

AUTONOMOUS VEHICLES AND ITALIAN LEGAL SYSTEM: HOW TO DEAL WITH CIVIL LIABILITY AND MOTOR INSURANCE RULES? †

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Abstract: The historical period we are living is characterized by very rapid technological innovations, on many different fields. Our society and our legal system are not always ready to immediately embrace new technologies as they usually need a testing and adaptation period, but also adequate regulation. An important innovation already implemented has been the rides sharing (sharing mobility). It is very relevant in the market, especially in Italy, and has changed the way we perceive cars ownership and use. Self-driving cars are also a very important innovation, not only due to the fact that they significantly increase the number of users or the available mobility services, but also mainly for a significant increase in road safety concerns. Based on that, this paper will analyze how the Italian legal system regulates the protection for victims of traffic accidents caused by autonomous vehicles in terms of civil liability and motor insurance rules.

Keywords: autonomous vehicles; civil liability; motor insurance.

INTRODUCTION

The historical period we are living is characterized by very rapid technological innovations, on many different fields. Our society and our legal system are not always ready to immediately embrace new technologies, usually they need a testing and adaptation period, but also adequate regulation. Therefore, implementation of new technologies depends not only on our engineers, but also and mostly on our legislators.

Mobility is currently at a crossroad. It is surpassing a new frontier, with increasing automation and connectivity allowing vehicles to “communicate” with each other, to the road infrastructure, and to other road users. New projects tend to create a communication network in mobility, so wide that the focus is not only on “smart cars”, but also on “smart cities”. These developments are opening an entirely new level of cooperation between road users, which could potentially bring enormous benefits for them and for the

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mobility system in general, making transport safer, more efficient, accessible and sustainable.

An important innovation already implemented has been the rides sharing (sharing mobility). It is very relevant in the market, especially in Italy, and has changed the way we perceive cars ownership and use. Traditionally, the use of a car was based on ownership, now it is more oriented on usability and efficiency. In European countries, which represents approximately 50% of the global carsharing market, growth has been increasingly fast, and forecasts say that, by the end of 2020, around 15.6 million of car-sharing users are expected¹. In the foreseeable future, this kind of service will be likely implemented with autonomous vehicles. We will probably be able not only to use a car without owning it, but also without the need of driving it. This scenario opens new frontiers for the market, with much more users able to access the car-sharing service, even those without a driver's license, people with disabilities, or those too old or too young to drive.

I. AUTONOMOUS AND SEMI-AUTONOMOUS VEHICLES

Self-driving cars are a very important innovation, not only due to the fact that they significantly increase the number of users or the available mobility services, but also mainly for a significant increase in road safety.

It has been stated that around 90% of traffic accidents are attributable to human error such as those arising from distraction, fatigue, drowsiness and lack of attention. Also, the costs associated to traffic accidents are enormous to the society, both in terms of human injuries and deaths and also property and economic losses. In Europe alone more than 25,000 people still lose their lives in traffic accidents every year, while more than 135,000 get seriously injured². Those numbers can be strongly reduced introducing autonomous vehicles or increasing the use of automatic driving assistances.

The International Committee of the Society of Automotive Engineers (SAE), along with experts from industry and government, released a report defining key concepts and standards related to the increasing automation of vehicles³. Six levels of driving automation have been issued: 0 (no automation), 1 (driver assistance), 2 (advanced driver assistance), 3 (conditional automation), 4 (high automation), and 5 (full automation).

¹ ANIA Discussion Paper “*Smart roads, veicoli connessi ed autonomi. Mobilità e assicurazione nel prossimo futuro: rc auto o rc prodotti?*”, October 2017.

² European Commission, *Road safety in the European Union. Trends, statistics and main challenges*, 2018.

³ The Report has been updated in 2018: *SAE J3016: Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems*.



