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Mitchell Hamline Law Review

Volume 46 | Issue 5 Article 3

2020

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Recommended Citation

Kouroutakis, Antonios E. (2020) "Autonomous Vehicles: Regulatory Challenges and the Response from Germany and UK," *Mitchell Hamline Law Review*: Vol. 46 : Iss. 5 , Article 3.
Available at: https://open.mitchellhamline.edu/mhlr/vol46/iss5/3

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AUTONOMOUS VEHICLES: REGULATORY CHALLENGES AND THE RESPONSE FROM GERMANY AND UK

Antonios E. Kouroutakis*

Abstract

The looming dominance of autonomous vehicles has an impact on well-established areas of human activity such as the architecture of the cities and the transportation system. At the legal front, laws at the national and international level have become obsolete as technological changes have created new realities. At the same time, such technology development is challenging long established principles of privacy, tort law, civil liability, criminal law, and insurance law.

Nowadays a number of countries, like Germany and the UK, have adopted legislation to allow the operation of autonomous vehicles, while others have been more reluctant. Lawmakers, in their effort to meet the fast technological pace, face a number of challenges. The question is how they decide to solve them.

This article examines how lawmakers respond to the presence of autonomous vehicles. In particular, it focuses on the recent legal framework adopted by Germany and the UK. By employing comparative methodology, this article evaluates the legislative initiatives from both Germany and the UK and underpins best practices that would be useful for lawmakers who intend to adopt laws regulating autonomous vehicles. Interestingly, the approaches on some core issues, such as the definition, standards, and characteristics of autonomous vehicles and the requirement for human oversight differ, but both legislative bodies decided to enact laws subject to a two-year review, which signals the experimental character of the laws.

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I. INTRODUCTION

The revolution in technology has fundamentally changed the way the world works. The modern era is characterized by profound complexity. Geographical distances are eliminated, and challenges are multiplied as new problems arise and spread at a rapid and inexorable pace, transcending borders. While they are compounded by other problems, their complexity creates unforeseen circumstances and unintended consequences. In perceiving changes as old traditional conventions which are no longer valid, institutions had to change their corresponding speeds. Such complexity affects numerous areas of human activity from the architecture of the cities to well established legal principles.

To be more specific, foreseeable challenges to the existing legal framework were posed by the WEB 2.0 era and artificial intelligence (AI). WEB 2.0 allows applications such as Uber, a mobile-app-based transportation network, and AirBnB, a platform for peer-to-peer short-term rentals, to flourish. These applications not only flourish but supersede, respectively, the Licensed Taxi Drivers legal framework in many cities, such as London,[1] as well as rent, tax, and competition laws.[2] Also, the startups' philosophy to "move fast and break things" shakes the legal framework of numerous industries.[3] Even the most tightly regulated areas, such as financial services, are impacted.[4]

Further, technological innovations such as the creation of autonomous vehicles and the proliferation of drones[5] are a step ahead

[1] *See* Leo Benedictus, *Why Taxi Drivers Are Going to War with Uber*, THE GUARDIAN (May 11, 2019), https://www.theguardian.com/world/shortcuts/2014/may/11/taxi-drivers-uber-london-black-cab-gridlock [https://perma.cc/B6Y9-W4FM].

[2] Will Coldwell, *Airbnb's Legal Troubles: What Are the Issues?*, THE GUARDIAN (July 8, 2014), https://www.theguardian.com/travel/2014/jul/08/airbnb-legal-troubles-what-are-the-issues [https://perma.cc/9MY8-J4WA]. For the complex dilemma posed to regulators from sharing economy applications, see Sofia Ranchordás, *Does Sharing Mean Caring? The Regulation of Innovation in the Sharing Economy*, 16 MINN. J.L., SCI. & TECH. 413 (2015).

[3] *Slings and Arrows*, ECONOMIST (May 9, 2015https://www.economist.com/special-report/2015/05/07/slings-and-arrows [https://perma.cc/A8M6-7RME].

[4] *Id.*

[5] Jack Nicas, *Drones Boom Raises New Question: Who Owns Your Airspace?*, WALL ST. J. (May 13, 2015), https://www.wsj.com/articles/drones-boom-raises-new-question-who-owns-your-airspace-1431535417 [https://perma.cc/4262-3ABT]. For the challenges posed by the use of drones in the US legal framework, see Michael L. Smith,

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of the existing legislative framework, occasionally challenging it, creating a question about how the existing national and international government agencies will address these issues.

The aim of this article is first to discuss the challenges posed by the rise of autonomous vehicles to regulators around the world. Indeed, autonomous vehicles, also known as driverless cars or self-driving cars, are no longer just features in science fiction movies. In particular, this article will highlight the challenges that lawmakers and policy-makers face in conjunction with the areas of law that are most affected by the presence of autonomous vehicles. Namely, autonomous vehicles are a technology still developing, and at a very fast pace. This renders laws at national and international levels obsolete.

What is more problematic is the disruption that such cutting-edge technology causes in existing legal frameworks. Autonomous vehicles are based on a technology that collects and stores data constantly, raising concerns from a privacy perspective. At the same time, such technology is very expensive compared to ordinary cars, and not completely safe, but safer than human driving.[6] This raises concerns regarding responsibility in case of an accident and how policy makers will allocate said responsibility.

Second, the article will examine how lawmakers respond to the presence of autonomous vehicles. Nowadays globally, a plethora of countries have adopted laws to open autonomous vehicle access to public roads. For instance, autonomous minibuses already operate in Norway, France, and Sweden.[7] In the United States, efforts to pass federal legislation have been unsuccessful, but state legislatures remain able to regulate autonomous vehicles.[8] In 2015, Nevada pioneered and allowed the operation of autonomous vehicles.[9] By 2015, four states (California, Florida, Virginia, and Nevada) and the District of Columbia allowed for the experimental use of automated cars.[10] Since then, twenty-

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Regulating Law Enforcement's Use of Drones: The Need for State Legislation, 52 HARV. J. LEGIS. 423 (2015).

[6] *See* Brian Markwalter, *The Path to Driverless Cars*, 6 IEEE CONSUMER ELECTRONICS MAG. 2 (Apr. 2017).

