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Future Mobility on the Old Continent. The Latest Regulatory Updates for Autonomous Vehicles

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ISABELLA FERRARI

FUTURE MOBILITY ON THE OLD CONTINENT. THE LATEST REGULATORY UPDATES FOR AUTONOMOUS VEHICLES*

Abstract: Two sets of regulatory filters apply to autonomous driving, operating in parallel at the international and national levels. While the 1968 Vienna Convention, UN/ECE regulations, and NHTSA safety standards provide the international regulatory framework, national legislators set the specific rules within their borders.
This paper examines recent international advances that will allow driverless vehicles to operate on public roads, as well as current national legislation. With the most recent update of the Vienna Convention on Road Traffic in 2022, the baton has been passed to individual states. They must now decide whether, how, when and under what circumstances to allow autonomous driving.
A comparative analysis of the countries where major automakers are based provides some de jure considerations.

Keywords: self-driving vehicles, autonomous driving, artificial intelligence.

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1. Environmental sustainability and self-driving vehicles

The automotive industry is undergoing a period of rapid evolution, driven by the introduction of innovative technologies designed to enhance safety and environmental sustainability. Indeed, the incorporation of sustainable design

principles into the development and implementation of advanced clean fuel and safety features is becoming increasingly prevalent, as evidenced by the growing sophistication of vehicles on the road.

In light of the European Green Deal commitments,[1] it is imperative to implement effective measures to reduce greenhouse gas emissions. The transport sector, which is responsible for a quarter of the total pollution of all member states, must be the primary focus of such measures. The objective of achieving carbon neutrality by 2050 will necessitate a unified effort on the part of citizens, automotive manufacturers, and legislators to collaborate towards a shared objective. The expansion of the electric vehicle fleet[2] and the increased utilization of biofuels[3] are not sufficient to achieve this goal.[4] Furthermore, the development and deployment of new intelligent mobility systems that can make a significant contribution to the environment will be necessary.

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[1] For an in-depth discussion of the Green Deal, ongoing geopolitical and trade discussions, and emerging developments, see Andrea Pezza, The European Green Deal: Shaping Environmentally Friendly Policies under Article 101 TFEU, in Market and Competition Law Review, 2020, 4 (2), p. 139; Mechthild Roos, Daniel Schade (eds.), The EU under Strain?: Current Crises Shaping European Union Politics, De Gruyter, 2023, p. 275.

[2] Nathan Jon Ross, Carbon Emmissions and Electric Cars - Introducing the Potential of Electric Vehicles in New Zealand's Climate Change Response, in New Zealand Journal of Public and International Law, 2015, 13 (Special Conference Issue: New Thinking on Sustainability), p. 235; David Messner, The Foundations of Civil Liability for Industrial Pollution, in Journal of European Tort Law, 2020, 11, p. 208.

[3] In co-operation with the European Committee for Standardisation (CEN), the EU aims to develop and improve the technical quality standards for biofuels and biofuel blends to be used in vehicle engines. Specifically, technical standards in this area are developed by CEN Technical Committee 19, which comprises experts from the automotive and fuel industries, biofuel producers and other stakeholders. A set of sustainability criteria for biofuels is included in the Fuel Quality Directive (1998) and the Renewable Energy Directive (2009), with their respective amendments and revisions. These criteria must be met in order for biofuel to count towards national renewable energy and fuel mix targets and to be eligible for financial aid. The current sustainability framework under these two EU Directives (Renewables and Fuel Quality) includes criteria on biodiversity and CO2 stocks, while advanced biofuels produced from waste and industrial residues only have to meet greenhouse gas reduction targets, as they do not address other sustainability issues. The criteria above apply equally to biofuels produced inside and outside the European Union. Thus, it is imperative that the issue of biofuels is approached on a global scale. This includes the Renewable Fuel Standard, a US federal programme that requires a minimum amount of renewable fuel to be included in transportation fuels sold in the United States (see Arnold W. Reitze Jr., Biofuel and Advanced Biofuel, in UCLA Journal of Environmental Law and Policy, 2015, 33 (2), p. 312 ff.; Adam Christensen, Connie Lausten, Fundamental Inconsistencies between Federal Biofuels Policy and Their Implications, in Environmental Law Reporter News & Analysis, 2014, 44 (5), p. 10395.

[4] 'The goal is to make the EU the first climate-neutral continent in 2050 and to reduce carbon emissions by 55% by 2030', see Karen Mohlenkamp, Sabine Schulte-Beckhausen, Bertil Kapff, The European Green Deal, in International Tax Review, 2021, 32 (2), p. 74 ff..

Indeed, the concept of smart mobility represents a convergence of the benefits derived from the shared economy, the Internet of Things (IoT), and environmental sustainability, with the objective of developing novel transport solutions.

The promotion of carpooling and platooning represents a crucial initial step towards the future of mobility, which will be characterised by a reduction in traffic congestion and air pollution.

Furthermore, the development of inner and outer urban networks will be enhanced in an environmentally conscious manner through the anticipated spatial reorganization.[5] Furthermore, the "zero net" scenario will be pursued through autonomous mobility.[6] This is due to the inherent ability of self-driving vehicles to communicate and interact with other road users and the surrounding infrastructure, which allows them to organize controlled flows on urban networks. This, in turn, leads to a reduction in pollutant emissions.[7] Furthermore, autonomous driving contributes to enhanced road safety by reducing human error, which is a significant contributing factor in road accidents. This is due to the fact that human error, such as driving under the influence of alcohol, fatigue, excessive

[5] The spread of car sharing mobility is associated with the expectation of a reduction in the amount of parking space available in urban areas. An interesting analysis in this respect is the environmental sustainability of the development of car-free urban clusters is offered in James A. Kushner, Car-Free Housing Developments: Towards Sustainable Smart Growth and Urban Regeneration through Car-Free Zoning, Car-Free Redevelopment, Pedestrian Improvement Districts, and New Urbanism, in UCLA Journal of Environmental Law and Policy, 2005, 23 (1), p. 1: 'European car-free and car-reduced housing projects … should .. be models for a policy to achieve sustainable urban life'. Moreover, reforming the way people enjoy mobility necessarily involves the dissemination of knowledge, skills and environmental awareness, which must be promoted on several fronts: at the governmental level, through green incentives/disincentives (higher fuel taxes and public subsidies for the purchase of bicycles or scooters, etc.); at the educational level, through green projects to be initiated as early as in kindergartens, etc., as remarked by Peter Newman, Sustainable Cities of the Future: The Behaviour Change Driver, in Sustainable Development Law & Policy, 2010, 11 (1), p. 7. Cf. Gregory M. Stein, The Impact of Autonomous Vehicles on Urban Land Use Patterns, in Florida State University Law Review, 2020, 48 (1), p. 193.

[6] For an in-depth discussion of technological advances in clean electricity, see Inês Azevedo, Michael R. Davidson, Jesse D. Jenkins, Valerie J. Karplus, David G. Victor, The Paths to Net Zero: How Technology Can Save the Planet, in Foreign Affairs, 2020, 99 (3), p. 18 ff..

[7] It is particularly interesting to note the drastic reversal of U.S. public opinion and doctrine in just two decades towards carpooling as a means of reducing air pollution: while there were indeed many opponents of the 1990 U.S. Clean Air Act, which 'requires employers with 100 or more employees in severe and extreme ozone nonattainment areas to increase passenger occupancy per vehicle in commuting trips between home and the workplace during peak travel periods by not less than 25 percent… this is a federal mandated car pooling and it is an outrage' (see Legislative History of the Clean Air Act Amendments (Arnold and Porter, 1995), carsharing was later intended as a tool that 'facilitates large decreases in the annual emissions of some households, which more than compensate for the collective small emission increases of other households', thus 'reducing net annual GHG emissions in North America' (Elliot W. Martin, Susan A. Shaheen, Greenhouse Gas Emission Impacts of Carsharing in North America, 2011 IEEE Transactions on Intelligent Transportation Systems 12 (4), 1077). For an extensive and accurate definition of the various shared mobility options, see Susan A. Shaheen, Nelson Chan, Apaar Bansal, Adam Cohen, Shared Mobility: A Sustainability and Technologies Workshop—Definitions, Industry Developments, and Early Understanding, 2015, TSRC, Berkeley.

speed, reduced visibility, and so forth, is responsible for the majority of road accidents.[8]

Nevertheless, the advent of autonomous driving is contingent upon the advancement of scientific and technological research, in addition to the emergence of related legal, ethical, and environmental developments that will shape the regulations governing future sustainable mobility systems. It is of the utmost importance to conduct a comprehensive examination of the current standards framework in this field, both domestically and internationally, in order to ascertain the viability and desirability of a harmonizing intervention by the European Union. Two possible options exist for the European Union to consider. One is to increase its involvement by implementing precise and targeted regulations to standardize the autonomous driving sector across all EU Member States, regardless of local political and economic conditions. The other is to allow unrestricted freedom to national legislators to govern the sector.