SAE J3016™ LEVELS OF DRIVING AUTOMATION

	SAE LEVEL 0	SAE LEVEL 1	SAE LEVEL 2	SAE LEVEL 3	SAE LEVEL 4	SAE LEVEL 5
What does the human in the driver's seat have to do?	You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You are not driving when these automated driving features are engaged – even if you are seated in “the driver’s seat”		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
What do these features do?	These are driver support features			These are automated driving features		
	These features are limited to providing warnings and momentary assistance	These features provide steering OR brake/acceleration support to the driver	These features provide steering AND brake/acceleration support to the driver	These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met	This feature can drive the vehicle under all conditions	
Example Features	<ul style="list-style-type: none"> • automatic emergency braking • blind spot warning • lane departure warning 	<ul style="list-style-type: none"> • lane centering OR • adaptive cruise control 	<ul style="list-style-type: none"> • lane centering AND • adaptive cruise control at the same time 	<ul style="list-style-type: none"> • traffic jam chauffeur 	<ul style="list-style-type: none"> • local driverless taxi • pedals/steering wheel may or may not be installed 	<ul style="list-style-type: none"> • same as level 4, but feature can drive everywhere in all conditions

The two highest levels of automation (levels 4 and 5) have not been implemented yet, but they will be available in a near future. Currently, our cars are provided with Advanced Driver Assistance Systems (ADAS), technological devices and features which do not substitute the need for a driver, but rather assist him. Even if current widespread use of technology is currently at a level 3 of automation, technological progress is constantly making huge steps forward in order to reach full automation for the vehicles. Internet of Things (IoT) and high-speed low-latency 5G networks, when applied to vehicles, will make a huge improvement in mobility and services. Not only making the car-sharing service possible, but also implementing innovative services in our own cars. For example, GPS navigator is connected to actual traffic information and uses online data to calculate the fastest route; internet connection is very helpful to call road assistance in case of accidents; or think about the possibility in the future to know where to find a free parking spot and reserve for it in advance. Vehicle obsolescence is not depending only on a mechanical point of view, but especially on standards of connectivity. People decide to buy a new car also because of new technologies and available features.

Many ADAS are already implemented in our cars and are available as an optional feature (i.e. assisted parking, lane shift assistant, safety distance control, alert control if the driver falls asleep, etc.), some of them became mandatory like the antilock braking system (ABS) or electronic stability controls (such as ESP, ESC, VDC, ASR), while others will be likely required

in the future. Current advanced systems (like the “Autopilot” function installed in Tesla vehicles) do not offer yet a full autonomous drive and still need human control behind the steering wheel. The driver must be ready to take over control at any time.

It has been demonstrated that ADAS can reduce the likelihood of accidents which means that insurance companies, providing motor insurance coverage to the most safe and advanced cars, sustain a lower risk than with conventional vehicles. In fact, some insurance companies already provide special rates, with extra discounts, for specific car models considered particularly innovative and safe, with a lower risk of damage.

II. MAIN ISSUES RELATED TO AUTONOMOUS VEHICLES DIFFUSION

There are different factors which slow down and prevent the autonomous vehicles to be in the market, even if they would be ready from a technological point of view.

First, we must consider the issues related to authorization to circulate on public roads. In order to comply with the principle of freedom of movement between European Member States, the EU Countries need common rules for type-approval and circulation of autonomous vehicles. For automated mobility to gain social and legal acceptance in every State, only the highest safety and security standards will suffice. Also, new questions such as the level of infrastructure support for driverless vehicles, and how this infrastructure should interact with the vehicles, should also be issue for regulators’ concern⁴.

In Italy, the Ministry of Transportation issued a decree in 2018 to regulate the testing of autonomous vehicles on public roads and the requirements for infrastructures to become “smart” and connected (smart roads)⁵.

Another aspect that needs tailor-made regulation regards the large amount of data generated by autonomous and connected vehicles, shared through communication devices and networks. This data has enormous potential to create new personalized services and products. This opportunity represents a revolution to existing business models and can be very efficient both for the corporations and final users. The European legislator is working on a framework of rules to set a level playing field to access in-vehicle data and resources and the goal is to set a balance between protecting consumers’ privacy rights while at the same time promoting innovation and fair

⁴ European Commission, Communication “*On the Road to Automated Mobility: an EU Strategy for Mobility of the Future*”, 17th May 2018, COM (2018) 283 final.

⁵ Ministry of Transportation Decree, 28th February 2018, on “*Modalità attuative e strumenti operativi della sperimentazione su strada delle soluzioni di Smart Road e di guida connessa e automatica*”.

competition⁶.

Digital data needs adequate protection and EU legislator will have to determine who will be in charge to collect all data and where they will be stored, but also how and for how long data can be kept before having to be destroyed⁷.

