks that deployment of those technologies could bring. In 2017, Parliament adopted a **resolution with recommendations to the Commission on civil law rules on robotics.**[9] This was the first EU-level policy document to map out the regulatory challenges related to AI technologies and robotics comprehensively. It **recommended that the European Commission take legislative action to address the challenges**. The 2017 Parliament resolution identified a number of horizontal issues requiring EU legislative attention in relation to the development and deployment of AI technologies in the EU. Those horizontal issues included: liability, ethics, intellectual property, flow of data, standardisation, investment in research and development and facilitation of an institutional framework to enhance cooperation between the Member States and the European Commission. The resolution also identified a number of economic sectors that, in the context of developments in AI technologies, require particular attention from the EU legislators. **Autonomous means of transport**, including autonomous vehicles and drones, **were identified as one of the five sectors most urgently requiring EU policy consideration**.

More specifically, in relation to AI in transport, the 2017 Parliament resolution stated that 'the automotive sector is in most urgent need of efficient Union and global rules to ensure the cross-border development of automated and autonomous vehicles so as to fully exploit their economic potential and benefit from the positive effects of technological trends'.[10] The resolution further emphasised that 'fragmented regulatory approaches would hinder implementation of autonomous transport systems and jeopardise European competitiveness'.[11]

The urgent need to provide a regulatory framework in relation to AI transport applications and, more specifically, autonomous vehicles, was also underlined by the respondents to the 2017 **European Parliament public consultation on robotics and AI**.[12] In response to the question 'In your opinion,

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7 For analysis see European Commission, Joint Research Council, The Future of Road Transport – Implications of automated, connected, low-carbon and shared mobility, 2019.

8 Under the Horizon Europe programme the EU is planning to establish a European Cooperative and Automated Mobility (CCAM) partnership in order to establish a strategic cooperative framework for a broad spectrum of stakeholders, maximise the benefits of public funding, and leverage private investments.

9 European Parliament resolution of 16 February 2017 with recommendations to the Commission on civil law rules on robotics (2015/2103(INL)).

10 European Parliament resolution of 16 February 2017, op.cit., para 25.

11 European Parliament resolution of 16 February 2017, op.cit., para 25.

12 In 2017, at the request of the European Parliament Committee on Legal Affairs, EPRS conducted an open, on-line public consultation, translated into all EU languages on civil law rules on robotics and AI. This was one of the first EU-

in which areas is EU regulatory action most urgent?', 87 % of all respondents indicated that action in the area of autonomous vehicles was the most urgent. Autonomous vehicles, were the top area for EU-level policy intervention.

The European added value assessment (EAVA) 'A common approach to liability rules and insurance for connected and autonomous vehicles' accompanying the 2017 Parliament resolution, focused on the cost of 'fragmented regulatory approaches' to liability for connected and autonomous vehicles (CAVs).[13] The EAVA on CAVs provided an analysis of the need to revise the EU legislation and estimated the European added value that could be generated as a result of the expedited roll-out of autonomous vehicles. The results of the legal analysis on the existing EU product and traffic liability rules, as well as the comparative analysis of national law in six EU Member States, provided as part of the EAVA on CAVs, included strong evidence in support of **the need to revise the existing EU liability legislation**. The analysis indicated that if not addressed, the application of the current legislative framework on liability to CAVs will likely result in a number of gaps (i.e. certain risks not covered) and 'grey areas' (i.e. lack of clarity on how current rules should apply). Thus, if not revised the current legislative framework would result in effect in diminished consumer protection and a high degree of legal and administrative uncertainty for both business and pubic administrations. The results of the EAVA on CAVs also suggested that acceleration of the adoption curve of CAVs by **revising the EU liability framework has the potential to generate European added value** worth approximately **€148 billion**.

Since the adoption of the 2017 resolution, the European Parliament has continued to work on the specific issues related to AI technologies identified in the resolution. Thus, in **2019** Parliament adopted a **resolution specifically addressing the challenges of the transport sector – 'Autonomous driving in European transport'**.[14] In relation to the development of AI in transport, this resolution stressed that 'appropriate regulatory frameworks, ensuring their safe operation and providing for a clear regime governing liability, needed to be in place as soon as possible in order to address the resulting changes, including interaction between autonomous vehicles and infrastructure and other users'.[15] The resolution further stressed the concerns Parliament had expressed in its 2017 resolution in relation to the regulation of liability and the need for corresponding legislative action. Accordingly, Parliament repeated its call on the Commission to revise current legislation on liability, insurance, registration and the protection of personal data, because those rules would 'no longer be sufficient or adequate when faced with the new risks emerging from increasing vehicle automation, connectivity and complexity'.[16]

Parliament has also continued its work on the horizontal issues related to the development and uptake of AI technologies, and in **2020 adopted two legislative resolutions**: on the **ethical aspects of artificial intelligence, robotics and related technologies**[17] and on a **civil liability**

wide consultations on the topic of AI. An overview of the results of the public consultation and summary report is available on the European Parliament website.

13 T. Evas, A common EU approach to liability rules and insurance for connected and autonomous vehicles, European Added Value Assessment, EPRS, European Parliament, 2018.

14 European Parliament resolution of 15 January 2019 on autonomous driving in European transport (2018/2089(INI)); See also the European Parliament resolution of 12 February 2019 on a comprehensive European industrial policy on artificial intelligence and robotics (2018/2088(INI)), which covered the transport sector among others.

15 European Parliament resolution of 15 January 2019, op.cit., para 19.

16 European Parliament resolution of 15 January 2019, op.cit., para 20.

17 European Parliament resolution of 20 October 2020 with recommendations to the Commission on a framework of ethical aspects of artificial intelligence, robotics and related technologies (2020/2012(INL)).

regime.[18] The 2020 resolution on an ethical framework (the 2020 resolution) has a specific section on AI applications in the transport sector.[19] When it comes to AI applications in the transport sector, Parliament first highlights the socio-economic and environmental potential of AI technologies. Second, it underlines that the Union must take action to promote more investment and strengthen the economic competitiveness of European business. Third, it stresses that 'the Union's **transport sector needs an update of the regulatory framework concerning such emerging technologies and their use in the transport sector and a clear ethical framework for achieving trustworthy AI,** including safety, security, the respect of human autonomy, oversight and liability aspects'. The EU regulatory framework must provide a balanced solution between support for innovation and protection of safety and consumer rights.[20] The 2020 resolution also highlights the importance of developing modern infrastructure (i.e. intelligent transport systems and a 5G network) and development of 'Union-wide trustworthy AI standards for all modes of transport, including the automotive industry, and for testing of AI-enabled vehicles and related products and services'.[21]