[7] KPMG International, *2019 Autonomous Vehicles Readiness Index* 6 (2019), https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/02/2019-autonomous-vehicles-readiness-index.pdf [https://perma.cc/VP7A-JNPF].

[8] *See, e.g.*, American Vision for Safer Transportation through Advancement of Revolutionary Technologies Act, AV START Act, S. 1885, 115th Cong. (2017).

[9] Nat'l Conference of State Legislatures, *Autonomous Vehicles: Self-Driving Vehicles Enacted Legislation* (Feb. 18, 2020), http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx [https://perma.cc/C875-XMS9].

[10] Norton Rose Fulbright, *Autonomous Vehicles: The Legal Landscape in the US and Germany* 6 (July 2016), https://www.nortonrosefulbright.com/-

one other states have passed legislation related to autonomous vehicles,[11] and in ten states, the Governors have issued executive orders related to autonomous vehicles.[12]

This article will focus on the recent legal framework adopted by Germany and the UK. By employing comparative methodology, this article will evaluate the legislative initiatives from both Germany and the UK and will underpin best practices that would be useful for lawmakers intending to adopt laws regulating autonomous vehicles.

As Germany is a civil law country and the UK is a common law country, the first difference arises from a legislative drafting point of view. As Stefanou points out, "[C]ommon law lawyers tend to produce very long and detailed contracts, in an attempt to include all possible eventualities; in contrast, civil law lawyers tend to be more concise because they rely on legislation that is usually contained in codes."[13] Interestingly, the approaches on some core issues, for instance, the definition, standards, and characteristics of autonomous vehicles and the requirement for human oversight, differ but both legislative bodies decided to enact laws subject to a two-year review, which signals the experimental character of the laws.

Finally, this article concludes with an assessment of the regulation of new technologies in general by arguing that legislative initiatives are necessary, but the role of the courts and of self-regulation shall not be underestimated, as the latter two infuse the legal framework with the necessary flexibility.

II. REGULATORY CHALLENGES: FAST-PACED TECHNOLOGY, OBSOLETE LAWS, AND THE QUEST FOR THE OPTIMUM REGULATORY RESPONSE

A. Autonomous Vehicles: Robots on Four Wheels

The revolution in technology has fundamentally changed the way the world works, and autonomous vehicles will impact existing legal

/media/files/nrf/nrfweb/imported/20160726---autonomous-vehicles-the-legal-landscape-in-the-us-and-germany.pdf?la=en-us&revision=fd49cbf4-d541-4aee-a4f0-65d72527fe0b [https://perma.cc/9GM3-7FM2].

[11] Namely Alabama, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Illinois, Indiana, Louisiana, Michigan, New York, North Carolina, North Dakota, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, Vermont, and Washington D.C. *See* Nat'l Conference of State Legislatures, *supra* note 9.

[12] Namely Arizona, Delaware, Hawaii, Idaho, Maine, Massachusetts, Minnesota, Ohio, Washington, and Wisconsin. *See* Nat'l Conference of State Legislatures, *supra* note 9.

[13] Constantin Stefanou, *Comparative Legislative Drafting: Comparing Across Legal Systems*, 18 EUR. J.L. REFORM 123, 134 (2016); *see also* HELEN XANTHAKI, DRAFTING LEGISLATION: ART AND TECHNOLOGY OF RULES FOR REGULATION 201 (2014).

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frameworks and conventions in multiple ways. While a plethora of problems can be solved with this new technology, such as reducing the number of car accidents,[14] challenges are multiplied as new problems arise and spread at a rapid and inexorable pace, transcending the borders. In perceiving changes as old traditional conventions are no longer valid, institutions had to change their corresponding speeds. Furthermore, while technological progress may be exponential, the legislative progress remains incremental.

Since 2018, a major acceleration in investment in autonomous vehicle technology has been recorded.[15] In 2017 Audi launched the first Level 3 autonomous car with conditional automation.[16] It is suggested that by 2050, the autonomous vehicle industry could be worth seven trillion United States dollars.[17] In addition, forecasts suggest there could be as many as twenty-one million autonomous vehicles in the United States and twenty-seven million in Europe over the coming decade.[18]

Having stressed the progress and the development of the automation vehicles industry, major challenges arise regarding the safety of autonomous vehicles. Currently, autonomous vehicles are not completely safe, which poses risks regarding their regulation, like obtaining permission from state authorities for autonomous vehicle use and the possible state liability for such authorization. Second, challenges arise when determining the liability in the case of an accident involving a driverless car, affecting areas and well-established principles of tort law, civil liability, criminal law, and insurance law.

To understand the technology behind autonomous vehicles and its fast development pace, it helps to realize that autonomous vehicles are in fact robots on four wheels. In general, the presence of

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[14] *See* Adam Thierer & Ryan Hagemann, *Removing Roadblocks to Intelligent Vehicles and Autonomous Vehicles*, 5 WAKE FOREST J.L. & POL'Y 339 (2015); *see also* Todd Litman, *Autonomous Vehicle Implementation Predictions Implications for Transport Planning* (Feb. 6, 2020), https://www.vtpi.org/avip.pdf [https://perma.cc/D92X-QLA7].

[15] *See Kia Kokalitcheva*, *Billions of Dollars Pour into Autonomous Vehicle Technology*, AXIOS (Oct. 27, 2018), https://www.axios.com/autonomous-vehicles-technology-investment-7a6b40d3-c4d2-47dc-98e2-89f3120c6d40.html [https://perma.cc/4VWG-2MRZ].

[16] *See* Rob Stumpf, *Audi Readies First Level-3 Autonomous Car for Production* (Apr. 25, 2017), https://www.thedrive.com/sheetmetal/9647/audi-readies-first-level-3-autonomous-car-for-production [https://perma.cc/94ZR-FA5C].

[17] David Z. Morris, *Autonomous Vehicles Will Be Part of a $7 Trillion Market by 2050*, FORTUNE (June 3, 2017), https://fortune.com/2017/06/03/autonomous-vehicles-market/ [https://perma.cc/8REW-K7A4].