Safety and proper functioning of autonomous vehicles circulation will depend indeed on cybersecurity⁸. This is also a very important issue to solve in order to protect data: hacking or malfunction of data can cause catastrophic damages. This problem involves the technological defence for data protection, the playing field of engineers and communication technicians, but also involves other areas of law, like criminal and privacy law.

On the civil law side, the main legal issue is related to the attribution of liability in case of accidents caused by an autonomous vehicle and how this risk can be covered by an insurance policy.

First, we must consider that by reducing the activity of the human driver, his liability should also be proportionally reduced. Actual international rules, based on United Nations Vienna Convention on road traffic, provide that “*vehicle systems which influence the way vehicles are driven*” have to be “*in conformity with the conditions of construction, fitting and utilization according to international legal instruments concerning wheeled vehicles, equipment and parts which can be fitted and/or be used on wheeled vehicles*” otherwise they are allowed only “*when such systems can be overridden or switched off by the driver*”⁹. In other words, until we don’t arrive to a full automation level (level 5 of automation), the driver will always have some form of control, at least in part, thus will also be considered responsible regarding his vehicle use. His liability would be related to the omission of taking manual control of the vehicle or about following the vehicle’s instructions or requests.

More problems are related to the situation, in a full automation scenario, where there is not a human driver anymore, but people inside a car are to be considered all as passengers. During the trip they can read a book, watch a movie, eat, sleep or do any other activity without paying attention to the road.

⁶ See, European Commission, *Communication On the Road to Automated Mobility: an EU Strategy for Mobility of the Future*, *supra*.

⁷ About Data Protection, see European Regulation 2016/679, *on the protection of natural persons with regard to the processing of personal data and on the free movement of such data* (GDPR - General Data Protection Regulation), 27th April 2016, repealing Directive 95/46/EC.

⁸ European Regulation 2019/881, *Cybersecurity Act*, 17th April 2019. For a deep analysis about cyber and privacy risks, see A.C. NAZZARO, *Macchine intelligenti (smart cars): assicurazione e tutela della privacy*, in *Diritto del mercato assicurativo e finanziario*, 2018, p. 60.

⁹ United Nations Vienna Convention on Road Traffic, article 8, par. 5-*bis*.

In this situation, the vehicle would operate itself as a robot and it would be very hard to attribute any liability to the person who is sitting behind the steering wheel (admitting that fully autonomous cars will still possess a steering wheel)¹⁰.

Driverless mobility promises great benefits, but also poses serious questions both on a legal and on an ethical point of view¹¹. Automation can reduce human errors, but there are situations where an accident cannot be avoided: how should the vehicle react? Which criteria or algorithms should be used to determine the vehicle's decision and, consequently, the injured party? Just think of a situation where a vehicle can't avoid an accident and should decide, using artificial intelligence, if running over a young lady or two old men. Software and algorithms play a fundamental role on the machine behaviour: the presence of an automated choice affects the process of determining the event and the effect of the choice.

Producers' liability is clearly involved, but we must first analyse the existent liability rules.

III. ITALIAN CIVIL LIABILITY RULES FOR THE CIRCULATION OF VEHICLES

The Italian legal system does not seem to be ready to deal with liability issues related to the circulation of autonomous vehicles. Italian tort law and motor insurance assume a fault-based liability system. In particular, motor insurance covers liability provided by art. 2054 c.c. and the insurance company pays for third-party damages only in case of negligence of the driver of the insured vehicle.

The civil code regulation¹² provides a presumption of negligence on the

¹⁰ It has been also considered the possibility to recognize subjectivity to automated machines. See European Parliament resolution of the 16th February 2017 with recommendations to the Commission on Civil Law Rules on Robotics [2015/2103(INL)], where, among the possible legal solutions, it is considered to create «a specific legal status for robots in the long run, so that at least the most sophisticated autonomous robots could be established as having the status of electronic persons responsible for making good any damage they may cause, and possibly applying electronic personality to cases where robots make autonomous decisions or otherwise interact with third parties independently» [point n. 59, letter f)].

¹¹ G. CALABRESI – E. AL MUREDEN, *Driverless car e responsabilità civile*, in *Rivista di diritto bancario*, 2020, p. 16. According to the authors, a risk assessment and a risk management must be carried out in advance to achieve the best solution to balance all the fundamental rights involved.

