LIABILITY FOR DAMAGES CAUSED BY AUTONOMOUS DRIVING VEHICLES FROM THE EU LAW PERSPECTIVE

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ABSTRACT

The rise of autonomous driving vehicles and artificial intelligence systems presents significant legal challenges in various regulatory fields. Among them is main subject of this paper: liability for damages caused by autonomous driving vehicles. Common regulatory approach of liability caused by vehicles is based on fault or negligence. The legal subjects responsible for causing the accident are held liable for damages. Traditional liability legal frameworks, designed for human drivers, struggle to address the complexities introduced by vehicles operated with assistance of artificial intelligence. When it comes to artificial intelligence systems general regulatory approach varies from extensive risk-based framework best represented by the new European Union Artificial Intelligence Act to the liberal technology friendly approach like one adopted in the United States. Particular focus of this research is on the European Union Product Liability Directive. The new Directive plays a crucial role in holding manufacturers and software developers accountable with application of its rules on strict product liability. Paper explores its interconnection with Artificial Intelligence Act when it comes to liability for damages caused by autonomous driving vehicles. Other legislative efforts aiming to fill regulatory gaps and establish clear rules for liability of damages caused by autonomous driving vehicles are also explored. The interplay between existing and emerging European Union liability frameworks is elaborated. The paper detects the need for harmonized legal standards to ensure consumer protection, fair compensation mechanisms, and legal certainty in the context of accidents related to the use of autonomous driving vehicles.

Keywords: *Autonomous driving vehicles, Artificial intelligence, EU Law, Liability for damages*

1. INTRODUCTION

Nikola Tesla wrote in 1935: 'today the robot is an accepted fact, but the principle has not been pushed far enough. In the twenty-first century the robot will take the place which slave labor occupied in ancient civilization'.[1]

The emergence of autonomous vehicles (AVs) represents a significant transformation in the transportation sector, promising advancements in safety, efficiency and accessibility. Most importantly, AVs have the potential to save lives and prevent injuries.[2] In the US National Motor Vehicle Crash Causation Survey from 2015 crashes from a two-year period where researched. Survey determined that the critical reason, which is the last event in the crash causal chain, was assigned to the driver in 94 percent (±2.2%) of the crashes.[3] Study of RAND Corporation from 2016[4] estimated that the benefits of AV technology—including decreased crashes, increased mobility, and increases in fuel economy—outweigh the likely disadvantages and costs.

Rapid technological development of AV produces complex legal challenges in various regulatory fields. Among them is main subject of this paper: liability for damages caused by autonomous driving vehicles. The anticipated future shift from human-operated to vehicles driven with the artificial intelligence (AI) will necessitate a re-evaluation of existing legal norms on liability for damages.

Introductory, we should conceptualise the term autonomous vehicles. United States National Highway Traffic Safety Administration (NHTSA) has adopted a system created by the Society of Automotive Engineers (SAE)[5] to describe the levels of vehicle automation. The scale goes from 0 (no automation) to 5 (full automation). The concept of autonomy generally in AI refers to the system's ability to make decisions or take actions that are not entirely pre-programmed.[6] This sets autonomy apart from automation[7]. Vehicles operating at levels 0, 1, 2 or 3

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1 Novak, M., *Nikola Tesla's Amazing Predictions for the 21st Century*, SMITHSONIAN Magazine, 2013., [https://perma.cc/29FU-MRYK], Accessed 21 March 2025.

2 Stanley, Karlyn D. *et al.*, *Autonomous Vehicles and the Future of Auto Insurance*, RAND Corporation, Santa Monica, Calif., 2020, p. 1.

3 *Ibid.*

4 Anderson, James M. *et al.*, Autonomous *Vehicle Technology: A Guide for Policymakers*, RAND Corporation, Santa Monica, Calif., 2016, p. xvii.

5 Stanley *et al.*, *op. cit.,* note 2, p. 2.

6 Buiten, M., *Product Liability for Defective AI*, European Journal of Law and Economics 57, 2024, pp. 239–273. [https://doi.org/10.1007/s10657-024-09794-z].