The field of autonomous driving encompasses a multitude of disciplines, including engineering, new technologies, urban planning, architecture, and sociology. Furthermore, it encompasses elements of law, economics, and ecology. In order to effectively unite the diverse perspectives and sectors involved in autonomous driving, it is necessary to adopt a single, coordinated approach. Currently, this can be accomplished on a global level by the United Nations, which serves as the depositary of the Vienna Convention on Road Traffic, and by the European Union for its Member States.

This essay will analyze the current legislation at the international, national, and European levels with the aim of demonstrating the importance of European harmonization for the sector's growth.

[8] Statistics show, as reported in Sven A. Beiker, Legal Aspects of Autonomous Driving, in Santa Clara Law Review, 2012, 52 (4), p. 1149 ff., that traffic accidents are caused by driver error (95%), road or weather conditions (2.5%), and technical failure (2.5%). See also Katherine L. Hanna, Old Laws, New Tricks: Drunk Driving and Autonomous Vehicles, in Jurimetrics, 2015, 55 (2), p. 275; Jeffrey R. Zohn, When Robots Attack: How Should the Law Handle Self-Driving Cars That Cause Damages, in University of Illinois Journal of Law, Technology & Policy, 2015, 2, p. 464.

2. *Shaping the next generation of mobility: the role of the Society of Automotive Engineering*

The analysis of the legal and regulatory aspects of autonomous driving is based on the global classification of the six variants of vehicle autonomy levels by the Society of Automotive Engineers.[9]

At the initial level, the vehicle is operated manually. At Level 1, the vehicle is equipped with visual or audible alarms that are activated in the event of hazardous conditions, as well as systems capable of performing dynamic sub-tasks related to longitudinal or lateral movement in specific circumstances (such as cruise control). At Level 2, semi-autonomous technology enables the vehicle's electronic systems to perform acceleration, braking, and steering in non-routine driving situations, provided that the driver continuously monitors the vehicle and is able to physically take control of the vehicle if necessary. At Level 3 (partial automation), the vehicle's accelerator, brakes, and steering are equipped with aids that permit them to operate in normal driving situations. In the event of an emergency, hazard, system request (fallback), or device malfunction, however, the driver is required to intercede. At Level 4 (advanced autonomy), the vehicle is capable of autonomous operation in a wide range of driving conditions, with the exception of those that are markedly unfavourable. Finally, at Level 5 autonomy, the vehicle becomes entirely independent, capable of operating autonomously in any weather condition or other variable. At this level, the driver is relieved of all responsibilities and obligations. In the absence of a human driver, the vehicle is occupied exclusively by passengers who cannot be considered responsible for any incidents caused by autonomous vehicle operation.

To date, vehicles have been marketed with at most the third level of driver assistance systems, despite the availability of SAE level four technologies. In point of fact, the regulatory framework still requires amendment in order to permit autonomous driving on public roads. Furthermore, the integration of two very different concepts of mobility, namely autonomous and traditional, is necessary.

Indeed, the coexistence of traditional and autonomous vehicles is bound to cause considerable practical difficulties. It is well documented that a driver who leaves a double-parked vehicle can cause issues for autonomous vehicles that follow. For

[9] For a detailed explanation of the six levels of autonomy, see Bryant Walker Smith, How Reporters Can Evaluate Automated Driving Announcements, in Journal of Law and Mobility, 2020, p. 1; Kenneth S. Abraham, Robert L. Rabin, Automated Vehicles And Manufacturer Responsibility For Accidents: A New Legal Regime For A New Era, in Virginia Law Review, 2019, 105, p. 130; Mason Baranczyk, Driving The Future: The Antiquated Treaties, Unintended Effects, and Inconsistent Implementation of Autonomous Vehicle Law, in Wisconsin International Law Journal, 2019, 37, p. 114 ff.

instance, an autonomous vehicle may position itself at the rear of the double-parked vehicle, unaware that others may be ignoring traffic rules. This can result in the autonomous vehicle waiting in vain for the double-parked vehicle to move on.[10] In other words, the binary thinking that is typical of the so-called electronic brain allows no exceptions and ultimately is incapable of adapting to the possible and frequent anomalies and variables that exist among humans.

Until the transition to fully autonomous driving is complete, the only possible solution is to provide dedicated roads for autonomous and conventional vehicles. The question of whether this solution is feasible in terms of local urban planning remains to be seen.

In examining the legal and regulatory aspects of this sector, it is imperative to underscore the potential for regulatory frameworks to impede technological advancement. The extensive global availability of SAE Level 4 technologies in the automotive industry may serve as evidence for this, as their restricted adoption highlights regulatory restrictions. In fact, their usage is frequently only permissible as an exemption to existing laws.

It is therefore of the utmost importance to streamline the discussion and establish uniform regulations in order to facilitate the necessary regulatory progress for technological advancement.

3. *An update of the Vienna Convention*

The concept of autonomous driving is addressed in two of the most significant international agreements governing road transport: the 1968 Vienna Convention on Road Traffic and the United Nations Economic Commission for Europe (UN/ECE) Regulations. The Sustainable Transport Division, through its Working Party 29,[11] specifically addresses legal issues related to technological innovations in vehicles.

[10] See Anthony D'Amato, Sam Dancel, James Pilutti, Levasseur Tellis, Emily Frascaroli, J. Christian Gerdes, Exceptional Driving Principles for Autonomous Vehicles, in Journal of Law and Mobility, 2022, p. 1: using the famous trolley dilemma as an analogy, the authors propose an overview of some exceptional situations that the autonomous vehicle might encounter, and discuss the possibilities of adjusting the software to maximize the safety of different road users.

[11] Article 29 Working Party (acronym WP.29) is the working group of technical experts and specialists in vehicle technical requirements established in 1949 by the United Nations Economic Commission for Europe (UNECE) Road Transport Subcommittee to implement the general technical provisions of the 1949 Geneva Convention on Road Traffic. To find out how WP.29 developed and evolved, see Kevin M. McDonald, Shifting Out of Neutral: A New Approach to Global Road Safety, in Vanderbilt Journal of Transnational Law, 2005, 38, p. 760; Debashis Chakraborty, Julien Chaisse, Shameek Pahari, Global auto industry and product standards, in Journal of International Trade Law and Policy, 2020, 19 (1), p. 13.

The Vienna Convention continues to serve as a foundational instrument in the regulation of road traffic across the globe.[12] It has been adopted by no fewer than 96 signatory countries, which periodically adopt amendments necessitated by technical and engineering progress and the safety standards gradually introduced in the transport sector.[13]

The two amendments to the Vienna Convention in 2015 and 2022, which have established the crucial international framework for autonomous driving, represent some of the most recent and significant regulatory updates in this field.

In 2015, the Convention's Article 8 was amended by the addition of section 5-bis.[14] This allows drivers to utilize autonomous driving mode, which implies that they can take their hands off the wheel. Nevertheless, the degree of autonomy granted is contingent upon the driver's capacity to promptly deactivate the system and resume manual control in the event that it is necessary.

Subsequently, the amendment of 14 July 2022 introduced Article 34-bis into the consolidated text of the Convention, thereby authorising level three to five autonomous vehicles to operate on public roads, subject to nationally defined limitations.

Indeed, the 2022 reform empowers each EU Member State to determine whether and under what conditions driverless vehicles may operate within their borders. The resulting legislation will be enacted concurrently at the national level.

This represents a significant departure from previous practices. Despite the challenges posed by the ongoing Covid-19 pandemic, the Ukraine war, and the energy crisis, autonomous driving has once again become a key area of focus for international regulatory bodies. Due to the lengthy and formal amendment procedure set forth in Article 49 of the Vienna Convention (which requires at least 18 months and the approval of two-thirds of contracting states for an amendment to enter into force),[15] national legislators had a considerable period of time, up to one and a half years, to prepare for the implementation of Article 34-bis.

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[12] For an introduction to the 1968 Vienna Convention on Road Traffic, see Steven Van Uytsel, Danilo Vasconcellos Vargas (eds), Autonomous Vehicles. Business, Technology and Law, Springer, 2021.

[13] The two international road traffic conventions currently in force, the 1949 Geneva Convention and the 1968 Vienna Convention, bind a total of 133 countries: 'fifty-two that are party only to the 1949 Convention, thirty-four that are party only to the 1968 Convention, and forty-seven that are party to both' (Bryant Walker Smith, New Technologies and Old Treaties, in AJIL Unbound, 2020, 114, p. 152). Of the two, the Vienna Convention is the only one that has been amended to take account of implementing autonomous driving systems.

[14] The 2015 reform came into force in 2016.

[15] According to Article 49 of the Vienna Convention on Road Traffic, upon receiving proposed amendments from the Contracting Parties concerned, the Secretary General of the United Nations communicates them to all Contracting Parties, giving them 12 months to accept, reject or convene a conference to evaluate the amendment's proposals. If, at the end of this annual period, less than one third of the total number of Contracting Parties have rejected or requested the review conference, the amendments shall be deemed to

Nevertheless, only a select few contracting parties to the Vienna Convention have taken advantage of the opportunity to update their national legislation prior to the entry into force of Article 34-bis for the purpose of implementing new technologies in motor vehicles as soon as the international legal framework allows it.[16] In order to support the international amendment introduced by the United Nations through the new Article 34-bis of the Vienna Convention, individual countries and the European Union have both taken action. This is evidenced by the numerous changes that have been discussed thus far and beyond. In addition, they have enacted legislation that incorporates both national laws and UN/ECE technical regulations (as detailed below), thereby significantly advancing the prospects for future mobility.