¹² For an analytical and in-depth analysis of the regulatory provisions on road traffic liability, distinguishing between autonomous and semi-autonomous vehicles, see A. ALBANESE, *La responsabilità civile per i danni da circolazione di veicoli ad elevata automazione*, in *Europa e diritto privato*, 2019, p. 999. See also U. RUFFOLO, *Self-driving car, auto driverless e responsabilità*, in *Intelligenza artificiale e responsabilità*, coordinated

driver, unless he proves that he has done everything possible to avoid the damage (art. 2054, par. 1, c.c.). Only in the case of collision of vehicles, it is presumed, until evidence to the contrary is offered, that each driver contributed equally toward causing the damage suffered by each vehicle (art. 2054, par. 2, c.c.). Also, the owner of the vehicle¹³, in the case he is not the driver, is considered responsible jointly and severally with the driver of the vehicle, unless he proves that the vehicle was being operated against his will (art. 2054, par. 3, c.c.). This is a joint liability, strict and indirect of the owner, until it's differently proven. In fact, the owner does not respond as a result of negligence, but on the basis of a legal imputation of wrongdoing committed by others.

Last paragraph of art. 2054 c.c. specifies that the driver and the owner are liable for damages arising from defects in the manufacturing or maintenance of the vehicle. It means that the injured person can ask for damages to the vehicle's driver/owner, who is entitled to act in recourse against the vehicle's manufacturer¹⁴.

It is evident how our liability and insurance system is not ready to properly regulate the circulation of fully autonomous vehicles, as it requires the existence of a driver to assign liability. Otherwise, applying this rule to autonomous vehicles, it would always result, in case of an accident, a civil liability against the car owner, even if he is not in the car when the accident occurs. The actual regulation can be able to work even for semi-automated vehicles, but not for fully autonomous ones. Italian legal system requires that a physical person is driving or, at least, is always ready to take control of the car, like it is provided by the actual ADAS or autopilot features. It means that the driver cannot be distracted and has to be focused on car's behaviour at all times, and any accident could be considered driver's fault because he didn't intervene on time.

In a full automation scenario, also who is on the driver's seat may be considered as a passenger of the car and it will be important to determine if any liability is assigned, considering that he is the operator of the automated car. Differently, damage compensation rules would be applied for passengers, as provided by art. 141 of the Italian Insurance Code, which poses an obligation to pay for the loss or injury suffered by passengers on the insurance

by U. Ruffolo, Milano, 2017, p. 45, who believes that the solution of the problems related to the circulation of autonomous vehicles can be found in the existing tort law and civil liability system.

¹³ Italian civil code, art. 2054, par. 3, considers equal to the owner, on a liability point of view, the usufructuary and the conditional buyer, that is the buyer under a title reservation agreement.

¹⁴ Italian Consumer Code (Law decree 6th September 2005, n. 206), articles 114-127. European Directive of European Council 85/374/CEE on liability for defective products, in *Official Journal of the European Communities*, L 210/29.

undertaking of the vehicle in which they are being carried at the time of the accident, regardless of which driver of the vehicles involved in the accident is liable. This rule is made in the interest of the injured passenger, making easier for him to obtain a compensation. Anyway, this rule doesn't apply to accidents caused by unforeseeable circumstances.

The Italian decree on Smart Roads and on procedures for testing autonomous vehicles on public roads, issued in 2018, introduced a rule for accidents caused by automated cars¹⁵. Recalling art. 2054, par. 3, c.c. and art. 196 of Italian Traffic Law, the decree assigns liability for autonomous vehicle accidents basically on the vehicle's owner [art. 11, par. 1, letter a)]. On the risk cover side, motor insurance is mandatory for testing autonomous vehicles, but the coverage ceiling provided in the contract must be at least four times higher than the minimum value set by the current law (art. 19, par. 1, "Smart Roads" decree of 2018). Also, the insurance company must be informed that the insured vehicle is going to self-drive on public roads and that has to be written on the insurance contract (art. 19, par. 2).

In the case of a fully autonomous car, an additional rule could also be applied. It is art. 2051 c.c., which provides liability for damages caused by goods held in custody¹⁶. According to that rule, it would be the user of the self-driving car who would have to be considered responsible, regardless of his fault or negligence. This is another strict liability rule and it provides as the only exemption of liability the proof of an accident (unforeseeable and external event) causing the damage, which excludes the causal link between the good and the damage. If the liability provided by art. 2051 c.c. is involved, it should be also covered by the insurance contract to give full protection to the autonomous vehicle's user.