7 *Ibid.*

on this scale are called automated and those that operate at levels 4 or 5 are called autonomous:

• Level 4, or high automation: automated driving system (ADS) on the vehicle can itself perform all driving tasks and monitor the driving environment— essentially, do all the driving—in certain circumstances. The human need not pay attention in those circumstances.

• Level 5, or full automation: automated driving system (ADS) on the vehicle can do all the driving in all circumstances. The human occupants are just passengers and need never be involved in driving.[8] Previous classifications did not encompass level 5 (they were within 0-4 scale).[9]

In the European Union (EU) the legal landscape is evolving to accommodate the unique challenges posed by the emerging digital age and rise of AI. Regulatory framework on autonomous driving vehicles is and will be integral part of that legal evolution. For example, in the European Commission's White Paper on AI from 2021 proposes provisions explicitly covering new risks presented by the emerging digital technologies including existing regulatory framework for defective product.[10] This process was not without its failures. The European Commission published a Proposal for a Directive on adapting non-contractual civil liability rules to artificial intelligence, better known as AI liability directive[11], in 2022 only to redraw it in 2025.[12] Better luck accompanied the Proposal for a new Directive on liability for defective products published also in 2022.[13] In this paper we will explore existing legal framework applicable to liability for damages caused by autonomous driving vehicles within the EU Law and discuss possible pathways to its development.

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8 Stanley *et al.*, *op. cit.,* note 2, p.2.

9 See for example in Webb, K.C., *Products liability and autonomous vehicles: who's driving whom*, Richmond Journal of Law & Technology, Vol. 23, No. 4, 2016, pp. 1-52.

10 European Commission, White Paper on Artificial Intelligence: A European Approach to Excellence and Trust. COM(2020) 65 final, Brussels, 2020.

11 European Commission, Proposal for a Directive of the European Parliament and of the Council on adapting non-contractual civil liability rules to artificial intelligence (AI Liability Directive), COM(2022) 496 final, 2022/0303(COD). Brussels, 2022.

12 See more in Spindler, G., *Different Approaches for Liability of Artificial Intelligence – Pros and Cons – the New Proposal of the EU Commission on Liability for Defective Products and AI Systems*, 2023. [http://dx.doi.org/10.2139/ssrn.4354468].

13 See more in Karanikić Mirić, M., *Product Liability Reform in the EU*, EU and Comparative Law Issues and Challenges Series (ECLIC), 7, 2023, pp. 383–413. [https://doi.org/10.25234/eclic/27456].

2. THE NEW EU PRODUCT LIABILITY DIRECTIVE

The new European Union's Product Liability Directive (PLD)[14] has been enacted in 2024 with transposition deadline for national legal orders of Member States by 9 December 2026 . Old PLD, that remains in legal force[15] until 9 December 2026, has long served as a cornerstone in harmonizing product liability laws across Member States, ensuring that consumers can seek compensation for damages caused by defective products. Both product liability directives are of maximum harmonization within the EU Secondary Law. Originally enacted in 1985, the first PLD[16] established a strict liability regime, holding producers accountable for harm caused by defects in their products, irrespective of fault - claimants are required to prove the defect, the damage, and the causal link. This framework was designed to balance the interests of consumers and producers, facilitating a fair mechanism for addressing claims related to product defects. The Court of Justice of the European Union (CJEU) has crated extensive case-law over time in interpreting the provisions of the old PLD.

The new PLD has been enacted with digital age in mind -that was main impetus for the initiation of its legislative process. The European Law Institute (ELI) published in 2021, same year when European Commission's White Paper on AI was published, Guiding Principles for Updating the Product Liability Directive for the Digital Age[17]. The ELI Guiding Principles provide good summarization of the necessities that revision of the product liability legal framework had to encompass:

- simple mechanism for seeking compensation should be available to a person who has suffered harm caused by a defective product;

- product liability system for the digital era must ensure an appropriate balance between protecting individuals and fostering innovation and utilisation of digital technology;

- PLD must be aligned with measures in related areas of law, as well as with non-legal measures such as insurance or compensation schemes;

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14 Directive (EU) 2024/2853 of the European Parliament and of the Council of 23 October 2024 on liability for defective products and repealing Council Directive 85/374/EEC (Text with EEA relevance), OJ L, 2024/2853.

