Pojazdy autonomiczne jako wyzwanie dla polityki transportowej Unii Europejskiej

Streszczenie

Artykuł odnosi się do zjawiska obecności pojazdów autonomicznych w polityce transportowej Unii Europejskiej. Ich wykorzystanie w praktyce oznacza potrzebę wdrożenia nowych rozwiązań zarówno w sferze technologii, prawa, ekonomii oraz polityki. Unia Europejska podejmuje różnorodne działania, aby przygotować państwa członkowskie do autonomicznej rewolucji. Celem artykułu jest zarówno konceptualizacja podstawowych problemów, które mogą być przedmiotem badań w zakresie tematyki pojazdów autonomicznych, jak również analiza stanowiska i strategii Unii Europejskiej wobec transportu autonomicznego. W artykule wykorzystano metodę decyzyjną. Wśród ustaleń badawczych należy wskazać, iż UE – jako organizacja międzynarodowa – jest otwarta i przygotowana, aby skutecznie stawić czoła wyzwaniom związanym z wdrażaniem transportu autonomicznego. Podejmuje ona efektywne działania, aby koordynować aplikację nowych rozwiązań na poziomie narodowym (w państwach członkowskich) oraz na poziomie ponadnarodowym. W ten sposób sektor transportowy ma szansę na dynamiczny rozwój i utrzymanie swojej znaczącej pozycji jako kluczowego działu gospodarki Unii Europejskiej. Wdrażanie innowacyjnych rozwiązań w zakresie transportu stanowi *conditio sine qua non* przyszłości tego sektora.

Słowa kluczowe: *pojazdy autonomiczne, polityka transportowa, sztuczna inteligencja, Unia Europejska, innowacyjność, zarządzanie wielopoziomowe*

Abstract

The article refers to the phenomenon of autonomous vehicles in the transport policy of the European Union. Their use in practice results in the need to implement new solutions in the fields of technology, law, economics and politics. The European Union is taking various steps to prepare the Member States for an autonomous revolution. The aim of the article is to conceptualise the basic problems that can be investigated in the subject matter of autonomous vehicles as well as to analyse the position and strategy of the European Union towards autonomous transport. The article uses the decision method. Among the research findings, it should be pointed out that the EU as an international organisation is open and prepared to address the challenges posed by the implementation of autonomous transport. It takes effective action to coordinate the application of new solutions at the national level (in the Member States) as well as at the transnational level. In this way, the transport sector has the chance to dynamically develop and maintain its prominent position as a key sector of the EU economy. The implementation of innovative transport solutions is a *conditio sine qua non* for the future of this sector.

Key words: *autonomous vehicles, transport policy, artificial intelligence, deep learning, European Union, innovation, multi-level governance*

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Autonomous vehicles as a challenge for the transport policy of the European Union

Autonomous vehicles are a relatively new phenomenon in the transport policy in the world. Work on solutions that eliminate people or reduce their participation in driving a vehicle is becoming increasingly promising from year to year. New technologies in the area of the so-called deep learning are an important factor (LeCun, Bengio, Hinton 2015: p. 436–444). Instead of programming the machine to behave in a certain way in a given situation, tools are created so that it could structure the environment itself (Girshick, Donahue, Darrell, Malik 2014: p. 580–587). These tools are computer-simulated neural networks, thanks to which machines learn the environment, analogically to a child who, from its birth, recognises the surrounding world with all its senses (Bottou 2014: p. 133–149). Automotive companies (e.g. Tesla, Daimler, Audi, Renault, Volvo, Continental) and companies representing the new technologies sector (Google, Valeo, Innoulce) are working on artificial intelligence, which will improve the technology of autonomous vehicles. This is important for both the European Union member states, as well as the US, Japan and other highly developed economies of the world.

Its use is a challenge not only from the point of view of technology, but also from a legal, economic, social and political perspective. It is important to cooperate properly in the above areas so that technology and changes in the field of law and policy facilitate the introduction of new solutions (Martino 1983). The most modern technology, without any support in the form of legislation and understanding from the

politicians who create the rules of the game, may prove to be of little use. Diagnosis of these problems, their analysis and understanding will allow for the preparation of appropriate legal and political solutions. The future of the European Union as the innovation leader on the regional and global scale will depend on them.