4. The EU's approach to autonomous vehicles

The European Commission has identified the potential of automated vehicles to drive technological advancement and economic growth. In 2018, the Commission published a communication entitled "On the Road to Automated Mobility" to standardize the self-driving vehicle sector within the Union.

In consequence, the European Union has made available a substantial and cross-border funding programme for research and trials with the objective of advancing the field in accordance with the EU Digital Compass's objectives.[17]

Moreover, Regulation (EU) 2019/2144 has empowered the EU to intervene by furnishing its Member States with a uniform approach, delineating the criteria for type-approving motor vehicles, as well as their trailers, components, separate technical units, and systems. This act, frequently referred to as the EU General

have been adopted. At the end of the aforesaid annual period, the Secretary General shall notify the Contracting Parties that the amendment has been accepted, with a statement that after a further period of six months, the amendment shall enter into force for all Contracting Parties except those that have opposed the rejection or have requested a review conference.

[16] Refer to paragraphs 7-9 below.

[17] The Strategic Programme for the Digital Decade 2030 sets out an annual collaborative scheme between the Commission and Member States for overseeing the digitalization of the economy and society. Periodic reports are produced based on this collaboration to detail the EU's progress and development in achieving a successful digital transformation as outlined in the Digital Decade 2030 policy agenda. The most recent EU reports (2030 Digital Decade - Report on the state of the Digital Decade 2023; 2022 Strategic Foresight Report) emphasizes the necessity to hasten and strengthen joint endeavors, by means of policy measures and investments in digital technologies, skills and infrastructure. It proposes that Member States should take concrete and specific actions to implement the most fitting adjustments internally, in order to reach the set targets.

Vehicle Safety Regulation, prioritizes the safeguarding of drivers, passengers, and vulnerable road users.

This EU regulation, which came into effect on 6 July 2022, has significantly reshaped discussions of product safety and liability. It mandates the inclusion of advanced driver assistance features in vehicles with the aim of enhancing road safety, and it establishes a legal framework for the validation and certification of autonomous and fully driverless vehicles in the Union. The suggested safety measures include intelligent speed assistance, reverse driving detection using sensors or cameras, alerts for driver drowsiness and distraction, event data recorders, and an emergency stop signal for all road vehicles, including cars, vans, buses, and lorries. In order to comply with regulatory requirements, it is also essential to integrate lane departure warning and automatic braking systems into cars and vans, in addition to advanced technologies designed to identify potential blind spots in buses and lorries.[18] Moreover, it is imperative to implement measures to mitigate the risk of accidents involving cyclists and pedestrians. Additionally, monitoring systems must be employed to ensure that tire pressure levels remain optimal.[19]

The recent regulation serves to illustrate the objective of European legislators to enhance road safety, thereby demonstrating the paternalistic character of European policy-making.

The policy determination is driven by alarming road accident statistics across Europe. From 2021 to 2022, there was a 3% increase in road fatalities, which can be attributed to a return to pre-pandemic traffic levels. The number of road accident casualties in 2022 exceeded the European authorities' predictions, resulting in 20,640 fatalities, which is almost twice the anticipated figure for 2030.[20]

[18] Large lorries and buses have substantial blind spots, commonly known as "No Zones". In this matter, the law is inconsistent. For instance, in Italy, the Milan municipality passed a resolution in October 2023 to prevent heavy goods trucks without blind spot safety sensors from entering urban areas. However, this was immediately overturned by the judicial court after only one month.

[19] These measures currently apply to new vehicle types and will apply to all new vehicles from 7 July 2024. Some of the new measures will be extended over time to cover different types of road vehicles until full inclusion in 2029.

[20] The European target set for 2030 is of 11,400 road fatalities.

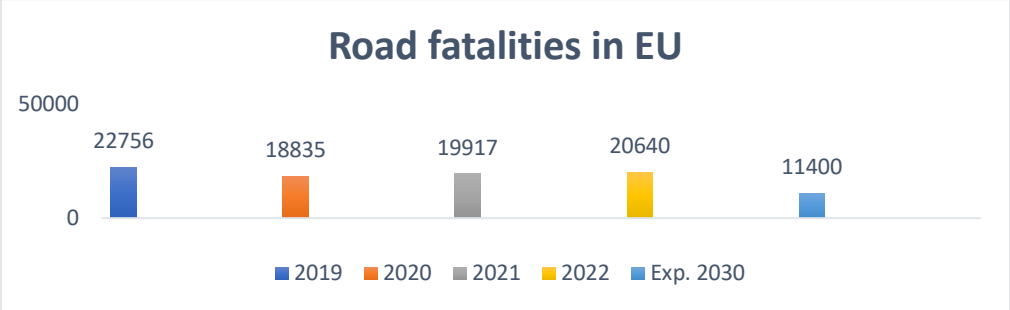

Table 1. Road fatalities in EU (source Eurostat - online data codes: tran_st_roadve)

Significant disparities exist among EU Member States. Lithuania, Poland, and Denmark have recently observed a decrease in fatalities, while Ireland, Spain, France, Italy, the Netherlands, and Sweden have stable or increased numbers. In this regard, national policies play a pivotal role, as the internally adopted sanctioning system for road traffic violations exerts a profound influence on the conduct of road users. Local policies can also enhance road safety by installing fixed or mobile speed cameras[21] and other devices that detect motoring offenses.[22] Moreover, police capillary monitoring can enhance road safety and, in turn, discourage dangerous, reckless, and irresponsible driving behaviors.

The distribution of urban and rural areas across a country's geographical layout can also have a substantial impact on road safety levels. This is due to the specific characteristics of the routes under analysis, which are influenced by factors such as frost, snow, non-linear tracks, and heavy traffic. These factors can affect driving conditions.

In light of the pressing need to improve road safety and the opportunity to integrate human driving abilities into new technologies to reduce distractions while driving, the Union has taken action.

The European Commission has implemented UN/ECE regulations to develop technical provisions for automated and connected vehicles, with the objective of reducing driver tasks on motorways through the use of Level 3 automated vehicles.[23] Additionally, the EU is endeavoring to facilitate the implementation of

[21] Among the various speedometers available in the market, noteworthy options include the Safety Tutor, SICVE (information system for speed control), Autovelox, and PASVC-project automation speed video control systems.

[22] See Photored and traffic light detectors, which are designed to enhance road monitoring and overall safety.

[23] See ECE/TRANS/WP.29/2019/34/Rev.2 for the framework document on automated, autonomous and Connected Vehicles adopted by WP.29 in 2019, and ECE/TRANS/WP.29/1140 for autonomy levels in vehicles. See also ISO/SAE PAS 22736:2021 / SAE: J3016 for the taxonomy and definitions for terms related to driving automation systems for on-road motor vehicles.

Level 4 automation in urban vehicles, which are designed to operate without human input. These vehicles may include city shuttles or robotaxis.
The recently enacted legislation, which integrates the EU General Vehicle Safety Regulation and UN/ECE regulations, aligns the EU's legal framework with the most recent updates to the Vienna Convention on vehicle automation.
The latest technical standards ensure that fully self-driving cars are subjected to rigorous assessment for safety before being permitted for sale on the European market. The criteria to be considered include testing procedures, cybersecurity obligations, data logging instructions, monitoring safety performance, as well as accident reporting requirements and duties for manufacturers of fully autonomous cars.
The contemporary era presents two significant challenges that threaten the reliability and centrality of the Union in regulating emerging technologies. Primarily, there is the challenge of ensuring the secure handling of these technologies. Secondly, there is the challenge of implementing them expeditiously and to a high standard.
What is the significance of developing cutting-edge technological systems for the European Union in the present-day landscape? This entails attaining an advantage through early intervention and reaping financial benefits, as well as assuming a leading and pioneering role in directing future progress.
This core objective of the Union necessitates an examination of other areas of EU intervention, in addition to autonomous driving. Among these, artificial intelligence stands out as a field of particular relevance and expected impact.
The European Parliament and Council recently published a proposal for a European regulation on artificial intelligence (dated April 21, 2021) following an extensive debate. The primary objective of the proposed legislation is to introduce the world's first regulation on this subject.
Although this proposal is not yet a binding and effective regulation, it nevertheless marks a significant turning point. It separates the era of unfettered artificial intelligence development from the future era of compliance with legal requirements to ensure users' safety. These requirements, while not yet mandatory, should be considered and implemented through the enactment of legislation.[24]
The European approach to artificial intelligence is notably inclusive, encompassing a wide range of applications within the scope of Article 2. This encompasses users

[24] Monika Zalnieriute, Lyria Bennett Moses, George Williams, The Rule of Law "By Design"?, in Tul. L. Rev., 2021, 95, p. 1063; Susan Ursel, Building Better Law: How Design Thinking Can Help Us Be Better Lawyers, Meet New Challenges, and Create the Future of Law, in Windsor Y.B. Access Just., 2017, 34, p. 28.