15 Old PLD shall continue to apply with regard to products placed on the market or put into service before that date (9 December 2026).

16 Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products, OJ L 210.

17 Twigg-Flesner, C., *Guiding Principles for Updating the Product Liability Directive for the Digital Age*, Pilot ELI Innovation Paper, European Law Institute, 2021, [https://ssrn.com/abstract=3770796], Accessed 21 March 2025.

- definition of 'product' in the PLD should be updated to cover (i) the combination of goods with digital elements and (ii) digital content and digital services supplied as 'digital products';

- category of persons liable towards an individual (the notion of 'producer') should be revised to reflect the different actors involved;

- notion of 'defect' which triggers the producer's liability should be reconsidered to reflect the particular features of digital products and digital elements;

- revisions of the notion of 'damage' could be considered to include damage to digital elements and data;

- burden of proof should be adjusted to reflect the complexity of goods with digital elements and of digital products;

- defences available to a producer need to reflect the impact of digitalisation on products;

- system for allocating the financial consequences of a successful claim by an individual to the party responsible for that loss should be an integral part of a revised product liability system.[18]

Under the old PLD the product was defined as mainly tangible, movable object. Products were distinguished from services, which are not covered by the old Directive. Thus, it was disputable[19] weather software at all was covered by the old PLD and if so to what extent (differentiation between software updates, which are services, and software upgrades as separate products was discussed). New PLD broadens the definition of product[20] to include digital products such as software (both standalone and integrated), digital manufacturing files, and artificial intelligence systems.

New PLD extends liability to digital services that influence a product's functionality, such as cloud-based services and real-time data services. AI systems are also explicitly covered, ensuring that developers and providers can be held accountable for defects. Liability is expanded to a broader range of economic operators[21]

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18 *Ibid.*

19 Chatzipanagiotis, M., *Product Liability Directive and Software Updates of Automated Vehicle*, Proceedings of SETN 2020 - 11th Hellenic Conference on Artificial Intelligence, 2020, pp. 123–130.

20 Definition of product in new PLD is contained in Art. 4 (1):
'product' means all movables, even if integrated into, or inter-connected with, another movable or an immovable; it includes electricity, digital manufacturing files, raw materials and software.

21 Definition of economic operator is stipulated in Art 4 (15): 'economic operator' means a manufacturer of a product or component, a provider of a related service, an authorised representative, an importer, a fulfilment service provider or a distributor.

including authorised representatives, fulfilment service providers and online platforms. They can be held liable jointly and severally (this is not a novelty).

New PLD introduces provisions to ease the claimant's burden of proof in complex cases which is particularly applicable to those involving advanced technologies. The defectiveness of the product shall be presumed if the defendant fails to disclose relevant evidence and the claimant demonstrates along with the casual link that the product does not comply with mandatory product safety requirements.[22] The causal link between the defectiveness of the product and the damage shall be presumed where it has been established that the product is defective and that the damage caused is of a kind typically consistent with the defect in question.[23]

Definition of damage was expanded in the new PLD to include destruction or corruption of data. Thus, new notion of damage encompasses personal injury, property damage and data loss. New PLD regulates that any party making substantial modifications to a product that affect its safety is considered a manufacturer and can be held liable for resulting defects (old PLD was silent on the subject of modifications). While old PLD established a 10-year long-stop period for bringing claims new PLD extends this period to 25 years in cases where the damage is latent and not immediately discoverable.

3. APPLICABILITY OF THE OLD AND NEW PLD ON AUTONOMOUS DRIVING VEHICLES

While the old Product Liability Directive is still in the legal force until 9 December 2026 is suitability for world of autonomous driving vehicles in the digital age is obviously inadequate. However, we cannot exclude its applicability on damages caused by AV put into circulation on the EU Internal Market. Furthermore, provisions of the old PLD will be applicable and after 2026 to products put in circulation before that date. Thus, since this is the current legal framework we should firstly examine the applicability of the old PLD on damages caused by AV. Autonomous driving vehicles are vehicles and therefore they are to be considered as products under the old provisions (tangible, movable object). There are several important legal question arising in this examination.