The aim of the article is conceptualisation of the most important research problems and analysis of the EU's position regarding new challenges in transport policy (in the context of the promotion of autonomous vehicles). This technology is becoming cheaper and, consequently, more accessible to a wider range of vehicle and consumer manufacturers, i.e. users of autonomous solutions. Innovativeness of technology forces in some way application of new solutions in transport policy in order to ensure full coherence between technical progress and legal regulations. It is a task to be implemented at both the EU and national level.

The basic hypothesis of the article is: popularisation of technological solutions in the field of autonomic transport sets new directions for innovative action of the transport policy of the European Union.

The issue of transport is popular in science, both in the area of exact sciences as well as in the field of social sciences. The exact sciences focus mainly on technical problems related to increasing transport efficiency, reducing emissions, introducing new technological solutions. In social sciences, transport is analysed mainly through the prism of its importance for the man and the economy. Special attention should be paid to the scientific work of researchers from the University of Gdańsk, in particular: Jan Burnewicz, Krystyna Wojewódzka-Król; Gdynia Maritime University: Andrzej Grzelakowski, Maciej Matczak, or University of Szczecin: Waldemar Grzywacz. These studies contribute – undoubtedly – to a better understanding of the problems of economics and the organisation of transport, logistics and supply chain management.

This article refers to a new phenomenon in the area of transport policy – autonomous vehicles. Scientific progress has been systematically taking place in this area over many decades, but in recent years work on the autonomy of transport has gained a decisive acceleration, which necessitates political adjustments.

In the context of methodology, the decision method will be used (Chodubski 2004: p. 114–133; Tomaszewski 2010: p. 129–130), which seems to be the optimal research tool to analyse innovative changes taking place in transport policy due to the technological advancement. This will allow us to reflect both in the subject area (who

is interested in changes in transport policy and why?), as well as in decision-making processes understood as a set of causal links leading to the adoption of specific policy solutions within the European Union. The issue of implementation of the decisions made will as also important, i.e. the analysis of the selection of appropriate methods and measures that will allow to effectively introduce autonomous vehicles for general use (see Chmaj, Żmigrodzki 1996: p. 47–48).

Autonomous vehicles – analytical perspectives and research problems

The theoretical principles of artificial intelligence have been known since the 1970s (Nilsson 1980: p. 1–8), but over the past few years, computer processors have become so efficient that they are able to effectively process a significant amount of data. It was a conditio sine qua non for the efficient development of autonomous transport, because the vehicle moving on the road should recognise in a real time various dangers and obstacles and effectively respond to them. Until a computer system of artificial neurons distinguishes pedestrians from cars or trees, it needs a specific training. For this purpose, images are uploaded, on which IT specialists have previously manually classified individual objects. If the computer was trained long enough, i.e. it saw many pedestrian objects, it will be able to recognise people on new photographs (Mnih et al., 2015: p. 529). The rule is that the longer the training, the more accurate the algorithm, and thus, the vehicle will move more safely on the road.

From the point of view of transport policy, the search for solutions that limit the role of man seems to be very much needed. In this way, you can, among other things: reduce the risk of fatal accidents (see table below), the number of victims (as a consequence, reduce the costs of rehabilitation and compensation), and transport costs on a large scale (by introducing autonomous convoys).

The European Union has been looking for such solutions for many years, which is evident, for example, in the arguments presented in subsequent documents of the European Commission, including: *White Paper Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system* (European Commission 2011); Communication: *Europe on the move. An agenda for a socially fair transition towards clean, competitive and connected mobility for all* (European Commission 2017) or Communication: *5G for Europe Action Plan* (European Commission 2016).

Table 1. Road accidents in 1990–2014 (taking into account serious injuries)

