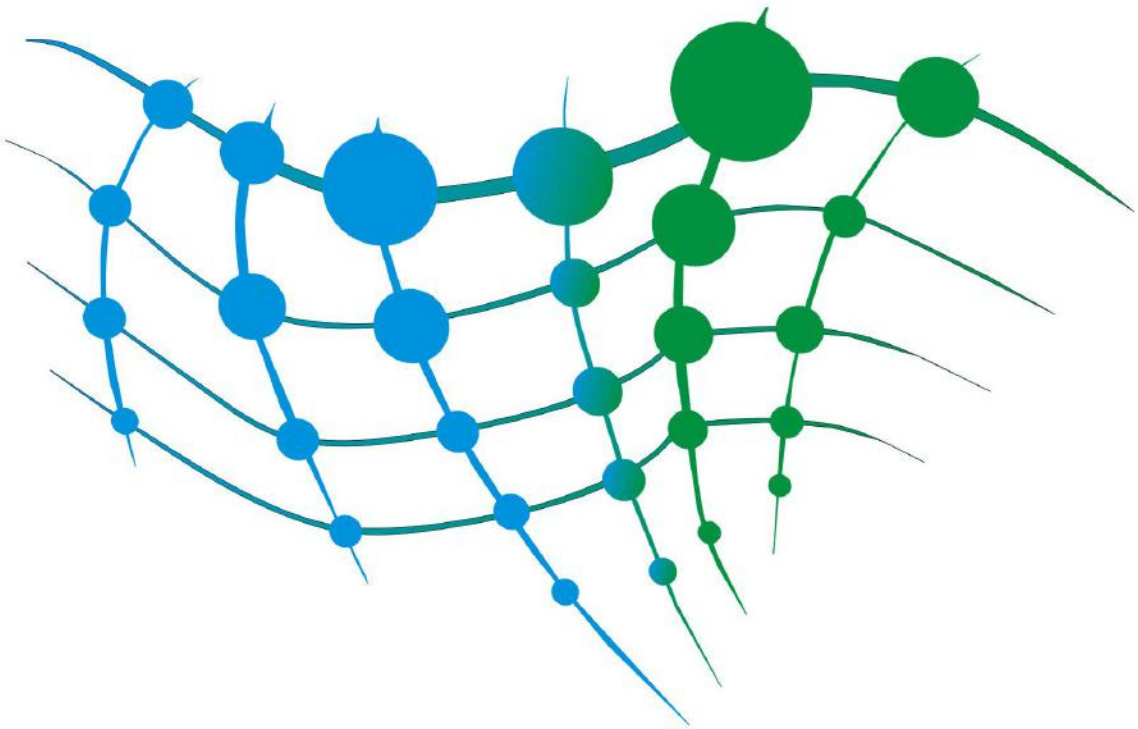
2023
SEMI-ANNUAL
Vol. 3
No. 2

ISSN 2720-2682

GIS Odyssey Journal

Previously: Conference proceedings (GIS Odyssey)



SILGIS Association

Croatian-Polish
Scientific Network

Vol. 3 No. 2 (2023): GIS Odyssey Journal

DOI: https://doi.org/10.57599/gisoj

The electronic version of the journal is the primary one.

The articles published in the “GIS Odyssey Journal” have been given a favourable opinion by the reviewers designated by the Editorial Board.

Cover designer: Assist. Prof. Anna Żemła-Siesicka Ph.D., University of Silesia in Katowice, Poland
Technical support: Assist. Prof. Krzysztof Świtała, Ph.D., Cardinal Stefan Wyszyński University in Warsaw, Poland

ISSN 2720-2682 (on-line)

Publisher: SILGIS Association, Będzińska Street 39/401, 41-200 Sosnowiec
tel. +48 32 3689716, e-mail: silgis@us.edu.pl, www.silgis.us.edu.pl
Co-publisher: Croatian-Polish Scientific Network, e-mail: cpsn@us.edu.pl, www.cpsn.us.edu.pl

Contact: gisjournal.us.edu.pl, www.us.edu.pl

Articles:

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.5

Srećko Favro[1], Dora Mužinić[2]

IMPROVEMENT OF PORT INFRASTRUCTURE ON CROATIAN ISLANDS USING EU FUNDS – THE ISLAND OF BRAČ, THE PORT OF BOL

Abstract: Bol is located on the island of Brač, therefore connecting Bol with the mainland or with the national road network is extremely important both for tourism and for the economy as a whole. Port Bol belongs to the ports of county significance and is managed by the Port Authority of Split-Dalmatia. In the town of Bol on Brač, there is a port open to public passenger traffic that connects the island of Brač with the mainland and the ports of the other islands. The existing port is characterized by limited capacity, dilapidation, and inadequate construction considering the demand of maritime traffic in the port. This paper will present the expansion of the port of Bol open to public traffic in order to create a high-quality harbor pier for public traffic, which would relieve the traffic burden of the city of Bol and the municipality of Bol and provide the local population with quality public transportation, which is currently not available, with as little as possible impact on the environment. The purpose of the project is not to make money, but to create content that will improve the quality of life of the local population and keep them in Bol in order to reduce the tendency of the "island dying". The local population is the main driver of the city's development and life. In order to improve the demographic picture, it is necessary to provide the local population with quality primary conditions for life and progress.

Keywords: economic development, Croatia, Island of Brač, Adriatic Sea, port

Received: 12 September 2023; accepted: 27 November 2023

[1] University of Split, Faculty of Economics, Business and Tourism, Department of Tourism, Split, Croatia, ORCID ID: http://orcid.org/0000-0002-9876-752X, email: srecko.favro@adriatic-expert.hr
[2] University of Split, Faculty of Economics, Business and Tourism, Department of Business Economy, Split, ORCID ID: http://orcid.org/0000-0002-0372-4229, email: doramuzinic@gmail.com

Introduction with analysis of the state of the problems

The municipality of Bol is located on the southern slopes of the island of Brač, in the central part of the coast, occupying 24.85 km^2 (Strategija razvoja Općine Bol, 2014, p. 9) with a population of 1,678 inhabitants according to 2021 census. In terms of the number of inhabitants, the municipality of Bol is one of the medium-sized municipalities on the island of Brač. The municipality has two settlements: Bol with 1,656 inhabitants and Murvica settlement with 22 inhabitants. Given that Bol is located on an island, connecting Bol with the mainland or with the national road network is extremely important both for tourism and for the economy as a whole. Bol is connected to island settlements by relatively good roads. In connection with the mainland, Bol is connected to Split by ferry via Supetar, then by ferry via the port in Sumartin, and also by sea with a catamaran to the island of Hvar. Brač has about 150 km of good roads that connect all settlements and all natural and cultural monument areas. By air, Bol is connected to airports in Croatia and Europe.

In the town of Bol on Brač, there is a port open to public passenger traffic that connects the island of Brač with the mainland and the ports of other islands. The existing port is characterized by limited capacity, dilapidation and inadequate construction considering the demand of maritime traffic in the port. The port of Bol has year-round direct lines and seasonal lines with other ports both on the mainland and on the islands, the lines that include the port of Bol are the following: the only national high-speed line: Jelsa-Bol-Split (Jadrolinija) and the following high-speed lines without public service obligations: Resnik-Bol-Stari Grad and vice versa (Adriatic fast ferries d.o.o.), Resnik-Split-Bol and vice versa (Adriatic fast ferries d.o.o.), Dubrovnik-Korčula-Hvar-Bol-Split and vice versa (MB Kapetan Luka) and Split-Bol- Makarska-Korčula-Sobra-Dubrovnik and vice versa (Jadrolinija) (Red plovidbe, 2023), (Fig. 1).

Considering the number of lines that include the port of Bol and considering that there is a demand for them, the quality of the wharf in the port of Bol does not meet the needs of the local population, making it inadequate and a limiting factor. A high-quality port port for public transport should be built, which will relieve the traffic of the town of Bol and the municipality of Bol and provide the local population with quality public transport, which at the moment is not available. All of the above represent state of problems that arise when we analyze the island and its connections the solution of which would bring a series of positive consequences and modernization of the area of the municipality.

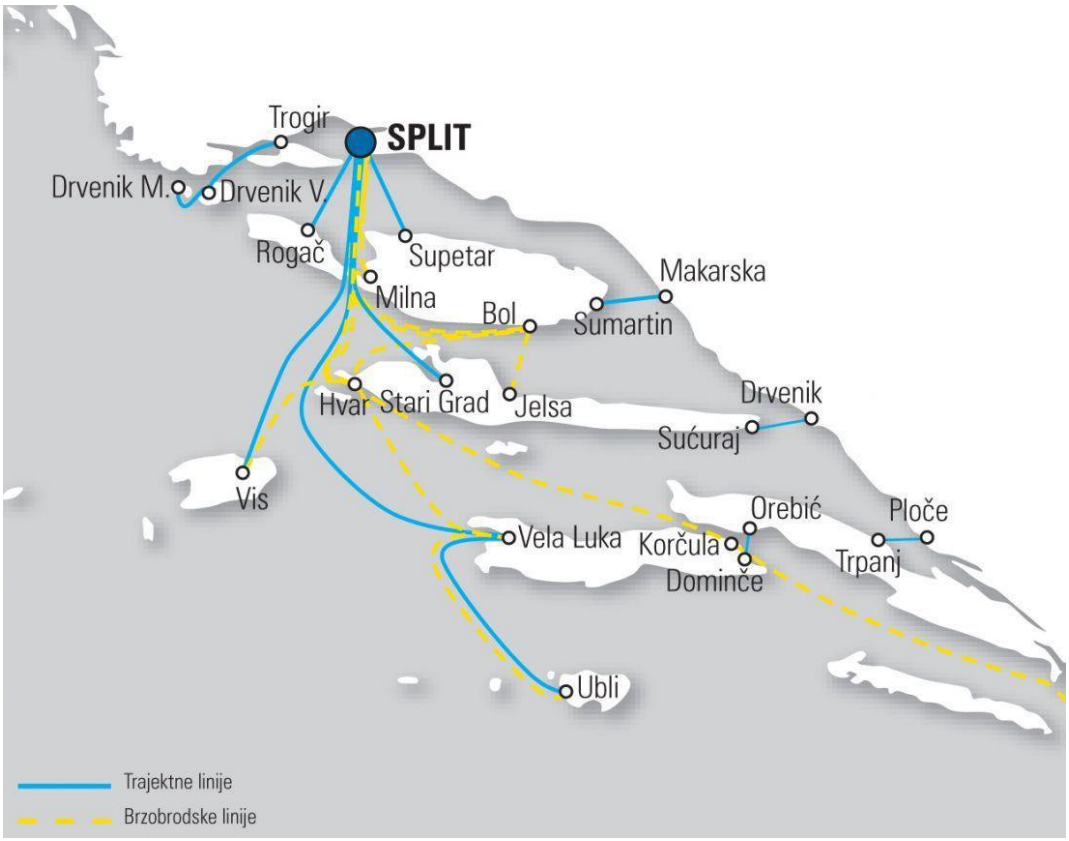


Fig. 1. Transport connection of the island of Brač
Source: Donosimo detaljan red plovidbe Jadrolinije za 2021. godinu.
Splitsko okružije

Material and methods

At the moment, there is no adequate quay in the area of the port of Bol for shipping lines that connect the port of Bol with neighboring ports on the mainland and on the islands, but it is possible in the port development plan. Using direct primary research and analysis of available secondary research data, an attempt will be made to show that there are foundations necessary for collecting funds that will realize the goals of this project with as little impact on the environment as possible, and for the purpose of relieving the city port of the moorings of tourist sailboats for the purpose of building infrastructure intended for the local population. The purpose of the project is not to make a profit, but to create content that will improve the quality of life of the local population and keep them in Bol in order to reduce the tendency of the "island dying". The local population is the main driver of the city's development and life. In order to improve the demographic picture, it is necessary to provide the local population with quality primary conditions for life and progress. Availability of work, education, and medical care must not be the reason for the depopulation of the town of Bol and the municipality of Bol, as well as the island of Brač. Poor quality connection with neighboring ports throughout the year is a key factor that impairs the quality of life and economic prosperity.

Results and discussion – EU opens the door

The accession of the Republic of Croatia to the European Union opened up the possibility of financing development from the instruments of cohesion policy, i.e. the instrument of the European Fund for Regional Development. The financial "weight" of cohesion policy reflects the scale of socio-economic differences within the EU, but also the political significance of cohesion for the project of a united Europe. Additional development funds from the EU level are a way to empower all regions and the population of the EU for the possibility of using all the advantages of the common market of goods, capital, labor and services: a larger market, greater mobility in work and education, a greater choice of services, etc. (The use of new provisions during the programming phase of the European structural and investment funds, 2016).

Cohesion policy instruments is a generic term for: European Regional Development Fund (ERDF), European Social Fund (ESF) and Cohesion Fund.

The Cohesion Fund would be significant for the development of port infrastructure and the environment. The overall framework for the use of EU cohesion policy instruments in the Republic of Croatia in the period from 2014 to 2020 is regulated by the Partnership Agreement between the Republic of Croatia and the European Commission for the use of EU structural and investment funds for growth and jobs in period 2014–2020 (hereinafter: Partnership Agreement). The general goal of the Partnership Agreement is to provide support in bringing the Republic of Croatia closer to other European Union member states, i.e. regions, by accelerating economic growth and encouraging employment (EU funds).

The basic principles of the National Transport Strategy draft, which are relevant in the wider context of EU transport and cohesion policy, are sustainability, availability and social inclusion, change in form of transportation and increased interoperability.

The key objectives of the draft Transport Strategy for Croatia are:

1. improvement of traffic connections and coordination with neighboring countries;
2. improving the availability of transportation for passengers on long distances in Croatia;
3. improvement of regional passenger connectivity in Croatia and promotion of territorial connectivity;
4. improving the availability of transportation for passengers to and within the main urban agglomerations;
5. improving the availability of freight transport in Croatia;
6. improving the organizational and operational structure of the transport system;
7. improving its efficiency and sustainability.

The 7th priority axis refers to traffic in the Operational Program Competitiveness and Cohesion 2014–2020 (OPKK) and marks the continuation of the strategic goals set in the OP "Transport" (2007–2013) modernization of railway infrastructure and system of inland waterways.

Within priority axis 7, the main priorities of ERDF and CF funding for OPKK are as follows:

- increase the level of use and relevance of the railway network (Cohesion Fund);
- improve the TEN-T road network and access to the TEN-T road network (ERDF);
- increase the number of passengers transported in public city transport (Cohesion Fund);
- improved accessibility of Dubrovnik by air (Cohesion Fund);
- improve the accessibility of inhabited islands to residents (Cohesion Fund);
- improve road safety in parts with a high level of mixed traffic (EFRR);
- increase the volume of freight traffic on inland waterways (Cohesion Fund).

According to the operational programs of competitiveness and cohesion, with an emphasis on specific objective 7ii1 Improving the accessibility of inhabited islands for their inhabitants, we can say that this project agrees with the following specified specific objective: "This specific goal aims to integrate the Croatian islands into the wider transport network and overcome a key obstacle to local economic growth. The goal is to gradually provide the islands with sustainable and modern transportation services throughout the year, regardless of the pressure of tourism, and thereby improve the availability of employment, education and other services to island communities".