Firstly, what constituents a defective AV? According to Art. 6(1) of the old PLD, a product is defective, when it does not provide the safety which a person is entitled to expect, taking all circumstances into account, including (a) the presentation of the product, (b) the use to which it could reasonably be expected that the product

[22] Art. 10 (2).

[23] Art. 10 (3).

would be put, (c) the time when the product was put into circulation[24]. Recital (6) of the old PLD clarifies that the defectiveness of the product is determined by reference to the lack of the safety which the public at large is entitled to expect. Therefore, the safety expectations are determined objectively, which means that reference is not made to the expectations of the specific user. In addition, the PLD establishes a duty to put into circulation products that are reasonably safe, taking into account all the circumstances not products that are absolutely safe[25]. The CJEU has ruled in the *Boston Scientific Medizintechnik* joint cases[26] that, where it is found that products belonging to the same group or forming part of the same production series have a potential defect, an individual product of such series may be classified as defective without there being any need to establish that this product has such a defect. If the damages are caused by the fully autonomous AV operating on level 5 (as explained in the introduction of this paper) we can conclude that AV is defective. Since the level of autonomy exclude the need for direct human control if damage is caused by the AV then it its defective product under old PLD. However, answer is not so clear with AV operating on level 4 and below. Because there is an element of direct human control liability of a driver or other occupant's defectiveness should be limited by the possibility of preventing damage with excising corrective human control. This is quite different when comparing to the damages caused by standard vehicles operating outside ADS. Courts usually do not have to delineate such nuances between human operation and level of automation when it comes to them. Thus, standard for defectiveness of AV will be harder to determine for level 4 or lower.

Secondly, who is liable for damages caused by the defective AV? Art. 3(1) of the old PLD includes in the definition of producers the manufacturer of the end product, the component manufacturer, the producer of any raw material, as well as any persons who, by putting their name, trade mark or other distinguishing feature on products present themselves as their producers. Furthermore, the importer of the product in the EU is also deemed a producer.[27] Where the producer of the product cannot be identified, each supplier of the product is treated as its producer, unless it informs the injured person, within a reasonable time, of the identity of the producer or of the person who supplied it with the product. Therefore, producer,

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24 Chatzipanagiotis, *op. cit.*, note 19.

25 *Ibid.*

26 Court of Justice of the European Union, Joined Cases C-503/13 and C-504/*13 Boston Scientific Medizintechnik GmbH v AOK Sachsen-Anhalt – Die Gesundheitskasse and Betriebskrankenkasse RWE* [2015], ECLI:EU:C:2015:148.

27 Chatzipanagiotis, *op. cit.*, note 19.

importers and suppliers of defective AV are deemed liable for damages caused even under the provisions of the old PLD.

Additional question relates the liability of third-party software providers to AV systems. It seems the existing liability regulatory framework does not encompass such providers as product providers and thus they are excluded from the scope of the old PLD. Some legal commentators, like *Michael Chatzipanagiotis*, have concluded that the PLD is inapplicable to software updates[28] even when they are coming from the producer.

New PLD is undoubtedly more suitable for the world autonomous driving vehicles. Software is now included in the notion of a product. Liability encompasses now both software updates to AV by producer and compatible third-party software providers. Liability is extended to the providers of services used by AV such as cloud services and third-party navigation sources. Therefore, scope of liable subject is much wider under the new regulatory framework.

Notion of damage is expanded in the new PLD to include data loss which can occur in the operation of the AV. This is one of the major changes in the regulatory regime of liability for damages. Cybersecurity concerns of operating AV are now met by holding manufacturers accountable for ensuring robust cybersecurity measures and timely updates. Primary conclusion that damages caused by the fully automated AV operating on level 5 makes AV a defective product remains. Problematic is, however, applicability of that standard to all the same AV regarding the case-law of the CJEU in the *Boston Scientific Medizintechnik* cases. AV operating on the level 5 have integrated AI systems that generate autonomous solutions differentiated form other AV of the same type or product series. Thus, liability for damages caused by a particular AV does not have to relate to the same group or the same production series.