of artificial intelligence systems within the Union, as well as suppliers who place such systems on the European market, regardless of their residence or registered office. It also includes both suppliers and users located in a third country, provided that the artificial intelligence system's output is used within the Union.
This results in an extension of the range of implementation that transcends the geographical boundaries of EU Member States. In fact, the proposed uniform rules at the European level also extend to non-EU actors. This broadening of the sphere of competence is necessary to create a secure and reliable environment for the development and use of artificial intelligence, while respecting the fundamental rights guaranteed by the European Union.
The European artificial intelligence regulation proposal employs a risk-based approach, imposing rigorous requirements on the quality, documentation, traceability, transparency, and oversight of high-risk artificial intelligence systems. These are defined as systems that could potentially threaten fundamental rights protected by the EU, national constitutions, and international conventions.
The regulatory acts that have been examined, namely the Vienna Convention on Road Traffic, the EU General Vehicle Safety Regulation and the EU proposal for AI Regulation, indicate two regulatory drives which do not always align.
One of the driving forces behind this initiative is the automotive and ICT industries, which aim to establish a consistent, all-encompassing legal framework to eliminate national regulatory obstacles and foster technological advancement.
Conversely, the EU demands a system that not only resolves divergences among diverse national legal systems but also ensures the paramount safeguarding of fundamental human rights.[25] The objective of this policy is to prevent potential

[25] The issue of civil liability for new or emerging technologies poses significant difficulty in terms of legal standardisation. This is due to the diverse criteria employed by national doctrine and jurisprudence in attributing liability. The assessment of civil liability necessitates consideration of evidence regarding the damage suffered, the wrongful action, and the causal link between the action and the damage. However, to ensure prompt compensation for damages, legal systems globally have developed the concept of strict liability, which is utilized in particular high-risk areas such as driving vehicles, industrial production, custody of objects or animals, regardless of malice or fault. In these situations, strict liability falls on either the motor vehicle driver or its owner (depending on the jurisdiction), the animal's owner, or the manufacturer. They should promptly compensate for any damages, either personally or through their insurer, to improve overall confidence in the system. Liability rules serve a two-fold purpose: they allocate risk in practical terms and also affect the overall system by promoting legal certainty, enhancing trust in the compensation process, and thereby stimulating the use of high-risk and innovative products. When considering civil liability related to artificial intelligence, it's important to examine certain factors. The realm of artificial intelligence and big data involves a constant exchange of information through a complex network of relationships, making it difficult if not impossible to legally assign fault for resulting damages retroactively. Artificial intelligence systems may also use machine learning, further complicating the process of determining responsibility. The proposed AI legislation aims to increase transparency and mitigate potential risks to society, but fails to address liability issues. In the absence of clear and potentially

breaches of privacy, discrimination, or errors that could compromise public or personal safety.

5. Technical standards for the automotive sector

The United Nations Economic Commission for Europe (UNECE) was established in 1947 by the United Nations with the objective of facilitating post-war European reconstruction through the promotion of economic cooperation and integration among its member states. The UNECE comprises EU Member Countries, in addition to Canada, Israel, the United States, and a number of Central Asian states.[26]

The UN/ECE's Internal Transport Committee, within the Commission's purview, is dedicated to the advancement of international agreements, conventions, and technical regulations for the safe and sustainable development of road transport in alignment with emerging technological advancements. Consequently, the aforementioned actions must be implemented in conjunction with the amendments to the Vienna Convention, as previously specified.[27]

In contrast to the amendments to the Vienna Convention, which lack binding force, all agreements, conventions, and regulations initialled by the UN/ECE Committee of Internal Transport are self-executing. Moreover, the European Union periodically adopts specific "umbrella" regulations with the objective of fully implementing all UN/ECE provisions and strengthening their binding force.

The United States represents a notable exception to the UN/ECE regulations. Despite its status as a member of this entity, the United States has chosen to disregard these rules and implement its own federal motor vehicle and road safety standards. Consequently, automobile manufacturers must adhere to disparate sets of standards, contingent upon the destination markets of their vehicles.

The United Nations Economic Commission for Europe (UNECE) Inland Transport Committee is comprised of six working parties, each of which is assigned specific tasks and expertise. These Working Parties are as follows: GRBP (Noise and Tyres),

uniform rules, it is critical to rely on national regulations that govern the specific sector in which AI systems are deployed.

[26] Accession by the USA to the Global technical regulations for wheeled vehicles is relatively recent and dates back to 1998: see the Agreement between the United States of America and Other Governments, signed in Geneva on 25 June 1998. Cf. Andy Klosterman, The United Nations' Agreement to Adopt Uniform Technical Regulations for Wheeled Vehicles: An Important Step toward International Harmonization for Vehicle Emissions Regulations, in Colorado Journal of International Environmental Law and Policy, 2000, 12, p. 239 ff.

[27] See paragraph 3.

GRE (Lighting and Light-Signalling), GRPE (Pollution and Energy), GRVA (Automated and Connected Vehicles), GRSG (General Safety Provisions), and GRSP (Passive Safety).

The GRVA is tasked with the preparation of draft regulations, guidance documents, and interpretation documents for adoption by the Working Party 29.[28] The focus is on the safety provisions related to vehicle dynamics, including braking and steering, advanced driver assistance systems, automated driving systems, and cyber security provisions. Four informal working groups are responsible for addressing the activities within the scope of the GRVA. These include the working groups on functional requirements for automated vehicles (FRAV) and validation methods for automated driving (VMAD), the event data recorder and data storage system for automated driving (EDR/DSSAD), and cyber security and over-the-air issues.

The World Forum for Harmonization of Vehicle Regulations has been operational for over half a century. Previously designated as Working Party 29, the organization was renamed the World Forum for Harmonization of Vehicle Regulations in March 2000. The Forum has attracted the participation of countries globally, as well as prominent vehicle manufacturers. The Forum establishes harmonized vehicle regulations on a global scale, which benefits road safety, environmental protection, and trade practices.

From 2020 to 2023, a series of substantial amendments were introduced to the UN/ECE regulations. These modifications permit the utilization of progressively sophisticated driving aids, which can assume full control of vehicles in either autonomous or remote modes.

In 2015, UN/ECE Regulation No. 79 underwent a reformulation, introducing Article 5.1.6.1, which permits the activation of automatically controlled steering within the maximum speed of 12 km/h.

Nevertheless, the most significant opening for autonomous driving has been made by UN/ECE Regulation No. 157, which sets out harmonized rules for approving

[28] WP.29 is a long-standing working group within the United Nations institutional framework, established to perform a specific mandate according to a defined set of rules and procedures. As a worldwide forum, it facilitates open debates related to the regulation of motor vehicles. Any UN member state or regional economic union formed by UN member states can participate fully in the World Forum activities and can become a contracting party to the vehicle agreements administered by the World Forum. Governmental and non-governmental organisations (NGOs) can also participate in WP.29 or its subsidiary working groups in a consultative capacity. WP.29 oversees the implementation of the three primary global United Nations pacts concerning automobiles: the 1958 and 1998 accords on directives for the ratification of new vehicles, encompassing performance criteria, and the 1997 agreement on criteria for periodic technical inspections of vehicles in operation.

vehicles equipped with an automated lane-keeping system (ALKS).[29] In June 2020, Regulation No. 157 underwent a revision that permitted the activation of ALKS at speeds below 60 kilometers per hour. During this process, the driver relinquished primary control of the vehicle to the system, while retaining control of the vehicle to enable immediate response to any warnings or requests for manual intervention from the vehicle itself.

Subsequently, in June 2022, Regulation No. 157 was further amended to permit SAE level three autonomous vehicles to operate on roads with segregated lanes designated for pedestrians and cyclists. Furthermore, as of January 2023, Regulation No. 157 permits national legislators to increase the maximum speed for autonomous driving to 130 kilometers per hour, even allowing for automated overtaking and lane changing.

While the vehicle is in autonomous mode, the display will also serve as an infotainment system, provided that the transition from autonomous to manual driving can be made quickly, safely, and smoothly at the simple request of the vehicle's control system. In the event that the driver does not respond promptly and appropriately to the warning signals received, the system will transition to manual driving in complete autonomy and safety. This transition will eventually result in the slowing, stopping, and bringing the vehicle to a halt in the emergency lane or other protected area.

In order to enhance road safety, UN/ECE Regulation No. 157 also requires the installation of a black box on vehicles with SAE autonomy level three or higher. This data can then be used to determine responsibility in the event of an accident and to improve the performance of the technologies used.[30]

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[29] For a detailed technical and legal discussion of installed sensors and technologies for geolocating and controlling autonomous vehicles, see Harry Surden, Mary-Anne Williams, Technological Opacity, Predictability, and Self-Driving Cars, in Cardozo L. Rev., 2016, 38, p. 144; Luca Caltagirone, Mauro Bellone, Lennart Svensson, Mattias Wahde, LIDAR–camera fusion for road detection using fully convolutional neural networks, in Robotics and Autonomous Systems, 2019, 111, p. 125. ALKS are automated systems that, when activated, control the lateral (ie steering) and longitudinal (ie accelerating, braking and shifting) movements of the vehicle for extended periods of time without driver input. They are the evolution of Advanced Driver Assistance Systems ('ADAS'), which include Adaptive Cruise Control, Lane Departure Warning and Advanced Emergency Braking. For a detailed discussion of ALKS and UN/ECE regulations, see Russell Williamson, Megan Curzon, Developments in the UK's Approach to the Regulation of Driverless Vehicles, in The Journal of Robotics, Artificial Intelligence & Law, 2021, 4 (2), p. 132.