[18] Daniel Araya, *Top 10 Industries Transformed By Self-Driving Cars*, FORBES (Jan. 10, 2019), https://www.forbes.com/sites/danielaraya/2019/01/10/top-10-industries-transformed-by-self-driving-cars/ [https://perma.cc/V7VJ-AVXG].

robots as active members of various industries is increasing.[19] Tesla's cars are assembled in a fully robotics-led automation factory, medical operations are conducted by medical robots, and even warfare and army missions are accomplished by robots, such as drones. Since Deep Blue, the famous machine playing chess with Garry Kasparov, machines have already exceeded human performance on a number of tasks and will reach and exceed human performance on many more tasks.[20]

Robots can be classified by a number of their attributes, including their applications,[21] their kinematics or locomotion,[22] and their autonomy or level of intelligence.[23] According to the classification based on their autonomy, the first level is the reactive machine, like Deep Blue, which is not able to form memories nor use past experiences to inform current decisions.[24] The second level is the "limited memory machine" based on a transient database.[25] The third level is the machine with a "theory of mind" capable of deep learning.[26] Finally, the fourth level is the machine with "self-awareness" with the ability to form representations about themselves.[27]

Based on the aforementioned classifications, autonomous vehicles are smart robots on four wheels. In particular, they are robots that can look into the past through transient memory and databases. They do not learn from their experiences, as they are lacking deep learning (classification based on autonomy), and they move on four wheels (locomotion). Their main function could be to transfer passengers, for instance as "taxibots."

Moreover, autonomous vehicles are also classified based on their level of automation. According to the Society of Automotive Engineers

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[19] *See* Yoram Koren, *Robotics for Engineers* (McGraw-Hill Book Company, 1985) (explaining that robot as a word derives its origin from the Czech word for "forced labor").

[20] *See* Francisco Suárez-Ruiz, Xian Zhou and Quang-Cuong Pham, *Can Robots Assemble an IKEA Chair?* 3 SCI. ROBOTICS 2 (2018) (exploring the area where humans perform better than robots in assembling furniture from IKEA).

[21] *See* MORDECHAI BEN-ARI AND FRANCESCO MONDADA, ELEMENTS OF ROBOTICS 1–20 (2017) (detailing robots and their applications).

[22] *See* Sven Böttcher, *Principles of Robot Locomotion*, http://www2.cs.siu.edu/~hexmoor/classes/CS404-S09/RobotLocomotion.pdf [https://perma.cc/M89L-D79U].

[23] *See* Arend Hintze, *Understanding the Four Types of AI, from Reactive Robots to Self-Aware Beings*, AP NEWS (Nov. 14, 2016), https://www.apnews.com/22966802d6e446ca938a487580f4837d [https://perma.cc/4F5Z-GVDG].

[24] *Id.*

[25] *Id.*

[26] *Id.*

[27] *Id.*

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(SAE) standards, cars are divided into 6 groups.[28] Level 0 and Level 1 are cars with no automation. Levels 2 through 4 are cars with partial, conditional, and high automation respectively, while Level 5 consists of cars with full automation where the presence of a driver is not necessary.[29]

As a report clarifies, each level of automation implies humans' necessary role in operating the car.[30] "[T]he different levels of automation (SAE L0-5), the user's driving tasks and responsibilities change with increasing automation, while each level places different demands on the user."[31] Hence, the SAE classification is important from a legal perspective, as the different technical configurations require an analogous legal framework. To exemplify this, Levels 2 through 4 of automation on the SAE scale require human supervision and takeover[32] when necessary, while Level 5 does not. This implies that the potential liability of the driver increases when the car is less autonomous, and *mutatis mutandis* the liability of the owner of the car, the insurer, or the manufacturer increases when the car is more autonomous. To put it differently, in a semi-autonomous car of Level 3 or 4, it may not be always clear whether it was a system failure or a driver's mistake that was responsible for an accident.

B. Obsolete laws and major gaps in existing legislation, national and international

At an international level, the Vienna Convention on Road Traffic ("Vienna Convention"), an international treaty concluded in 1968 with seventy-four current State Parties, regulates the driving of cars and ensures consistency and compatibility in traffic laws.[33] However, major countries leading the research and development of autonomous vehicles, such as the UK, the United States and China, are not parties to the agreement.[34] This means that autonomous vehicles may operate

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[28] *See* Vineet Chatterjee, *Society of Automotive Engineers (SAE) Automation Levels for Cars* (July 17, 2018), https://www.automotivelectronics.com/sae-levels-cars/ [https://perma.cc/U6JJ-YTAM].

[29] *Id.*

[30] Matthew Wood et al., *Safety First for Automated Driving* 59 (2019), https://www.aptiv.com/docs/default-source/white-papers/safety-first-for-automated-driving-aptiv-white-paper.pdf [https://perma.cc/LM7H-S2GV].

[31] *Id.*

[32] *Id.* at 75 (explaining how human interaction with autonomous cars, especially of level 3 and 4, the so-called takeover, is a subject of concern from major companies in the autonomous vehicle industry).

[33] *See* Vienna Convention on Road Traffic art. 47, Nov. 8, 1968, 1047 U.N.T.S. 17, https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XI-B-19&chapter=11&Temp=mtdsg3&clang=_en [https://perma.cc/5d6Z-YME8].