4. EU AI ACT AND AUTONOMOUS DRIVING VEHICLES

European Union legislative process during the last several years experienced regulatory stampede[29] with Regulation on AI[30], generally known as EU AI Act, being at its forefront. The AI Act entered into force on 1 August 2024, following its pub-

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28 *Ibid.*

29 Vuletić, D., *High Risk Artificial Intelligence Systems and Legal Doctrine of Essential Facilities: in Search for a Dynamic Model*, Interdisciplinary Description of Complex Systems Vol. 23, No. 1, 2025, pp. 72-81. [https://doi.org/10.7906/indecs.23.1.4].

30 Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Di-

lication in the Official Journal on 12 July 2024. However, the legal applicability starts partially on 2 February 2025 and continues in phases until full applicably of all provisions on 2 August 2027. Majority of provision will become legally applicable on 2 August 2026. The Act applies to manufactures, providers and deployers of AI systems both within and outside of the EU. The Act also applies to importers and distributors, authorised representatives of providers and affected persons (including users) that are located in the Union.

Primary object of regulation of EU AI Act is artificial intelligence system (AI system).[31] The Act sets harmonised rules for the development, placement on the market and use of AI systems in the Internal Market following a proportionate risk-based approach. The risk based approach of the EU AI Act basically means that artificial intelligence systems are classified into four tiers of risk:

- unacceptable;
- high;
- limited;
- minimal or low risk.

The AI system unacceptable practices are generally prohibited by the EU AI Act (with certain exemptions) and have already become legally applicable (since 2 February 2025). High risk AI system practices are subject to specific requirements and conformity assessments. Limited risk AI practices are subject to transparency and information obligations. Minimal or low risks AI practices are permitted with no restrictions under the Act.

The main subject of analysis of EU AI Act for purposes of this paper is EU AI Act applicability on autonomous driving vehicles. Firstly, we should note that AV are inherently interconnected with use of AI systems. All AV operating on levels 5 and 4 of automation (as described in introduction of this paper) are by technological necessity using some kind of AI systems. Consequently, there cannot be any doubt that EU AI Act will be applicable to them to certain extent. Real subject of examination is what is the classification of AV under AI Act risk-based approach in regards to obligations and requirements imposed.

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rectives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) (Text with EEA relevance), OJ L, 2024/1689.

31 More on definition of AI system in Vuletić, D. *et al., Algorithmic Collusion in Competition Law: Overview*, EU and Comparative Law Issues and Challenges Series (ECLIC), 8, pp. 377-394. [https://doi.org/10.25234/eclic/35845].

The EU AI Act expressly stipulates[32] that following AI systems intended to be used as a safety component of a product, or is itself a product, covered by the Union harmonisation legislation are deemed as high risk:

- two or three-wheel vehicles and quadricycles;
- agricultural and forestry vehicles.

Therefore, we can conclude that when it comes to two or three-wheel vehicles and quadricycles and agricultural and forestry vehicles that can be considered AV (using levels 5 or 4 of autonomy) classification as high-risk AI systems is presumed. The requirements and conformity assessments for high risks AI systems from AI Act include: risk management systems; data governance; technical documentation; record keeping; transparency and provision of information to users; human oversight; accuracy, robustness and cybersecurity[33]. When it comes to other AV there is no general answer to our examination. Answer is dependable on the specific characteristics of the AI system used by AV. This has to be examined on the case-to-case basis bearing in mind that AI systems assisting AV generate autonomous solutions differentiated even form other AV's of the same type and series.