The European added value assessment on the European framework on ethical aspects of artificial intelligence, robotics and related technologies put forward evidence that EU joint legislative action on **ethical standards for AI systems could 'boost the internal market and establish an important strategic advantage**'. An EU common framework on ethics has the potential to bring the European Union **€294.9 billion** in additional GDP and **4.6 million additional jobs** by 2030.[22]

1.2.2. Position of the European Commission on AI in road transport and EU strategy on AI

European Commission policy initiatives relating to AI technologies in the road transport sector focus on three interlinked areas: (1) revision of existing and discussion on possible future initiatives related to road transport infrastructure; (2) initiatives related to AI applications in road transport, e.g. autonomous vehicles, and (3) horizontal initiatives related to AI technologies in general.[23]

The Commission's **infrastructure-related policy and research initiatives** focus both on developing the physical and 'data' infrastructure necessary for the deployment of CAVs and on the use of AI systems as a supporting decision-making tool for infrastructure asset management.[24] Initiatives relating to the development of a physical road infrastructure for CAVs, for example, focus on updating and developing cooperative intelligent transport systems (C-ITS), including digital traffic management systems.[25]

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18 European Parliament resolution of 20 October 2020 with recommendations to the Commission on a civil liability regime for artificial intelligence (2020/2014(INL)).

19 European Parliament resolution of 20 October 2020, op.cit., 2020/2012(INL), paras 103-108.

20 European Parliament resolution of 20 October 2020, op.cit., 2020/2012(INL), paras 103-105.

21 European Parliament resolution of 20 October 2020, op.cit., 2020/2012(INL), paras 106-107.

22 T. Evas, European framework on ethical aspects of artificial intelligence, robotics and related technologies, : European added value assessment, EPRS, European Parliament, 2020.

23 The overall EU vision when it comes to development of connected and automated mobility is outlined in the 2018 Commission strategy; European Commission, Communication 'On the road to automated mobility: An EU strategy for mobility of the future', COM(2018) 283 final.

24 For an analysis of AI as a tool for infrastructure asset management in the future, see for instance the deliverables and analysis published within the framework of the Horizon2020 infra4Dfuture project.

25 For the list of applicable legislation related to intelligent transport systems and ongoing standardisation activities, see for example, European Commission, Intelligent transport systems – Cooperative, connected and automated mobility (ITS-CCAM) and electromobility, Rolling plan 2020. On traffic management programmes and projects, see European

Policy initiatives related to connected and autonomous vehicles focus primarily on analysis of new risks that can be triggered by higher levels of autonomy. One of the first analyses in this respect is a recently published report of the European Commission Expert Group entitled 'Ethics of Connected and Automated Vehicles – Recommendations on road safety, privacy, fairness, explainability and responsibility'.[26] This report makes 20 specific ethical recommendations concerning the future development and deployment of CAVs.

The sector-specific focus related to AI systems in road transport is only one element of EU AI policy and research initiatives. **EU AI-related policy developments** have so far been mainly horizontal, and focused on developing policy by setting out a strategic vision,[27] and analysing ethical implications and risks specific to AI.[28] No specific horizontal legislation related to AI technologies has been adopted so far at EU level, but according to the 2020 Commission work programme, the Commission intends to propose a number of legislative acts in 2021.[29] Overall the vision and approach to AI supported by the EU is that the development of AI systems must be 'human centric', secure and trustworthy. The EU's approach must build on the ecosystems of excellence and trust, and provide a future-oriented, 'risk based' and balanced approach to innovation.[30]

In line with its Green Deal agenda, the EU also aims to benefit from the positive environmental impacts that AI (and digitalisation in general) could bring to the economy. Regarding the transport sector, in December 2020 the European Commission published a strategy for sustainable and smart mobility[31] (previously in 2018 the Commission had presented a strategy that focused primarily on automated mobility – On the road to automated mobility: an EU strategy for mobility of the future)[32]. Among many objectives related to limiting and achieving zero-emissions of different transport modes, the recent strategy envisages that by 2030 automated mobility will be deployed on a large scale. Therefore, two areas of action related to smart mobility are emphasised in the document: (i) making connected and automated multimodal mobility a reality and (ii) boosting innovation and the use of data and AI for smarter mobility.

Commission, Transport Research and Innovation Monitoring and Information System, information web page. See also, European Commission, Connected and automated mobility in Europe, information web page.

26 European Commission Expert Group Report, Ethics of Connected and Automated Vehicles – Recommendations on road safety, privacy, fairness, explainability and responsibility, 2020.

27 European Commission, Communication on artificial intelligence for Europe, COM(2018) 237 final; European Commission, Communication on a coordinated plan on artificial intelligence, COM(2018) 795 final; European Commission, White paper on artificial intelligence: A European approach to excellence and trust, COM(2020) 65 final.

28 On Commission work on the ethical aspects of AI see: High Level Expert Group on Artificial Intelligence (AI HLEG), Ethics Guidelines for Trustworthy Artificial Intelligence, 8 April 2019; High Level Expert Group on Artificial Intelligence (AI HLEG), Assessment List for Trustworthy Artificial Intelligence (ALTAI), 17 July 2020; Expert Group on Liability and New Technologies – New Technologies Formation, Report on liability for artificial intelligence and other emerging technologies, 21 November 2019; European Commission, Report on the safety and liability aspects of AI, COM(2020) 64 final, 19 February 2020.

29 2020 Adjusted Commission work programme and 2021 Commission work programme.

30 European Commission, White paper on artificial intelligence: a European approach to excellence and trust, COM(2020) 65 final, 19 February 2020; European Parliament resolution of 20 October 2020 with recommendations to the Commission on a framework of ethical aspects of artificial intelligence, robotics and related technologies (2020/2012(INL)); European Parliament resolution of 20 October 2020 with recommendations to the Commission on a civil liability regime for artificial intelligence (2020/2014(INL)); European Parliament resolution of 20 October 2020 on intellectual property rights for the development of artificial intelligence technologies (2020/2015(INI)).

31 European Commission, Sustainable and Smart Mobility Strategy – Putting European transport on track for the future, COM(2020) 789 final.

32 2020 Adjusted Commission work programme; European Commission, On the road to automated mobility: An EU strategy for mobility of the future, COM(2018)283 final.