[34] *See id.*

Published by Mitchell Hamline Open Access, 2020

in these countries without any concern about their international obligations under the Vienna Convention.[35]

In the Vienna Convention, a number of provisions require adaptation to the autonomous vehicle reality, as the convention's drafters did not foresee self-driving cars. For instance, a provision of article 8 provides that "[e]very moving vehicle or combination of vehicles shall have a driver,"[36] thereby appearing to prohibit autonomous vehicles. Likewise, article 4 does not foresee autonomous vehicles as it states that "[d]anger warning signs shall be installed at a sufficient distance from obstructions to give drivers adequate warning."[37] Also, article 7 states that "[d]rivers shall take care that their vehicles do not inconvenience road-users or the occupants of properties bordering on the road, for example, by causing noise or raising dust or smoke where they can avoid doing so."[38]

Given that the Vienna Convention includes outdated provisions, in 2014, the governments of Belgium, France, Germany, and Italy proposed amending article 8 of the Convention to allow for automated driving technologies.[39] The amendment to the Convention entered into force on March 23, 2016.[40] Accordingly, all signatories to the Vienna Convention need to update their national laws to comply with these amendments. For instance, on December 12, 2016, Germany amended its laws in accordance with the obligations of the Vienna Convention on Road Traffic.[41]

Furthermore, the presence of autonomous vehicles has a side effect on the organization of state agencies. In particular, preconditions for autonomous vehicles, such as quality mobile internet and 4G (or even 5G) coverage, quality of roads, and energy supply require a regulatory framework and supervision to guarantee minimum standards.[42] Hence, the role of the varying agencies is crucial for the

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[35] *Id.*

[36] *Id.* at art. 8, ¶ 1.

[37] *Id.* at art. 4(c).

[38] *Id.* at art. 7, ¶ 4.

[39] Comm. of the Inland Transport, Rep. of the Working Party on Road Traffic Safety on Its Sixty-Eighth Session, U.N. DOC. ECE/TRANS/WP.1/144 (2014), https://www.unece.org/fileadmin/DAM/trans/doc/2014/wp1/ECE-TRANS-WP1-145e.pdf [https://perma.cc/8XXZ-TMLQ].

[40] Press Release, UNECE Paves the Way for Automated Driving by Updating UN International Convention, U.N.E.C.E Press Release (Mar. 23, 2016), http://www.unece.org/?id=42459 [https://perma.cc/H64A-TKC5].

[41] Der Bundespräsident Joachim Gauck, Die Bundeskanzlerin Dr. Angela Merkel, Der Bundesminister für, Verkehr und digitale Infrastruktur A. Dobrindt, Der Bundesminister des Auswärtigen Steinmeier, *Gesetz zur Änderung der Artikel 8 und 39 des Übereinkommen über den Straßenverkehr*, Vom. 8 (Nov. 8, 1968).

[42] *See* Paul J. Pearah, *Opening the Door to Self-Driving Cars: How Will This Change the Rules of the Road?*, 18 J. HIGH TECH L. 38 (2017).

function of autonomous vehicles.[43] But, currently, all of the aforementioned conditions fall under the purview of different departments and levels of government, such as transport and communication, or the central and local government.

Thus, new agencies with overlapping competencies are necessary to monitor and implement policies for the operation of autonomous vehicles. In addition, such agencies must be formed before the operation of the autonomous vehicles as they might have to prepare for the transition with appropriate and upgraded signs on the roads. They might also have to adopt further regulation in order to define the areas where it is not appropriate to activate the driverless mode, or when the deactivation is mandatory, for instance, in case of a flood or other extreme weather conditions. Accordingly, in 2015, the UK set up a government agency, the Centre for Connected and Autonomous Vehicles (CAV), which is part of the Department for Transport and the Department for Business, Energy & Industrial Strategy, with the aim to make the country a premier development location for connected and automated vehicles.[44] It is also worth mentioning that in 2018, Australia launched an office of Future Transport Technologies to prepare for autonomous cars.[45]

New regulations will also be required to respond to disruptions in prominent industries. For example, the taxi industry will be significantly disrupted by the presences of autonomous vehicles.[46] Such disruptions will require new regulation and intervention from lawmakers, as no country has regulation for driverless ride hailing services.[47] Already, in 2018, Waymo commercialized a completely autonomous taxi service

[43] *See* Jeremy A. Carp, *Autonomous Vehicles: Problems and Principles for Future Regulation*, 4 U. PA. J.L. & PUB. AFF. 81 (2018).

[44] *See* Dep't of Transp. et al., *New Cyber Security Standard for Self-Driving Vehicles* (Dec. 19, 2018), https://www.gov.uk/government/news/new-cyber-security-standard-for-self-driving-vehicles [https://perma.cc/RRG2-JZN3]; *see also* Dep't of Transp. et al., *The Key Principles of Cybersecurity for Connected and Automated Vehicles* (Aug. 6, 2017), https://www.gov.uk/government/publications/principles-of-cyber-security-for-connected-and-automated-vehicles/the-key-principles-of-vehicle-cyber-security-for-connected-and-automated-vehicles [https://perma.cc/RZS3-C5J9].

[45] KPMG International, *supra* note 7.

[46] Antonios Kouroutakis, *Disruptive Innovation and Sunset Clauses: The Case of Uber and Other on Demand Transportation Networks*, SSRN (July 1, 2019), https://ssrn.com/abstract=3417083 [https://perma.cc/U432-YZSH].

[47] *Id.* at 2.

with Lyft to operate in three areas in Phoenix, Arizona,[48] and Yandex launched the first driverless ride hailing service in Europe.[49]

In substance, several areas that will require significant updates are insurance law as well as civil and criminal liability. Insurance law is an area affected by the launch of autonomous vehicles. Currently, insurance law is based on the idea that humans, as drivers, have a personal responsibility to compensate third parties for the personal injuries and property damage they cause while driving.[50] As a result, compulsory vehicle insurance requires amendments in order to cover the responsibility for accidents caused by autonomous vehicles.[51]

Furthermore, the issue of who is liable in case of an accident is also an area that will be affected by autonomous vehicles.[52] In principle, the manufacturer and the owner of the driverless car are the natural and legal persons closest to and most directly associated with the autonomous vehicle. In cases of torts, where such liability can be placed on the insurer, it is questionable who would be liable for the criminal aspects of accidents of autonomous vehicles, including substantial injuries or deaths. Assignment of criminal liability when a driverless car fatally strikes a pedestrian raises seminal concerns, especially from the perspective of juristic persons, such as corporations.[53] In the US, the Uber accident in Tempe, Arizona in March 2018[54] (where one of Uber's

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[48] Graham Rapier, *Lyft Is Partnering with Waymo to Launch Robo-Taxis in Arizona*, BUSINESS INSIDER (May 7, 2019), https://www.businessinsider.com/lyft-waymo-self-driving-robo-taxi-partnering-phoenix-arizona-2019-5 [https://perma.cc/33NN-GQFW].