The activities to be financed must be in accordance with the Strategies and strategic guidelines of the Republic of Croatia. Strategy of maritime development and integral maritime policy of the Republic of Croatia. It enumerates numerous goals for the development of shipping, and for the purposes of this study, we note only a few of the more significant ones, which concern the development of the port of Bol, are in line with the project in question. For example:

1. To achieve self-sustainability of the port system while increasing the efficiency of the system:
   - Reduce the participation of the state in the co-financing of port infrastructure projects;
   - Create more favorable conditions for the investment of private capital in the construction of port infrastructure and specialized port terminals through various forms of public-private partnership;
   - Increase the efficiency and quality of service provision in order to ensure the competitiveness of the traffic direction;
   - To encourage the development of port infrastructure in the function of the development of passenger traffic, primarily through the development of the infrastructure of county ports.
2. Revitalize already built and build new port capacities:
   - Expand port areas to include all existing facilities intended for mooring vessels, as well as expansion of the sea area for anchoring purposes;
   - Put unused and abandoned former industrial, military or similar facilities into the function of economic development.
3. To position Croatia as the most important nautical destination in Europe and the Mediterranean:
   - Encourage the application of appropriate ecological standards in the protection of the marine environment, as a common interest and task.

In accordance with the acceptable activities in the port of Bol, part of the coast will be upgraded and infrastructure will be built that will improve the quality and safety of communication with other ports on neighboring islands and with mainland ports. The construction as well as the use of the vessel will be in accordance with eco standards that will monitor safety and environmental protection. The need for development in the sense of sustainable development is the need for economic development and the basis of any serious development strategy (Luković & Gržetić, 2007; Favro & Kovačić, 2010). Speaking of protected areas, one of which that certainly stands out is Zlatni Rat, which has become a world-famous symbol of Bol due to its specific shape. The construction of the marina also contributes to its protection, because now in its area you can find sailboats and yachts that are anchored and thus impair the quality of the seabed and the cleanliness of the sea.

While the specific goal of 7ii1 itself is focused on the integration of Croatian islands into the wider transport network and overcoming key obstacles to local economic growth, the ultimate goal is to gradually provide the islands with sustainable and modern transportation services throughout the year regardless of the pressure of tourism and thereby improve the availability of employment, education and other services to island communities.

Legislation. According to the principles of NATURA 2000 and Directive 2000/60/EC of the European Parliament, which refers to the protection of the environment and the well-being of the local population, to see that this project is being done for the needs of the local population, and thus is the basis for the protection of water areas and maritime assets that are population closely related. With the project, the local population will have multiple benefits, from just a better connection of the island with the mainland, to an increase in the quality of life of the locals themselves, while during the implementation of the project, great attention will be paid to the protection of the environment itself.

Is it necessary? The subject project has three measurable end results that we will discuss further. Those are:

- Option 1 – existing state of the infrastructure;
- Option 2 – minimal investment in infrastructure;
- Option 3 – investments in infrastructure foreseen by the project documentation.

Option 1 – Do nothing. This alternative presupposes that no further investments are made in material assets and improvement of the port infrastructure for the local point of view. Taking into account that, on the one hand, such investments are necessary due to outdated infrastructure, the increasing demand of the local population for transport services, and at the same time the reduction of the quality of life and safety of the local population, the above option does not represent a satisfactory and optimal solution and would lead to the following negative results:

1) There would be no increased investment in local infrastructure and modernization of the existing port and increase in security.

2) If the project is not implemented, there would be no connection with other islands and the mainland throughout the year.

3) The quality of life of the local population would remain at a low level and would decline due to inadequate public services.

4) Failure to implement the project would reduce the population's opportunity for employment and education, which leads to an increase in unemployment.

5) The potential provided for the local environment would remain unused.

6) The town of Bol and the municipality of Bol remain insufficiently integrated into the wider transport network and do not have the ability to overcome key obstacles to local economic growth.

7) With the existing situation, no additional value will be realized in the future either for the local or wider community.

Option 2 – Do minimum. As part of the option, the option was analyzed in which to invest in the rehabilitation and extension of the main breakwater of the port of Bol, the arrangement and extension of the gas station jetty (secondary breakwater) and the arrangement of the coastal line from the gas station jetty to the existing central jetty with the reconstruction of the existing coastal wall of the mooring from the beach to the central jetty with the reconstruction of the existing coastal wall of the mooring from the beach to the central jetty, and the arrangement of the outer coastal line from the root of the main breakwater to the new promenade. However, the partial arrangement of the port open to public traffic is not satisfactory for the following reasons:

1) Better infrastructure would be achieved only for the already existing main breakwater and central pier, but the safety and quality of the pier would still be questionable for the local population.

2) The impossibility of influencing the reception of vessels, increased traffic of the port and the safety of the infrastructure.

3) Failure to implement the project would not solve the problem of reduced opportunities for employment and education of the local population due to the lack of transport connections.

4) The town and municipality of Bol would still remain insufficiently integrated into the wider transport network and the goal of overcoming the obstacle to local economic growth would not be achieved.

5) The infrastructure would remain undeveloped and the negative impact of tourism on the port could not be reduced.

The analysis determined that the mentioned option is not a favorable solution due to its lack of comprehensiveness. Despite the fact that the rehabilitation and extension of the existing breakwater and the rehabilitation of the jetty would minimally improve the quality of the local population in that part, the problem of insufficient integration of the local population of Bol into the transport network would still remain open. The insufficient possibility of mobility of the local population would still result in a lower quality of life and an outflow of the population, which could not be solved solely for the sake of investing in the existing breakwater and jetty without renovating the remaining part of the port of Bol.

Option 3 – Project option. Project option for "Extension of the port open to public traffic Bol-phase 1" The option in which the project is realized in its full extent is the

only acceptable option that guarantees that the town of Bol will be integrated into the wider transport network in order to overcome the key obstacles for local economic growth and higher quality of life of the local population for the following reasons:

1) The project will establish adequate capacities for year-round traffic.

2) A satisfactory level of service will be achieved throughout the year for the local community.

3) Employment opportunities for the local population will increase and population outflow will decrease.

4) Traffic jams will be minimized.

5) The level of quality of life and safety of the local population will increase.

6) The town of Bol and the municipality of Bol will be integrated into a better connected transport network between the mainland and the island.

Analysis of alternative and/or competitive modes of transportation. There is no settlement/place on the island of Brač where an alternative competitive line to these lines could be created. The port of Bol is located on the southern side of the island of Brač, in the central part of the coast. It is the only port on that part, therefore there are no alternative and competitive lines that could be compared to the lines that operate through the port of Bol.

The main factor to look at when determining the location that represents a restrictive, neutral and stimulating factor are general that is purity of the sea, climate conditions, indebtedness of the coastline and special characteristics such as availability of the ports, safety of navigation, etc. (Dundovi et al., 2015.)

Bol is a port in the middle of the southern coast of the island of Brač. When talking about characteristics of the port, the latitude of the port is 43° 16' N with the longitude of 16° 40' E, length pf the pier is 155 m, dock area is 833m2 and water area is 36.230 m^2. Port of Bol is protected from the east by a 140m long knee pier with a breakwater. The depths along it are from 3.3 m under the head with the port light to 2.5 m to the place where it breaks. Further on are the boats of the locals, and they are about a meter deep. It is the same along the waterfront all over the port. It is deeper along the waterfront on the northern side of the harbor. Where the moorings of the locals end, and the waterfront widens into a plateau with palm trees, there are only four to five spots for boaters. Moorings and connections for electricity and water have been installed.

ORIENTATION: The bell tower of the monastery to the east of the settlement and the tall gray building to the west of the monastery, the light at the head of the breakwater - a square stone port with a green dome and the light at the head of the jetty - a red tower.

WEATHER CONDITIONS: It is protected from all winds and waves except from the SW wind, which causes rough seas; small boats are recommended to moor on the part of the coast east of the tree line.

ANCHORAGE: Larger ships anchor in front of the harbor at depths of 20-25 m, depending on the tide, by mooring to the shore. South and southwest winds cause rough seas.

MOORING: Laterally on the inside of the breakwater or in a four-berth along the shore. The jetty in the western part of the harbor is intended for tourist boats and ships on regular lines.

Existing condition east of BOL port. The coastline of this stretch to the east of the port of Bol, in a position towards the location known as "Stara fabrika", is approximately 350 m long. On the north side of this area, from the main breakwater in the direction of the east, in a length of about 280 m, there is a recently built new coastal wall with a promenade and a new coastal parapet wall on the part above the existing beaches, and above these walls is the recently partly reconstructed local road "Račić Street". The remaining part of this coastal stretch is characterized by sikas and smaller beach areas.

Technical feasibility and environmental sustainability. Demand analysis. A description of the demand and supply analysis will give us answers to the potential expected demand and supply. First of all, we will look at all the parameters that affect the demand for the services of the project "Extension of the port open to public traffic Bol Phase 1", that is, the demand of the local population for a quality and safe shipping line.

As a result of the emigration process, the population of both Croatia and the town of Bola is decreasing. Negative demographic trends also lead to negative social consequences. The quality of life in accordance with modern standards is not at the best level throughout the year, even for other generations.

The town of Bol recorded an increase in population from 1961-2001, and in 2011 it recorded a decrease of 2.31%, but in 2021, a growth of 2.92%.

The source of the natural movement of the population is the state registers of births, deaths and marriages, which are kept by registrars for each register area. Vital statistics data refer to all persons who were born, died or married in a certain calendar year, and were registered in the state registers of births, deaths and marriages. From the above table, we can read that in 2011 there were a total of 27 live births, while there were 2 deaths in the same year. The natural increase was 7, and the vital index was 135.

In 2022, the number of live births was 16, while the number of deaths was 18, therefore the natural increase was negative, while the vital index in 2022 was 88.9.
In the municipality of Bol, there are 150 students in primary school, of which 69 are boys and 81 are girls, in secondary school in the municipality of Bol there are 42 of them, of which 21 are boys and 21 are girls.

The average household in the municipality of Bol has 2.64 members (Table 1), which is certainly quite worrying from the aspect of demographic structure.

Table 1. Private households according to the number of members in the Municipality of Bol

Household number													
	Total	1	2	3	4	5	6	7	8	9	10	11 and more	Average number of persons in the household
Household number	624	187	145	117	107	40	18	6	1	1			2,64
Number of persons	1646	187	290	351	428	200	108	42	8	9			

Source: Popis 2021. Državni zavod za statistiku

Conclusions

This project will be carried out with the aim of having as little negative impact on the environment as possible, while at the same time redirecting the local population to the use of shipping lines, which will carry out boat traffic for the local population every day throughout the year. The necessity of realizing this project is evident from the way of doing business so far and the analysis that showed that it is only in this way that it is possible to ensure that transport services for the local population are improved throughout the year, regardless of the pressure of tourism, and thus improve the availability of employment, education and other service to Bol. With this option, the existing situation would be changed, and by increasing the quality of the capacity available to the port, it would provide a quality pier for shipping lines, and the local population would receive a higher quality of service and level of safety. In this way, the town of Bol will once again become a competitive area for year-round living and work for the local population.

References

Donosimo detaljan red plovidbe Jadrolinije za 2021. godinu. Splitsko okružije (*We present the detailed sailing schedule of Jadrolinija for the year 2021. Split area*). https://www.morski.hr/donosimo-detaljan-red-plovidbe-jadrolinije-za-2021-godinu/ [access: 28.11.2023].

Dundović Č., Kovačić M., Badurina-Tomić P. (2015). Prilog istraživanju postojećeg stanja i tendencije razvitka nautičkog turizma u Republici Hrvatskoj (*A contribution to research on the current state and development trends of nautical tourism in the Republic of Croatia*). Rijeka.

EU funds. Ministry of finance, Republic of Croatia. https://mfin.gov.hr/highlights-2848/croatia-and-the-eu/eu-funds/2922 [access: 01.09.2023].

Favro S., Kovačić M. (2010). Nautički turizam i luke nautičkog turizma (*Nautical tourism and ports of nautical tourism*). Split.

Luković T., Gržetić Z. (2007). Nautičko turističko tržište u teoriji i praksi Hrvatske i europskog dijela mediterana (*Nautical tourism market in theory and practice in Croatia and the European part of the Mediterranean*). Split.

Morski.hr, Jadranski web portal. https://www.morski.hr/donosimo-detaljan-red-plovidbe-jadrolinije-za-2021-godinu/ [access: 30.11.2023].

Popis 2021. Državni zavod za statistiku (*Census 2021. State Bureau of Statistics*). https://dzs.gov.hr/u-fokusu/popis-2021/88 [access: 04.09.2023].

Red plovidbe (*Sailing order*) (2023). https://boljani.info/red-plovidbe [access: 03.06.2023].

Strategija razvoja Općine Bol (*Development strategy of the Municipality of Bol*) (2014). Split.

The use of new provisions during the programming phase of the European structural and investment funds. Final report (2016). https://ec.europa.eu/regional_policy/sources/policy/how/studies_integration/new_provision_progr_esif_report_en.pdf [access: 01.09.2023].

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.17

Agnieszka Besiekierska[1]

LIMITATIONS OF THE ACCESS TO SPATIAL DATA AND SERVICES DUE TO INTELECTUAL PROPERTY RIGHTS. POLISH PERSPECTIVE

Abstract: The Inspire Directive introduces a conceptual framework related to spatial data infrastructure, unifying the issues related to the access to spatial data within the European Union. The Directive was implemented into Polish law in the Act of 4 March 2010 on spatial information infrastructure. Both the Directive and the Act provide for the possibility of introducing limitations to access to spatial data and services in connection if access would adversely affect, among others, intellectual property rights. The carried out study shows that most poviats subject to the study have not acquired the required scope of intellectual property which may potentially result in the access limitations.

Keywords: Inspire Directive, spatial data, spatial data sets, intellectual property rights

Received: 30 October 2023; accepted: 27 November 2023

[1] Cardinal Stefan Wyszyński University, Faculty of Law and Administration, Warsaw, Poland, ORCID ID: https://orcid.org/0000-0002-1223-1442, email: a.besiekierska@uksw.edu.pl

Introduction

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an infrastructure for spatial information in the European Community (INSPIRE Directive) imposed on the Member States of the European Union, including Poland, the obligation to collect and make available their own spatial data (in the form of services network services, e.g. data browsing or data downloading services) (Ganczar, 2020). Sharing spatial data is subject to the limitations indicated in Art. 13 (1) of the Directive which provides that accessibility can be excluded due to intellectual property rights. This paper presents the basic conceptual framework for spatial data and intellectual property law and points out the limitations related to copyright protection. In further parts, it contains the results of the carried out study based on the contracts concerning spatial data or services entered into by selected local government units (poviats). The analysis of the contracts provides the answer to the question whether the intellectual property rights have been acquired in the sufficient scope or if there are some shortcomings which may lead to the limitations due to intellectual property rights.

Conceptual framework and general principles of using spatial data

The Inspire Directive introduces a basic conceptual framework for spatial data, defining key concepts from the point of view of the analyzed topic, such as "spatial data", "spatial data set", "spatial data services", or "INSPIRE Geoportal". "Spatial data" means any data relating directly or indirectly to a specific location or geographical area (Article 3(2)). For example, spatial data included in the Polish state owned service called Geoportal include among others photogrammetric aerial photos, basic geodetic networks, State Register of Borders (PRG), Maps, State Register of Geographic Names, Database of General Geographic Objects, Terrain Utilities (GESUT), Orthophotomap (ORTO), Digital Terrain Model (DTM), Digital land cover model (NMPT), LIDAR measurement data, Database of topographic objects (BDOT10k), Register of land and buildings (EGiB), Database of topographic objects (BDOT500), Database of detailed geodetic networks (BDSOG). The collections of spatial data form databases which the Inspire Directive calls "spatial data sets" and defines as recognizable sets of spatial data (Article 3(3)).