							1 000	%
	1990	1995	2000	2005	2010	2013	2014	Change '13/'14
EU-28	1 502.08	1 433.020	1 505.653	1 341.981	1 130.398	1 055.358	1 080.756	2.4
BE	62.446	50.744	49.065	49.307	40.569	35.632	41.481	16.4
BG	6.478	7.735	6.886	8.244	6.610	7.016	7.015	0.0
CZ	21.910	28.746	25.445	25.239	19.675	20.342	21.054	3.5
DK	9.155	8.373	7.346	5.413	3.498	2.985	2.881	-3.5
DE	389.350	388.003	382.949	336.618	288.297	291.105	302.435	3.9
EE	2.099	1.644	1.504	2.341	1.347	1.382	1.436	3.9
IE	6.067	8.117	7.749	6.533	5.779	4.976	5.405	8.6
EL	19.609	22.798	23.001	16.914	15.032	12.109	11.690	-3.5
ES	101.507	83.356	101.729	91.187	85.503	89.519	91.570	2.3
FR	162.573	132.949	121.223	84.525	67.288	56.812	58.191	2.4
HR	14.471	12.668	14.430	15.679	13.274	11.228	10.323	-8.1
IT	161.782	182.761	256.761	240.011	212.997	181.660	177.031	-2.5
CY	3.172	3.052	2.411	1.382	1.198	0.774	0.758	-2.1
LV	4.325	4.056	4.482	9.310	3.193	3.489	3.728	6.9
LT	5.135	4.144	5.807	6.772	3.530	3.391	3.256	-4.0
LU	1.216	1.145	0.899	0.775	0.787	0.949	0.908	-4.3
HU	27.801	19.817	17.493	20.777	16.308	15.691	15.847	1.0
MT	0.238	0.969	1.253	0.848	0.577	1.208	1.449	20.0
NL	44.892	42.641	42.271	27.007	10.778	9.522	13.358	40.3
AT	46.338	38.956	42.126	40.896	35.348	38.502	37.957	-1.4
PL	50.532	56.904	57.331	48.100	38.832	35.847	34.970	-2.4
PT	45.110	48.339	44.463	370.66	35.426	30.339	30.604	0.9
RO	9.708	9.119	7.889	19.819	25.995	24.827	25.355	2.1
SI	5.177	6.567	8.951	10.509	7.659	6.568	6.168	-6.1
SK	8.236	8.713	7.884	7.903	8.119	4.729	5.064	7.1
FI	10.175	7.812	6.633	7.020	6.072	5.334	5.324	-0.2
SE	16.975	15.626	15.770	18.094	16.627	14.942	13.091	-12.4
UK	265.600	237.336	242.117	203.712	160.080	144.480	152.407	5.5
AL		0.399	0.428	0.853	1.564	2.075	1.914	-7.8
ME					9.138	5.264	5.531	5.1
MK	2.300	2.436	1.667	2.821	4.223	4.230	3.852	-8.9
RS					14.179	13.043	13.638	4.6
TR	55.771	66.029	75.201	87.273	116.804	161.306	168.512	4.5
IS	0.564	1.057	0.979	0.671	0.876	0.808	0.805	-0.4
NO	8.801	8.625	8.440	8.078	6.434	5.241	4.972	-5.1
CH	23.834	23.030	23.737	21.706	19.609	17.473	17.803	1.9

Source: Statistical Pocketbook 2016: p. 108.

New technologies pose a serious challenge for politicians at European and national level, especially in the context of introducing adequate provisions that will respond to changing social needs (Bonaccio, Dalal 2006: p. 127). Bearing in mind the above, it seems particularly important to: forecasting of economic changes, the law-making process and – in the sociological dimension – the analysis of the per-

ception of society, that is attitudes (positive or negative) towards new technological solutions.

Preparing for the future, it is necessary to effectively and quickly perform the operationalisation of key research areas, through which appropriate analytical actions will be taken:

- in the area of legislation – it is necessary to verify existing legal solutions (at the level of Member States and the European Union) in terms of their modification or updating (Hix 2013: p. 429–450). The legal systems of individual countries allow the use of autonomous vehicles (or solutions in the field of autonomous transport) to a greater or lesser extent. Do their owners have the right to use the functionality of all on-board devices (especially autonomous), if their use is unacceptable in the country to which they travel, although in the country where they bought the car – is it completely legal?

  Another research task consists in the comparative analysis of legal solutions adopted outside the EU, e.g. in the US or Japan, where autonomous vehicles are becoming more and more popular and automotive companies are working towards further development of these systems. The exegesis of current and planned legislation could, in principle, help to improve the law-making process in the area of European Union transport policy.
- in the social area – a detailed and comprehensive analysis of social perception in relation to new technologies (autonomous vehicles) is needed. For example, in the 2017 Eurobarometer survey, two-thirds of respondents confirmed that the latest digital technologies have a positive impact on society, the economy and their own lives. This shows the openness of citizens to new technology. At the same time, it should be emphasised that the majority of respondents were of the opinion that the EU, Member State authorities and enterprises must take action regarding raised issues related to digitisation (Eurobarometer 2017). This means that the public perceives the need for the presence of public authorities in this area of life and the necessity of its systematic ordering so that technology serves progress and at the same time is friendly and safe for users.