[30] The 2022 reform of UN/ECE Regulation 157 introduced the requirement to install an On-Board Data Storage System for Automated Driving (DSSAD) and data retrieval in the event of an accident, similar to the black boxes in aircraft or ships. The purpose is to record each activation and deactivation of the automated driving system, each lane change in autonomous mode and all cross-referenced data to verify relevant parameters and data before, during and after an accident. This is clearly information that, in line with the provisions of Regulation 155 on cybersecurity and software updates, must be collected and handled with extreme care. On security challenges in the context of IoT, see Rolf H. Weber, Evelyne Studer, Cybersecurity in the Internet of Things: Legal aspects, in Computer Law & Security Review, 2016, 32 (5), p. 715; Matthew

Other regulations that are vital for the implementation of autonomous driving are Regulations No. 155 and 156 of the UN/ECE. These regulations focus on cybersecurity and software management. They were also amended in June 2022 to require vehicle manufacturers to certify that the cybersecurity management system installed in each vehicle conforms to the technical standards.[31]

Two additional UN/ECE regulations, which are likely to have a significant impact on autonomous mobility, were amended in June 2022. These are Regulations No. 152 on advanced emergency braking systems and No. 140 on electronic stability control systems.[32]

The recent amendments to the technical standards governing the vehicle system in each of its components by the United Nations Economic Commission for Europe (UNECE) warrant brief consideration.

The technical and regulatory framework within which autonomous driving is being developed in Europe is undergoing a period of rapid and constant evolution. This is at the behest of the major automotive manufacturers in the sector, who defend their economic interests by directing and influencing international regulation.

The law, which will determine the direction of future mobility, is once again following and chasing technological progress.

It is noteworthy that the legislative and regulatory changes previously mentioned have coincided with efforts by the technical, legal, and engineering sectors to introduce autonomous driving into their respective fields by the summer of 2022. This is consistent with the implementation of the Vienna Convention's new Article 34-bis, which implicitly urges national legislators to promptly revise their regulations and fully embrace 21st-century road transport.

In order to ensure complete adherence to local legislation, the vehicle's ALKS and ADAS technologies are designed to unlock and take control of the vehicle in autonomous mode only when the system is geolocated on the navigator's maps within allowed areas. These areas are defined as roads with dedicated lanes that do

Channon, James Marson, The liability for cybersecurity breaches of connected and autonomous vehicles, in Computer Law & Security Review, 2021, 43, p. 1; Moritz Minzlaff, Christopher Kusch, Hans-Peter Fischer, Cybersicherheit in voller Fahrt, in Automobil-Elektronik, 2020, 3, p. 26.

[31] A cybersecurity certificate must be issued by the appropriate national authority. The certificate's requisite does not apply to vehicles type-approved before 1 July 2024, for which it's sufficient for the manufacturer to demonstrate that cybersecurity has been adequately considered during the design and development of the vehicle. On cybersecurity, the proposal to introduce cyber-insurance to cover any damage or loss resulting from the use of high-tech systems for transporting goods, people and luggage is noteworthy: Petr Dobias, Insurance of Cyber Risks in International Transport, in Masaryk University Journal of Law and Technology, 2022, 16 (1), p. 3.

[32] Jessica B. Cicchino, Authentication Failed Effects of automatic emergency braking systems on pedestrian crash risk, in Accident Analysis & Prevention, 2022, 172, p. 106686.

not allow pedestrians or cyclists. The integration of ALKS, ADAS, and the data stored in the maps also ensures that the autonomous vehicle, whose control system is calibrated to the maximum speeds allowed locally, obeys the speed limits and does not permit coercion or exceptions.
A joint analysis of technical standards, UN/ECE regulations, and the state of technical and engineering research conducted by Working Party 29 has identified the essential features for the safe operation of autonomous vehicles. These features include a maximum of eight passengers in addition to the driver, control of lateral and longitudinal movements by means of the ALKS system, and the possibility for the driver to refrain from supervising the vehicle in autonomous mode, with the obligation to immediately resume manual control at the system's signal.
This approach represents an internationally standardized methodology for SAE level three systems. Its objective is to facilitate the implementation of highly automated driving systems as a standard feature in newly launched vehicles by car manufacturers.
In light of the aforementioned considerations, it is evident that the UNECE is spearheading the advancement of autonomous vehicles.

6. National road transport rules

It is of paramount importance to examine and address the most recent developments in the autonomous driving industry, with a particular focus on updates to national rules and policies.
The legislative diversity among the various states impedes technological innovation and prevents autonomous vehicles from circulating freely within the Schengen area.
It is well established that road transport is one of the areas of shared competence of the European Union, as set forth in Article 4 of the Treaty on the Functioning of the European Union. Consequently, this area is subject to a dual system of central and national regulation. In point of fact, the legislative authority of the European Union does not extend to the entirety of transport regulation. Indeed, EU Member States are at liberty to enact additional national regulations beyond the boundaries of the Community.[33]
Consequently, it is of vital importance to conduct a comprehensive examination of the domestic regulations that govern the automotive and high-tech industries,

[33] Cf. Sacha Garben, Inge Govaere (eds), The Division of Competences between the EU and the Member States. Reflections on the Past, the Present and the Future, 2017, Hart Publishing, Oxford.

while taking into account the dichotomy between leading and lagging countries. It should be noted that this differentiation is solely relevant to regulatory matters and is not pertinent to the field of technology. All EU and non-EU nations are engaged in the creation of novel technologies, with contributions and incentives from the EU being utilized in this endeavor. However, this is not the case with regard to regulatory developments, which emerge from the convergence of internal political, technical, technological, social, and ecological factors.[34]

As will be demonstrated in the following sections, innovation is becoming increasingly linked to legislation.

Given that the recent 2022 updates of the Vienna Convention on Road Traffic and the UN/ECE regulations on autonomous driving systems were long overdue, the timely update prepared by some European legislators to facilitate the transition to autonomous driving is not unexpected.

The following paragraphs summarize the countries that have effectively revised their national legislation to encourage innovation in the automotive industry, as opposed to those that have lagged behind.

7. Autonomous driving in Germany

Following the 2015 reform, which permitted exempted testing of automated and connected vehicles in real-world conditions, Germany amended its Road Traffic Act in 2017[35] to allow road testing of self-driving vehicles, subject to insurance limits twice the legal minimum for conventional vehicles, the installation of a black box and emergency eCall system on board and compliance with the ethical code for the design and use of autonomous vehicles.[36]

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[34] Essentially, there are two opposite poles: Germany, Great Britain, and France, who are committed to promoting initiatives for the swift incorporation of autonomous driving technology, and Italy, Sweden, and Norway who have impeded its progress due to an ongoing regulatory deadlock, despite being among the initial adopters of the technology.

[35] For an extensive view of the 2017 reform of the German Highway Code (Straßenverkehrsgesetz), see Eric Hilgendorf, Uwe Seidel (eds), Robotics, Autonomics, and the Law: Legal Issues Arising from the AUTONOMICS for Industry 4.0 Technology Programme of the German Federal Ministry for Economic Affairs and Energy, 2017, Nomos, Baden-Baden, p. 171; Sabine Gless, Kurt Seelmann (eds), Intelligente Agenten und das Recht, Nomos, Baden-Baden, 2016, p. 225. On increasing insurance coverage, see also the combined provisions of § 20 StVZO, and European Directives 2002/24/EC, 2003/37/EC and 2007/46/EC.

[36] Christoph Luetge, The German Ethics Code for Automated and Connected Driving, in Philosophy & Technology, 2017, 30, p. 547; Andreas Wolkenstein, What Has the Trolley Dilemma Ever Done for Us (and What Will It Do in the Future)? On Some Recent Debates about the Ethics of Self-Driving Cars, in Ethics and Information Technology, 2018, 20, p. 163. For more on the ethical debate surrounding autonomous driving, see also Catherina Maracke, Autonomous Driving - Reality Or Wishful Thinking?, in Rutgers Computer and Technology Law Journal, 2020, 46 (2), p. 17.

Nevertheless, the 2017 Road Traffic Act has not impacted the testing process. In point of fact, vehicles to be type-approved, whether autonomous or conventional, are still subject to the same approval procedure as before. This includes a case-by-case verification of the concrete existence of a high and robust level of road safety and information technology. Only upon the successful completion of this examination will the competent ministry issue a special license for road testing, delineating the spatial and temporal parameters within which the tests are to be conducted.

Moreover, the enactment of the Autonomous Driving Act on July 28, 2021, marks another significant reform in Germany, with amendments to both the Highway Code and the Insurance Code.[37]

These novel regulations represent a pioneering effort in the European context, paving the way for Germany to swiftly implement Article 34-bis of the Vienna Convention (see above) upon its enactment.[38] This is due to the fact that the German federal law enacted the international changes concerning autonomous driving in advance and made its validity contingent upon the enactment of the amendment to the Vienna Convention.