Access to spatial data takes place through spatial data services, which mean operations that can be performed by a computer application on spatial data contained in spatial data sets or on the metadata associated with them (Article 3 (4)). The Inspire Directive specifies which spatial data services should be established and operated by Member States (Article 11(1)). These are (Article 11(1)): search services, browsing services, download services, transformation services and services enabling the launch of spatial data services. The directive, when listing individual services, briefly characterizes them, indicating their basic features, e.g. in the case of search, indicating that it is to be based on the corresponding metadata. Additionally, the Directive specifies that services offered in accordance with the Directive should take into account relevant user

requirements and should be easy to use, publicly available and accessible via the Internet or other appropriate means of telecommunication (Szpor, 2016).

Limitations on the access to spatial data sets and services

The Inspire Directive specifies possible limitations on the access to spatial data services. Art. 13 (1) introduces a general clause allowing Member States to limit public access to spatial data sets and services due to issues that are key to the existence of the state, i.e. where such access would have an adverse impact on international relations, public security or national defense. However, the grounds for limitations may be of a minor less nature. Member States may also limit public access to spatial data sets and services through services if access would adversely affect one of the areas identified in Article 13 (2) areas, including intellectual property rights (in addition to the confidentiality of the activities of public authorities, the activities of the administration of justice, the confidentiality of commercial or industrial information, the confidentiality of personal data or files relating to a natural person, the interests or protection of any person who has voluntarily provided the information that is the subject of the request, or the protection of the environment). Member States may not, invoking intellectual property rights, restrict access to information on emissions into the environment. The implemented provisions regarding limitations on the use of collections and services are included in Article 11 (1) and (2), and the provision regarding the possibility of limiting access on the basis of the provisions on intellectual property in Art. 11 (2) point 6 of the Act, according to which limitations may occur if access to these data is subject to restrictions on the basis of separate provisions regarding, in particular, intellectual property rights (Felchner & Jankowska, 2013).

Both in the case of the INSPIRE Directive and the Polish Act, the concept of protection of intellectual property rights appears not only in the context of limitations on the use of spatial data sets and services, but also takes the form of a general clause according to which the Directive and the Act do not infringe the rights of based on the provisions on the protection of intellectual property rights (Article 2(2) of the Directive and Article 2 of the Act). In the case of the Act, this principle is strengthened pursuant to Art. 4 (3), according to which, in the case of files maintained by a third party that has been allowed to be included in the infrastructure, the administrative body may take action under the Act only with the consent of the entity that has intellectual property rights to these data.

Protection of intellectual property rights in the context of spatial data

Intellectual property rights can be divided into four categories in Polish law, depending on the legal source of protection: (i) copyright and related rights provided for in the Act of 4 February 1994 on copyright and related rights, (ii) industrial property rights, which protection follows from the Act of 30 June 2000 on Industrial Property Law, (iii) database protection law in accordance with the Act of 27 July 2001 on the

protection of databases and (iv) protection of know-how as a trade secret within the meaning of the Act of 16 April 1993 on combating unfair competition.

In the context of protection of spatial data sets or services, the first and third category are important, i.e. copyright and database protection rights. Industrial property rights concern a closed catalog of rights, i.e. inventions, utility models, industrial designs, trademarks, geographical indications and topography of integrated circuits (Article 1 (1) of the Industrial Property Law). Taking into account the definitions of those rights, access to spatial data sets and services will not fall within this scope. In particular, unlike in some legal systems, Polish industrial property law does not grant patent protection to software, including software related to the provision of spatial data access services (Sztobryn, 2015). Similarly, spatial data sets and sharing services will also not be protected as know-how under the Act on Combating Unfair Competition as they will not fulfill the requirements of a definition of a business secret (Nowińska & Szczepanowska-Kozłowska, 2022).

As far as copyright and related rights are concerned, in accordance with the Act on copyright and related Rights, the subject of protection is a work understood as any manifestation of creative activity of an individual nature, established in any form, regardless of its value, purpose and method of expression (Article 1(1) of the Copyright Act). The Act then provides examples of works that are subject to copyright protection, including cartographic works (Article 1(2)(1) of the Copyright Act). However, over the years, there has been a noticeable tendency to procedurally enforce protection in relation to even the smallest manifestations of human creative activity such as railway timetables or user manuals (Markiewicz, 2020). Additionally, even if the whole set will not be copyright protected, single parts may be subject to copyright protection (Jankowska, 2017).

In addition, protection covers a collection that meets the characteristics of a work, even if it contains unprotected materials, provided that the selection, arrangement or combination adopted therein is of a creative nature, without prejudice to the rights to the works used (Article 3). At the same time, official documents are excluded from the scope of protection, materials, signs and symbols (Article 4(2) of the Copyright Act). Protection provided for in the Copyright Act is granted primarily to the creator, but in the event of secondary acquisition, either by way of an agreement on the transfer of copyright or an employment contract, where the purchaser is will be the employer, the buyer is entitled to copyright protection. Copyright protection under Polish law applies regardless of the fulfillment of any formalities, which means that no additional activities confirming the existence of copyrights, such as entry in the register, are required (Article 1(4)).

Spatial data sets protection results from the Act on database protection, which implemented Directive 96/9/EC of 11 March 1996 on the legal protection of databases (OJ EC L 77 of March 27, 1996). "Database" is a set of data or any other materials and elements collected according to a specific taxonomy or method, individually available in any way, including electronic means, requiring a significant investment in terms of quality or quantity in order to prepare, verify or present it. content (Article 2(1)). The

definition implies that only databases for which investment expenditure has been made may be subject to protection. A significant investment is, in accordance with the recitals of the preamble to the directive is understood broadly, i.e. "The investment related to the preparation of a database may consist in the involvement of human resources, technical and financial resources, but this investment should be significant from a quantitative or qualitative point of view. Quantitative assessment refers to resources that can be expressed numerically, and qualitative assessment refers to expenditures whose amount cannot be determined, such as the contribution of intellectual work or energy expenditure". And "a relevant investment in preparing (creating) a database is an investment in obtaining data for the database" (Markiewicz, 2021). Database protection is granted to the database maker (...) In the case of spatial data, a question may be asked to whether and to what extent a third party's investment in creation of the database may be seen as significant if the scope and structure of the database has been specified in legal provisions (e.g. in the Regulation on spatial data sets and metadata in the field of spatial development). The answer to this question will probably depend on the specific case. Database protection is independent of protection under the Copyright Act, i.e. a data set may be protected under copyright law and the Act on database protection.

As mentioned, copyright protection is enjoyed by the creator or holder of economic copyrights, and in the case of a database – by the maker. The work or database may be subject to an exclusive or non-exlusive licence. In the case of spatial data and services related to them, a number of activities related to the development and maintenance of access to data are performed by third parties other than a public entity, legal entities or natural persons who are not employees of the public entity. In such a situation, it is important that the State Treasury or a local government unit acquires the full scope of intellectual property rights. Failure to acquire or incomplete acquisition will lead to limitations on the use of spatial data resulting from intellectual property rights. This is particularly important in the context of the above-mentioned broad interpretation of the concept of a work, i.e. the subject of copyright protection.

Results and discussion

The provisions of copyright law precisely specify the form of the contract transferring copyrights (written), as well as its content, primarily the field of exploitation, regulate the issue of personal copyrights (possibility of modification and use of derivative works) and remuneration. Over the years, practice has developed regarding the content of copyright clauses, which in practice are extremely extensive. Similarly, the rights to the database can be transferred from the maker to another entity, as well as they may be subject of a license.

Within the study contracts concerning spatial data that appeared in public procurement documents published in 2020–2023 by the Central Office of Geodesy and Cartography and by ten largest poviats have been analysed. Within that period, three procedures for the award of public contracts were announced by the Headquarters of the Geodesy Office (GUGIK, http://www.gugik.gov.pl/bip/zamowienia-publiczne). As

part of the tender documentation, template contracts were made publicly accessible for view. All of the templates included extensive copyright clauses transferring economic copyrights to GUGIK. There were no provisions regarding databases in the contracts, which in two cases was due to the nature of the proceedings – the subject was the preparation of a map (BDG-ZP.2610.13.2023.GI, GI-TOPO.2611.4.2022). In the case of the third one concerning development of tools for automatic generalization and cartographic editing of the Topographic Objects Database – it cannot be ruled out that such records may have been necessary or should have been introduced preventively (GI-TOPO.2611.3.2022).

The ten biggest poviats terms of the number of inhabitants were chosen on the basis of Statistics Poland from 2015 (http://www.gminy.pl/Rank/PZ/Rank_PZ_L.html). The analysis covered tender documentation published on the website ezamowienia.gov.pl, whereas "geodetic", "cartographic", "map" as key search words (Table 1).

Table 1. The biggest poviats terms of the number of inhabitants

Poviat (powiat)	IP clause	Database protection clause
Poznań	N/A	N/A
Kraków	None	None
Wołomin	Extended clause	None
Nowy Sącz	None	None
Wejherowo	N/A	N/A
Kielce	Extended clause	None
Tarnów	N/A	N/A
Nowy Targ	Short, insufficient clause	None
Cieszyn	None	None
Piaseczno	None	None

Source: own elaboration

Analyzing the contracts, it can be observed that there is no uniform approach to the acquisition of intellectual property rights, and the exemplary approach of the GUGIK is not a source of inspiration for poviats which did not attach importance to that topic.

Moreover, poviats use contract templates which do not differ from each other in terms of copyright clauses. Basically, if a poviat has decided not to regulate copyright issues in the contract, this approach is uniform in all contract templates. Individual counties approach the issue of copyright to spatial data in different ways – ignoring it or

taking it into account. In all cases examined, no contractual clauses relating to databases were found. Such approach may ultimately lead to the limitations with regard to the access, resulting from the incomplete scope of the public entity's rights to the spatial data sets or services.

The above-mentioned approach in the field of intellectual property rights differs significantly from the approach practiced in the private sector, where the issue of copyrights as well as rights to databases is approached very scrupulously, in particular often out of caution with the assumption that the subject of an assignment is the work within the meaning of the act on copyright and derivative rights and that the contractor is copyright-entitled (Okoń, 2022).

Conclusions

Member States may limit public access to spatial data sets and services through services if access would adversely affect one of the areas identified in Article 13 section 2, including: intellectual property rights. The performed study shows that in many cases there has been no acquisition of copyrights to works containing spatial data, and in all the cases the issue of ownership of spatial databases is completely omitted. Such approach may ultimately lead to the limitations with regard to the access to spatial data or services, resulting from the insufficient scope of the public entity's rights to ensure an unlimited access.

References

Act of 16 April 1993 on compating unfair competition, Dz.U. (Journal of Laws) of 2022, item 123.

Act of 4 February 1994 on copyright and derivative rights, Dz.U. (Journal of Laws) of 2022, item 2509.

Act of 4 March 2010 on spatial information infrastructure, Dz.U. (Journal of Laws) of 2021, item 214.

Act of 27 July 2001 on database protection, Dz. U. (Journal of Laws) of 2021, item 386.

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), OJ L 108, 25.4.2007, pp. 1–14.

Directive 96/9/EC of 11 March 1996 on the legal protection of databases, OJ L 077 27.3.1996, p. 20.

Felchner K., Jankowska M. (2013), Ustawa o infrastrukturze informacji przestrzennej. Komentarz (*Act on spatial information infrastructure. Commentary*), Lex.

Ganczar M. (2020), Wdrożenie dyrektywy IN SPIRE do krajowego porządku prawnego w zakresie budowy infrastruktury informacji przestrzennej (*Implementation of the INSPIRE directive into the national legal system regarding the construction of spatial information infrastructure*), Studia prawnicze KUL, 3 (83).

Jankowska M. (2017), Charakter prawny mapy cyfrowej (*Legal character of digital map*), Warszawa.

Markiewicz R. (2020), Commentary on the Act on copyright and derivative Rights, Lex.
Markiewicz R. (2021), Commentary on the Act on database protection, Lex.
Nowińska E., Szczepanowska-Kozłowska K. (2022), Ustawa o zwalczaniu nieuczciwej konkurencji. Komentarz (*Act on combating unfair competition. Commentary*) Lex.
Okoń Z. (2022), Prawnoautorska ochrona programów komputerowych (*Copyright protection of computer programs*), Warszawa.
Regulation of the Minister of Development, Labour and Technology of 26 October 2020 on spatial data sets and metadata in the field of spatial development, Dz.U. (Journal of Laws) of 2020, item 1916.
Szpor G. (2016), Zakres regulacji zagospodarowania przestrzennego (*Scope of spatial development regulations*), Kontrola Państwowa, no. 2 special, p. 58–74.
Sztobryn K. (2015), Ochrona programów komputerowych w prawie własności intelektualnej w Unii Europejskiej (*Protection of computer programs in intellectual property law in the European Union*), Lex.

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.25

Grażyna Szpor[1]

EUROPEAN LEGAL FRAMEWORK FOR THE USE OF ARTIFICIAL INTELLIGENCE IN PUBLICLY ACCESSIBLE SPACE

Abstract: The terms AI and AI systems are ambiguous but attempts are being made to agree on their definitions. International organizations and national public authorities are constructing legal acts and policy documents oriented toward maximizing benefits and reducing risks of the AI development and use. The EU draft AI Act prohibits the use of certain AI systems in the publicly accessible space. Therefore, it is important to clarify the definition of this category of the space and the scope of prohibited practices. The general principles applicable to all artificial intelligence systems introduced by the European Parliament in 2023 will affect the development and use of GIS in the publicly accessible space under the EU jurisdiction and their indirect impact may be even broader.

Keywords: artificial intelligence, AI, publicly accessible space, law

Received: 6 November 2023; accepted: 16 December 2023

[1] Cardinal Stefan Wyszyński University, Faculty of Law and Administration, Department of Informatics Law, Warsaw, Poland, ORCID ID: https://orcid.org/0000-0002-3264-9360, email: g.szpor@uksw.edu.pl

Introduction

The development and use of artificial intelligence (AI) is the subject of intense work by many entities around the world. To meet new challenges, public authorities are constructing legal frameworks oriented toward maximizing benefits and reducing risks. The lawmaking process in the EU is advanced. The term "publicly accessible space" appears in the proposed regulation of the European Parliament and the Council. The purpose of this article is to verify, using the dogmatic-legal method, the hypothesis of the importance of this category of space in the structure of AI regulation and its binding with GIS.

A geographic information systems (GIS) are a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many different kinds of data on one map, such as streets, buildings, and vegetation. This enables people to more easily see, analyze, and understand patterns and relationships (National Geographic).

Tips for Exploring ChatGPT with GIS are: data cleansing, image interpretation and semantic classification and segmentation (Duke, 2023). Generally, the convergence of intelligent geolocation and artificial intelligence technologies such as machine learning and Deep Learning is becoming known as GeoAI – advanced analysis of geospatial data enabled by GIS software. GeoAI supports institutions in answering complex and relevant questions at a scale and frequency never before possible. The results of rapidly identifying patterns and relationships in spatial data are: real-time updating of route maps in GPS, finding and pinpointing objects with specific features on maps, forecasting on the basis of GIS the spread of threats (e.g. epidemiological), supporting response to natural disasters (e.g. marking the territorial scope and sequence of actions in fires, floods, earthquakes) (ESRI).