  With this kind of suggestion in mind, it would be crucial to carry out further research in the Member States to determine the level of public support for such solutions.

  Another area of analysis should cover security problems of implemented technologies for people and the potential scope of responsibility for possible road

incidents that may occur in the case of using autonomous transport means. The question arises as to whether responsibility in such situations would be on the side of computer programmers, car manufacturers, the owner of the vehicle, or the entity managing the intelligent infrastructure.

The next area of analysis covers the issues of personal data protection in modern technologies in transport systems. Vehicles communicate with each other, connect with infrastructure elements. In this way, users leave electronic traces that can be used by both private entities and state institutions. The collection of this type of data should be strictly regulated as they concern citizens and their mobility.

- in the area of economy – autonomous transport is an opportunity for the economy, but also a challenge. Therefore, it seems crucial to start a research reflection on the changes that should be initiated in the economy for a more effective use of new technologies, in particular:

a. What support instruments should be used to strengthen the innovation potential at the national and EU level?
b. How to support start-up companies dealing with autonomous vehicles?
c. How to modify the employee education system for the autonomous transport sector (preparation for the profession: IT specialists, programmers, engineers responsible for creating the infrastructure)?

An important challenge consists also in forecasting economic development and economic change in terms of the use of autonomous vehicle technologies (SWD 2017b). The problem of predetermination, or thinking about tomorrow with the "today" category is a challenge for any forecast (Mintzberg 1994: p. 221–225). Meanwhile, the phenomenon of autonomic transport develops with such dynamics and to such an extent that it is difficult to prepare an accurate forecast (or scenario) based on current data.

– in the area of infrastructure – it is generally in the sphere of economy, however, due to the nature of the challenges associated with the use of autonomous transport technology, it seems justified to separate it in the form of a separate analytical category (Wojewódzka-Król 2006: p. 44–49).

Bearing in mind the infrastructure, it is important to undertake an analysis regarding the possibility of introducing special lanes for autonomous transport. In this way, it is possible to separate traditional systems based on human participation, from autonomous systems, and thus to reduce potential security risks.

Another challenge in this area is the mere understanding and perception of "infrastructure". In the era of autonomous transport, it should be understood more broadly than only in the context of the transport corridor. It is also composed of IT networks operating for autonomous transport (telecommunications networks, power grids, charging stations for electric vehicles). Appropriate modernisations in this area are a conditio sine qua non for effective use of new solutions.

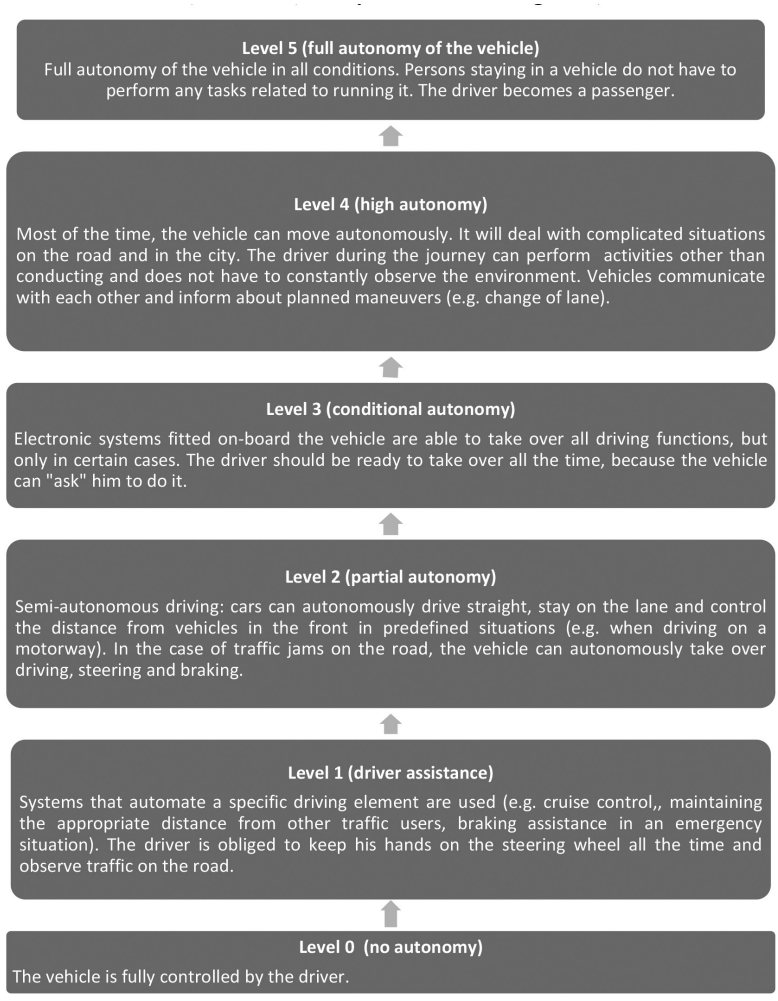
The problem of intelligent infrastructure is also a part of the functioning of smart cities. Autonomous vehicles will be in the future a key element of the urban communication network, hence the importance of designing cities to take into account the future needs of autonomous transport.