IV. AUTONOMOUS VEHICLES AND PROTECTION FOR VICTIMS OF TRAFFIC ACCIDENTS: WHICH LIABILITY RULE?

The Italian legal system, and also most of the European States law, is capable of giving a proper regulation even with advanced hi-tech vehicles which support ADAS, until there is the need of a driver who should be ready to take control in any situation. That allows to assign liability to the driver if an accident occurs, following the same rules we have for circulation of

¹⁵ For a brilliant analysis about the state-of-the-art of law after the Smart Roads decree, see D. CERINI, *Dal decreto Smart Roads in avanti: ridisegnare responsabilità e soluzioni assicurative*, in *Danno e responsabilità*, 2018, p. 401.

¹⁶ A. ALBANESE, *La responsabilità civile per i danni da circolazione di veicoli ad elevata automazione*, *supra*, p. 1007, assumes that article 2051 c.c. provides an extension of responsibility for the autonomous vehicle's owner/user/keeper, compared to the situation regarding conventional vehicles. The liability rule at article 2051 c.c. should be applied only to fully automated vehicles.

conventional cars. The legal problems will only be faced when a human driver is no longer present, that is when cars reach level 4 or level 5 of automation¹⁷.

If an accident is caused by an autonomous vehicle, it is much more difficult to understand who is liable, given that there are many different possible responsible subjects, thus very difficult to provide any proof of liability. On one side there are the owner and the user of the vehicle (if not the same person), and on the other side, liability could be attributed to the vehicle manufacturer and the producers of the installed software and automation algorithms, but also should be involved the officers and collectors of information and data shared by the vehicles, as well as the suppliers of the car maintenance and services. Many reasons could be the cause of an accident, like a wrong information received by the vehicle from another vehicle or from a road infrastructure (smart roads) that affects the vehicle's choices or behaviour. In such a wide array of possible liable subjects, which rules should be provided by a legal system?

The first consideration should be about the main purpose of tort law.

If we account as the primary need the effective compensation of damages to victims of accidents (compensative function of tort law), possible solutions are: a strict liability rule, a no-fault insurance system, and a guarantee fund.

Providing a strict liability rule, maybe on the vehicle/software manufacturers or on the vehicle's owner/user, it would be much easier for victims to identify the subject obliged to indemnify and there is no need to prove his fault or malice, but only the causality link between the damage and the wrongdoing by the automated car¹⁸. In this way, we would move from a "driver focused" model of liability to a "product focused" one¹⁹. On the other

¹⁷ See also M.C. GAETA, *Liability rules and self-driving cars: the evolution of Tort Law in the light of new technologies*, Napoli, 2019, p. 139-145.

¹⁸ This kind of rules would aim to realize the maximum satisfaction of collective interests deemed worthy of protection, like guarantee a compensation to injured people. G. CALABRESI, *The Future of Law and Economics*, New Haven, 2016.

¹⁹ E. AL MUREDEN, *Autonomous cars e responsabilità civile tra disciplina vigente e prospettive de iure condendo*, in *Contratto e impresa*, 2019, p. 912, who proposes a remodulation of the relationship between "product focused" liability, that should be improved, and "driver focused" liability rule. Of the same opinion, previously, D. CERINI, *Dal decreto Smart Roads in avanti: ridisegnare responsabilità e soluzioni assicurative*, *supra*, p. 405-409, who envisages the introduction of a mandatory insurance for defective products liability and the diffusion of policies able to cover the cyber-risk, considering new insurance products with a risk assessment that is no longer focused only on the owner or on the driver of the vehicle. See also A. DI ROSA, *Auto a guida automatica: profili assicurativi e di responsabilità civile*, in *www.altalex.com*, 2018.

About the need for updating the product liability regulation, see the European Commission Report, *Evaluation of Council Directive 85/374/EEC on the approximation of laws, regulations and administrative provisions of the Member States concerning liability*

side, there are many players involved in the production of an automated vehicle and it is not easy to decide who should be the liable one. Thinking of a joint and several liability on all of them would not seem a fair option. Another consequence related to the assignment of a strict liability rule on the vehicle manufacturers is the unavoidable increasing prices of autonomous cars. In fact, automobile companies would transfer the costs of damages to the consumers, with the consequence of higher retail prices and a lower diffusion, slowing down the progress of technology and the economic development of this market.