When planning the development and applications of GeoAI, it is important to take into account the changing regulatory environment.

Material and methods

The article presents the results of a desk research study of the formation of a legal framework for the development and use of artificial intelligence. The draft of the Artificial Intelligence Act of the European Parliament and Council was analyzed against the background of other international and national initiatives: UN, OECD, US, China, India. While preparing the paper, DeepL was used.

AI & AI system – definitions

No single definition of "artificial intelligence" is accepted by the scientific community and the term "AI" is often used as a "blanket term" for various computer applications based on different techniques, which exhibit capabilities commonly and currently associated with human intelligence (CAHAI, 2020).

Comprehensive explanations of AI maybe found in online encyclopedias. These explanations vary in structure and priority. This is shown by comparing Wikipedia and Baidu Baike (ch. 百度百科; pinyin Bǎidù Bǎikē), a semi-regulated Chinese-language collaborative online encyclopedia owned by the Chinese technology company Baidu. According to Wikipedia: "artificial intelligence (AI) is the intelligence of machines or software, as opposed to the intelligence of humans or animals. It is also the field of study in computer science that develops and studies intelligent machines". According to Baidu Baike: Artificial Intelligence (AI) it is "a new technical science that studies and develops theories, methods, technologies and application systems for simulating, extending and expanding human intelligence. AI is an important driving force for a new round of scientific and technological revolution and industrial transformation ...". Within the meaning of encyclopedias, AI also includes a branch of informatics – a science the subject of which are algorithms, programs and devices in which programs are implemented (Węgrzyn, 1999; The Great Encyclopedia, 2021). Colloquially, AI is often briefly explained as the simulation of human intelligence processes by machines, especially computer systems (Techtarget, 2023). However, it should be noted that human intelligence is also understood differently. In the EU, AI is a fast evolving family of technologies that can contribute to a wide array of economic and societal benefits across the entire spectrum of industries and social activities but at the same time, depending on the circumstances regarding its specific application and use, AI may generate risks and cause material and immaterial harm to public interests and rights that are protected by Union law (Proposal, 2021, Rec 3, 4).

In official documents, attempts are mainly made to define the phrase "artificial intelligence system". According to the 2019 Recommendation of Organisation for Economic Co-operation and Development (OECD), an "artificiaI intelligence system" (AI system) is a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. AI systems are designed to operate with varying levels of autonomy (Recommendation, 2019).

The European Commission proposed in 2021 that a regulation of the European Parliament and the Council should provide that the "artificial intelligence system" (AI system) is software that is developed with one or more of the techniques and approaches listed in Annex I [(a)Machine learning approaches, including supervised, unsupervised and reinforcement learning, using a wide variety of methods including deep learning; (b)Logic- and knowledge-based approaches, including knowledge representation, inductive (logic) programming, knowledge bases, inference and deductive engines, (symbolic) reasoning and expert systems; (c)Statistical approaches, Bayesian estimation, search and optimization methods] and can, for a given set of human-defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments they interact with (Proposal, 2021, Art. 3, paragraph 1 – point 1).

According to the amendment adopted by the European Parliament on 14 June 2023 to the proposal of the Artificial Intelligence Act prepared by European Commission:

‘"artificial intelligence system" (AI system) means a machine-based system that is designed to operate with varying levels of autonomy and that can, for explicit or implicit objectives, generate outputs such as predictions, recommendations, or decisions, that influence physical or virtual environments (Amendments, 2023, No165 for a regulation Article 3 – paragraph 1 – point 1).

The carried out analysis shows that the term artificial intelligence (AI) is used, on one hand, to designate a new field of science, integrating elements of several scientific disciplines, mainly informatics (computer science) and, on the other hand, a certain category of machine-based systems, which is defined by law.

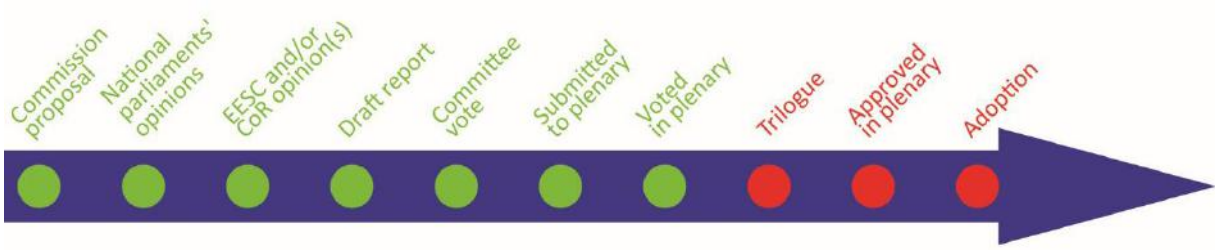
The lawmaking processes

From an axiological perspective, in the formation of standards for the development of artificial intelligence, the following approaches may be observed: the American one, called "pragmatic", the Chinese one – "social cohesion" and the third – "trustworthy AI", proposed in Europe and as an international standard. The May 2019 OECD Recommendation on Artificial Intelligence, exposing the development of trustworthy AI and its responsible management within value chains, is the first intergovernmental policy standard in this area. It was adopted as a reference at the G20 summit in Osaka in June 2019, and was included in subsequent Council of Europe, EU and UN, acts, including UNESCO's Recommendations on Global Ethical Principles for Artificial Intelligence in Research, Science, Education and Communication, adopted on November 24, 2021, with the participation of 193 countries (Kubiak Cyrul, 2020; Kroplewski, 2021). These international agreements have also influenced national regulatory approaches.

In the US, Blueprint for an AI Bill of Rights: "Making Automated Systems Work for the American People" was published by the White House in October 2022 (Blueprint for an AI Bill of Rights, 2022). The National Telecommunications and Information Administration (NTIA) of the US Department of Commerce initiated a formal public request (open until June 10, 2023) for input on policies that should shape an AI accountability ecosystem. The seven major companies developing AI technology (Microsoft, Google, Meta, OpenAI, Anthropic, Inflection AI, Amazon) pledged to follow a set of principles to ensure the security of their products in July 2023. Activities to be carried out before they are released cover testing the capabilities of AI systems by internal and external experts, along with publishing the results of those tests. In addition, the companies undertook to prioritize security of their systems against cyberattacks, clearly label AI-generated content, and invest in AI-based solutions to society's biggest problems, from cancer treatment to climate change to job creation. The U.S. President Joe Biden said new laws, regulations and oversight are needed alongside voluntary commitments from companies. He announced that he intends to "take executive action to help America lead the way to responsible innovation” soon (PAP, 2023). The executive action took the shape of the Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence released on 30 October 2023.

In China, alongside the "New Generation Artificial Intelligence Development Plan" adopted by the State Council on July 8, 2017 (Guofa, 2017, No. 35) on September 25, 2021, "in order to promote the healthy development of artificial intelligence", the "New Generation Artificial Intelligence Ethics Code" was issued by the National New Generation Artificial Intelligence Governance Professional Committee. The "Ethical Code" puts forward six basic ethical requirements, including enhancing human welfare, promoting fairness and justice, protecting privacy and security, ensuring controllability and credibility, strengthening responsibility, and improving ethical literacy. At the same time, 18 specific ethical requirements for specific activities such as artificial intelligence management, research and development, supply, and use are proposed (New Generation Code, 2021). In 2023, the Ministry of Science and Technology launched a special deployment of "AI for Science" to accelerate innovation and promote the high-level application of AI in key industries. AI was identified as a key industry in China's controversial industrial plan "Made in China 2025", in which it was stated that China's goal was to become a global leader in this field by 2030. China is developing new regulations to balance policy goals and incentives for innovation and new technological products. They specifically concern generative artificial intelligence, that is, both large language models and algorithms, such as those for creating images or video. The law is expected to require companies to obtain licenses to release products containing generative artificial intelligence. Major companies working with artificial intelligence, such as Baidu and Alibaba, are working to bring their products into compliance with the legal guidelines and rules (China Briefing, 2023).

The European Union has been preparing a comprehensive regulation to ensure the conditions for the production and use of trustworthy artificial intelligence in the EU market for a few years.



Data source: AI – EPRS_BRI(2021)698792_EN

In April 2021, the European Commission presented a proposal for an EU regulatory framework for artificial intelligence (AI). In December 2021, the Council agreed on the general position of EU member states (Proposal, 2021). In June 2023, Parliament voted on its position (Amendments adopted by the European Parliament, 2023). Next steps are "Trilogue negotiations". The legislation is expected to be approved by the end of 2023. The comprehensive law on artificial intelligence is part of the EU's digital strategy. The goal is a better environment for the development and use of this innovative technology and protection of the rights and data of Europeans**.** Recent lawmaking activity confirms the accuracy of the view that Regulating the "speeding train" has the

advantage that we minimize the risk of it crashing, but on the other hand it will move slower than competing connections. It seems […] that the direction is good, but the risk of slowing down the development of AI in Europe is significant, and both of these issues should be taken into account when introducing possible regulations" (Trzciński, 2023).

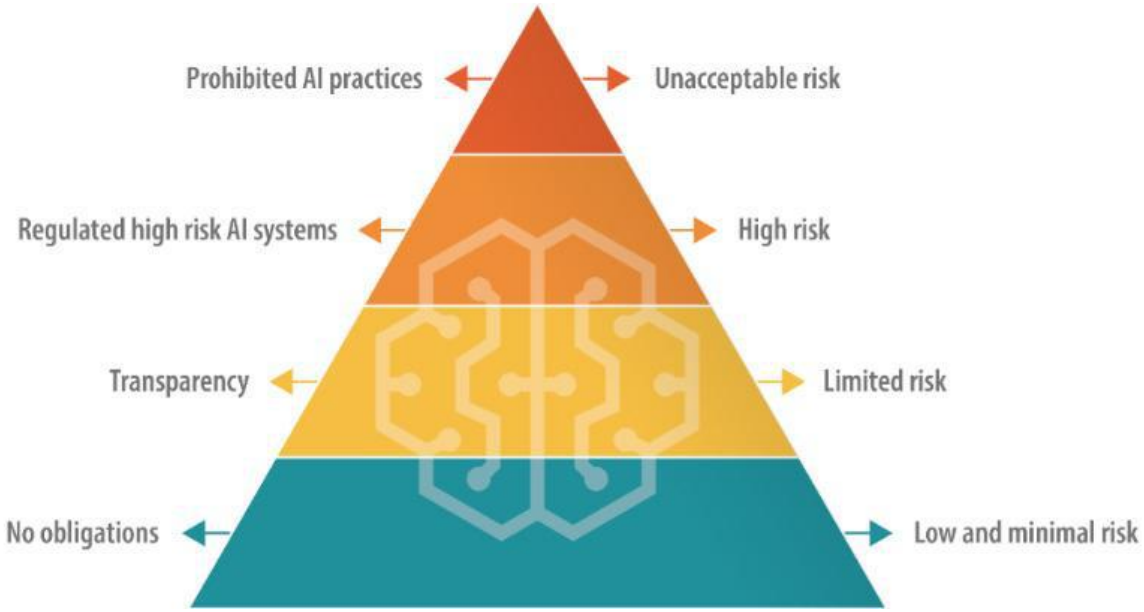
The EU AI Act was met with interest in other countries, including India (Lal, 2023), where "the pace of AI adoption is faster than the rules formed to regulate it" (Prabhu, 2023). The existing IT Act 2000 is to be replaced by the Digital Act, which is in the draft stage (incorporating EU standards of the personal data protection) and AI issues, including ethical aspects (Proposed Digital India Act, 2023).

The attractiveness of EU standards is reinforced by the fact that, in the past, states protecting individual dignity and freedom won global competition in various fields where creativity and innovation was important. It may also affect the competitiveness of China's Belt and Road and EU Global Gateway initiatives in times of AI expansion (Mc Alllister, 2023; Bradford, 2020; Szpor, 2016).

The analysis shows that the standards of legal regulation of AI are shaped not only by the global leaders in its development, but also by the leaders in the consumption of AI system solutions in the global market, and EU solutions are also taken into account outside the EU.

Structure of the EU Artificial Intelligence Act

The proposal of the Commission "sets harmonised rules for the development, placement on the market and use of AI systems in the Union following a proportionate risk-based approach" (Proposal, 2021, rec. 1). The risk-based approach was reflected in the Commission's proposed structure of the act. It included: Preamble (rec. 1–89); Title I General provisions (art. 1–4); Title II Prohibited artificial intelligence practices (art. 5); Title III High-risk ai systems (art. 6); Title IV Transparency obligations for certain ai systems (art. 52); Title V measures in support of innovation (art. 53–55); Title VI governance (art. 56–59]; Title VII eu database for stand-alone high-risk ai systems (art. 60); Title VIII post-market monitoring, information sharing, market surveillance art. 61–68); Title IX codes of conduct (art. 69); Title X Confidentiality and penalties (art. 70–72); Title XI Delegation of power and committee procedure (art. 73–74); Title XII Final provisions (art. 75); Annex i Artificial intelligence techniques and approaches referred to in article 3, point 1; Annex II List of union harmonisation; Annex III High-risk ai systems referred to in article 6(2).



Data source: European Commission; AI – EPRS_BRI(2021)698792_EN

In accordance with the Commission's proposal the AI practices which shall be prohibited include "placing on the market, putting into service or use of an AI system": (a) that deploys subliminal techniques beyond a person's consciousness in order to materially distort a person's behaviour in a manner that causes or is likely to cause that person or another person physical or psychological harm; (b) that exploits any of the vulnerabilities of a specific group of persons due to their age, physical or mental disability, pertaining to that group in a manner that causes or is likely to cause that person or another person physical or psychological harm; (c) by public authorities or on their behalf for the evaluation or classification of the trustworthiness of natural persons over a certain period of time based on their social behaviour or known or predicted personal or personality characteristics, with the social score leading to either or both of the following: (i)detrimental or unfavourable treatment of certain natural persons or whole groups thereof in social contexts which are unrelated to the contexts in which the data was originally generated or collected; (ii)detrimental or unfavourable treatment of certain natural persons or whole groups thereof that is unjustified or disproportionate to their social behaviour or its gravity. Among the prohibited AI practices was also "the use of real-time remote biometric identification systems in publicly accessible spaces for law enforcement purposes" (Article 5. ust. 1. d), 2, 3, 4).

The scope of prohibited practices set out in Article 5 has been extensively amended by Parliament. Among changes, a new Article 4(a) has been added, setting out General principles applicable to all artificial intelligence systems (Amendments, 2023). The final form of the above provisions should be known by the end of 2023, but undoubtedly the legislative processes confirm the validity of the thesis that "law is a plane of compromise between the need for security and the need for development" (Pańko, 1984), with an overall cross-state compromise achievable despite the diversity of national hierarchies of needs.

Publicly accessible space

EU authorities have assumed that the use of AI in 'publicly accessible space' may involve unacceptable risks. It is therefore important both to define this category of the space and to precisely define the scope of prohibited practices. On both of these issues, the Parliament made more than a dozen amendments to the Commission's text in 2023 (bold text).