This examination is important because violation of the applicable obligations and requirements effects liability for damages caused by use of AV. Therefore, unconformity of AI system used by AV with EU AI Act will bring liability for the caused damages within the broad conceptualisation of the term in the new PLD (now encompassing and liability for data loss). Unconformity of AI system used by the AV with applicable requirements of AI Act would made AV inherently defective under the provisions of new PLD. We can conclude that AI Act and PLD are intrinsically interconnected when it comes to the liability for the damages caused by use of AV.

5. CONCLUSIONS

The legal landscape of the EU Law is in the process of evolution in order accommodate the unique challenges posed by the emerging digital age and rise of AI. This legislative evolution has by technological necessity include regulation of autonomous driving vehicles and damages caused by their operation. The new Product Liability Directive (PLD) enacted in 2024 with transposition deadline by 9 December 2026 represents expected progress in the regulatory framework more fitting for the digital age. Definition of product is expanded to include digital products such as software, digital manufacturing files and artificial intelligence

[32] Art. 6 (1) (a) in relation to Annex I.

[33] Vuletić, *op. cit.*, note 29.

systems. Liability in the new Directive is expanded to include digital services that influence a product's functionality, such as cloud-based services and real-time data services. AI systems are also explicitly covered, ensuring that developers and providers can be held accountable for defects. Liability is expanded to a broader range of economic operators including authorised representatives, fulfilment service providers and online platforms. Definition of damage was expanded to include destruction or corruption of data. Thus, new notion of damage encompasses personal injury, property damage and data loss. This all makes the future new regulatory framework more suitable for the world of autonomous driving vehicles. However, provisions of the old Product Liability Directive are still applicable and will continue to be applicable even after 9 December 2026 when it comes to products put in circulation on the Internal Market before that date.

This paper brings examination of the applicability of the provisions of old and new Product Liability Directives on the liability for damages caused by autonomous driving vehicles. Examination concludes that under provisions of the old Directive producer (including manufacturer of the end product, the component manufacturer, the producer of any raw material, as well as any persons who, by putting their name, trade mark or other distinguishing feature on products present themselves as their producers) can be held liable for damages caused by defective AV. However, unlike with new regulatory framework liability does not extend to software providers and software updates. Furthermore, since the definition of damage has been expanded possible damage caused by the AV will be wider in scope once when the provisions of the new Directive became applicable. Analysis concludes that if the damages are caused by the fully autonomous AV operating on level 5 product is to be considered defective both under the provisions of the new and old Directive. Standard for defectiveness of AV will be harder to determine for level 4 or lower levels classified under the system created by the Society of Automotive Engineers.

The case-law of the Court of Justice of the EU will have to be adjusted to new regulatory framework. The CJEU rule from the *Boston Scientific Medizintechnik* joined cases that when products belonging to the same group or forming part of the same production series have a potential defect, an individual product of such series may be classified as defective without there being any need to establish that this product has such a defect, will have to be revised when it comes to damages caused by the AV operating under level 5. Reason for that is that autonomous driving vehicles operating on the level 5 have integrated AI systems that generate autonomous solutions differentiated form other vehicles of the same type or product series. Thus, liability for damages caused by a particular AV does not have to relate to the same group or the same production series.

The research also explores interconnectedness of the product liability regime with the new EU AI Act that has been enacted in 2024. Conclusion here is that EU AI Act will be applicable to operation of autonomous driving vehicles to certain extent. The EU AI Act expressly stipulates that AI systems in two or three-wheel vehicles and quadricycles and agricultural and forestry vehicles intended to be used as a safety component of a product, or is itself a product, are deemed as high risk. Thus, specific requirements and conformity assessments for high risks AI systems under EU AI Act will be applicable to these vehicles in the future if they operate on the levels 5 and 4 of autonomy. When it comes to other AV applicability of EU AI Act is dependable on the specific characteristics of the AI system used by AV. It has to be examined on the case-to-case basis bearing in mind that AI systems assisting AV generate autonomous solutions differentiated even form other AV's. Unconformity of AI system used by AV with the provisions of the EU AI Act will lead to the conclusion that vehicle concerned is defective product. General conclusion is that EU AI Act and new product liability regime are intrinsically interconnected when it comes to the liability for the damages caused by use of autonomous driving vehicles.

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