The analysis of these areas and the diagnosis of problems are not – in fact – exhaustive. It is rather an attempt to critically look at the new issue from the political perspective in order to conceptualise the most important directions of research and to indicate the de lege ferenda recommendation. In conclusion, it should be emphasised that:

- conducting research on autonomous transport requires an interdisciplinary approach. This kind of research perspective seems indispensable. The use of the technological potential that scientists are working on in the field of exact sciences will be possible only when full synergy with researchers in the area of social sciences is ensured. Autonomous transport is undoubtedly a special case of research, where the boundary between technical and social is extremely fluid;
- it is necessary to introduce an appropriate legal framework for fully exploiting the potential of new technologies. Without appropriate regulatory instruments, it will not be possible not only to implement new technologies, but also legally use them. When talking about autonomous vehicles, it should be remembered that they are de facto different in terms of the level of autonomy. In order to determine the degree of autonomous driving, a multi-level scale is most often used (NHTSA 2018; SAE 2014): from simple solutions supporting single operations (level 1) to unmanned driving, where the driver is actually a passenger and does not interfere with the operation of on-board systems, and his role is limited to indicating the destination (level 5).
- An important element in the success of the "autonomous" revolution is to provide social support for it. Citizens (at the national and supranational level)

will accept new solutions only on the condition of having full confidence in their security. Convincing society to such solutions is connected – in turn – with the need to create clear rules of criminal responsibility in the event of any anomalies related to the functioning of autonomous systems. Citizens will be willing to accept new solutions in a situation when there will be full clarity on who and to what extent is responsible for their implementation and functioning.

Scheme 1: Vehicle autonomy scale – by NHTSA (National Highway Traffic Safety Administration, USA) and SAE (Society of Automotive Engineers)



Source: own study based on NHTSA 2018 and SAE 2014.

To sum up, the problem of autonomous vehicles requires an interdisciplinary view, which will include not only technological but also legislative, economic and social issues.

Autonomous transport in the political narrative of the European Union

The subject of transport is an issue that has been present in the European Union for many years. Contemporary legal bases of EU transport policy have been included in the provisions of the Treaty on the Functioning of the European Union (TFEU). They can be divided into two categories: dispersed rules (applicable to transport issues) and integrated provisions, included in Title VI: *Transport*. With regard to the dispersed provisions, particular importance should be attached to Art. 4 TFEU, which indicates that the field of transport is a competence shared between the Union and the Member States. The provisions of Title XVI: *Trans-European networks*, are relevant to transport policy, in particular Art. 170 TFEU, which states that "the Union contributes to the establishment and development of trans-European networks in transport infrastructures".

When discussing the problems of autonomous vehicles, it is impossible not to mention the provisions of the TFEU, contained in Title XIX: *Research and technological development and space.* Art. 179 point 1 states that "the Union shall have the objective of strengthening its scientific and technological bases by achieving a European research area in which researchers, scientific knowledge and technology circulate freely, and encouraging it to become more competitive [...], while promoting all the research activities deemed necessary by virtue of other Chapters of the Treaties". Additionally, in Art. 180 TFEU it was added that "in pursuing these objectives, the Union shall carry out the following activities, complementing the activities carried out in the Member States: (a) implementation of research, technological development and demonstration programmes, by promoting cooperation with and between undertakings, research centres and universities; (b) promotion of cooperation in the field of Union research, technological development and demonstration with third countries and international organisations; (c) dissemination and optimisation of the results of activities in Union research, technological development and demonstration". The treaty also states that "the Union and the Member States shall coordinate their research and technological development activities so as to ensure that national policies and Union policy are mutually consistent" (TFEU: Art. 181, point 1).