1.2.3. Position of EU Member States on AI in road transport

Most recently on 7 October 2020, EU Member States have expressed their opinion on connected and automated driving in the conclusions of the fourth High Level Meeting on Connected and Automated Driving, which were also endorsed by three Directorates-General of the European Commission and 13 international organisations.[33] In these conclusions, the EU Member States underlined three main building blocks on the basis of which the development of AI systems in road transport should be based. First, AI systems should be deployed in road transport in a **'human-centric'** manner. In this context the Member States called on the Commission to put into practice an action plan on the ethical development and deployment of automated driving systems.[34] Second, to enable an uptake of AI systems, the EU should **enhance framework for data sharing**.[35] Third, the current **regulatory framework should be reformed** and coordination at regulatory level among the EU Member States should be enhanced. The Member States' conclusions stress that the regulation 'should be enabling, risk-based, goal-based and performance-based as well as technology-neutral in order to be future-proof'.[36] In relation to cooperation between Member States, the conclusions underline that '(...) synchronisation is needed also between the EU Member States. In order to avoid putting up barriers to the single market in CAD, we must achieve more coordination at the regulatory level among the EU Member States, for technical rules but also with regard to traffic rules and the digitalisation of such rules, while fully respecting different legal traditions and frameworks and the principle of subsidiarity'.[37]

1.3. Cost of non-Europe: Artificial intelligence in road transport – Objective, scope and methodology

The overall **objective** of establishing the cost of non-Europe in this area is to identify how addressing, at EU level, certain key gaps and barriers to the deployment and use of AI in the transport sector could benefit the EU in achieving its ambition in the field. There is an EU-level consensus that the EU needs to reap the economic benefits of these technologies, limit their potential negative effects, become a **global leader** in the development of **secure, trustworthy and ethical AI** (AI the 'EU way') and ensure its **digital sovereignty**.[38]

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33 Conclusions from the 4th High-Level Meeting on Connected and Automated Driving, Helsinki, 7 October 2020, Ministry of Transport and Communications of Finland.

34 Further conclusions and actions endorsed by the Member States are as follows: (i) 'Member States recognise the need to clearly define the roles of the various stakeholders relating to the development and use of ADS as well as the responsibilities and rights attached to these roles'; (ii) 'The Member States recognise the need to develop the vehicle/system behaviour transparency of the algorithms'; (iii) 'The Member States conclude that the companies should be supported by the necessary regulatory framework and industry-led open standards as well as by creating concrete tools to help the practical implementation of a culture of responsibility and trust'.

35 Specifically endorsed actions are as follows: (i) 'The Member States conclude that the EU plays an absolutely pivotal role in developing a common governance model for data sharing and supportive structures'; (ii) the European Commission should continue the development of an EU-level framework that ensures interoperability, identifies specific roles in the data governance model and consolidates the development of the data economy, such as in the context of the revision of the ITS Directive and its delegated regulations; (iii) 'The Member States, together with the industry and possibly the European Commission, will start a voluntary public-private task force to discuss and develop a framework that will support (statistical) data sharing to gain insights into the potential and impact of different ADAS systems and automated systems and to develop methods to describe the safe performance of such systems'.

36 Conclusions from the fourth High-Level Meeting on Connected and Automated Driving, op.cit.

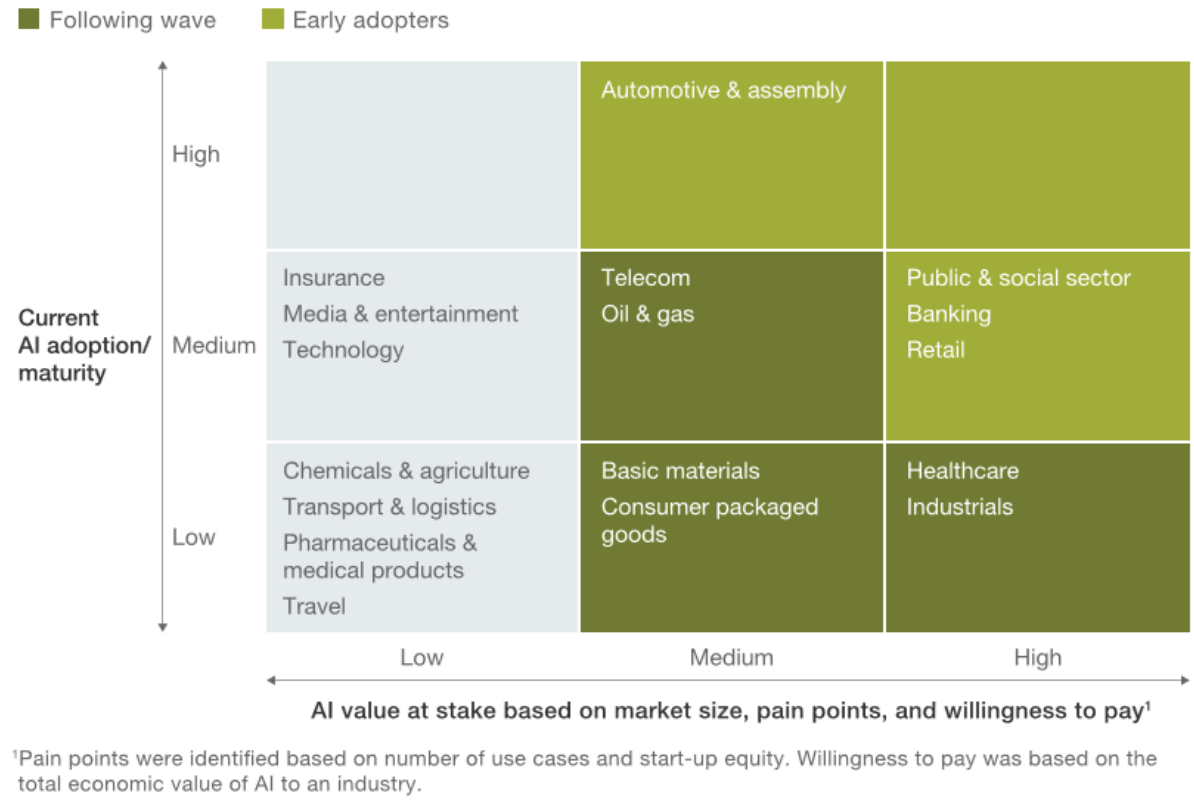
37 Idem.

38 European Council, Conclusions – 1 and 2 October 2020, EUCO 13/20.

The **scope** of this research project (see Chapter 2 in Annex 1 for more detail)[39] was narrowed down to **means of road transport**. It therefore covers personal, public and freight road transportation together with related infrastructure and operations. This leaves aside warehousing and logistics-specific issues (such as package optimisation). AI technologies and AI are understood as defined by the European Commission High-Level Expert Group on Artificial Intelligence.[40]

Transport has been chosen as a sector to study on account of the adoption and **maturity of AI systems** as well as the **potential added value** that could be brought by AI (Table 1) (see more on impacts in Chapter 2 below). Transport is also an area with an important level of European regulation despite, remaining a shared competence with national level.