For the purpose of AI Act „publicly accessible space' means any physical place accessible to the public, regardless of whether certain conditions for access may apply (Art. 3., p. 39). After the Parlament's Amendment (No 195 Proposal for a regulation) Article 3 – paragraph 1 – point 39 reads as follows: (39) "publicly accessible space" **means any publicly or privately owned** physical place accessible to the public, regardless of whether certain conditions for access may apply, **and regardless of the potential capacity restrictions.**

In the amendment No 26 to Recital 9 clarifies the explanation of this definition: "(9) For the purposes of this Regulation the notion of publicly accessible space should be understood as referring to any physical place that is accessible to the public, irrespective of whether the place in question is privately or publicly owned **and regardless of the potential capacity restrictions**. Therefore, the notion does not cover places that are private in nature and normally not freely accessible for third parties, including law enforcement authorities, unless those parties have been specifically invited or authorised, such as homes, private clubs, offices, warehouses and factories. Online spaces are not covered either, as they are not physical spaces. However, the mere fact that certain conditions for accessing a particular space may apply, such as admission tickets or age restrictions, does not mean that the space is not publicly accessible within the meaning of this Regulation. Consequently, in addition to public spaces such as streets, relevant parts of government buildings and most transport infrastructure, spaces such as cinemas, theatres, **sports grounds, schools, universities, relevant parts of hospitals and banks, amusement parks, festivals**, shops and shopping centres are normally also publicly accessible. Whether a given space is accessible to the public should however be determined on a case-by-case basis, having regard to the specificities of the individual situation at hand".

In the Commission's proposal Article 5 1. provided for: "The following artificial intelligence practices shall be prohibited: […] (d) the use of 'real-time' remote biometric identification systems **in publicly accessible space**s **for the purpose of law enforcement**, unless and in as far as such use is strictly necessary for one from the objectives mentioned in the three points (i, ii, iii) and shall take into account the two elements indicated in the paragraph 2 and in addition shall comply with necessary and proportionate safeguards and conditions in relation to the use, in particular as regards the temporal, geographic and personal limitations". Paragraph 3. provided that each individual use requires prior authorization by a judicial authority or independent administrative body of the Member State where the use is to take place, issued upon a reasoned request and in accordance with specific provisions of national law, the form

of which is set forth in paragraph 4. However, it was allowed as an exception to apply for authorization after the start of use or even after the end of use".

Following Parliament's amendments, point d) prohibits the use of "real-time" remote biometric identification systems in **publicly accessible spaces** (Am. 220). So the prohibition applies to the use, for whatever purpose (37), of a "real-time remote biometric identification system", which, according to the definition in Article 3(1)(37) as corrected by Amendment 194, "means a remote biometric identification system whereby the capturing of biometric data, the comparison and the identification all occur without a significant delay. This comprises not only instant identification, but also limited delays in order to avoid circumvention". According to the revised definition in point 36), remote biometric identification system' means an AI system for the purpose of identifying natural persons at a distance through the comparison of a person's biometric data with the biometric data contained in a reference database, and without prior knowledge of the deployer of the AI system whether the person will be present and can be identified, excluding verification systems (Am. 193).

It is further prohibited, pursuant to the added Article 5(1)(d)(d), the putting into service or use of AI systems for the analysis of recorded footage of **publicly accessible spaces** through 'post' remote biometric identification systems, unless they are subject to a pre-judicial authorisation in accordance with Union law and strictly necessary for the targeted search connected to a specific serious criminal offense as defined in Article 83(1) of TFEU **that already took place** for the purpose of **law enforcement** (Am. 227). In general, "law enforcement" means activities carried out by law enforcement authorities **or on their behalf** for the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, including the safeguarding against and the prevention of threats to public security (Art. 3, par. 1 point 41, Am. 196).

AI systems other than those prohibited in accordance with Art. 5 may in the publicly accessible space subject to the EU jurisdiction operate on the basis of the "General principles applicable to all artificial intelligence systems". A new Article 4(a) states in paragraph 1, that all operators falling under this Regulation shall make their best efforts to develop and use AI systems or foundation models in accordance with the following general principles establishing a high-level framework that promotes a coherent human-centric European approach to **ethical and trustworthy Artificial Intelligence**, which is fully in line with the Charter as well as the values on which the Union is founded: a) 'human agency and oversight' […]; b) 'technical robustness and safety' means that AI systems shall be developed and used in a way to minimize unintended and unexpected harm as well as being robust in case of unintended problems and being resilient against attempts to alter the use or performance of the AI system so as to allow unlawful use by malicious third parties […]; c) 'privacy and data governance' […]; d) 'transparency' […]; e) 'diversity […]; f) 'social and environmental well-being' […]. Paragraph 1 is without prejudice to obligations set up by existing Union and national law. For high-risk AI systems, the general principles are translated into and complied with by providers or deployers by means of the requirements set out in Articles 8 to 15, and the relevant

obligations laid down in Chapter 3 of Title III of this Regulation. For foundation models, the general principles are translated into and complied with by providers by means of the requirements set out in Articles 28 to 28b. For all AI systems, the application of the principles referred to in paragraph 1 can be achieved, as applicable, through the provisions of Article 28, Article 52, or the application of harmonised standards, technical specifications, and codes of conduct as referred to in Article 69,without creating new obligations under this Regulation. The Commission and the AI Office shall incorporate the "general principles" in standardisation requests as well as recommendations consisting in technical guidance to assist providers and deployers on how to develop and use AI systems. European Standardisation Organisations shall take the "general principles" into account as outcome-based objectives when developing the appropriate harmonised standards for high risk AI systems as referred to in Article 40(2b) (Am. 213).

Conclusions

The term artificial intelligence (AI) is used to designate either a new field of science, integrating elements of several scientific disciplines, mainly informatics (computer science) or a certain category of machine-based systems, which are defined by law. International regulatory standards are oriented towards the development of trustworthy artificial intelligence, which is in line with the European approach. Legislative processes adopt general principles applicable to all AI systems but also different legal instruments for the categories of systems distinguished according to the level of risk associated with development and use. The thesis that "law is a plane of compromise between the need for security and the need for development" remains valid, while the hierarchies of these needs differ from country to country, and the compromise reached in the acts of international law covers only general principles. The draft of Regulation of the European Parliament and Council – a high-level act directly applicable in the EU member states – prohibits the use of a "real-time" remote biometric identification systems in the publicly accessible spaces for any purpose and severely restricts use of AI systems for the analysis of footage recorded in the publicly accessible spaces through "post" remote biometric identification systems. Such bans and restrictions have never been implemented in the world before. The EU's AI Act raises concerns about reducing Europe's competitiveness, but past experience justifies the assumption that the development of the AI legal standards in the global market will be shaped not only by the global producers but also by the leaders in the consumption of AI systems solutions. It should be noted, that in recent centuries the states that protect individual dignity and freedom have won the global competition in various fields where creativity and innovation is important.

References

Amendments (2023), Artificial Intelligence Act P9_TA(2023)0236. Amendments adopted by the European Parliament on 14 June 2023 on the proposal for

a regulation of the European Parliament and of the Council on laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union legislative acts (COM(2021)0206 – C9-0146/2021 – 2021/0106(COD) https://www.europarl.europa.eu/doceo/document/TA-9-2023-0236_EN.html [access: 6.11.2023].

Baidu Baike https://pl.wikipedia.org › wiki › Baidu Baike, https://en.wikipedia.org/wiki/Artificial_intelligence [access: 6.11.2023].

Blueprint for an AI Bill of Rights, the White House October 2022, https://www.whitehouse.gov/wp-content/uploads/2022/10/Blueprint-for-an-AI-Bill-of-Rights.pdf [access: 6.11.2023].

Bradford A. (2020), The Brussels Effect: How the European Union Rules the World. Oxford University Press. New York, https://scholarship.law.columbia.edu/books/232 [access: 6.11.2023].

CAHAI (2020), Ad hoc committee on artificial intelligence (CAHAI) Feasibility Study. 17 December 2020, https://rm.coe.int/cahai-2020-23-final-eng-feasibility-study-/1680a0c6da [access: 6.11.2023].

China Briefing (2023), https://www.china-briefing.com/news/understanding-chinas-new-regulations-on-generative-ai-draft-measures/ [access: 6.11.2023].

Duke B. (2023), 3 Tips for Exploring ChatGPT with GIS. April 26, 2023.

ESRI, https://www.esri.com/pl-pl/artificial-intelligence/overview [access: 6.11.2023].

Executive Order 14110 of October 30, 2023, Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence, https://www.federalregister.gov/documents/2023/11/01/2023-24283/safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence [access: 6.11.2023].

Kroplewski R. (2021), Kodeks etyczny AI – prekursorzy narzucą standard (*AI Code of Ethics – Forerunners will impose a standard*). Pomorski Thinkletter no. 4.

Kubiak Cyrul A. (2020), Rekomendacje OECD jako ramy etyczne i prawne dla rozwoju sztucznej inteligencji. Studies in Law: Research Papers, no. 1 (26). DOI: 10.34697/2451-0807-sp-2020-1-008.

Lal V. EU Artificial Intelligence Act: An Overview. https://www.legalserviceindia.com/legal/article-12136-eu-artificial-intelligence-act-an-overview-.html [access: 6.11.2023].

Mc Alllister David Global Gateway: If not now, when? https://www.politico.eu/article/global-gateway-if-not-now-when/ [access: 6.11.2023].

National Geographic, Education, https://education.nationalgeographic.org/resource/geographic-information-system-gis/ [access: 6.11.2023].

New Generation Artificial Intelligence Ethics Code (2021) released by Ministry of Science and Technology of the People's Republic of China. 2021-09-26, https://baike-baidu-com.translate.goog/item/%E6%96%B0%E4%B8%80%E4%BB%A3%E4%BA%BA

%E5%B7%A5%E6%99%BA%E8%83%BD%E4%BC%A6%E7%90%86%E8%A7%84%E8%8C%83/58655047?_x_tr_sl=zh-CN&_x_tr_tl=pl&_x_tr_hl=pl&_x_tr_pto=sc&fromModule=lemma_inlink [access: 6.11.2023].

Pańko W. (1984, 2016), O prawie własności i jego współczesnych funkcjach. (*On property law and its contemporary functions*), Katowice.

PAP (2023). Polish Press Agency, 21 July 2023 https://businessinsider.com.pl/technologie/bezpieczna-sztuczna-inteligencja-microsoft-google-i-meta-godza-sie-na-testy/ksr93n0 [access: 6.11.2023].

Prabhu A. (2023), Artificial intelligence in the context of the Indian legal profession and judicial system, https://www.barandbench.com/columns/artificial-intelligence-in-context-of-legal-profession-and-indian-judicial-system, published 12.08.2023, [access: 6.11.2023].

Proposal (2021), Proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain union legislative acts. European Commission Brussels, 21.4.2021 COM(2021) 206 final.

Proposed Digital India Act, 2023, Ministry of Electronics and Information Technology Government of India. Digital India Dialogues 09.03.2023 Bengaluru, Karnataka https://www.meity.gov.in/writereaddata/files/DIA_Presentation%2009.03.2023%20Final.pdf; https://www.legalserviceindia.com/legal/article-13760-the-road-ahead-an-overview-of-the-proposed-digital-india-act.html [access: 6.11.2023].

Recommendation (2019), Organisation for Economic Co-operation and Development, Recommendation of the Council on Artificial Intelligence. Adopted on: 22/05/2019

Szpor G. (2016), Jawność i jej ograniczenia. T 1. Idee i pojęcia (*Openness and its limitations. Vol. 1 Ideas and Concepts*), Warsaw.

Wielka Encyklopedia Prawa. T. XII Prawo Informatyczne (*The Great Encyclopedia of Law. Vol. XII Informatics Law*), G. Szpor, L. Grochowski (ed.), Warszawa 2021, s. 213–214, 435.

Techtarget (2023), https://www.techtarget.com/searchenterpriseai/definition/AI-Artificial-Intelligence [access: 6.11.2023].

Trzciński T. (2023), Regulowanie rozpędzonego pociągu (*Regulating a speeding train*). IDEAS NCBR, https://ideas-ncbr.pl/jak-ai-act-wplynie-na-badania-nad-sztuczna-inteligencja-komentarz-ekspertow-ideas-ncbr/ [access: 6.11.2023].

Węgrzyn S. (1999), Informatics science, Archiwum informatyki teoretycznej i stosowanej, vol. 11 no. 2.

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.37

Agnieszka Gryszczyńska[1]

CRIMINAL LIABILITY FOR CLI SPOOFING

Abstract: Spoofing involves masking the identity of a person, group or organisation, by manipulating addresses, identifiers or other data used to identify a user or system. This can range from falsifying IP addresses, phone numbers and email addresses to generating persuasive, fake signals capable of disrupting the reception of legitimate GPS signals by receivers.

The article aims to analyse the criminal liability of spoofing attacks, with a focus on CLI spoofing. Additionally, the article will identify the most common methods used by perpetrators of spoofing attacks. This will be followed by an examination of the statutory measures implemented in Poland to mitigate the effects of spoofing attacks, which are considered as reasons for criminal responsibility.

The article confirms the research hypothesis that effective reduction of CLI spoofing requires not only legislation that introduces criminal liability for spoofing, but also appropriate legal regulations that impose certain obligations on telecommunications entrepreneurs, efficient international cooperation, and comprehensive education in the fields of cybersecurity and cyber hygiene.

Keywords: spoofing, cybercrime, smishing, abuse of electronic communication, hacking, cybersecurity

Received: 13 November 2023; accepted: 16 December 2023

[1] Cardinal Stefan Wyszyński University, Faculty of Law and Administration, Department of Informatics Law, Warsaw, Poland, ORCID ID: https://orcid.org/0000-0003-3004-5253, email: a.gryszczyńska@uksw.edu.pl

Introduction

Electronic communication is used by several billion users. Global growth is being observed in the number of Internet users - in July 2023 they accounted for about 64.5% of the population. Unique mobile subscribers around the world accounted for an estimated 5.56 billion, equating to 69.1 % of the global population. Mobile phone adoption increased by 2.7 % over the past year, thanks to almost 150 million new users (DataReportal, 2023 a). The time that Internet users spend online varies meaningfully by geography and demography. In Poland, the average time spent online by Internet users aged 16 to 64 is 6 hours and 42 minutes, compared to a global average of 6 hours 37 minutes (DataReportal, 2023 b).

The proliferation of electronic communication services and the corresponding rise in online activity unfortunately provides an opportunity for criminal abuse. Incidents can vary in complexity, ranging from those that exploit very simple social engineering techniques to more sophisticated attacks that combine social engineering with the exploitation of vulnerabilities, loopholes, manipulation of computer systems and the use of disruptive technologies. The goals of perpetrators responsible for the abuse of electronic communications vary, however the primary goal is to achieve financial gain by acting to the detriment of end-users or companies providing interpersonal communication services.

One of the techniques used by offenders is spoofing. Spoofing can range from faking IP addresses, phone numbers, email addresses to generating false signals that are strong enough to interfere with receivers' reception of real GPS signals.

IP and email spoofing are prevalent among cybercriminals. IP spoofing is used to conceal the attacker's IP address, while email spoofing is often used to enhance the effectiveness of an attack rather than to conceal the attacker's email address. In recent years, in Poland, attacks where the perpetrators spoofed telephone numbers have been particularly troublesome. The significant number of attacks targeting politicians' personal information has prompted a wider discussion on how to counter CLI spoofing and how to investigate perpetrators using this technique.

The purpose of this article is to analyse criminal liability for attacks using spoofing. In addition, regulations introduced in Poland in 2023 by the Act on Combating Abuse in Electronic Communications (ACAEC), designed to limit spoofing, and in particular CLI spoofing, were discussed. The broader approach involving consideration of administrative law provisions is further aimed at verifying the effectiveness of this regulation in reducing CLI spoofing attacks and protecting victims.