Consequently, vehicles may currently be operated in highly automated mode in Germany only in the areas and under the conditions defined by law. These areas and conditions are, for example, on centrally designated sections of road and within the limits of the normal use envisaged by the vehicle manufacturer for each vehicle model. In order to ensure transparency and clarity, each manufacturer is required to provide a detailed description of the operating system installed, to specify any restrictions on its use, and to indicate clearly and unambiguously which uses are permitted in practice and which are excluded.

Consequently, it is incumbent upon individual automotive manufacturers to determine the circumstances under which the autonomous driving function should be activated, taking into account the design specifics of each system vehicle, in addition to the ministerial decision regarding road sections that can be driven in autonomous mode.[39] For instance, a vehicle may be designed to operate safely in autonomous mode exclusively in urban areas where speed limits are relatively low, or exclusively on motorways where there are no junctions, traffic lights, or parking

[37] Gesetz zum automatisierten Fahren.

[38] According to the preamble to the German law of 18.7.2021: 'In order to take account of the innovative dynamics of autonomous driving technology, the national regulatory framework must create appropriate conditions for the introduction of smooth operation in the interim period until harmonisation with EU legislation'.

[39] Bundesgerichtshof [BGH], Oct. 7, 1986, p. 345: type-approval of a vehicle is still not an exemption from the manufacturer's responsibility.

spaces. Failure to adhere to the manufacturer's instructions renders the insurance warranty null and void, thereby exposing the vehicle owner and driver to joint liability for any resulting damage.[40]

In accordance with the user manual, the driver is able to transfer control of the vehicle's longitudinal and lateral movement, acceleration, and deceleration to the vehicle within a defined space-time context. This allows the driver to take their hands off the wheel, avert their eyes from the road, and engage with the on-board infotainment system.[41] The driver is only required to remain alert, awake and in a position to regain manual control of the vehicle if necessary.[42]

Germany's 2021 legislation on autonomous driving also imposes rigorous technical specifications on the construction and equipment of autonomous vehicles. In particular, it requires the installation of redundant control systems to guarantee overall safety even in the event of failure of the primary control system. Furthermore, the vehicle must be equipped with special accident-avoidance systems programmed to drive the vehicle autonomously in a minimum-risk state if continued driving would contravene traffic regulations.[43]

In particular, the software utilized to regulate the vehicle's operation must be configured in a manner consistent with the provisions of the Highway Code at all times. Nevertheless, the data collected by the system and transmitted to the relevant authorities cannot be used by the latter to introduce new and indirect traffic controls. In particular, the data on driving time, distance travelled, and

[40] The new law stipulates under Article 2 that 'the owner of a vehicle with an autonomous driving function within the meaning of Article 1d of the Highway Code is obliged to take out and maintain civil liability insurance within the meaning of paragraph I [Article 1 of the Compulsory Insurance Act of 5 April 1965, et seq. mm] also for the technical supervisor'. This leaves the normal rules on compulsory motor vehicle liability insurance in § 4 of the PflVG unchanged, with the exception that the range of persons to be insured is extended to include the person remotely supervising the SAE level 4 autonomous vehicle. In fact, the German system of liability for road traffic damage is based on the strict joint liability of the driver (or technical supervisor) and the owner, with the latter being obliged to take out insurance, supplemented by the manufacturer's liability for damage caused by a defect in the product or a single component. This distribution of risk, which the Autonomous Driving Act also extends to the technical supervisor, is intended to ensure as full protection as possible in the event of damage or accident.

[41] However, the hardware and software for vehicle operating functions must be strictly separated from infotainment, telematics and navigation applications.

[42] When the control system deems it necessary to switch from autonomous to manual control, it alerts the driver with audible and/or visual signals.

[43] The autonomous driving system must be designed to avoid or otherwise reduce the resultant damage in the event of an unavoidable accident, with the utmost respect for the human life of those involved (excluding any assessment of personal characteristics such as age, gender and physical or mental condition, see § 1-e, para. 2, no. 4, in accordance with the guidelines of the German Ethics Commission on Automated and Related Driving. On the need for an ethical code for intelligent autonomous systems, Michael Chatzipanagiotis, George Leloudas, Automated Vehicles and Third-Party Liability: A European Perspective, in University of Illinois Journal of Law, Technology & Policy, 2020, 1, p. 149.

average speed cannot be used as evidence in administrative proceedings for offenses committed.[44]

The Department for Transport and Digital Infrastructure will undertake a reassessment of the Autonomous Driving Act in late 2023 (as part of a report projected to be released by mid-2024). Should the reassessment identify any requirements that were not previously addressed, the Act will be revised accordingly.

8. The UK's Automated Vehicles Bill 2023

In 2018, the United Kingdom's Automated and Electric Vehicles Act initiated a reform that permits the circulation of fully autonomous vehicles on public roads, despite the fact that the necessary operational technologies have not yet been developed.

Indeed, the 2018 Act delineates the regulatory framework for autonomous and electric vehicles, from the initial testing phase to the circulation of SAE level five autonomous vehicles for private use.[45]

In essence, the application of this new legislation would immediately exempt the driver from any civil liability, as if he or she were a mere passenger. In order to prevent the aforementioned dangerous drift in interpretation, the government has established the Centre for Connected and Autonomous Vehicles (CCAV) since 2015. The CCAV's specific task is to identify policy lines for the safe development of new technologies through discussion and collaboration between all stakeholders, including new technology research organizations and centers, car manufacturers, universities, local authorities, transport operators, etc.[46]

[44] The vehicle must store and retain information on the vehicle identification number, its geolocation, times of use, activation and deactivation of the autonomous driving function, number and timing of authorization of alternative driving maneuvers, system monitoring data, software status, environmental and weather conditions network parameters (transmission latency and available bandwidth), on the name of activated and deactivated passive and active safety systems, on the status of safety systems, on vehicle acceleration in longitudinal and transverse directions, on speed, lighting, vehicle power, external commands, and external information received from the vehicle. For a distinction between data protection and data privacy, based in the former case on public data protection, and in the latter case on self-determination expressed through consent, see Jos Dumortier, Pieter Gryffroy, Ruben Roex, Yung Shin Van Der Sype, Europe, in IEL Privacy and Technology Law, 2022, p. 22.

[45] Cf. James Marson, Katy Ferris, Jill Dickinson, The Automated and Electric Vehicles Act 2018 Part 1 and Beyond: A Critical Review, in Statute Law Review, 2020, 41 (3), p. 395; James Prior, Connected and Autonomous Vehicles, Cyber Threats, and the UK Motor Insurance Framework: Is the Automated and Electric Vehicles Act 2018 Fit for Purpose?, in Exeter Law Review, 2021, 46, p. 125 ff.

[46] On CAV (Connected and Autonomous Vehicles), see Antonio Kouroutakis, Autonomous Vehicles: Regulatory Challenges and the Response from Germany and UK, in Mitchell Hamline Law Review, 2020, 46 (5), p. 1111.

The second title on electric mobility was promptly implemented, while the title on autonomous driving underwent extensive discussion, review, and revision from relevant engineers.[47]

In order to achieve this objective, the Centre for Connected and Autonomous Vehicles submitted a formal revised draft of the Act in 2022. This draft was based on the 75 amendments proposed by the Law Commission of England and Wales and the Scottish Law Commission.[48] The Automated Vehicles Bill, published on November 8, 2023, and currently being reviewed in the House of Lords, is founded on this draft.

The Automated Vehicles Bill 2023 establishes two new legal entities with distinct rights and obligations: the user-in-charge or responsible user and the non-user-in-charge or NUIC operator. The former is the individual operating the vehicle in-person, while the latter is the individual controlling the vehicle remotely.[49]

In addition to the obligation to monitor the vehicle in order to take over its manual control in case of danger or necessity, the responsible user and the NUIC operator would be responsible for insurance and maintenance costs, the obligation to respect traffic limits and road signs (including while parked), the payment of tolls or other charges related to the movement, parking or stopping of the vehicle.[50] Conversely, individuals operating autonomous vehicles would be exempt from criminal liability for offenses committed by the vehicle itself.[51]

The Automated Vehicles Bill 2023 also includes provisions for the rigorous identification of requirements to be fitted as standard to all autonomous vehicles. These include clear and multi-sensory signals to be linked to the request to switch from autonomous to manual driving, or the calibration of the system to return the vehicle to the driver within a reasonable time, sufficient to perceive the danger and act accordingly.

Nevertheless, the autonomous driving reform must also encompass the requisite supplementary adjustments. The Highway Code must be augmented with a

[47] The reform envisages a specific mechanism for entry into force with different effective dates for the different titles of the Act (see Article 21 of the Automated and Electric Vehicles Act 2018).

[48] Law Commission of England and Wales, Automated Vehicles: joint report, HC 1068 SG/2022/15.

[49] Features and requirements for the authorized user-in-charge and the non-user-in-charge operator can be found in paragraphs 12, 14, and 46 of the Automated Vehicles Bill 2023. These paragraphs implement the proposals on this topic formulated by the Law Commission. The Law Commission's proposals for the NUIC operator state that a five-year operating license will be granted by the Department of Transport upon verification of the applicant's 'good standing', professional competence, and financial capacity. The applicant must also submit documentation outlining its plans for the management of physical and digital security of the vehicle and passengers, as well as the equipment, personnel, and connectivity.