Table 2 – Prioritisation based on industry attractiveness, artificial intelligence (AI) adoption/maturity, and value at stake



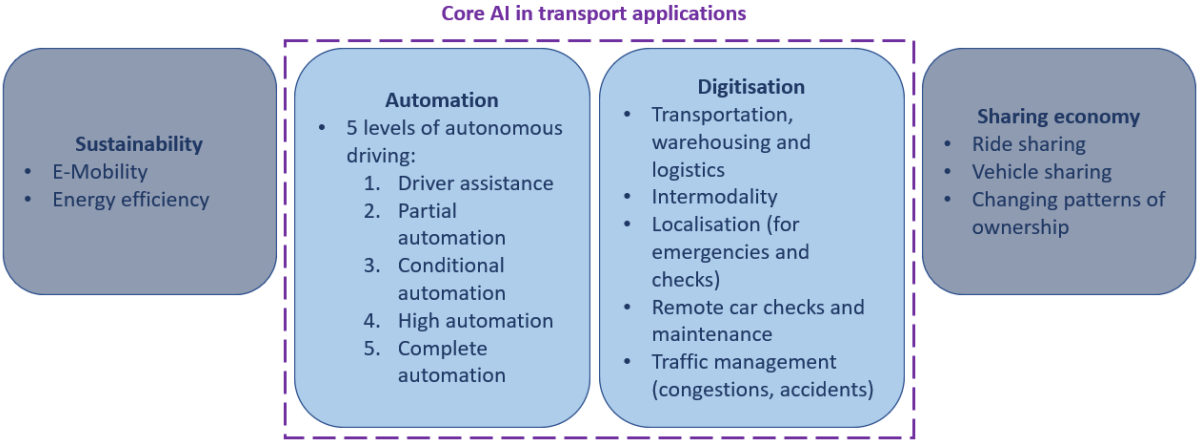
Source: McKinsey&Company, Artificial intelligence: The time to act is now, Exhibit 3, 2018.

Four **key megatrends** were identified by the study underpinning this CoNE report (see Chapter 2.2 in Annex 1) but **automation** and **digitalisation** were pointed to as the most relevant to AI applications in transport (Figure 1). Only some aspects of **sustainability** and the **sharing economy** were identified as key to boosting AI in transport.

[39] O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS (see Annex 1).

[40] Artificial intelligence are 'software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions'. AI HLEG (2019), A Definition of AI: Main Capabilities and Disciplines.

Figure 2 – Megatrends in transport and focus of the CoNE – AI in transport



Source: O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS.

The study underpinning this CoNE report has also identified **key enablers** that, if properly addressed, could have an important impact on the uptake of AI in transport, boosting the estimated added value in its connection, and more generally help the EU achieve its strategic objectives in this field (see Chapter 2.2.2 and Table 1 in Annex 1). The key enablers are:

- infrastructure,
- technology,
- investment,
- ethics,
- the legal and policy framework, and
- social acceptance.

The analysis focuses mainly on the enabler that is an **EU-level legal and policy framework and on social acceptance** (especially increased AI user trust). It further identifies the gaps and barriers in this field and, by developing potential EU-level policy options, proposes a way to address them. The cost of non-Europe is estimated on the basis of a quantitative analysis of these policy options in comparison to a baseline option.

2. Why act at EU level?

2.1. Importance of AI for the transport sector – Potential impact on the economy, society and the environment

A variety of research has confirmed the major economic, societal and environmental potential that could be realised by means of the extensive adoption of AI in the transport sector. It is believed that 'society will gain countless hours of productivity with just the introduction of autonomous transportation and AI influencing our traffic congestion issues, not to mention the other ways it will improve on-the-job productivity. Freed up from stressful commutes, humans will be able to spend their time in a variety of other ways'.[41]

Various analyses as well as market developments show that robotics and AI have enormous economic potential worldwide and specifically for the European Union. The latest 2019-2024 edition of 'Mapping of the Cost of Non-Europe' estimates a potential **efficiency gain** within the European economy of **€206 billion per year** by 2025 if appropriate EU policies to promote and regulate AI technologies are introduced.[42] The latest report by the McKinsey Global Institute for the European Commission,[43] estimates that the **net economic impact in the EU by 2030** of all sorts of high-impact technologies that will shape the European economy and society could be worth **€2.2 trillion** in cumulative additional GDP or 14.1 % in growth compared with 2017. Many of these high-impact technologies are crucial to AI and robotics in the transport sector. Examples of technologies and infrastructure include artificial intelligence, big data analytics, the internet of things and NextGen internet and infrastructure (such as 5G and beyond), while examples of high-impact applied technologies include autonomous mobility and smart cities.[44]

Another analysis relating specifically to transport predicts great economic potential in particular for **autonomous vehicles**, which could cumulatively increase the EU's GDP by 5.3 % by 2050 compared with 2016 and bring as much as **€17 trillion to the European economy by 2050**.[45] A PWC study from 2018 expects Europe's transportation and logistics sector to **increase GDP** by 10 % on average by 2030 (see Table 2). This gain will come mainly from improvements to internal processes, the sector's companies, and its overall functioning. The European Commission meanwhile estimates that by 2030 intelligent transport systems could reduce fuel consumption and CO_2 emissions by 1.2 % annually.[46] AI will also enable **hours spent in traffic** to be cut and, by way of example, it is estimated this will bring approximately €23 billion (£20 billion) in savings to United Kingdom GDP

41 Bernard Marr, What Is The Impact Of Artificial Intelligence (AI) On Society? 2019.

42 A. Teasdale, Europe's two trillion euro dividend: Mapping the Cost of Non-Europe, 2019-24, April 2019, pp. 116-118. This preliminary estimation on the EU potential efficiency gain focussed on three dimensions - (i) automation of knowledge work, (ii) robots, and (iii) autonomous vehicles and was an extrapolation - based on European Commission data on the potential global impacts of AI by 2025 and EU share of the global market.

43 European Commission, 'Shaping the digital transformation in Europe', study by McKinsey & Company, September 2020.

44 In the context of high-impact technologies that will shape European economy and society the McKinsey & Company Shaping the digital transformation in Europe report for the European Commission points to eight enabling technologies and infrastructure and eight high-impact applied technologies.