The article verifies the research hypothesis, according to which not only legislation introducing criminal liability for spoofing, but more broadly appropriate legal regulations imposing certain obligations on telecommunications operators, efficient international cooperation, as well as comprehensive education in the field of cybersecurity and cyber hygiene are necessary to effectively reduce CLI spoofing.

Material and methods

The article applies primarily the dogmatic method, as the analysis of criminal liability for CLI spoofing was based both on selected normative acts and the literature on the subject. Complementarily, a comparative legal method was applied. The basis for the analysis was the Polish Act on Combating Abuse in Electronic Communications (ACAEC, 2023) and the Polish Criminal Code (PCC, 1997) and the solutions introduced in them related to differentiated liability for both spoofing and technical maintenance of infrastructure and services enabling such attacks.

State of a problem: the concept of spoofing

Activities in cyberspace allow perpetrators to maintain a high level of anonymity. Criminals attempting to conceal their own identity often use fictitiously created identities or assumed identities to do so. The problem of impersonation is complex and multidimensional (Gryszczyńska, 2020). Spoofing can be defined as the act of concealing the identity of a person, group or organisation by manipulating addresses, identifiers or other data, that can be used to identify a user or system. It is a tactic that involves hiding or disguising one's true identity, as well as manipulating data, changing attributes, or using certain tools to hide the identity of the originator. Additionally, spoofing aims not only at hiding the identity of the source but also at mimicking a trusted and legitimate source. The objective of spoofing is to deceive the target into thinking they are interacting with a trustworthy entity when this is not true. For spoofing to succeed, the user's trust is crucial. Spoofers exploit this trust to gain unauthorised access or deceive the recipient by posing as a trusted authority. By masquerading as a reliable source, spoofers can bypass security measures, enabling malicious content or activities to proceed without obstruction. Successful spoofing is characterised by its difficulty in being detected. Messages that seem to originate from a trustworthy source generally do not raise red flags, leading to difficulty for both systems and users in differentiating between legitimate and spoofed communications. It is important to note that spoofing is not a standalone crime, but rather a component of a multifaceted criminal act that aims to facilitate the perpetrator in achieving a specific objective (e.g. obtaining unauthorised information, financial gain, or causing harm).

The most common types of spoofing include: IP spoofing (source address manipulation), email spoofing (forgery of message headers), CLI Spoofing (Calling Line Identification Spoofing), text Spoofing (sending SMS or text messages from a forged sender, commonly used in smishing attacks), website spoofing, DNS Cache Poisoning (DNS Spoofing), Wi-Fi spoofing (impersonating access points), MAC Spoofing, ARP Spoofing (poisoning the ARP table), GPS spoofing (confusing navigation systems), biometric spoofing (deceiving recognition systems), SSL/TLS spoofing (forgery of certificates).

The use of the COVID-19 pandemic and social engineering based on it for massive cyber attacks, as well as swatting, which consists of sending information about planting explosives, as well as impersonating politicians' phone numbers to make criminal

threats against other people, triggered legislative action in Poland. As a result, on 28 July 2023, the Act on Combating Abuse in Electronic Communications (ACAEC, 2023) was adopted, which includes new obligations for telecommunications providers to combat abuse in electronic communications, as well as administrative (financial) and criminal sanctions.

The ACAEC broadly defines the misuse of electronic communications as the provision or use of a telecommunications service or the use of telecommunications devices contrary to their intended purpose or contrary to the law, the purpose or effect of which is to cause damage to a telecommunications operator or end-user or to obtain an undue advantage for the misuser of electronic communications, another natural person, legal person or unincorporated entity. Abuses of electronic communications under Article 3 of the ACAEC include, inter alia, the generation of artificial traffic, smishing, CLI spoofing and unauthorised modification of address information. A broad definition of spoofing among the abuses identified in Article 3 of the ACAEC would include both smishing, CLI spoofing and unauthorised modification of address information, i.e. the unlawful modification of address information that makes it impossible or significantly more difficult for authorised entities or telecommunications operators involved in the transmission of a communication to determine the address information of the user sending the communication. The definition of a communication in Polish law is very broad, encompassing any information exchanged or transmitted between specific users via publicly available telecommunications services (Article 2(17) Telecommunications Law, 2004). The definition of address information used by the Polish legislator is also very broad and includes both a telephone number and any other identifier of the user sending the message (Article 2(3) ACAEC). The identifier may therefore be a subscriber identification character, including an electronic address, a name, a code, a radio station identification character or an IP address.

It will therefore be an abuse of electronic communications to modify the address information of short text messages (including the so-called headers), multimedia MMS messages, as well as the address information of a voice call. It will not be an infringement to change only the IP address of the user sending the communication, as this is the basis for services such as VPN or PROXY.

Calling Line Identification Spoofing

Calling Line Identification spoofing (CLI spoofing) involves telephone calls being made using a false caller identifier (known as caller ID). Caller ID allows the caller's user number to be displayed on the recipient's telephone so that the recipient can decide whether to answer the call. This number is transmitted between operators without mechanisms to authenticate this information (i3Forum, 2020). A user of services that allow the impersonation of an MSISDN number, using the infrastructure of operators that violate the integrity of the network, can enter any telephone number to be displayed on the screen of the recipient of the call. The risk of impersonation of the originating number has not been taken into account in the design of telecommunications

networks, and the communication itself and the transfer of call bundles between operators is based on trust. Therefore, if the call originator pretends to be a different MSISDN number, the telecommunications network operators do not verify this information and the exchanges rely on the messages sent by the other exchanges. The services that enable call originator impersonation are readily available on the Internet and inexpensive, so the perpetrator does not need to have specific knowledge of how the telecommunications network works. For this reason, it is very easy for fraudsters to impersonate a specific number using Internet VoIP gateways. Examples of such impersonated voice calls include: calls originating from abroad where the address information indicates the number of a user in the country, voice calls impersonating an emergency number (e.g. 112), voice calls impersonating a number that does not comply with the national numbering plan.

The Polish legislator, when introducing the catalogue of telecommunications abuses in the ACAEC defined CLI spoofing as the unauthorised use or exploitation by a user or a telecommunications operator, making a voice call, of address information indicating a natural person, a legal person or an unincorporated organisational unit other than that user or telecommunications operator, legal person or unincorporated organisational unit other than that user or telecommunications undertaking, in order to impersonate another entity, in particular to cause fear or anxiety or to induce the recipient of the call to perform a specific act, in particular to disclose personal data, damage property or install software (Art. 3(1)(3) ACAEC). It should be noted, however, that the terminological scope of CLI spoofing as an abuse of electronic communications is broader than the scope of the offence under Article 31 ACAEC, which consists in the use of address information indicating another entity when making a voice call.

Attack scenarios that exploit CLI spoofing

As indicated in the literature, antispoofing has not been a major design consideration in the development of not only telecommunications networks and protocols, but also civil GPS and WAAS signal architectures. However, rapid progress in computing power has made it much more possible to create advanced "all software" spoofer systems. The widespread use of electronic communication and GPS technology in various applications has made it more appealing to carry out attacks, mainly in pursuit of financial gain (Scott, 2003). This trend is on the rise.

Spoofing, including CLI spoofing, is a global phenomenon and has been used in various criminal scenarios for many years. In particular, media reports of attacks in the USA are described and referred to as swatting, a crime that has evolved from a dangerous prank to a cybercrime that can be ordered as a service. Swatting is where someone makes a hoax emergency call to law enforcement in order to get armed police (hence the SWAT reference) to target a particular address. While the attacks vary in nature, it is significant that swatting also occurs in the Swatting-as-a-Service model. Using the anonymity provided by electronic communications, CLI spoofing and voices generated by artificial intelligence (AI), individuals or groups of individuals offer

swatting services for small fees to cause the evacuation of public facilities (Arntz, 2023). CLI spoofing is also used in fraudulent activities, which are becoming increasingly sophisticated and difficult to detect. It usually originates offshore, readily adapts to disruption measures and ruthlessly exploits new opportunities and vulnerabilities (C661:2022).

CLI spoofing in 2022 and 2023 in Poland was most commonly observed in scenarios where the perpetrator pretended to be a bank customer service call centre employee. The phone number displayed to the victim was that of the bank's call centre. Victims were most often informed that an attempt to allegedly break into a bank account had been detected and asked to install a remote desktop application that would give the perpetrators access to the victim's device. In scenarios where a bank call centre number has been impersonated, the perpetrators' aim is most often to phish for personal data, e-banking passwords, to induce a transfer to a specified bank account, to induce the installation of malware or other software that allows the perpetrator to access the victim's device.

For similar purposes and scenarios, the perpetrators impersonate the telephone number of a police unit (including, but not limited to, the telephone numbers of the Central Bureau for Combating Cybercrime), informing the victim of an alleged intrusion into their bank account and the need to transfer funds to another bank account. The perpetrators impersonate the telephone numbers of bank call centres or police units in order to increase the credibility of the socio-technical scenario and thus the effectiveness of the attack, the primary objective of which is to obtain the funds deposited in the victim's bank account.

CLI spoofing is also used to make criminal threats, harassment or to report a non-existent threat (e.g. planting explosives). A significant number of such incidents were reported in Poland in late 2021 and early 2022. The perpetrators impersonated the phone numbers of public figures, politicians, journalists and cybersecurity experts. In most cases, tools that convert text into synthetic speech (voice synthesizers) were used and a pre-recorded message was played. Given the modus operandi of the perpetrators, it should be noted that in this scenario the aim was to trigger action by law enforcement agencies (e.g. police) and services necessary to ensure safety and health protection (fire brigade, ambulance). The vast majority of these attacks also aimed to harm the person whose data was used, both by making them feel ridiculed or less credible, and by targeting them for law enforcement action. Persons whose telephone numbers have been impersonated and whose data have been used should therefore in principle be considered as victims of identity theft (i.e. the offence defined in Article 190a § 2 PCC). Unfortunately, in some cases victims of identity theft have been treated as perpetrators of criminal threats (i.e. an offence under Article 190a § 1 PCC) or swatting (Article 224a PCC).

Misdirected pre-trial investigations in CLI spoofing cases can be avoided by a thorough analysis of the connection lists for the MSISDN to which the call was made and the MSISDN that allegedly initiated the call (the impersonated number). The purpose of comparing the incoming and outgoing calls for both numbers is to check that

the call under investigation is included in the call lists of both MSISDNs and that the data relating to this call is the same on both call lists (as regards the start and end time of the call). Spoofing may also be indicated by discrepancies in the time at which the call should have been established, the termination of the call or the duration of the call, the absence of the IMEI number of the device or BTS data in the call list.

Identifying the person responsible for a particular attack and the infrastructure provider is not easy because the perpetrators of individual attacks use foreign telecommunications infrastructure. In addition, the connection is repeatedly routed between different operators. In order to determine where the call originated, law enforcement authorities should, after obtaining data from the call list indicating spoofing, request the telecommunications operator to provide the call path, i.e. data on the operator from whose network the call was routed. Once this information has been obtained, a similar request should be made to the next operator. Since in all the cases analysed for the purpose of this article, calls to the Polish network were routed from foreign operators, it was necessary to use the instruments of international legal cooperation in order to establish the path of the call. Due to the critically short period of time during which data was stored to allow tracing a connection, even the immediate preservation of data in accordance with Article 29 of the Convention on Cybercrime (2001) did not make it possible to determine the originator of the connection.

The effectiveness of the attacks in which CLI spoofing was used indicates the need for widespread educational efforts to raise awareness of the risks and cyber hygiene. In cases of CLI spoofing, the victim would not have been harmed if he or she had ended the call and called back the number that the perpetrators were impersonating.

The offence of spoofing in Poland

The Act on Combating Abuse in Electronic Communications contains four criminal provisions. These introduce criminal liability for the generation of artificial traffic (Article 29), smishing (Article 30), CLI spoofing (Article 31) and modification of address information (Article 32).

According to Art. 31 of the ACAEC states that anyone who, with the aim of obtaining a financial or personal advantage or causing damage to another person, uses, without being entitled to do so, address information identifying another natural person, legal person or organisational unit without legal personality, when making a voice call, in order to impersonate another entity, in order to induce the recipient of such a call to disclose personal data, to dispose unfavourably of property or to install software, to disclose computer passwords, access codes or other data allowing unauthorised access to information stored in a computer system, data communication system or data communication network. In its basic type, this offence is punishable by imprisonment from 3 months to 5 years; in the case of lesser gravity, the perpetrator is subject to a fine, restriction of liberty or imprisonment for up to one year. Only if the offence is committed against a person close to the perpetrator is the victim prosecuted.

This is a intentional offence. Since the perpetrator must act with the aim of obtaining financial gain, personal advantage or causing harm to another person, and then with the aim of inducing the recipient of the call to disclose personal data, dispose of property or install software, disclose computer passwords, access codes or other data that allows unauthorised access to information, from a subjective point of view – direct intent is required.

The use by the offender of address information indicating another entity in a voice call is intended to impersonate another entity in order to induce the recipient of the call to act in a particular way. However, it is not necessary to achieve the objective in order to fulfil the elements of the offence. Even if the recipient of the call does not transmit data or install malicious software, the mere impersonation of another entity makes the offence under Article 31 ACAEC an offence and not merely an attempt. The offence is therefore of a formal nature.

It should be stressed that Article 31 only defines criminal liability for the use of address information impersonating another entity when making a voice call. Pretending to be another entity when sending a text message (SMS), a multimedia message (MMS) or a message via other interpersonal communication services is punishable under Article 30 of the ACAEC.

The most general provision relating to the modification of address information is Article 32 of the ACAEC, which covers the unlawful modification of address information that prevents or significantly impedes the determination of the address information of the user sending the communication by the authorised entities or telecommunications undertakings involved in the delivery of the communication, for the purpose of obtaining a pecuniary advantage, personal benefit or causing harm to another person. For the purposes of fulfilling the elements of Article 32 ACAEC, it is also not necessary to analyse whether the impersonator's purpose was to induce the recipient of the communication to disclose personal data, to dispose of property, to install software, to disclose computer passwords, access codes or other data allowing unauthorised access to information. It is sufficient to establish that the primary objective of the perpetrator is to obtain financial gain or personal advantage or to cause harm to another person, without examining his or her indirect objective. Article 31 ACAEC is therefore *lex specialis* to Article 32 ACAEC.

According to the general conflict rule that the more specific law should be applied before the more general law (*lex specialis derogat legi generali*), Article 31 of the ACAEC should apply to scenarios of attacks primarily aimed at monetisation, i.e. the impersonation of banks or police officers described above in order to defraud e-banking data, induce a transfer or install software. For scenarios where the perpetrators impersonate another person's telephone number in order to make criminal threats or to inform about a non-existent threat, Article 32 of the ACAEC will apply.

In principle, the criminal provisions of the ACAEC will not be the only basis for the perpetrator's liability, as changing address information is not an end in itself, but a means to another end. When determining the liability of an offender using CLI spoofing and directing criminal threats, criminal liability for identity theft (Article 190a § 2 PCC)

and directing criminal threats (Article 190 § 1 PCC) should also be taken into account. In swatting cases, criminal liability for identity theft (Art. 190a § 2 PCC) and inducing an institution to act by reporting a non-existent threat (Art. 224a PCC) should be taken into account. In cases involving monetisation, depending on the scenario, criminal liability for fraud (Art. 286 § 1 PCC), computer fraud (Art. 287 § 1 PCC), break-in (Art. 279 § 1 PCC) and hacking (Art. 267 § 1 PCC).