Summing up the above, it can be concluded that the provisions on EU transport policy and trans-European networks, in combination with regulations in the field of research and technological development, provide the necessary legislative base that undoubtedly promotes the effective development of autonomous transport technologies in practice. The specification of many problems has also been reflected in numerous secondary legislation.

Moving to the analysis of priorities and tasks in the area of transport, it should be admitted that they changed depending on the stage of the integration process (Maryl 2010: p. 59–61). In recent years, the priority importance has been attributed to the innovation of transport and reducing its negative impact on the environment. According to the European Commission's 2017 economic assessment, mobility is currently the largest economic sector in the world. Over 11 million people are employed in the EU transport and storage sector, which accounts for over 5% of total employment (Eurostat 2016) and corresponds to almost 5% of the EU's gross domestic product (Eurostat 2014). The sector is responsible for around 20% of EU exports to the EU's main trading partners. Road transport is the main mode of transport in the EU, bringing together almost half of all freight transport (almost three-quarters of which is by land transport) (Statistical Pocketbook 2016). The sector is also crucial for citizens who spend an average of almost 10 hours a week using transport. They cover an average of 34.7 km per day, devoting around 13% of all consumption expenditure to items related to transport (IPSOS – BCG 2017).

The analysis of the data encourages a deeper reflection on the transport sector. One of the topics related to the challenges for the future, apart from the economics of transport and security, is undoubtedly the issue of "the revolution in the field of digital mobility". This is how the European Commission defines the phenomenon of the autonomy of transport and a number of processes correlated with this issue. The quality of connection networks and social media are changing the traditional concept of mobility (European Commission 2016). New business models are emerging, through which innovative mobility services are developing, including new Internet platforms for carrying out operations related to the transport of goods, organising carpooling or offering car or bike sharing services or applications for smartphones that offer real-time analysis and data on traffic conditions (European Commission 2016a; European Commission 2016b).

Vehicles evolve under the influence of digital technologies. Thanks to the availability of on-board cooperating services connected to the network and a greater degree of

automation, they are becoming more and more intelligent. The European Commission recognises that autonomous vehicles will have to function based on secure two-way data transfer with other vehicles and with road infrastructure. This will require building a network with high performance and stability to allow simultaneous data exchange between millions of vehicles. Therefore, it seems appropriate to emphasise the need for investment in new infrastructure solutions. Fully automated driving will require new telecommunications and satellite infrastructure as well as services in the field of positioning and communication between vehicles. The fifth generation mobile network (5G) and Galileo services offer a significant opportunity to meet these needs (European Commission 2016b). Autonomous driving and ecologically clean vehicles will require integrated planning and adequate infrastructure investments to equip roads with the necessary telecommunications and charging network (e.g. for electric cars) and provide a high standard of road data (e.g. high resolution digital maps) and fully interoperable on-board devices.

The objective of the European Union's prospective activities is to build a system of clean, competitive and network-based mobility within 2025, under which all means of transport will be integrated. This system must extend on the entire Union and connect it with its neighbours and the world. It should enable users to travel comfortably within and between cities and rural areas, while ensuring that the connection is maintained. The system must also be based on a sector that is a global leader in the production and provision of services (Huez, Jany-Roskova, Rabinovici 2012: p. 182)

The key to achieving these goals seems to consist in the fact that the European Commission sees the need for an integrated approach at EU, national, regional and local levels, covering many different policy areas (Maryl 2010: p. 66–67). This means that the concept of multi-level governance would be synergistically combined with postulates of interdisciplinary looking at the development of this sector of the economy (Ruszkowski 2010: p. 262).

Achieving the assumed results will require, it seems, to prepare a targeted set of common rules and standards containing a number of supporting measures (Finger, Holvad, 2013: p. 9). These include infrastructure investments, research and innovation projects, cross-border research on interoperable deployments and cooperation platforms between stakeholders.