45 Policy Network, Freeing the Road: Shaping the future for autonomous vehicles, 2016.

46 European Commission, Europe on the move, Mobility package factsheet.

alone.[47] **Optimisation of the transportation grid** could bring savings of approximately €100 billion annually on costs incurred in the EU due to traffic congestion, especially in and around urban areas.[48, 49]

Among the main wider societal benefits of the use of AI in transport is the **reduction in road traffic accidents** (reducing the human factor that is responsible for 90 % of fatal crashes)[50] and the improvement of **quality of life** especially of people with disabilities, for whom traditional driving otherwise constitutes a barrier. Effects on **employment** might be twofold. On the one hand, low-skilled jobs are expected to be lost because of AI. On the other, more qualified workers will be in higher demand.[51]

Along with economic and societal benefits, AI systems in transport may also pose a number of **risks**, related, for instance, to: respect for **fundamental rights** (such as data security and privacy), difficulties attributing **liability**, or the **environmental effects** of increased of travel using autonomous and connected vehicles.[52]

Table 3 – Impacts: EU costs and benefits of AI in road transport*

Economy		Society		Environment	
Benefits:					
Issue	Quantitative estimate	Issue	Quantitative estimate	Issue	Quantitative estimate
Transport-ation and logistics sector	+ 9.9 % southern Europe GDP in 2030[53] + 11.5 % northern Europe GDP in 2030	Compensation for driver shortage	N.A.	Improved energy efficiency/ electrification – reduced air and noise pollution	N.A.
Energy savings	N.A.	Entrepreneur-ship opportunities – for start-ups e.g. in mobility as a service sector		Use of big data including for management of traffic flows – reduction of time, fuel,	N.A.

47 O. Batura et al. (2020), op.cit. after J. Després et al. (2018). An analysis of possible socio-economic effects of a Cooperative, Connected and Automated Mobility (CCAM) in Europe effects of automated driving on the economy, employment and skills, European Commission.

48 O. Batura et al. (2020), op.cit. after European Commission (n.d.). Clean transport, Urban transport.

49 For an overview of other economic effects of AI in transport see Chapter 3.3.1 in Annex 1 – Study by O. Batura et al. (2020), op.cit.

50 European Commission, Europe on the move, Mobility package factsheet.

51 For a detailed overview of the effects of AI in transport on employment see Chapter 3.3.2 in Annex 1 – Study by O. Batura et al. (2020), op.cit.

52 For a detailed overview of the effects of AI in transport on employment see Chapters 3.3.3-3.3.5 in Annex 1 – Study by O. Batura et al. (2020), op.cit.

53 PWC (2018), The macroeconomic impact of artificial intelligence.

				noise and emissions	
Eliminating congestion cost	€100 billion/ year	Safety in road traffic	N.A.	Reduced waste production	N.A.
Eliminating road infrastructure cost	€38 billion/ year	Improved quality of life	N.A.	Installed vehicle base	-25 % by 2030 (decrease from 280 million to 200 million vehicles)
Eliminating road accidents cost	From 0.5 to 3.8 % of GDP/year[54]	Potential to enhance personal autonomy especially for people with impaired driving abilities	N.A.		
Reducing travel time	€23 billion/ year	Updated and harmonised EU-wide liability framework for connected and autonomous vehicles	€148 billion		
Costs and risks:					
New infrastructure cost	N.A.	Truck driving jobs lost	Between 0.9 million and 2.7 million jobs by 2040	Rebound effect of increased personal mileage – e.g. increase in non-exhaust traffic emissions	N.A.
Traffic fines and parking fees	N.A.	Taxi driver jobs lost	N.A.	Installed vehicle base increase – it might decrease by 2030 in Europe but could increase in	N.A.

[54] W. Wijnen and W. Vanden Berghen (2017), Analysis of road crash costs in EU countries.

				other world markets, e.g. China	
Increase in energy consumption	N.A.	Data security and privacy – a greater risk of being subjected to AI control	N.A.		
Increase in personal mileage	23 % by 2030 equivalent to 5.88 trillion km[55]	Digital divide and exclusion risk – if equal access to technology is not guaranteed	N.A.		

Source: Authors, based on Annex 1 – Study by O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS, Chapter 3.3. Effects of AI on transport.
* The effects are not cumulative as they might overlap.

2.2. Existing gaps and barriers to developing and deploying AI in road transport

As previously mentioned, key enablers (identified in the research underpinning this report – see Annex 1) for achieving the benefits from AI in transport and ensuring EU's leadership in it are: infrastructure, investment, technology, ethics, regulatory and policy framework and social acceptance.

Many EU-level policies, programmes and funds have been having a direct impact on and supporting these enablers for many years. Nevertheless, there is still room for improvement, especially regarding **infrastructure**, **investment** and **technology** in which development the EU is lagging behind.[56] Moreover, big differences exist between Member States, for instance in the quality of road infrastructure or connectivity, and this fragmentation is a barrier in itself. Furthermore, there is still an investment gap in AI in the EU. In response, the new multiannual EU budget for the years 2021 to 2027 provides for further funding and supporting investment for the necessary infrastructure and connectivity that will be vital for AI in transport.

Gaps and barriers also exist in the **EU's legal and policy framework**, although it is constantly growing as new laws at EU level were recently adopted and others will soon be proposed (first quarter of 2021) by the European Commission.[57] The research undertaken for this CoNE report identified EU legislation relevant to AI in transport and in particular to autonomous vehicles – AV

[55] Due to electrification and vehicle sharing.

[56] For further details see Chapter 4.1., Annex 1 – Study by O. Batura et al. (2020), op.cit.

A relevant forthcoming legislative proposal from the European Commission will set out requirements for AI in relation to the ethical and legal issues the systems might raise. European Commission, Inception impact assessment on a proposal for a legal act of the European Parliament and the Council laying down requirements for artificial intelligence, July 2020.

[57] For a review of the EU regulatory framework relevant to AI in transport see Chapter 4.1.3 in Annex 1 – Study by O. Batura et al. (2020), op.cit.

(see Annex 1 – Chapter 4.1.3). It further establishes that the potential gaps and barriers of the EU's regulatory framework revolve around **liability**, **empowering users** (both business and consumers), **cybersecurity**, and **data privacy** (see Table 3 below and for details see Chapter 4.2 in Annex 1). On a similar note, the European Commission states that the current EU legal framework applicable to the use of AI (related not only to transport) does not provide for effective enforcement of EU rules designed to protect fundamental rights, or the application of EU rules on safety and the rules regarding the attribution of liability.[58]

[58] European Commission, Inception impact assessment on a proposal for a legal act of the European Parliament and the Council laying down requirements for artificial intelligence, July 2020.