[50] See paragraphs 47 and 48 of the Automated Vehicles Bill 2023.

[51] According to paragraphs 47 of the Automated Vehicles Bill 2023, an individual shall not be held liable for any offence if the vehicle is operated in autonomous mode.

delineation of the activities permitted and prohibited for supervisors. The Ministry of Transport must draft a uniform safety standard and prepare a national technical approval system for autonomous vehicles operating within the national territory. The penal sector must be redesigned, with the introduction of new criminal offenses and the establishment of a new independent police unit with investigative responsibilities in cases of accidents involving autonomous vehicles.[52]

Only a small proportion of the proposed changes had been implemented. New articles H1 to H3 on the subject of "self-driving vehicles" were introduced into the Highway Code.[53] In accordance with the UK reform, self-driving vehicles are defined as vehicles equipped with autonomous driving technology that operate without external control and are included on a specific list published by the Secretary of State for Transport. It is possible to restrict autonomous driving for supervisory and contingency reasons, as well as to restrict it to certain sections of road. Furthermore, the owner of an autonomous vehicle who adheres to the relevant legislation and the manufacturer's instructions for use will be exempt from criminal liability for any actions undertaken during autonomous driving. Nevertheless, the operator of the vehicle will remain directly liable for compensation in the event of bodily injury or material damage caused to passengers or goods transported, regardless of any specific finding of intent or fault.[54]

After a protracted period of stalemate, legislation pertaining to autonomous driving has at last been enacted in the United Kingdom. This development follows the introduction of the new Article 34-bis of the Vienna Convention (as referenced above). The accelerated pace of the legislation serves to illustrate the pivotal role of the automotive sector in the nation's business, industrial, and sustainable development policies.

[52] E.g. an appropriate penalization for misrepresentation in the vehicle type-approval, in the application for authorization to operate in autonomous mode, or in the application for authorization to operate as a responsible user or NUIC operator.

[53] Alongside the Highway Code amendments, there are additional amendments to the Road Traffic Act (sections 2, 3, 4, 5, 5A, 14 and 15), the Automated and Electric Vehicles Act 2018 (section 1) and the Road Vehicles (Construction and Use) Regulations 1986 (regulations 100, 104, 109 and 110) for aspects concerning autonomous driving.

[54] Hence the need for adequate insurance cover: James Davey, By Insurers, for Insurers: The UK's Liability Regime for Autonomous Vehicles, in Journal of Tort Law, 2020, 13 (2), p. 163; Anat Lior, Insuring AI: The Role of Insurance in Artificial Intelligence Regulation, in Harvard Journal of Law & Technology, 2022, 35 (2), p. 467.

9. The French experience

France has initiated a significant legislative reform to facilitate the introduction of autonomous driving within its borders between 2019 and 2022. This follows initial experiments with autonomous vehicles conducted under the auspices of the Ministry of Transport, which issued permits on a case-by-case basis.

First, Law No. 2019-1428 authorized legislative intervention in the field of autonomous driving. Then, Ordinance No. 2021-443 and Decree No. 2021-873 modified the areas of civil and criminal liability, insurance, experimental approval procedures, and approval procedures for new means of transport in order to allow highly automated vehicles to circulate within the limits of SAE level 4.

In particular, articles 319-1 to 319-4 of Chapter IX of the Highway Code, which are dedicated to autonomous driving and which came into force in July 2021, establish new legal obligations for the various players in the field of intelligent mobility:[55] on the one hand, vehicle manufacturers must define in advance the conditions for the safe use of the vehicle in autonomous mode. On the other hand, there is an obligation for the owner and the driver to undergo personal training, particularly with regard to the transition from autonomous to dynamic control.

This implies that the driver is no longer required to maintain visual contact with the vehicle when the automated driving system is engaged. In contrast, the driver must remain vigilant in order to respond promptly to any calls for assistance from the vehicle, to warnings from law enforcement, and to facilitate the passage of emergency vehicles, such as ambulances, firefighters, and police, as they provide services in their respective areas.

Furthermore, the legislation introduces a radical change to the criminal liability regime applicable in the event of an accident caused by a vehicle operating in autonomous mode in compliance with the conditions of use specified by the manufacturer. In essence, the new legislation exempts the driver from any criminal liability, subject to insurance obligations, in order to facilitate the prompt compensation of injured parties.[56]

[55] France is the first European country to have adapted its Highway Code to autonomous vehicles: in fact, the implementing decree 2021-873, in force since 1 July 2021, has introduced into the Highway Code Chapter IX entitled 'Dispositions applicables au véhicule à délégation de conduite' (Provisions applicable to the vehicle with delegated driving). For an introduction to the French launch of the rules on autonomous driving, see Michèle Guilbot, Le véhicule 'autonome' et les conditions juridiques du déploiement, 2018, Riséo, Haute Alsace, p. 49.

[56] Full damage compensation for victims of traffic accidents is governed by the so-called Loi Badinter (Act on the Improvement in the Situation of the Victims of Accidents in Road Traffic and on the Acceleration of the Compensation Proceedings, 07/05/1985): civil liability for road accidents involving a motor vehicle falls directly and jointly on the driver and the owner of the vehicle, unless the latters can provide concrete evidence that the victim was responsible for causing the event. Cf. Francesco Paolo Patti, The European Road

The 2021 reform has also affected the Highway Code, adding a new fifth title on automated road transport systems. This title defines the requirements, qualifications, licenses, and obligations of supervisors who remotely control fleets of highly automated vehicles dedicated to the public or private transport of passengers or goods. In fact, the remote driver must not only be medically fit to drive, but must also possess the requisite skills, which are acquired through specific training courses of at least four days and additional practical exercises conducted in remote intervention centers.[57]

The ongoing French reforms in the field of autonomous driving continued in 2022 with the two decrees of August 2 on the approval procedures and authorization of remote operators in the context of automated road transport systems, and the order and decree of August 5 on the content of the opinions of approved and authorized entities. These include the requirement for a prior binding opinion from a recognized qualified body to authorize autonomous operation for vehicles already authorized in their traditional version. In addition, the Technical Service for Cableways and Guided Transportation (STRMTG) will be required to provide an opinion to authorize autonomous vehicles.

This demonstrates that France was the inaugural European nation to establish the fundamental regulatory framework for the operation of autonomous vehicles, with close collaboration between central and local authorities, manufacturers, and French road haulers.

As of September 2022, applications for autonomous driving permits and new vehicle registrations are permitted upon demonstration of the system's capacity to react in a safe manner to foreseeable traffic situations on designated routes.

France has thus promptly implemented the reform provided for in Article 34-bis of the Vienna Convention of 14 July 2022. In fact, it has introduced not only the rules for the circulation of self-driving vehicles on national public roads, but also the rules for the approval and sale of véhicules autonomes, thus further stimulating the entire national economy, namely road transport. This was done in a timely manner, namely one year before the entry into force of the 2022 reform of the Vienna Convention.

to Autonomous Vehicles, in Fordham International Law Journal, 2019, 43(1), p. 132. A summary of the development of the case law in French road traffic law is provided by the Cour de Cassation, 6 February 2014, Case Cass. Civ. 2ème no 13-13265.

[57] The training requirement should also be included in contracts for the sale or lease of autonomous vehicles, with the resulting amendments to the Consumer Code, Chapter IV, Title II, Book II, Section 6, Subsection 6 on autonomous driving. Remote operator training comprises two modules, both mandatory: a general module on remote intervention activities adapted to the technical system concerned and a specific module adapted to the particularities of the system on the routes or zones where it is used.

10. Northern countries and smart mobility

The Scandinavian countries have been particularly active in the field of autonomous driving, which has the potential to enhance road safety on local roads where darkness, snow, and ice prevail for six months of the year.[58]

Indeed, adverse weather conditions and poor visibility, which limit autonomous driving in temperate climates, are the primary motivation for the robust Nordic research initiative to develop smart mobility solutions.

In fact, as early as 2015, the Swedish Parliament, Riksdag, commissioned a special investigator to identify and propose legislative reforms to enable the development and deployment of SAE level three to five autonomous vehicles.[59] Despite the seven-year period during which preparations for the new law have been underway, it is already possible to test autonomous vehicles on public roads under a special administrative exemption granted by the Swedish Transport Administration.[60]

In contrast, the reform has been much more expeditious in Norway, where the Act on the Testing of Self-Driving Vehicles on Public Roads was passed in 2017.[61] The procedure for applying for a testing license is nearly identical to that in Sweden, with the sole distinction being that the authorizing national authority is the Directorate of Public Roads (within the Norwegian Public Roads Administration), which issues the operating license after verifying that the legal prerequisites (road safety, ability to control the vehicle, potential return to manual driving, etc.) are met in practice.