Another solution could be the provision of a mandatory no-fault insurance system for automated vehicles, where, in case of a damage, every insured party receives compensation directly from his insurance company, regardless of the fault in causing the accident. In Italy, a first-party insurance would be in contrast with the current Italian system, based on a third-party civil liability: Italian motor insurance is a fault-based system and the insurer must cover for third-party damages only when the insured driver's liability is assessed²⁰. The rule of compensation for passengers (art. 141 of Italian insurance code) might seem like an exception, but it is not because the insurance undertaking which has paid damages has a right of recourse against the liable party and/or his insurance undertaking, resulting that the final subject obliged to pay is the one that is liable for the damage (or his insurance company).

One more option addressed to ensure a compensation for victims of driverless vehicles is the establishment of a guarantee public fund financed through a specific "tax" paid by the owners of the automated machines (or by the automotive companies²¹). This would be similar to the national guarantee funds for road victims already existing in European member states and would cover damages caused by automated cars, in order to avoid the rise of damage without responsibility²². A proposal for a guarantee fund is based on

for defective products, 2018. For the effectiveness of current Product Liability discipline with regard also to self-driving cars, see M.C. GAETA, *Liability rules and self-driving cars: the evolution of Tort Law in the light of new technologies*, *supra*, p. 141.

²⁰ G. PONGELLI, *Il risarcimento diretto nel codice delle assicurazioni*, Milano, 2011, p. 98.

²¹ See G. CALABRESI – E. AL MUREDEN, *Driverless car e responsabilità civile*, *supra*, p. 13-15, for the need of sharing the costs of damages arising from the circulation of autonomous vehicles through the introduction of a guarantee fund supplied by all the manufacturers, proportionally divided in relation to their market share and, therefore, to the risk introduced into society.

²² See S. LANDINI, *The Insurance Perspective on Prevention and Compensation Issues Relating to Damage Caused by Machines*, in *The Italian Law Journal*, 2020, p. 84. About European Law, see European Parliament and Council Directive 2009/103/EC relating to insurance against civil liability in respect of the use of motor vehicles, and the enforcement of the obligation to insure against such liability, in *Official Journal of the European Union*,

“Manufacturer Enterprise Responsibility” (MER), that is a manufacturer-financed, strict responsibility bodily injury compensation system, administered by a fund created through assessments levied on automated vehicles manufacturers²³. To be effective, MER will have to be a uniform system enacted at a European and international level and applicable throughout all the member States. Since it would address liability to manufacturers, it can be only applied for the circulation of highly automated vehicles or fully autonomous vehicles (level 4 or 5 under the SAE classification system). MER would cover only bodily injuries arising out of the operation of the vehicle, up to the specified benefit limits, except for injuries caused by the vehicle owner’s own negligence (negligent failure to install software updates, negligent tweaking of software, or negligent maintenance).

Considering another important aspect of Tort Law, that is the deterrence function, all the solutions above could be appointed as inconsistent. That is true when there is a driver which negligence or wrongdoing generates responsibility, but not in a highly or full automated scenario where there is no human driver. In this case, charging owners and/or occupants of the vehicle for their own insurance would not have any direct effect on safety levels, because these individuals would have no control over the operation of their vehicles. On the other hand, even without any negligence liability, some positive effects can be generated²⁴: manufacturers (hardware and software)

2009, L 263/11, in particular the “whereas” at point 53.

Italian Law, on the constitution of a public guarantee fund for road accidents, anticipated EU Law by many years. The guarantee fund was at first established by the law 24th December 1969, n. 990 (article 19), now repealed and replaced by the Italian Insurance Code (Law Decree 7th September 2005, n. 209), which regulates the public funds at articles 283 and followings. On the Italian Road Guarantee Fund, see S. LANDINI, *sub* articles 283-287, in *Il codice delle assicurazioni private*, coordinated by F. Capriglione, Padova, 2007, III, 2, p. 3; G. PONGELLI, *sub* articles 283-286, in *Codice delle Assicurazioni Private annotato con la dottrina e la giurisprudenza*, coordinated by A. Candian e G.L. Carriero, Napoli, 2014, p. 1107.