Table 4 – Overview of gaps and barriers in the legal framework related to autonomous vehicles (AV)

Identified gap	Rules on introducing AVs to the market	Rules on using AVs
1. Liability and insurance		**I. Insurance** **Motor Vehicle Insurance Directive 2009/103 (MID)** • Does not harmonise liability regimes across EU Member States • Even though under MID motor vehicles could cover AVs, the regulation does not prevent the driver from being considered liable for the damages caused. **II. Liability** **Fault-based liability and civil liability** • Not harmonised within the EU **Product Liability Directive 85/374** • Scope limited to B2C relationship • Does not applies to services • Qualification of software as 'product' highly debatable • Burden of establishing defective nature of the product lies with the victim. • Defective nature must be established by victim. • Exemptions for defects in technological products and for defects that do not exist at the time when the product is placed on the market. **General Data Protection Regulation 2016/679 (GDPR)** • Liability for any damages resulting from a violation of the regulation • Liability only for operation of processing personal data triggering GDPR application. **Intelligent Transport Systems (ITS) Directive 2010/40** • Applicability of Product Liability Directive rules to use of ITS limited to applications and services set out according to specifications adopted by the Commission. • Does not provide any guidance on how to assess the defective nature of services (which are in principle excluded from the PLD's scope).

2. Empowering users	**General Product Safety Directive 2001/95 (GPSD)** • Information on safety risks of products apply only in B2C context **Regulation 2018/858 on approval and market surveillance of motor vehicles (AMSVR)** • Increases transparency of software and algorithms for technical services and approval authorities but does not impose explainability of AV decisions for technical services, approval authorities and users of the vehicle.	**I. Consumer protection** **Unfair Commercial Practice Directive 2005/29 (UCPD)** • Prohibition of misleading actions and misleading omissions of important information regarding main products and services characteristics apply only in B2C context. **Consumer Rights Directive 2011/83 (CRD)** • Mandatory information (including on main characteristics) before consumer is bound by sale or service contracts only in B2C context. **Digital Content Directive 2019/770 (DCD) and Directive on certain aspects of sales contracts of goods 2019/771 (DSCG)** • Mandatory information on important (security) updates and integration of goods/services. **II. Data protection** **General Data Protection Regulation 2016/679 (GDPR)** • Transparency vis à vis users through information and access rights in B2B and B2C context only if personal data are processed. • Increased transparency in cases of decisions based solely on automated processing of personal data. The possibility to obtain explanation of an automated decision on this basis remains debatable.
3. Cybersecurity	**Cybersecurity Act (Regulation 2019/881)** • Framework for cybersecurity certification is only voluntary and not mandatory. **General Safety Regulation 2019/2144 on type-approval requirements for motor vehicles (GVSR)** • Requires compliance of vehicle and vehicle components with UNECE technical regulation on cybersecurity, which is not yet in force.	**Network and Information Systems Directive 2016/1148** • Obligation for the operator of essential services (OES), including the operator of ITS, to adopt appropriate security level with regard to risks of their activities. • Qualification of a car manufacturer as an OES is uncertain and left to the discretion of Member States. **General Data Protection Regulation 2016/679 (GDPR)** • Appropriate level of data security (including ensuring confidentiality, integrity, availability and resilience of processing systems and services) for data processors and controllers applies only to personal data processing operation.

4. Data protection and privacy	**Radio Equipment Directive 2014/53 (RED)** • Possibility of additional privacy and safety requirements for specific radio equipment products (that can be used in AV) through delegated acts. Such delegated acts are not yet adopted. **General Safety Regulation 2019/2144 on type-approval requirements for motor vehicles (GVSR)** • Data protection and privacy rules for advanced safety systems such as event data recorders and driver drowsiness and attention warnings. • Requirement of processing of personal data 'within a closed loop system' for advanced safety systems such as event data recorders and driver drowsiness and attention warnings. At this stage it remains unclear if this requirement is equivalent to the notion of 'local processing' identified in the European Data Protection Board (EDPB) guidelines on connected vehicles. • Recital 10 of the regulation seems to exclude processing of biometric data for advanced safety systems even if no unique identification is pursued. This requirement does not appear in the articles of the regulation. **eCall Regulation 2015/758** • Data protection and privacy requirements limited to the scope of eCall systems. This requirement should also apply to other vehicle systems and car components.	**General Data Protection Regulation 2016/679 (GDPR)** • Specific rules on sensitive data that applies for biometric data apply only if data is processed solely for the purpose of identifying a person. In that sense, the GDPR seems to authorise processing of biometric data on the basis of other legal grounds

Source: Based on O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS.

2.3. Estimating the benefits of addressing the gaps and barriers identified

Addressing gaps and barriers related to infrastructure, investment and technology will continue to create a **level playing field** for businesses in the EU single market, especially in the single transport area. Moreover, solving certain digital challenges **at EU level**, especially when a large critical mass is required, could be **most effective**.[59]

Addressing gaps and barriers relating to liability, empowering users, cybersecurity, and data privacy could **benefit** the adoption of **all AI-based products and services**, and not only AVs. The European Commission argues that continuation of a status quo could **negatively impact** enforcement of existing laws **protecting fundamental rights**, would create legal **uncertainty for business**, creates **challenges for market surveillance and supervisory authorities** and poses the risk that victims of AI could have **difficulties in obtaining compensation**.[60] The Commission also claims that the objective for AI to be safe and trustworthy and respect EU values cannot be reached effectively by Member States alone and that EU action could limit the risk of the proliferation of divergent national frameworks.[61] This would thus avoid **fragmentation of the digital single market**.

Against this backdrop, the research underpinning the report (see Annex 1), concludes that the two **most necessary policy options** that should be considered at EU level should address the issues of **liability and explicability** and **security and safety** of AI applications in transport (see Chapter 5.1.2 of Annex 1). If properly addressed these could help to address the second identified set of gaps and barriers in the EU's legal and regulatory framework (relating to liability, empowering users, cybersecurity, and data privacy).

[59] European Commission, 'Shaping the digital transformation in Europe', study by McKinsey & Company, September 2020.

[60] Idem.

[61] European Commission, Inception impact assessment on a proposal for a legal act of the European Parliament and the Council laying down requirements for artificial intelligence, July 2020.