[49] Paul Sawers, *Yandex Leads Europe's Autonomous Taxi Push with Public Test Launch in Russia*, VENTUREBEAT (Aug. 28, 2018), https://venturebeat.com/2018/08/28/yandex-leads-europes-autonomous-taxi-push-with-public-test-launch-in-russia/ [https://perma.cc/7BZ7-YZQZ].

[50] Val Jackson, *Personal Motor Insurance*, CHARTERED INSURANCE INSTITUTE (Oct. 13, 2018) https://www.cii.co.uk/learning/knowledge-services/reference-resources/classes-of-insurance/personal-motor/ [https://perma.cc/27LY-E4Y3].

[51] *See* Insurance Information Institute, Inc. et al., *Background On: Self-Driving Cars and Insurance*, (July 30, 2018), https://www.iii.org/article/background-on-self-driving-cars-and-insurance [https://perma.cc/5KYM-9UU7].

[52] *See* Roeland de Bruin, *Autonomous Intelligent Cars on the European Intersection of Liability and Privacy: Regulatory Challenges and the Road Ahead*, 7 EUR. J. RISK REG. 485–501 (2016) (detailing discussion about liability and privacy in conjunction with autonomous cars) https://www.cambridge.org/core/journals/european-journal-of-risk-regulation/article/autonomous-intelligent-cars-on-the-european-intersection-of-liability-and-privacy-regulatory-challenges-and-the-road-ahead/1201AA8848CF235B2304E158FE1DE38F [https://perma.cc/4DLK-P8S3].

[53] *See* Albert W. Alschuler, *Two Ways to Think About the Punishment of Corporations*, 46 AM. CRIM. L. REV. 1359 (2009); Sara Sum Beale, *A Response to the Critics of Corporate Criminal Liability*, 46 AM. CRIM. L. REV. 1481 (2009).

[54] Sean Hollister, *Uber Won't Be Charged with Fatal Self-Driving Crash, Says Prosecutor*, THE VERGE (Mar. 5, 2019, 7:55 AM),

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self-driving vehicles struck a pedestrian who ultimately died as a result of the accident) was the first case before the criminal justice system that tested the law. The prosecution concluded that Uber would not be charged for the fatal self-driving crash; however, it is still unclear whether the backup driver will be held responsible.[55]

Relevant to the liability issues is the Trolley dilemma or problem.[56] The ethical question of whether the driverless car should make the choice to crash into an old person instead of a young person raises fundamental concerns of embedded discrimination in the code of the autonomous vehicles.[57] However, it is also argued that this problem is in the theory sphere without any practical applications.[58] In general, driverless cars are expected to be programmed to follow the traffic code of each country, such as the UK Road Traffic Act 1988.[59] But it is possible that the updated Vienna Convention setting common and uniform standards would be necessary to be ratified by more countries, thus allowing for greater global reach.

Last, but not the least, there is an issue of privacy. As mentioned above, autonomous vehicles are, in reality, a smart robot on four wheels. Such robots constantly collect and process data, which is necessary for driving purposes. Obviously, third parties, other drivers, or pedestrians would not consent to the collection of their data.[60] Such data might be communicated first with other autonomous vehicles, known as vehicle-to-vehicle communications or V2V. Second, the data might be communicated with state infrastructure such as smart traffic lights,

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https://www.theverge.com/2019/3/5/18252423/uber-wont-be-charged-with-fatal-self-driving-crash-says-prosecutor [https://perma.cc/UN8T-QMCX].

[55] *See id.*

[56] *See* Judith Jarvis Thomson, *The Trolley Problem*, 94 YALE L.J. 1395 (1985); Kyle Wiggers, *MIT Study Explores the 'Trolley Problem' and Self-Driving Cars*, VENTUREBEAT (Oct. 24, 2018, 4:40 PM), https://venturebeat.com/2018/10/24/mit-study-explores-the-trolley-problem-and-self-driving-cars/ [https://perma.cc/4FJ4-EXEL]. The Trolley Dilemma, sometimes referred to as the Trolley Problem, comes in many variations, but usually asks a person to decide what to do in the hypothetical dilemma: if an out of control trolley is on a path to kill a number of people, is it morally better for you (as an intervenor) to push one innocent bystander in front of the Trolley to save the crowd?

[57] *Id.*

[58] For criticism on the trolley dilemma application on autonomous vehicles, see Marcus Baram, *Why the Trolley Dilemma Is a Terrible Model for Trying to Make Self-Driving Cars Safer*, FAST COMPANY (Feb. 19, 2019), https://www.fastcompany.com/90308968/why-the-trolley-dilemma-is-a-terrible-model-for-trying-to-make-self-driving-cars-safer [https://perma.cc/MK9V-GXZP].

[59] *Who's in the Driving Seat? Driverless Cars, Liability and Insurance*, TAYLORWESSING (Nov. 2017), https://www.tayorwessing.com/download/article-whos-in-the-driving-seat.html [https://perma.cc/QL99-LLYJ].

[60] Maria Cristina Gaeta, *Data Protection and Self-Driving Cars: The Consent to the Processing of Personal Data in Compliance with GDPR*, 24 COMM. LAW 15 (2009).

Published by Mitchell Hamline Open Access, 2020

known as vehicle-to-infrastructure communications or V2I. Third, it might be communicated with other devices, such as smartphones, tablets, smart watches, or personal computers (known as vehicle-to-device communications or V2D).[61]

The questions of what the use of such data would be, how long it may be kept, and who will have access to it is unknown. This poses some risks and, on its face, is incompatible with the recently adopted General Data Protection Regulation in Europe.[62] However, a more concrete legal framework in relation to robots, AI, and data protection is necessary.[63]

III. WHAT ARE DIFFERENT JURISDICTIONS DOING?

A. The Legislative Framework: Germany's and the UK's New Laws

Having presented the challenges for the rise of autonomous vehicles and the existing areas of laws affected by them, this part of the article will focus on a number of regulatory measures taken by Germany in 2017 and the UK in 2018 to address the issue. As shown below, German and UK legislators have followed a completely different approach in terms of substance. On the one hand, the German law requires the presence of a driver, who is ultimately responsible in case of an accident; on the other hand, British law allocates a *de facto* responsibility on the owner or the insurer. Another key difference appears in the definition of autonomous vehicles, with Germany adopting a more strict and precise definition by setting a list of six features as the standard, while the UK adopted a more open-ended definition.