It is noteworthy that the 2017 Norwegian legislation also permits the experimental operation of autonomous vehicles without a driver on board, provided that the requisite technology is available to handle all driving situations. In accordance with the 2017 legislation, Norway has permitted the operation of vehicles designed and

[58] Geographical diversification in autonomous vehicle research and development is explored in Nikolas Thomopoulos, Scott Cohen, Debbie Hopkins, Lauren Siegel, Simon Kimber, All work and no play? Autonomous vehicles and non-commuting journeys, in Transport Reviews, 2021, 41 (4), p. 459.

[59] The study, which was commissioned by the Swedish government, was presented and discussed in detail by Johan Axhamn, Look out: Self-Driving Vehicles around the Corner, in Scandinavian Studies in Law, 2018, 65, p. 372.

[60] The procedure for authorizing experimental trials was introduced in 2017 by a decree issued by the local Government.

[61] For Norway's Act No 112 of 15 December 2017 on the testing of self-driving vehicles (Lov om utprøving av selvkjørende kjøretøy - LOV-2017-12- 15-112), see Bård Torvetjønn Haugland, Tomas Moe Skjølsvold, Promise of the obsolete: expectations for and experiments with self-driving vehicles in Norway, in Sustainability: Science, Practice and Policy, 2020, 16, p. 37 ff.; Bård Torvetjønn Haugland, Changing oil: self-driving vehicles and the Norwegian state, in Humanities and Social Sciences Communications, 2020, 7, p. 5. One of Norway's key research areas for autonomous driving is cyber-safety, as illustrated by a study commissioned by the Norwegian Ministry of Transport: Sunniva F. Meyer, Rune Elvik, Espen Johnsson, Risk Analysis for Forecasting Cyberattacks against Connected and Autonomous Vehicles, in Journal of Transportation Security, 2021, 14 (3), p. 227 ff.

manufactured outside the country on its territory for several years. Only recently, following the 2022 Vienna Convention reform, has Norway observed a slight decrease in autonomous testing, which is inversely proportional to the simultaneous increase in testing on U.S., French, German, Italian, and UK roads.[62]

11. Test drives in Italy for future mobility

In 2024, the Italian Highway Code will continue to define a vehicle as a machine that travels on roads driven by a person. This is in accordance with Article 46, which states that any machine of any type that travels on roads driven by a person will be considered a vehicle.

Consequently, the implementation of the 2022 reform of the Vienna Convention on Autonomous Driving in Italy will necessitate a prior amendment to the Italian Highway Code.

In the interim period preceding the enactment of the requisite legislation, it is possible to apply for the testing of autonomous vehicles on public roads within the limits of SAE level three, in accordance with the Smart Roads Decree. Furthermore, from September 2020, it is even possible to apply for the testing of 'innovative vehicles' without a steering wheel and pedals.[63]

Although private use and registration of self-driving vehicles are still excluded in Italy, work is underway to advance the sector in a number of ways, including in terms of design and production, as well as from a legal and regulatory point of view. Moreover, although the National Recovery and Resilience Plan does not include specific measures for autonomous driving, it does address the issue of mobility in a comprehensive manner. It allocates significant resources to the Automotive Fund, which is dedicated to the development, research, and technological progress in the

[62] The development of autonomous driving has opened up extensive discussions on both the need for specific testing procedures and standards for self-driving vehicles (Catherina Maracke, Autonomous Driving - Reality Or Wishful Thinking?, cit.), and the requirements necessary to supervise an autonomous vehicle, as a simple driving license is not considered sufficient on a global level.

[63] The 2018 Smart Road Decree led to the creation of the National Technical Observatory. The Observatory is responsible for coordinating experiments and supporting research and studies, particularly in the field of road safety. The decree requires the presence of a properly trained supervisor on board the autonomous vehicle being tested, capable of switching from automatic to manual mode at any time. Insurance and technical aspects must be documented in the application for authorization submitted to the Ministry of Transport, and every 15 days the experimenter must submit a report on events or problems that may affect public safety, even potentially. If the trials are carried out by parties other than the vehicle manufacturer, such as research centers or university institutes, the manufacturer's approval is also required. Subject to compliance with these technical conditions, the Smart Road Decree authorizes experimentation and imposes only two conditions in terms of civil liability, namely that the driver remains responsible for the vehicle, even when driving in autonomous mode (Article 10), and that the autonomous vehicle is insured for a minimum of four times the amount required by law for non-autonomous vehicles.

transport sector, in line with the environmental sustainability objectives of the European Green Deal.[64]

Italy's regulatory lag should not be attributed to a lack of interest in a sector that is a driving force for the national economy. Rather, it should be attributed to the geopolitical and economic context, which made it a priority to take measures to mitigate the economic crisis caused first by the Covid-19 pandemic and then by the war in Ukraine. While parliamentary debates were primarily focused on economic and energy matters, the government intervened with alacrity, approving the establishment of Italy's inaugural regulatory sandbox in Turin as part of the Sperimentazione Italia initiative.[65]

The regulatory sandbox has been borrowed from the financial sector. Indeed, it was first used in the United Kingdom in 2015 and has subsequently been recommended by the United Nations as a useful and innovative regulatory reform tool that allows the testing of new financial products, new technologies, and business models in real time and in a protected environment, under constant supervision and with guarantees of protection for all parties. The system allows regulators to assess potential regulatory reforms ex ante, or before they are officially adopted. This enables subsequent regulatory intervention to be tailored to the genuine needs of the industry.

The Italian government has demonstrated an exemplary application of this regulatory reform tool to the mobility sector, anticipating the use of sandboxes with respect to the recommendations set forth at the European level by the Proposal for Regulation 2021 on artificial intelligence. It has established test environments for experimentation with autonomous driving on the road, in controlled contexts and under the supervision of the competent authorities, with the objective of assessing the conditions and modalities to be adopted in the subsequent regulatory reform. Consequently, further regulatory developments in this area are anticipated.

12. Europe's vision for autonomous driving

The 2022 amendment to the Vienna Convention, which introduced the new Article 34-bis on autonomous driving, has delineated a clear distinction between countries

[64] Italy has approved its national recovery and resiliency plan, which is designed to boost economic recovery after the Covid-19 pandemic and promote green and digital development.

[65] It is part of the Italian strategy to innovate and digitize, initiated by Article 36 of Law No 76 of 16 July 2020 on Simplification and Digital Innovation, converted by Law No 120 of 11 September 2020. Launched in Turin, the project involved collaboration between the Ministry of Digital Transformation, the Ministry of Economic Development and the Ministry of Sustainable Infrastructure and Mobility.

at the vanguard of regulatory development and those more comfortable with the status quo.

This distinction does not relate to the technical-engineering sector, which is rapidly evolving in all the national contexts examined in the previous sections. Rather, it concerns the different pace at which each legislature adapts its national rules.[66]

The disparate legal frameworks across countries may impede technological advancement and facilitate the offshoring of production.[67] In point of fact, the legislative diversity described above constitutes a significant obstacle to technological innovation and prevents autonomous vehicles from circulating freely within the Schengen area.

To prevent this from occurring, the European Union has committed to regulating all areas that interconnect with autonomous driving to the fullest extent possible.

These new regulations harmonize the EU legal framework with the most recent UN rules for Level 3 automation. They integrate EU legislation, international conventions, and the UN/ECE Regulation. Moreover, the legislation introduces novel EU technical provisions for fully autonomous vehicles, which represent the inaugural instance of such provisions at the international level. These technical standards ensure a comprehensive assessment of the safety and advancement of fully automated vehicles prior to their introduction into the EU market. The regulations encompass a range of elements, including testing protocols, cybersecurity obligations, data logging guidelines, safety performance surveillance, and incident reporting mandates for producers of fully autonomous automobiles.

It is evident from the aforementioned information that the European Union is attempting to establish a unified approach for all Member States, with the objective of facilitating national regulatory coordination. Nevertheless, the primary objective of the European agenda is to ensure the well-being of end users, including pedestrians and transportation users. It is of paramount importance to guarantee their physical and digital safety, above all other considerations.

The scientific literature has frequently debated the most appropriate approach to the adoption of novel technologies,[68] with the aim of reconciling the divergent individual and collective interests at stake, which are often viewed as being in

[66] Lawrence Lessig, The Law of the Horse: What Cyberlaw Might Teach, in Harvard Law Review, 1999, 113 (2), p. 501.

[67] Considering that manufacturers prefer to test and sell their vehicles in places where there is well-established and definite legislation, there has been a European-wide effort to implement uniform autonomous driving regulations.

[68] The reference is to the famous trolley dilemma. Hallvard Lillehammer, The Trolley Problem, 2023, Cambridge University Press, Cambridge.

tension. However, the European Union is now challenging this perspective, adopting a new point of view: the latest technologies, particularly in the automotive industry, are not deemed by the European Union solely as instruments to benefit an individual user at the expense of the wider community. Instead, they are viewed as a shared opportunity. Even when utilized by a single user, these technologies offer advantages to all.

The objective of assisted driving systems has evolved beyond the original intention of enhancing the comfort of the operator while driving. These systems now extend their benefits beyond the passenger area of the vehicle, positively impacting all road users. These systems are designed to address human error and reduce the incidence of road accidents, which unfortunately result in a significant number of fatalities on European roads each year.

Consequently, any technical or technological tool capable of preventing road accidents should be welcomed at all levels, in accordance with the European approach previously outlined.