3. Key findings – Cost of non-Europe report on AI in road transport

This chapter presents potential action at EU-level that could address the existing gaps and barriers that were identified as being obstacles to the rapid adoption of AI in road transport and gaining benefits from that adoption. It presents the results of research conducted for this report (see Annex 1, Chapters 5 and 6). The **time line** analysed for these EU-level policy actions is the coming decade, **2020 to 2030**. It is assumed that the actions described would be fully effective from the start year of the analysis (2020). Quantitative results come from modelling with a computable general equilibrium (CGE) model that **does not account for the impact of the coronavirus pandemic** on the economy.

3.1. EU policy action to address existing gaps and their impacts

The report identifies: infrastructure, investment, technology, ethics, regulatory and policy framework and social acceptance as key enablers for further development and deployment of AI in road transport. Gaps and barriers are further analysed but only for aspects relating to the regulatory and policy framework and social acceptance (see Chapter 2). The last part of the analysis below presents quantifications of what benefits (avoided costs) could be achieved if the gaps were addressed by EU-level action.

This does not however mean that gaps and barriers that exist in the fields of infrastructure, investment and technology are less important or should not be further addressed at EU level. Although these areas are not analysed nor quantified, they could potentially be addressed in a possible further extension of the report.

3.1.1. EU policy action 1 – No additional intervention at EU level

The first policy action analysed is the **continuation of the current situation**, which comprises a (recently adopted) fully effective regulatory framework applicable to AI in road transport.[62] This action constitutes the baseline for this analysis. As it envisages no additional intervention at EU level, it does not address any of the gaps or barriers identified relating to ethics, the regulatory and policy framework or social acceptance.

Nevertheless, this scenario will allow for a certain degree of AI development and innovation as it will ensure new safety procedures. This will be possible because it provides for full effectiveness of two recently adopted transport sector-specific EU regulations that were revised to take the challenges of autonomous vehicles (AVs) into consideration: Regulation 2018/858 on the approval and market surveillance of motor vehicles (AMSVR), and the General Safety Regulation 2019/2144 on type-approval requirements for motor vehicles (GVSR).

[62] For example, two EU regulations are sector-specific: the Regulation (EU) 2018/858 of the European Parliament and of the Council of 30 May 2018 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles, applicable since 1 September 2020 and the Regulation (EU) 2019/2144 of the European Parliament and of the Council of 27 November 2019 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, which will apply from 6 July 2022. For a thorough overview of applicable legislation, including horizontal legislation – see Annex 1, Chapter 4.1.3.

Moreover, regarding the gaps and barriers identified, this scenario would provide some level of physical security and would address certain aspects of cybersecurity (such as cloud computing), without however addressing other important questions. Regarding the gaps in liability and the empowerment of users, this scenario would have a positive impact but it would be limited, as the recently adopted legislation, if effectively implemented, could increase transparency with regard to software, algorithms and automated decisions.

Regarding quantitative impacts, the research conducted for this report finds that if this scenario were realised, the EU economy would have an annual GDP growth rate between 2020 and 2030 of slightly above 3 % with the same level of growth in private consumption. Capital stock would grow at almost 5 % per year on average during the period analysed and employment would be slightly above 0.2 %. Employment in traditionally labour-intensive sectors such as agriculture and construction is expected to decline, while transportation is the only area where any substantial increases in employment would be seen.

Table 5 – Average annual percentage growth rate of selected macroeconomic variables over the 2020 to 2030 period if there is no additional intervention at EU level, EU-27

Sector	GDP	Private consumption	Employment	Capital stock
Annual growth rate	3.04	3.07	0.21	4.82

Source: O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS.

The feasibility of implementing this policy action, as well as its proportionality and subsidiarity, were analysed as high (on a scale from low – medium – high) because it is based on legislation that has already been adopted at EU level.

3.1.2. Policy action 2 – A harmonised liability regime for AI in road transport

This EU-level action proposes a solution to the existing gaps and barriers related to the **liability and insurance** of connected and automated vehicles. It addresses several risks that connected and automated vehicles generate. The box below presents some key characteristics.

Main characteristics of Policy action 2:

- In the Product Liability Directive 85/374, the **notion of product is expanded** to include AI software and algorithms.
- The **burden of proof is reversed**: the AV user does not need to prove how or why AV software or services failed.
- The **manufacturer** (AI developer), as the person most in control of all aspects of AV assumes **no-fault liability**; the **victim** is entitled to **compensation for damages prima facie**.
- To ensure compensation, manufacturers (AI developers) are obliged to take out **liability insurance** (similarly to the current motor insurance).

Source: O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS.

By improving the liability rules the EU would not only create a level playing field for AI developers and manufacturers, it would also increase EU citizens' trust in this technology. It may also lead to development of new insurance products that could apply to different levels of cybersecurity assurance from AV manufacturers. This could ultimately influence and lead to an improvement in

the safety and security of vehicles. Removing the burden of proof from AI users and giving victims the right to be compensated reinforce users' rights.

The research conducted for this report finds that if this scenario is realised there will be a positive effect on the EU economy with an increase in GDP and employment, as well as in private consumption and a small increase in capital stock (Table 5).

Table 6 – Impact of implementing Policy action 2 on selected macroeconomic variables, percentage and absolute deviations from Policy action 1, EU-27

Sector (percentage deviations)	2020	2030
GDP	0.06	1.49
Employment	0.13	2.48
Private consumption	0.07	1.58
Capital stock	0.00	0.49

Sector (absolute deviations)	2020	2030
GDP (millions of euros)	7 868	231 097
Employment (thousand persons)	243	5 181
Private consumption	N/A	N/A
Capital stock	N/A	N/A

Note: GDP is reported at constant 2019 prices. Percentage deviations refer to difference from Policy action 1 in percentages.
Source: O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, European Parliamentary Research Service.

Clear and harmonised EU rules on who is liable for which potential failure in a connected and automated vehicle could result in an increase in consumer trust as well as in legal certainty for business users. This scenario does not however offer new protection in terms of security and cybersecurity.

This scenario is assessed as having a high level of proportionality and subsidiarity. This is due to the fact that it could remedy the existing fragmentation of single market where AI liability rules for CAVs are not harmonised. This would be difficult to achieve by separate action of Member States at national level.

3.1.3. Policy action 3 – Stronger trust and protection of AI users in road transport

This EU-level action builds on the previous one (harmonisation of the liability regime for AI in road transport) and further extends it. It adds **even more security for AI users**, enhances the transparency requirements for producers and developers and ensures personal data protection even if the General Data Protection Regulation (GDPR)[63] does not apply. Thus, this scenario addresses all key regulatory gaps and barriers (previously identified in the research on the cost of non-Europe) relating to: liability, empowering users, cybersecurity and data privacy. It proposes a legal framework to address challenges relating to data protection and privacy challenges relating to CAVs.