1. Germany: Road Transportation Act

In 2017, Germany amended the Road Transportation Act (Straßenverkehrsgesetz StVG) to add provisions to allow vehicles with automated systems to operate in traffic on public roads.[64] According to the law, autonomous vehicles are vehicles: (1) with full control of the driving task, (2) capable of conforming to traffic regulations in full

[61] *See* Declaration of Amsterdam of 14 and 15 April 2016 on Cooperation in the field of connected and automated driving, 2016 Paragraph 2d. (discussing details about the communication systems of autonomous vehicles).

[62] Regulation 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, repealing Council Directive 95/46/EC 2016 O.J. (L 119).

[63] Gaeta, *supra* note 60, at 19.

[64] *See* Straßenverkehrsgesetz [StVG] [Road Transportation Act], Mar. 5, 2003, BUNDESGESETZBLATT [BGBL I] at 310, as amended June 16, 2017, BGBL I at 1648 (Ger.).

automation, (3) that allow the driver to manually override or deactivate the automation at any time, (4) with the capacity to recognize that it is necessary for the driver to take control and deactivate the automation, (5) with the visual and acoustic and tactual indication that the driver shall take control with sufficient time for the driver to take control, and (6) with the capacity to indicate wrong use to one of the system descriptions.[65]

However, a driver must be sitting behind the wheel ready to take control if doing so becomes necessary or if the driver is prompted to do so by the driverless car.[66] The new provisions clarify the issue of liability, as the driver will be primarily liable for accidents that take place under their control.[67] Obviously, the driver of the autonomous vehicle is expected to be insured like any driver.[68] However, there is no specific provision in the event the automated system breaks down and causes an accident. In this case, it is assumed that general law on product liability will be applied and then the manufacturer will be responsible.[69] The law includes a two-year review clause as the Federal Ministry of Transport and Digital Infrastructure will evaluate the application of the regulations after the end of 2019 in light of any technological developments.[70]

An innovation in the law is required for the manufacturers to include a "black box" inside the driverless car that would be able to collect data and thus clarify the conditions of accidents.[71] Data protection concerns were raised for the first version of the provision on the black box.[72] Hence, the final provision included some safeguards such as the time limitation (six months) of storage of the data, unless the car is involved in an accident.[73]

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[65] *Id.* § 1a(1).
[66] *Id.* § 1b(2).
[67] *Id.* § 18.
[68] For more details on the liability and insurance law of Germany, see Fabian Pütz et al., *Reasonable, Adequate and Efficient Allocation of Liability Costs for Automated Vehicles: A Case Study of the German Liability and Insurance Framework*, 9 EUR. J. RISK REG. 548 (2018).
[69] *Id.*
[70] Straßenverkehrsgesetz [StVG] [Road Transportation Act], Mar. 5, 2003, BGBL I at 310, as amended June 16, 2017, BGBL I at 1648 § 1c (Ger.).
[71] *Id.* 1648 § 63a.
[72] *German Bundestag Adopts Law on Automatic Driving*, NOERR (May 4, 2017), https://www.noerr.com/en/newsroom/news/german-bundestag-adopts-law-on-automatic-driving [https://perma.cc/DW44-AKY7].
[73] Straßenverkehrsgesetz [StVG] [Road Transportation Act], Mar. 5, 2003, BGBL I at 310, as amended June 16, 2017, BGBL I at 1648 § 63a (Ger.).

2. United Kingdom: The Automated and Electric Vehicles Act 2018

In 2018, the UK Parliament enacted the Automated and Electric Vehicles Act 2018 allowing autonomous vehicles to operate in Great Britain,[74] and it adopted a specific framework to regulate the insurance and the liability of autonomous vehicles.[75] But the Automated and Electric Vehicles Act 2018, which received Royal Assent on July 19, 2018, is not in force as it is subject to a Commencement Order.[76] This means that a statutory instrument, or secondary legislation, issued by regulation at the orders of the Secretary of State for Transport is necessary to signal its activation.

According to this Act, insurers will be liable for damages caused by autonomous cars in self-driving mode.[77] In particular, the existing compulsory third-party insurance framework was extended to cover the use of autonomous vehicles. However, in the case where the driverless car is not insured at the time of the accident, the owner of the vehicle is liable for resulting damage.[78]

The Automated and Electric Vehicles Act 2018 "introduces the notion that an insurer or owner can be liable for the consequences of an accident caused by the actions of an AV at a time when it is not under the immediate physical control of a human being."[79]

Furthermore, the Automated and Electric Vehicles Act 2018 includes provisions about the contributory negligence of the person in charge of the vehicle.[80] Such provisions are activated, removing the liability of the insurer or the owner (if not the person in charge) of the vehicle, for accidents and damage caused by the driverless car in circumstances when used in automated mode "where it was not appropriate to do so."[81]

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[74] Automated and Electric Vehicles Act 2018, c. 18, § 1. According to the act, a driverless car "is 'driving itself' if it is operating in a mode in which it is not being controlled, and does not need to be monitored, by an individual." *Id.* § 8.

[75] *Id.* Interestingly, two years after its enactment, the Act will be subject to review by the Parliament. *Id.* § 7, entitled 'Report by Secretary of State on operation of this Part.'

[76] *See id.* § 21, entitled "Commencement." This Act comes into force on whatever day or days the Secretary of State appoints by regulations.

[77] *Id.* § 2(1).

[78] *Id.* § 2(2).

[79] Julie Bond, *Automated and Electric Vehicles Act 2018 Becomes Law*, PENNINGTONS LAW (July 24, 2018), https://www.penningtonslaw.com/news-publications/latest-news/2018/automated-and-electric-vehicles-act-2018-becomes-law/ [https://perma.cc/7E89-CZDN].