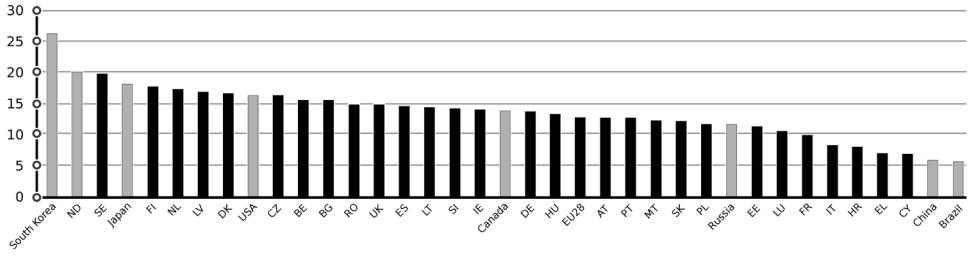
The issue of autonomous transport in the European Union is no longer a matter of the future, but it is an important challenge for the current policy in the context of

shaping new political solutions. The narrative of the European Commission in this area is as optimistic as it is realistic. In its diagnoses, it recognises the importance of the sector to the economy and the emergence of new global trends, which should be tackled in an interdisciplinary way and in line with the spirit of multi-level governance. It also indicates the need for specific actions, mainly in the area of developing the trans-European smart infrastructure.

Autonomous vehicles – challenges and realities of the European Union

Despite the support from the European Union and the involvement of Member States in improving and popularising autonomous transport, activities in this area are quite complicated. It results from differences between Member States in terms of levels of automation and new generation communication technologies (see figure below).

Figure 1. The average speed of a broadband connection (Mbps) in 2017 (EU and selected countries of the world).



Source: Akamai – Q3, 2016 for SWD 2017b: page 27.

For example, in most countries it is only possible to operate driver assistance systems while driving. Meanwhile, in Germany since 2016, new regulations apply that authorise the use of technical vehicle control systems, if a person is able to take control at any time (Straßenverkehrsgesetz 2017). The driver cannot therefore concentrate entirely on an activity other than driving, but he can legally use the phone or other mobile devices available on board. The law also provides for the possibility of a black box

where data is stored about who and when travelled by the vehicle. Manufacturers from the automotive sector can therefore implement new technological solutions that are fully compatible with German law.

Large-scale studies on open roads are another problem that is difficult to effectively operate. They are essential for achieving technological advances, foster cooperation between different actors and facilitate public acceptance. In the letter of intent signed on 23 March 2017 regarding driving vehicles connected to the network and fully automated, EU Member States, Norway and Switzerland have committed to strengthening cooperation on cross-border sections, on travel routes or in corridors to be subject to testing, testing and large-scale demonstrations in the field of road safety, data access, quality and responsibility (European Commission 2017: p. 15).

The implementation of the European Union's priorities requires making appropriate analyses in the context of the possibilities of their implementation. Taking the above into consideration, it seems crucial:

- to define general safety requirements for passenger cars, trucks and buses defined in the type approval, with a view to a possible increase in safety standards (Regulation 661/2009);
- to analyse the rules on the safety of road infrastructure and tunnels that are applicable in the context of the trans-European transport network in order to assess whether the level of safety should be increased **(Directive 2004/54/EC)**;
- to develop solutions for data sharing and ownership rules that are extremely important for the development of automated driving (European Commission 2017a; SWD 2017a);
- to prepare interoperable intelligent transport systems so that autonomous vehicles can communicate directly with each other, as well as with traffic lights, road infrastructure and other transport users (European Commission 2017a);
- to improve cyber security and data protection, which is of paramount importance in terms of both operational efficiency and public acceptance of new communication technologies.

The European Commission has set up a special working group called GEAR 2030 (European Commission 2015) the task of which is to develop recommendations for the future regulatory framework of the automotive sector. A recommendation on autonomous vehicles which are to appear by 2020 was one of the first results of its work. The introduction of such vehicles on the EU market is possible under the applicable

EU type-approval framework by assessing the ad hoc safety of the vehicle. The next stage to which we should prepare consists in higher levels of automation in relation to vehicles designed up to 2030 (GEAR 2017).

In addition, under the C-ROADS platform, Member States are working together to jointly implement collaborative intelligent transport systems (SWD 2017a). This platform aims to ensure interoperability by defining common technical specifications and cross-border research.

Conclusion

The issue of implementation of autonomous vehicles for autonomous use is a new and innovative issue, both on the European Union's as well as on a global scale. The global importance of this issue is demonstrated by the fact that the UN Economic Commission for Europe, in cooperation with the EU Member States and the Commission, undertakes joint work at the international level in the field of implementing such solutions in everyday life.