If the perpetrator's actions are considered to constitute a single offence which fulfils the elements set out in two or more provisions of the criminal law, the court will convict the perpetrator of a single offence on the basis of all the concurrent provisions. The court will punish the offender on the basis of the provision that provides for the most severe punishment. In swatting cases – the most severe punishment is provided by Article 224 a PCC (8 or 12 years imprisonment), if the perpetrator fulfils the elements of identity theft - Article 190 a § 2 PCC (8 years), if the remaining provision in concurrence is Article 286 § 1 PCC (8 years) or Article 279 § 1 PCC (10 years), these articles will be the basis for the punishment, as the upper limit of criminal liability for acts under Articles 31 and 32 ACAEC is 5 years imprisonment.

Results and discussion: effectiveness of criminal law regulation vs. other measures

In the current network environment, there are an increasing number of untrustworthy devices (including the private automatic branch exchange, call centre and VoIP access system) that interconnect to a public land mobile network/public switched telephone network. As a result, a large number of phone numbers are leased to anonymous call providers who help fuel phone spam. Calls with spoofed numbers come from all over the world and account for a significant and growing proportion of nuisance calls.

The perpetrators – both those responsible for providing the infrastructure necessary for spoofing and those who use this infrastructure for impersonation – are extremely difficult to identify due to the anonymisation methods they use. The low detection rate of CLI spoofing perpetrators means that criminal provisions will not be effective. Diverse measures are needed to reduce CLI spoofing and its negative effects.

Caller ID spoofing, although a common threat, can be effectively minimized with modern technologies and standards. Two key solutions are STIR/SHAKEN and robocall blocking. While these technologies are available, their effectiveness depends on their proper implementation. All network operators must update their systems to support STIR/SHAKEN protocols, and users must take advantage of the robocall blocking option, if available. Each network must confirm the authenticity of a caller's number before forwarding the call to the next network. This means that all operators around the world must update their systems to support these protocols. For obvious reasons, this is a postulate that is impossible to implement on a global scale. However, these solutions are being introduced locally (Telephone Robocall Abuse, 2020). In addition, they are accompanied by the imposition of various obligations on telecommunications

entrepreneurs (US TRACED Act, 2019). Those who do not fulfil these obligations may be subject to legal liability (U.S. Dept. of Justice, 2020).

In addition to the criminal liability discussed above, the Polish law also provides for a number of obligations imposed on telecommunications operators to take proportionate (and risk-based) measures to prevent and combat the misuse of electronic communications. One such measure is the monitoring of telecommunications services to detect cases of CLI spoofing. Article 16 of the ACAEC imposes an obligation on a telecommunications undertaking to either block a voice call or to conceal the identification of the calling number to the end-user when CLI spoofing occurs. Voice call blocking should be used when the likelihood of CLI spoofing is very high or high. In other cases, the telecommunications undertaking should conceal the caller identification from the end user. Hiding the caller identification means in practice that the recipient is told that an unknown number is calling, rather than being told, for example, that a close friend whose number is in the contact list is calling.

To effectively combat CLI spoofing, a telecommunications operator must also be able to monitor traffic on the telecommunications network to detect suspicious voice calls. Measures are also needed to enable the exchange of information about such calls between operators – traffic on the telecommunications network is often routed through the telecommunications networks of different operators. Finally, measures are needed to deal with suspicious calls – either to block such a call or to conceal the identification of the calling number from the end user. According to Article 19 of the ACAEC, the telecommunications undertaking shall apply organisational and technical measures to monitor, detect and exchange information on CLI spoofing and either block the voice call or conceal the caller identification to the end user. A provider of publicly available telecommunications services who provides telecommunications services to at least 50,000 subscribers and who is also an operator may enter into an agreement with the President of the Office for Electronic Communications in which it specifies the detailed organisational and technical measures it will apply in fulfilling the obligations referred to in Article 16. The drafting of this provision was based on Recommendation M.3362 of the International Telecommunications Union (M.3362, 2020). By signing and correctly implementing this agreement, operators fulfil their obligation to take appropriate organisational and technical measures to prevent CLI spoofing. The ACAEC also introduces an exemption from liability for non-performance or improper performance of the telecommunications service for those operators that correctly implement the agreement. The exemption from liability for correct implementation of the agreement will provide a strong incentive to join the agreement. With this solution, the largest telecommunications operators, with the support and supervision of the Office for Electronic Communications, will be able to develop the best organisational and technical solutions to combat abuse in electronic communications. For smaller telecommunications operators that may not be able to fulfil the obligations set out in the agreement, the President of the Office for Electronic Communications will issue recommendations specifying organisational and technical measures to implement the obligations related to combating CLI spoofing. The correct implementation of the

recommendations of the President of the Office for Electronic Communications will exclude the liability of these operators for the non-performance or improper performance of telecommunications services resulting from the introduction of these measures.

In addition, taking into account the fact that criminals very often impersonate call centre numbers of various entities that are only used to receive calls and not to call customers, a mechanism has been introduced to prevent impersonation of these numbers. Pursuant to Article 17 of the ACAEC, the President of the Office for Electronic Communications shall maintain, by means of an ICT system, an unclassified list of numbers used only for receiving voice calls and shall make this list available in the Public Information Bulletin on his authority's website. Banks and public financial institutions, among others, may request to be included in the list. It is the responsibility of the telecommunications company providing the voice call service to block incoming calls to its network using a number included in the list.

Apart from criminal liability, the ACAEC contains provisions on administrative fines. Not only a telecommunications operator who commits an abuse of electronic communications, such as the generation of artificial traffic, smishing, CLI spoofing, unauthorised change of address information, but also a telecommunications operator who fails to comply with the obligations imposed by Articles 16 and 17 of the ACAEC may be fined. It should be noted, however, that if an act constituting an abuse of electronic communications also exhausts the elements of a criminal offence, only the provisions on criminal liability apply to a telecommunications operator that is a natural person.

It should also be noted that an administrative fine will be introduced for the four abuses of electronic communications mentioned above. For the remaining abuses, a specific entity may be held criminally liable and subject to general civil liability rules.

Irrespective of the fine imposed on a telecommunications undertaking, the President of the Office for Electronic Communications may, by decision, impose a fine of up to 300% of the monthly earnings of the management of a telecommunications operator.

Conclusions

Countering and combating electronic communication abuse requires a variety of legal, organizational, and technical measures due to its multifaceted and intricate nature.

Some opinions on the draft ACAEC, however, pointed out that phenomena such as smishing, CLI spoofing or unauthorised change of address information do not require such extensive criminalisation and that administrative or misdemeanour penalties would be sufficient for these behaviours (Supreme Court of the Republic of Poland, 2023). However, given the specific nature of the actions of the infringers, it should be considered that such an adoption of the scope of liability, taking into account the limited legal means to establish the identity of those responsible for providing the infrastructure enabling CLI spoofing and impersonation of other subscribers, would

make administrative and misdemeanour liability only illusory. It is only through criminal law that specific information can be gathered quickly to identify the person or entity responsible. Especially as the cases in which CLI spoofing is used are of a cross-border nature.

Irrespective of criminal liability, there is a need for provisions that impose certain obligations on telecommunications undertakings in relation to the prevention of telecommunications abuse against certain persons who are perpetrators of the offences set out in the ACAEC or the PCC. Administrative fines should be provided for violations by the telecommunications providers themselves or for not implementing the obligations related to the protection of users.

Entrepreneurs will only make the financial effort to implement certain technical measures if the supervisory authority can impose a financial penalty on the entrepreneur (and at the same time the management of the company).

At the same time, the effects of CLI spoofing can be mitigated by widespread and mass cybersecurity education. The formation of habits related to the verification of information and the verification of the identity of the caller are the fundamentals of cyber hygiene.

The article confirms the research hypothesis that effective reduction of CLI spoofing requires not only legislation that introduces criminal liability for spoofing, but also appropriate legal regulations that impose certain obligations on telecommunications entrepreneurs, efficient international cooperation, and comprehensive education in the field of cybersecurity.

References

ACAEC (2023). Act of 28 July 2023 on Combating Abuse in Electronic Communications. Journal of Laws 2023, item 170.

Arntz P. (2023). Swatting-as-a-Service is a growing and complicated problem to solve. https://www.malwarebytes.com/blog/news/2023/04/swatting-as-a-service-is-a-growing-and-complicated-problem-to-solve [access: 25.11.2023].

C661:2022. Reducing Scam Calls and Scam SMS. Industry Code. Communications Alliance LTD. https://www.commsalliance.com.au/__data/assets/pdf_file/0015/72150/C661_2022.pdf [access: 25.11.2023].

DataReportal (2023 a). Digital 2023 October Global Statshot Report. https://datareportal.com/reports/digital-2023-july-global-statshot [access: 17.11.2023].

DataReportal (2023 b). Digital 2023 Global Overview Report. https://datareportal.com/reports/digital-2023-global-overview-report [access: 17.11.2023].

Gryszczyńska A. (2020). Identity theft in cybercrime cases. In: Yearbook of Maritime Security, Teleinformation Crime 2019, J. Kosiński, G. Krasnodębski (ed.). Gdynia, pp. 207–227.

i3Forum (2020). International Interconnection Forum for Services over IP (i3 FORUM). Technical Report Calling Line Identification (CLI) spoofing (Release 1.0) October. https://i3forum.org/blog/2020/11/04/i3forum-calling-line-identification-cli-spoofing-report/[access: 17.11.2023].

M.3362. 2020. Recommendation M.3362 (06/20). Requirements for telecommunication anti-fraud management in the telecommunication management network. International Telecommunication Union. https://www.itu.int/rec/T-REC-M.3362-202006-I/en [access: 25.11.2023].

PCC (1997). Criminal Code of June 6, 1997. Journal of Laws of 2022, item 1138, as amended.

Scott L. (2003). Anti-Spoofing & Authenticated Signal Architectures for Civil Navigation Systems, Conference Paper. ION GPS/GNSS 2003. Portland, OR.

Supreme Court of the Republic of Poland (2023). Opinion on the government draft law on combating abuse of electronic communications. Sejm print no. 3069. Supreme Court of the Republic of Poland.

Telecommunications Law (2004). Telecommunications Law of 16 July 2004. Journal of Laws 2022 items 1648, 1933 and 2581 and 2023 items 1394 and 1703.

Telephone Robocall Abuse (2020). Telephone Robocall Abuse Criminal Enforcement and Deterrence Act 2020. Report to Congress. U.S. Department of Justice. https://www.justice.gov/opa/press-release/file/1331576/download [access: 25.11.2023].

The Convention on Cybercrime of the Council of Europe (CETS No. 185) (2001). https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/185 [access: 25.11.2023].

U.S. Dept. of Justice (2020). The Department of Justice Files Actions to Stop Telecom Carriers Who Facilitated Hundreds of Millions of Fraudulent Robocalls to American Consumers. https://www.justice.gov/opa/pr/department-justice-files-actions-stop-telecom-carriers-who-facilitated-hundreds-millions [access: 25.11.2023].

US TRACED Act (2019). Pallone-Thune Telephone Robocall Abuse Criminal Enforcement and Deterrence Act (Public Law 116–105). https://www.govinfo.gov/content/pkg/PLAW-116publ105/pdf/PLAW-116publ105.pdf [access: 25.11.2023].

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.51

Marzenna Miłek[1], Jerzy Stanik[2], Maciej Kiedrowicz,[3] Jarosław Napiórkowski[4]

THE USE OF THE GIS SYSTEM IN OPTIMIZING THE COSTS OF INSPECTING TECHNICAL DEVICES

Abstract: Enterprises using cranes, HDS platforms, other handling equipment, or pressure equipment in their activities are subject to registration with the Office of Technical Inspection (UDT), which is obliged to conduct inspection activities on them. Inspections of technical devices are aimed at checking their technical condition. Approximately 1.3 million technical devices are currently subject to UDT supervision in Poland. Annually, UDT inspectors carry out over 1 million tests of technical devices, and the activities carried out by UDT translate into a constant reduction in the accident rate. All this takes place in conditions that require continuous work planning and scheduling. This article aims to present and discuss the use of open-source solutions for planning the work of teams carrying out inspection activities, along with the concept of their use.

Keywords: open data, GIS, FSM, field service management, work scheduling, work dispatching, continuous planning, non-disruptive replanning, real-time planning, overconstrained planning

Received: 27 November 2023; accepted: 18 December 2023

[1] Military University of Technology, Faculty of Cybernetics, Institute of Computer and Information Systems, Warsaw, Poland, ORCID ID: 0009-0002-9806-6755, email: marzenna.milek@wat.edu.pl
[2] Military University of Technology, Faculty of Cybernetics, Institute of Computer and Information Systems, Warsaw, Poland, ORCID ID: 0000-0002-0162-2579, email: jerzy.stanik@wat.edu.pl
[3] Military University of Technology, Faculty of Cybernetics, Institute of Computer and Information Systems, Warsaw, Poland, ORCID ID: 0000-0002-4389-0774, email: maciej.kiedrowicz@wat.edu.pl
[4] Military University of Technology, Faculty of Cybernetics, Institute of Computer and Information Systems, Warsaw, Poland, ORCID ID: 0000-0003-3286-3751, email: jaroslaw.napiorkowski@wat.edu.pl, corresponding author.

Introduction with analysis of the state of the problems

The Office of Technical Inspection (UDT) is a key institution responsible for supervising the safety of technical equipment in Poland. It plays an important role in ensuring compliance with standards and regulations concerning technical infrastructure. As a state legal entity, UDT operates based on several legal acts and, above all, based on the Act of 21 December 2000 on technical inspection (Journal of Laws of 2000, item 122, pos. 1321). This regulation is the legal foundation for the Office of Technical Inspection activities, enabling effective monitoring and assessment of compliance with safety standards.

The history of the Office of Technical Inspection dates back to over a hundred years of Polish technical inspection tradition, which confirms its deep-rooted heritage. Since its inception, UDT has been developing and adapting to dynamic technological and industrial changes. Currently, as one of the pillars of the technical safety system in the country, UDT plays a key role in maintaining high safety standards in various sectors of the economy.

The location of 10 local branches and 22 offices throughout Poland enables UDT to operate effectively at local levels, approaching individual regions' specific needs and challenges. This strategic location of field units and offices allows for a quick response to situations and effective management of technical supervision processes throughout the country.