[80] Automated and Electric Vehicles Act 2018, c. 18, § 3.

[81] *See id.* § 3(2) ("The insurer or owner of an automated vehicle is not liable under section 2 to the person in charge of the vehicle where the accident that it caused was

Another important regulation created by the Automated and Electric Vehicles Act 2018 is the exclusion or limitation of liability in cases when the insured party has made unauthorized software alterations or failed to update the software of the car with critical safety software.[82]

Finally, it seems that the Automated and Electric Vehicles Act 2018 leaves room for product liability of the manufacturer as it recognizes the right of the insurer or the owner to claim compensation against the manufacturer in case the latter is responsible for the accident.[83]

B. Comparative Evaluation

By comparing and contrasting the aforementioned laws, a number of core differences arise. First and foremost, while both laws define "autonomous vehicles," the German law establishes a number of standards and characteristics for autonomous vehicles. Hence, the German legal framework is more specific, sets higher standards, and implies that an autonomous car allowed to operate in the UK might not be allowed to operate in Germany.

Furthermore, the German law requires a driver to constantly monitor the automated process. This human oversight connotes the liability of that person and makes the attribution of liability between the autonomous machine and the human supervisor more complex. However, it is not clear whether the drivers overseeing autonomous cars need special training.[84] In response to the complexity caused by the human oversight requirement and the interaction between machine and human, the German law also requires the presence of a "black box," equivalent to what airplanes have, to record data constantly. The data recorded in the black box might be critical to clarify the conditions of an accident to allocate responsibility.

On the other hand, the UK legal framework is simpler by defining *ex ante* the responsibility of the insurer or the owner in case of an accident. The law then prescribes conditions that limit the liability of the insurer and the owner; among them, the contributory negligence is a very reasonable and fair provision.

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wholly due to the person's negligence in allowing the vehicle to begin driving itself when it was not appropriate to do so.").

[82] *Id.* § 4.

[83] *See id.* § 5, entitled "Right of insurer etc to claim against person responsible for accident".

[84] Research is ongoing regarding the interactions between autonomous vehicles and human drivers, and it is questioned whether a human would need additional driver-training programs. *See* M. Kyriakidis et al., *A Human Factors Perspective on Automated Driving*, 20 THEORETICAL ISSUES ERGONOMICS SCI. 223, 235 (2019).

Overall, the German law gives the impression that it regulates only autonomous vehicles of Level 3 and Level 4 without full autonomy, while the UK law is a step ahead, regulating autonomous vehicles up to Level 5 with full autonomy. In addition, the German law- making process takes into consideration the concerns of data protection and privacy, while the UK lawmakers did not include a provision on this issue, although they voiced concerns on data protection during the debates.[85]

That said, both legislative bodies decided to enact laws subject to a two-year review clause, which signals the experimental character of the laws. However, the UK law is not active yet, implying reluctance of the lawmakers. The activation of the UK law is subject to a decision by the Secretary of State. In addition, the UK law gives Henry VIII powers to the Secretary of State allowing him to make minor amendments to the law.[86] Hence, the UK law is also distinct because it employs delegated legislative powers to face the technological speed in the automation vehicles industry.[87]

IV. NEW TECHNOLOGIES, THE ROLE OF THE COURTS AND SELF-REGULATION

To begin, it is important to stress that regulators should not go to square one to face such technological challenges. In fact, technological changes are an omnipresent challenge to the existing legal framework, and regulators have to constantly update obsolete legal frameworks and innovate new ways to deal with legal issues.[88] For each generation,

[85] For instance, an MP stated:
Some things are contentious and some are not. Data sharing is really contentious, whether because of general data protection regulation or because motor manufacturers are concerned about infringement of their intellectual property. We are very keen for there to be some clarity about the storage and transmission of data, the form that data are transmitted in so that they are useful, and the speed of transmission—there is no point us getting the data three months later. That is not in the Bill.
See 31 Oct. 2017, Parl Deb HC (6th ser.) (2017) col. 12 (UK).

[86] *See* Automated and Electric Vehicles Act 2018, c. 18, § 20 (UK). Henry VIII power is the delegated power to the executive according to which the minister may amend with secondary legislation primary laws. *See* DELEGATED POWERS AND REGULATORY REFORM COMMITTEE, STRENGTHENED STATUTORY PROCEDURES FOR THE SCRUTINY OF DELEGATED POWERS, 2012, HL (UK), https://publications.parliament.uk/pa/ld201213/ldselect/lddelreg/19/1903.htm [https://perma.cc/MA6Q-Q6H7] (providing a history and explaining the utility of Henry VIII powers).

[87] Delegation of powers is a significant mechanism in the modus operandi of Parliament to confront the needs of technological change. *See* PAUL CRAIG, ADMINISTRATIVE LAW (Sweet & Maxwell, 7th ed. 2012) (providing more details on delegated power).

[88] *See* Mark A. Graber, *Technological Change, Constitutional Flexibility, and Regime Stability*, 79 MD. L. REV. 56, 58–59 (2019).

technology has been revolutionary, in relative terms, with a profound impact on the society requiring institutions to adapt to the new societal needs and changes.

The reality is that lawmakers rely on existing laws and principles and even reapply existing legal principles. For instance, most of the current principles in private law emanate from Roman law,[89] and they are constantly adjusted to the needs of the era and the technological evolution. Additionally, while lawmakers have a critical role to update obsolete legislation, the role of judges in this process, especially in common law jurisdictions, is crucial. Calabresi has accurately argued that courts are in a better position to update obsolete statutes both in areas based in common law or governed by statutes.[90] Hence, principles in data protection, tort law or civil liability, and insurance law may be updated by judges in order to meet the needs of autonomous vehicles.[91]

Interestingly, the role of lawmakers in the era of technological change becomes increasingly passive, and a *de facto* outsourcing of legislative powers occurs. The reason is threefold. First, legislating is typically far too slow to keep up with technology. Second, the law-

[89] *See* Albert R. Crittenden, *Roman Law in Modern Life and Education*, 15 CLASSICAL J. 148 (1919) (explaining the influence of Roman Law on current legal principles).