The implementation of scientific research in this area can be an important impulse for the development of technology, while at the same time can enable the elimination of legal and political barriers in the Member States (European Commission 2017). Effective management of new technologies in the field of transport, however, requires an interdisciplinary approach and a comprehensive analysis of potential problems (Burnewicz, Bąk 2013: p. 83–87), which may appear in the process of introducing autonomous vehicles for public use.

Interdisciplinary approach is necessary due to the complexity of the problem. It cannot be limited only to the sphere of technology, but should be seen in a broader economic and social context. New technologies require social acceptance and an adequate level of education, so that this peculiar technological revolution can proceed in a harmonious and natural manner, in accordance with the principles of security and respect for citizens' right to privacy.

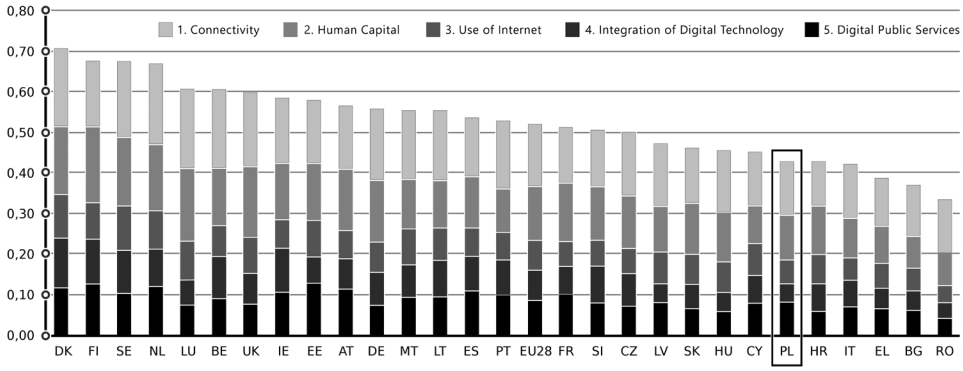
Comprehensive analysis of problems is connected, in turn, with the need for thoughtful designing of the future in order to avoid the risk of predetermining (thinking about tomorrow's issues using categories known today) and eliminating errors resulting primarily from the lack of coordination of actions at the supranational level or excessive haste in the implementation of technology without their full refinement (Grzywacz 2006: p. 19).

In conclusion, it is worth referring to the main hypothesis presented in the introduction to this article. Autonomous transport is certainly a difficult challenge for the European Union and the Member States and enforces the need to take innovative actions and tackle new complex problems (e.g. protection of personal data of users of intelligent transport infrastructure). If the European Union intends to subscribe to global trends in this area, if it strives to maintain the status of an innovative economy, it must be ready to adopt new technological solutions and to implement them safely in the Member States.

An analysis of current EU activities in this area indicates that there is full awareness of the challenges as well as the existing difficulties. Specific projects are being undertaken to prepare Member States for cooperation. These include the issues of developing an appropriate strategic framework, designing legal solutions and creating a technological architecture for autonomous transport.

Does the European Union have a chance of success in this area? The answer to this question seems ambiguous. The diversity of Member States, especially with regard to the level of technological development, may be the main obstacle to effective action.

Figure 2. Digital Economy and Society Index (DESI) 2017 ranking[1]



Source: SWD (2017b), European Digital Progress Report

The states that are the vanguard in this area certainly include countries that have strong motoring traditions (e.g. Germany, Sweden, France), as well as advanced internet of things and extended digital systems in the economy (SWD 2017b). These

[1] The Digital Economy Society Index (DESI) is a composite index that summarises relevant indicators on Europe's digital performance and tracks the progress of EU Member States in digital competitiveness.

countries can also gain the most, because modern technologies are an important element of the impact on the domestic economic situation (e.g. by stimulating development) (Gawlikowska-Fyk 2017).

The remaining participants of the European integration process are also open to new solutions, but these will require financial outlays for the development of modern infrastructure and the development of autonomous transport systems, which requires considerable motivation from the national governments. They must convince citizens that autonomous transport is as important as other issues that need to be resolved within the framework of current political and economic life. This can be a difficult test for autonomous vehicles and ambitious goals that the European Commission puts before them in the context of the future transport policy.

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