[63] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance).

The key characteristics of this policy action are presented in the box below.

Main characteristics of Policy action 3:

- An obligation of **explainability of algorithms** and AI applications used by AVs
- An obligation of **local data processing** at least when sensitive data under the GDPR are involved; this should include, whenever technically possible, an obligation of local data processing/storage relating to personal data relating to the uses and habits of the driver/owner of (automated) vehicles, as these can reveal life habits
- Whenever technically possible, an obligation of **live processing of personal data** (or a very short storage period, such as for eCall/driver monitoring and the data event recorder/black box)
- An obligation to obtain **consent for processing of biometric data** (as per Recital 10 of the General Safety Regulation 2019/2144 on type-approval requirements for motor vehicles (GVSR)), even if no unique identification purpose is pursued (this obligation is suggested because Article 9 of the GDPR seems to apply only if biometric data are processed for the purpose of unique identification); the aim of this obligation is to ensure that people know that sensitive data is being used and processed, even locally; the obligation of prior consent could include an explanation about the nature of data processed in the vehicle
- Mandatory **cybersecurity certification** for AVs in the EU market

Source: O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS.

If pursued, this scenario would result in the highest economic gains compared with the scenario of no additional intervention at EU level and the scenario introducing a harmonised EU liability regime for AI in road transport (see Table 7 comparing the three policy actions considered).

Table 7 – Impact of implementing Policy action 3 on selected macroeconomic variables, percentage and absolute deviations from Policy action 1, EU-27

Sector (percentage deviations)	2020	2030
GDP	0.08	1.77
Employment	0.16	2.94
Private consumption	0.09	1.89
Capital stock	0.00	0.6

Sector (absolute deviations)	2020	2030
GDP (millions of euros)	10 305	275 287
Employment (thousand persons)	315	6 147
Private consumption	N/A	N/A
Capital stock	N/A	N/A

Note: GDP is reported at constant 2019 prices. Percentage deviations refer to difference from Policy action 1 in percentages.
Source: O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS.

This action would also guarantee the highest level of consumer protection as well as of cybersecurity for a vehicle. Its disadvantage would be however that it would not be as easy to implement as Policy action 2. This could be due to a lack of consensus as to what exactly explicability of algorithms and of AI is and how to implement it. Some stakeholders believe that the GDPR requirements may suffice to protect data. Moreover, some evidence exists that heavy data protection and privacy rules can have a negative impact on the research and development of AI.

Table 8 – Summary of how well the three policy actions (PAs) would address gaps

	No additional intervention at EU level	PA 2: Harmonised liability regime for AI in road transport	PA3: Stronger trust and protection of AI in road transport
New enabler targeted	n/a	• Road infrastructure • Technology • Liability and insurance • Research, development and innovation policies	• Road infrastructure • Technology • Ethical framework for AI • Liability and insurance • Research, development and innovation policies
Innovation potential	+	++	+++
Security and safety of the vehicle	++	++	++
Cybersecurity of the vehicle	+	+	+++
Increased consumer trust	+	++	+++
Improved legal certainty	+	+++	+++
Feasibility of implementing a policy option	+++	++	+
Proportionality and subsidiarity	+++	+++	+++

Notes: Feasibility, proportionality and subsidiarity are ranked from low (+), medium (++) to high (+++).
Source: O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS.

3.2. What is the cost of inaction at EU level – The Cost of Non-Europe?

If the EU does not undertake additional action on AI in road transport to address the identified gaps and barriers that do not allow optimal development and deployment of AI in transport a cost of non-Europe will occur. This cost will be borne by EU citizens, public organisations and the private sector.

The lost benefit of acting at EU level is identified as a lower benefit based on Policy action 2 and as an upper benefit based on Policy action 3, compared to no further intervention at EU level, as in Policy action 1 (Table 8).

Table 9 – Estimated direct cost of non-Europe, in 2030, EU-27

	Lower bound	Upper bound
GDP (millions of euros)	€231 097	€275 287
Employment (million persons)	5.181	6.147

Note: the lower bound and upper bound estimates refers to the benefits that Policy actions 2 and 3 would bring additionally to Policy action 1, as quantified using the CGE model.
Source: O. Batura et al. (2020), Cost of Non-Europe Report on Artificial Intelligence: Transport, EPRS.

4. Conclusions

Transport is one of the key economic sectors of the EU. The ongoing transformation of the transport sector triggered by AI technologies is both a promising opportunity and also the reason for legislative attention at EU level. AI systems are already used in transport-related decision making. However, the biggest transformation in the sector would come with the widespread uptake of CAVs. The CoNE report suggests that joint EU regulatory action to accelerate deployment and uptake of AI systems in the transport sector could generate significant benefits. Those benefits would be lost if EU did not take active measures. In order to reap the full benefits of applying AI systems in the road transport sector the EU should focus on measures to establish the infrastructure necessary for AI systems to operate (i.e., data, connectivity, interoperability and C-ITS); intensify investments, and address gaps and grey areas in the current legislative framework.

An analysis of the current regulatory framework indicates that the current legislation is not fully fit for the purpose of the deployment of AI systems in AV transport. The main gaps and risks identified are the legal framework relating to liability, and the framework relating to ethics and consumer trust, cybersecurity and data privacy. The cumulative effect or cost of the gaps or risks identified is the slower development and uptake of AI technologies in road transport in the EU. This would lead to the loss of benefits that AI systems promise in the sector in terms of economic efficiency and effectiveness, and social and environmental benefits. If not addressed the gaps and risks also will impact negatively on the competitiveness of the EU's transport sector.

5. Annex 1: Cost of Non-Europe Report on Artificial Intelligence: Transport

The annex is published as a separate volume, available online in the European Parliament's Think Tank.

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Cost of non-Europe reports analyse possibilities for gains and realisation of a public common good through action at EU level. They attempt to identify areas that are expected to benefit from deeper EU integration and for which the EU's added value is potentially significant.

Road transport is one of the economic sectors where deployment of artificial intelligence is most advanced and most promising in terms of the potential added value that could be brought to the EU's economy and society.

This report aims to establish what would be the economic loss in terms of GDP and jobs not generated were no action to be taken at EU level to address the existing gaps relating to liability and protection of users of AI systems in road transport. For these two aspects alone, the cost of non-Europe ranges between €231 097 and €275 287 million but the figures could have been even higher were the scope of the quantitative analysis broader.

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