[90] GUIDO CALABRESI, A COMMON LAW FOR THE AGE OF STATUTES 163 (Harvard University Press 1985).

[91] Contracts are regulated by common law. Over time, courts have adapted the "offer and acceptance" framework of contracts to mesh with the modern technology of instantaneous communications such as telex and emails. For instance, in *Brinnes*, the Court of Appeals made existing precedent more specific. *Tenax Steamship Co v. Owners of the Motor Vessel Brinnes* [1974] EWCA Civ 15 (Eng.). The court held that when there is use of telex, the crucial time for contract formation is when the telex was received in the charterer's office, not when it was read. *Id.*

However, in areas governed by statute, the court's role is more passive. A prime example can be drawn from copyright law in the United States. In the last century a series of machines such as the television, radio, video, photocopy machine, and tape recorder changed the pre-existing legal framework from 1909. *See* Copyright Act of 1909, Pub. L. 60–349. In 1964, the first bill to revise the copyright framework was presented in Congress but it was not adopted until 1976. *See* Barbara Ringer, *First Thoughts on the Copyright Act of 1976*, 22 N.Y. L. SCH. L. REV. 477, 477 n.4 (1976–1977) (providing a complete account on the efforts to revise the Copyright Act of 1909); Jessica Litman, *Copyright Legislation and Technological Change*, 68 ORLANDO L. REV. 275, 311 (1989) (giving a more detailed analysis of the revision of the Copyright Act). However, the Betamax case exemplifies the role of the court in adjusting copyright law due to the impact of new technologies. *See Sony Corp. of America v. Universal City Studios, Inc.*, 464 U.S. 417 (1984); Pamela Samuelson, *The Generativity of* Sony v. Universal*: The Intellectual Property Legacy of Justice Stevens*, 74 FORDHAM L. REV. 1831 (2006) (describing the impact of the Betamax case on new technologies and copyright law); Jessica Litman, *The Sony Paradox*, 55 CASE WESTERN L. REV. 917 (2005).

making process has a significant transactional cost. Finally, it is essentially impossible for legislators to foresee every eventuality.

Hence, it is not a hyperbole to say that courts might substantially undertake the task to update legislation in order to meet the contemporary standards, especially in common law jurisdictions,[92] while the role of lawmakers is basically the codification of judicially created law. This is particularly exacerbated in times of technological change and innovation. In effect, courts undertake the responsibility to update and adjust the existing legal framework. But, to the extent that an existing legal framework cannot assimilate to technological change, the burden is shifted to the civil society and self-regulation.[93] Thus, it is also possible that the legal vacuum be filled by a nexus of non-binding rules and customs formed by the civil society.

Private parties may form their own set of rules. Such rules, despite their legal nature as *jus dispositivum*, regulate the relationship between the private entities involved, with the most remarkable example being the terms and conditions in insurance contracts. To exemplify that, insurance companies might include in the insurance contracts of autonomous vehicles special terms, which will form part of the agreement between the insurer and the owner of the driverless car. Such agreements are a step ahead from the existing legislation, and so long as legislators do not intervene to update the existing law and adapt it to the current needs, private entities will substitute for legislators, and such private agreements will be deemed to make or unmake the law.

V. CONCLUSION

The looming dominance of autonomous vehicles will impact well established areas of human activity, such as the architecture of the cities and the transportation system. On the legal front, a number of countries, like Germany and the UK, have steadily and progressively adopted legislation to allow for the operation of autonomous vehicles, while others have not taken any initiative to regulate this issue.

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[92] It is also argued that courts are in a better position to regulate disruptive technologies as they gather better information. *See* Marta K. Kołacz, & Alberto Q. Orlin Yalnazov, *Who Should Regulate Disruptive Technology?*, 10 EUR. J. RISK REG. 4 (2019).

[93] *See* Joel R. Reidenberg, *Governing Networks and Rule-Making in Cyberspace*, 45 EMORY L. REV. 911 (1996) (describing self-regulation in the Internet); M. E. Price & S. G. Verhulst, *In Search of the Self: Charting the Course of Self-Regulation on the Internet in a Global Environment*, REGULATING THE GLOBAL INFORMATION SOCIETY 57 (Christopher T. Marsden ed., Routledge 2000). As a matter of fact, self-regulation in the absence of a specific set of rules is not a modern phenomenon. The analogy between self-regulation in the Internet and self-regulation in international trade—lex mercatoria—is made by Reidenberg. *See* Joel R. Reidenberg, *Lex Informatica: The Formulation of Information Policy Rules Through Technology*, 76 TEX. L. REV. 553 (1998).

Lawmakers, in their effort to meet the fast technological pace, face a number of challenges. First, a number of laws will become obsolete as the technological change creates new realities. Even laws enacted today are in danger of becoming obsolete. Moreover, the law-making process is not always fast paced. In principle, legislation always follows the reality and comes to heal its pathology.

At an international level, the Vienna Convention was updated promptly. However, legislation at an international level with a focus on autonomous vehicles might be necessary to harmonize, or even to make uniform, the legislative framework with a set of basic principles.

Germany and the UK have enacted specific laws allowing the operation of autonomous vehicles and defining the issues of liability. From the comparative analysis of the two laws, it seems that both are at an experimental level, as both are subject to review. But, the UK law is not activated yet.

In terms of substance and public policy, legislators have followed a completely different approach. On the one hand, the German law requires the presence of the driver, who is ultimately responsible in case of an accident; on the other hand, British law allocates a *de facto* responsibility on the owner or the insurer. In addition, these two countries have adopted different standards for the definition of autonomous vehicles, with Germany adopting a more strict and precise definition, while the UK definition is more vague. Interestingly, a major difference making the UK law more flexible is that it includes delegated powers to the Secretary of the State to make adjustments with secondary legislation.

That said, it is probable that when autonomous vehicles appear on the street, judicially created law and self-regulation will complement the existing legal framework. All in all, smart technology requires smart regulatory approaches. More legislation at a local level would be ideal as more laws could be tested by the application of autonomous vehicles, and eventually the optimum legislation will prevail.