²³ K.S. ABRAHAM - L.R. RABIN, *Automated Vehicles and Manufacturer Responsibility for Accidents: A New Legal Regime for a New Era*, in *Virginia Law Review*, 2019, p. 145; M.A. GEISTFELD, *A Roadmap for Autonomous Vehicles: State Tort Liability, Automobile Insurance, and Federal Safety Regulation*, in *California Law Review*, 2017, p. 1611; E. AL MUREDEN, *Autonomous cars e responsabilità civile tra disciplina vigente e prospettive de iure condendo*, *supra*, p. 921. For an Italian perspective see A. DAVOLA - R. PARDOLESI, *In viaggio col robot: verso nuovi orizzonti della r.c. auto (driverless)?*, in *Danno e responsabilità*, 2017, p. 627.

²⁴ This is also opinion of S. LANDINI, *The Insurance Perspective on Prevention and Compensation Issues Relating to Damage Caused by Machines*, *supra*, p. 86: «are we sure that in case of damage caused by a machine running in full automation civil liability can prevent damage thanks its deterrence function? The insurers, covering the liability of the owner or of the producer or acting as delegate of public funds in compensating damages to

would have an incentive to invest in R&D to make their products increasingly safer, and the reduction of risk would also indirectly affect the amount of their financial contribution towards maintaining the guarantee fund²⁵.

In conclusion, there are different perspectives that can be considered for the regulation of automated vehicles. One is focused on the damage compensation for injured parties and includes solutions that go away from Italian third-party liability system and motor insurance, as providing public guarantee funds, a strict liability of vehicles/software manufacturers, or a mandatory insurance for the manufacturers of self-driving cars²⁶. Another point of view would leave the actual Italian discipline to regulate autonomous vehicles circulation on public roads, assigning liability to the user and to the owner of the vehicle, as well as to the manufacturer.

Probably our legal system is not ready for driverless vehicles. There is the need for new regulatory changes in order to build a harmonised, complete and future-proof framework of rules for full automation²⁷. The highest investments required by automotive companies, by public administration and by society in general cannot be done without adequate legislation. Any chosen legal solution applied to the liability of robots and of artificial intelligence in cases other than those of damage to property should in no way restrict the type or the extent of the damages which may be recovered, nor should it limit the forms of compensation which may be offered to the aggrieved party on the sole grounds that damage is caused by a non-human

victims of AI can create and update standards and guidelines in order to ‘educate’ machines with a relevant role in prevention of damage caused by AI thanks to tools like the ‘reinforcement learning’ concerning with how software agents can take actions in an environment so as to maximize some forms of cumulative reward».

²⁵ A. DAVOLA - R. PARDOLESI, *In viaggio col robot: verso nuovi orizzonti della r.c. auto (driverless)?*, *supra*, p. 628, believe in the need for a legal system which assigns liability to the subjects entitled of ensuring the good and safe functioning of a driverless car and of the installed software. Owner or driver responsibility, on the other hand, has no influence on reducing the damages for automated vehicles. About the efficient allocation of liability, according to the principles of economic analysis of law, see the reference work of G. CALABRESI, *The Cost of Accidents: A Legal and Economic Analysis*, Yale University Press, 1970.

²⁶ The future legislative instrument should be based on an in-depth evaluation whether the ‘strict liability’ or the ‘risk management’ approach should be applied. European Parliament seems to suggest a hybrid solution using both insurance and a guarantee fund. See the Annex to European Parliament resolution of the 16th February 2017 with recommendations to the Commission on Civil Law Rules on Robotics [2015/2103(INL)]: «An obligatory insurance scheme, which could be based on the obligation of the producer to take out insurance for the autonomous robots it produces, should be established. The insurance system should be supplemented by a fund in order to ensure that damages can be compensated for in cases where no insurance cover exists».

²⁷ N. BEVAN, R. MERKIN, K. NOUSSIA, *Driverless Vehicles – Where are we wrong?*, in *Connected and Autonomous Vehicles: The future?*, House of Lords UK, 2017.

agent²⁸. European countries require a common framework of rules, also to allow and preserve the free circulation of vehicles between different member States²⁹. On a systematic point of view, European legislation must take into account the relationship between different regulatory aspects that cannot be considered individually: they include the protection of road victims and general safety on public roads, the personal data protection, the cybersecurity, the manufacturers' liability for defective or dangerous products, the technological development for safer and more innovative products

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²⁹ M. CHANNON, *Autonomous Vehicles and Legal Effects: Some Considerations on Liability Issues*, in *Diritto del mercato assicurativo e finanziario*, 2016, p. 33.

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