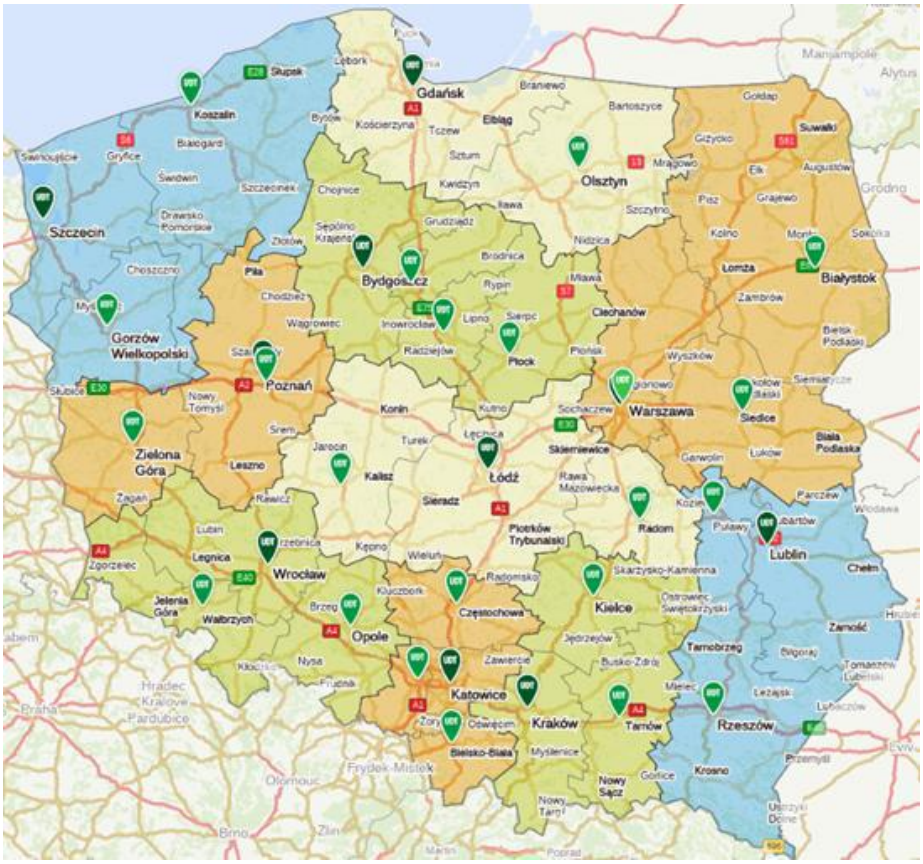


Fig. 1. Map of branches – territorial division

Source: https://www.udt.gov.pl

UDT operates mainly based on the Technical Inspection Act, the legal basis for its activities. It is worth noting, however, that regulations specifying the functioning of this institution can also be found in executive acts related to the Act above. This comprehensive approach allows for effective monitoring and control of areas related to the safety of technical equipment.

However, the activity of the Office of Technical Inspection is not limited only to the framework defined by the Technical Inspection Act. This institution also acts as a Notified Body No. 1433, under the Act of 30 August 2002 on the conformity assessment system and the Act of 13 April 2016 on conformity assessment and market surveillance systems. In addition, UDT operates based on relevant notifications, which entitle it to perform conformity assessment within the scope of nine EU New Approach Directives and two regulations (Journal of Laws of 2002, item 166, pos. 1360).

UDT also acts as a certification body, operating under the name UDT-CERT. Within this activity area, the institution conducts audits, focusing on the certification of management systems, certification of people's competencies, and certification of products. UDT-CERT is important in ensuring compliance with norms and standards in various fields. Through certification audits of management systems, UDT-CERT confirms that organizations meet specific quality, environment, or safety requirements. At the same time, the certification of individuals is a key tool in confirming professional qualifications and raising the standards of competence of employees. Finally, the product certification process assures that products meet specific norms and standards. Therefore, the activity of UDT-CERT is not only an element protecting against inconsistencies and risks but also supports the improvement of quality, safety, and sustainable development in various sectors of the economy.

Another area in which UDT plays an important role in the Polish market is being a certification body for installers of Renewable Energy Sources (RES) and is responsible for accreditation centers conducting training for these installers (Journal of Laws of 2015, item 478). Regarding certification, UDT confirms that RES installers meet certain standards of competence and qualifications, which is crucial to ensure a high level of performance of works related to renewable energy. At the same time, through the accreditation process of training centers, UDT ensures that the set standards conduct training for RES installers. This means these centers are reliable, provide reliable knowledge, and effectively transfer the necessary skills required in Renewable Energy Sources. This works to raise industry standards while fostering the sustainability of the RES sector by ensuring high standards of installer competence and the quality of training offered by accredited centers. This is an integral part of UDT's commitment to developing and maintaining high standards in renewable energy.

Finally, UDT, as an entity statutorily responsible for the popularization of knowledge in the field of safety of technical equipment at the stage of design, manufacture, and operation, also offers training, which is an initiative aimed at improving the professional qualifications of both manufacturers and users of technical

equipment. This area of activity is directly related to the requirements of the Technical Inspection Act, which imposes liability related to the operational safety of technical equipment. As part of these trainings, UDT focuses on providing practical knowledge and skills necessary to effectively and safely use various types of technical devices. For manufacturers, this means raising standards in their production processes by applicable standards and regulations. On the other hand, these trainings are an excellent opportunity for users to understand the principles of safe operation and proper equipment maintenance. Through these training initiatives, UDT not only fulfills its mission related to technical supervision but also actively supports the improvement of competencies in the field of technical safety at various levels of production and use. This, in turn, contributes to a safer and more efficient working environment in technical equipment.

As you can see, such diverse areas of UDT's activity testify to its versatility and ability to adapt to various technical security aspects. As a result, UDT not only complies with the national regulations on technical inspection but also actively participates in the conformity assessment system at the EU level, which confirms its high rank and importance in the context of technical safety in Poland and Europe. One thousand three hundred high-class engineers carry out these tasks.

In the context of dynamic technological development and the increased importance of safety in the work environment and society, the role of UDT is becoming even more crucial. This article takes a closer look at the challenges faced by the Office of Technical Inspection, particularly in field service management (FSM). It also analyses how UDT can effectively deal with these challenges using modern tools, technologies, and proven management practices.

Despite such a wide range of services, the main area of UDT's activity is technical equipment inspections. The Office of Technical Inspection (UDT) controls many technical devices, including m.in. Machines and devices move people or loads within a limited range. Examples of such devices include overhead cranes, winches, cranes, hoists, freight lifts, escalators, escalators and moving walkways, forklift trucks, cabin and platform circular conveyors, cranes for transporting people or cargo, lifts for moving people for tourist and sports purposes, and many others. The Office of Technical Inspection controls transport-related equipment, including ropeways and mobile platforms in ferry harbors. UDT also inspects pressure equipment that contains liquids or gases at pressures other than atmospheric, as well as non-pressure vessels and tanks with an overpressure of up to 0.5 bar. All this means that UDT cares about the safety and quality of equipment subject to increased pressure and may threaten people and the environment. The Office of Technical Inspection (UDT) conducts tests and inspections of these devices to ensure their safe and effective operation and to protect the health and life of people and the environment. In Poland, over 1.5 million devices are subject to technical inspection, and UDT inspectors perform over a million yearly technical inspections. Performing such a large number of inspections with limited human resources is extremely challenging. This must be done with diligence, time regime, and

the use of a minimum number of resources (personnel, equipment – the so-called PDB – measurement and research equipment) and efficient logistics of inspections.

To perform supervisory tasks, each UDT inspector must have the required competencies. To standardize the sets of such skills, they were divided into groups of activities that can be performed. Examples of specializations are presented in Table 1.

Table 1. Selected authorizations

Code	What to do	Full name
ZP	BT, UD, UZ, SK, OZ, OZBT	Portable tanks and acetylene generators
K	BT, UD, UZ, BS, OZ, OK	Boilers and power pipelines
ZS	BT, UD, UZ, BS, OZ	Fixed tanks and pipelines
DZP/DZ	BT, SK	Cranes & Conveyors – Cranes Only
DZP/PK	BT, SK	Cranes & Conveyors – Conveyors Only
DZP-pr	BT, SK, UD, UZ, PEL, OZ	Cranes and conveyors, excluding conveyors for leisure and entertainment purposes
SOUP/ZU	BT, SK	Cranes, mobile platforms, and hoists – cranes only
B	BPR	Process safety
B	Bfs	Functional Safety Equipment
B	CBP	Industrial Cybersecurity
M	ohm	Technical acceptance of metal materials
M	Ots	Technical acceptance of plastic materials
M	ohm	Technical acceptance of metal materials
E	Bts	Electromobility – Technical Research

Source: Own elaboration

Acquiring competence in a given field is long-term and ends with an exam. In the Office of Technical Inspection, this is determined by detailed rules of conduct concerning specialization training, examination, authorization, and maintenance of competencies of the technical personnel of the Office of Technical Inspection. This significantly impacts the availability of engineering staff who can carry out inspection activities.

The inspection process itself is also not a simple matter. As part of it, several activities should be carried out to assess the condition and compliance of the device with specific regulations and standards. These include, for example:

1. Visual Assessment: A visual assessment of the device is carried out, checking for the general condition, damage, signs of wear, looseness, or leaks.
2. Functional testing: Tests are performed to verify that the device works as intended and meets the technical requirements. This may include commissioning, checking operating parameters, and determining the performance or accuracy of measurements.

3. Measurements and tests: Measurements and tests are performed to evaluate the specific technical parameters of the device. These can be electrical measurements, pressure measurements, temperature, noise, or other physical properties.
4. Document control: Technical documentation related to the device, such as operating instructions, certificates, test protocols, and evidence of repairs or upgrades, is checked.
5. Risk identification: Potential hazards associated with using the equipment are analyzed, and countermeasures or recommendations for safe operation are identified.

Another huge obstacle in implementing the inspection process is the dispersion of technical equipment throughout the country. As of 1 January 2023, there are 2477 municipalities in Poland. Our country has no municipality where at least one technical device is not installed. Some of them are devices that do not change their location (e.g., technological pipelines, (Fig. 2)).

Fig. 2. Technological pipelines
Source: udt.gov.pl

Unfortunately, a significant number of devices do not have a fixed location. These are not only devices such as mobile cranes or other cranes mounted on mobile chassis (Fig. 3) but also those that can be easily dismantled and reassembled in another location (Fig. 4)

Fig. 3. Mobile crane
Source: udt.gov.pl

Fig. 4. Tower crane
Source: udt.gov.pl

Constantly rising fuel prices or an increase in the rates per 1 kilometer of vehicle mileage, according to which the employer covers the costs of using private vehicles used by employees for business purposes, increase the costs of conducting statutory activities of the Office of Technical Inspection. This has a direct impact on the operating costs of the business.

An area in which savings can be sought is the optimization of the costs of travel of UDT inspectors to the locations where the devices that are the subject of the inspection are installed. Such optimization cannot be a one-time search for savings but a long-term strategy.

In the next part of the article, the concept of using the GIS class system and optimization algorithms will be presented to optimize the costs of conducting inspections of technical equipment while applying the limitations existing in this area. The results will be presented in the form of the architecture of the potential solution. Tools will be presented, thanks to which it will be possible to implement the concept.

Material and methods

Geographic Information Systems (GIS) offer tools and features that can be effectively used to optimize the inspection process for technical equipment. The following are some of how GIS can help reduce costs:

- Inspection Route Planning: Using spatial data in GIS enables inspector route planning quickly, easily, and efficiently. By analyzing data on the location of technical equipment, terrain conditions, and priorities related to the need for inspections, it is possible to create optimal inspection routes, minimizing travel

and time costs. This approach saves time and costs associated with the movement of inspectors.

- Inspection scheduling: GIS also allows you to schedule inspections efficiently. Data on the timing of recent inspections, maintenance cycles, and other factors can be incorporated into creating optimal inspection plans, minimizing costs, and ensuring equipment continuity (Palmer, 2019).

While route planning itself is not a new issue and algorithms for creating optimal routes are known, in the case of an issue such as optimal inspection planning, it is necessary to take into account additional constraints resulting from the availability of resources (people, equipment) and the competencies that must be possessed to perform inspection activities effectively.

To effectively use the Geographic Information System (GIS) to optimize the cost of inspecting technical equipment, you can use various tools, both software and geospatial data.

The key solutions are, of course, the GIS software itself (e.g., ArcGIS, QGIS, or Google Earth Engine), spatial databases, or spatial data itself (e.g., OpenStreetMap (OSM), data from state systems). Of course, you can use languages such as Python with GIS libraries (Geopandas, Shapely) or R with GIS packages (sf, leaflet). However, route planning tools such as Route4Me or OptaPlanner are the kind of tools that can be easily used to optimize route planning and that can be adapted to the specific inspection requirements of technical equipment.

OptaPlanner is an open-source operational optimization software used to solve planning and scheduling problems. First of all, it is:

- Optimization Engine: OptaPlanner is an extensive optimization engine that can solve various optimization problems such as route planning, task scheduling, lesson planning, resource allocation, etc.
- NP-hard problem solver: It is structured to deal with computationally difficult problems (NP-hard), which means there is no fast algorithm to solve them, but OptaPlanner tries to find the best possible solution.
- Programming Interface: Provides a programming interface that allows software developers to implement and adapt optimization algorithms to a specific problem.
- Multi-language support: OptaPlanner supports multiple programming languages such as Java, .NET, Python, etc.

It is important to remember that OptaPlanner is not a ready-for-everything application. It provides an optimization engine but is not a ready-to-use system that can be fully configured without any programming knowledge. Its use requires some programming knowledge. It is also not a data analysis platform: Although it can analyze data in the context of solving an optimization problem, it is not oriented towards data analysis in a general way, like data analysis tools, for example. It is also not a data storage tool or database. OptaPlanner operates on data provided by the user. Finally, it's not a data visualization system either. While it can provide some output data in a form

that can be visualized, it's not a tool for visualizing data in general. Dedicated data visualization tools are usually used for this purpose.

Nevertheless, OptaPlanner is a powerful optimization tool that provides an engine for solving optimization problems, but its full use requires programming work and adaptation to the specific problem domain. One of the key advantages of OptaPlanner is its ability to deal with all sorts of limitations and preferences. It can be customized for a specific domain by specifying optimization rules and criteria. Thus, it can be used to solve a variety of problems.

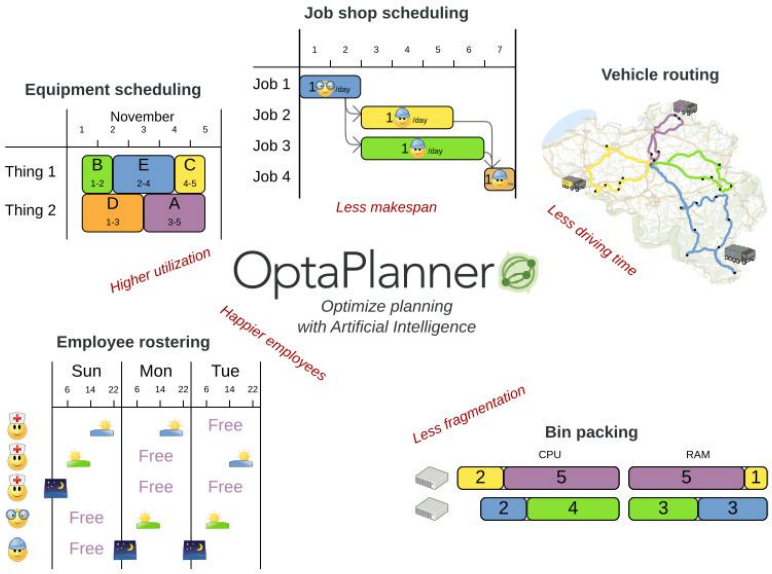


Fig. 5. OptaPlanner – application areas
Source: https://www.optaplanner.org

In optimizing the costs of inspection of technical devices, we limit ourselves to two areas of optimization: task assigning and vehicle routing.

The data for feeding the optimization engine has been prepared to be directly used in the optimization engines provided by OptaPlanner.

In the case of the data for the algorithm for optimal assignment of tasks, information on the competencies of inspectors (Lichtarski, 2011) and their absences (holidays, illnesses) was used as input. In this set, the limitations are the sets of competencies and the availability of people.

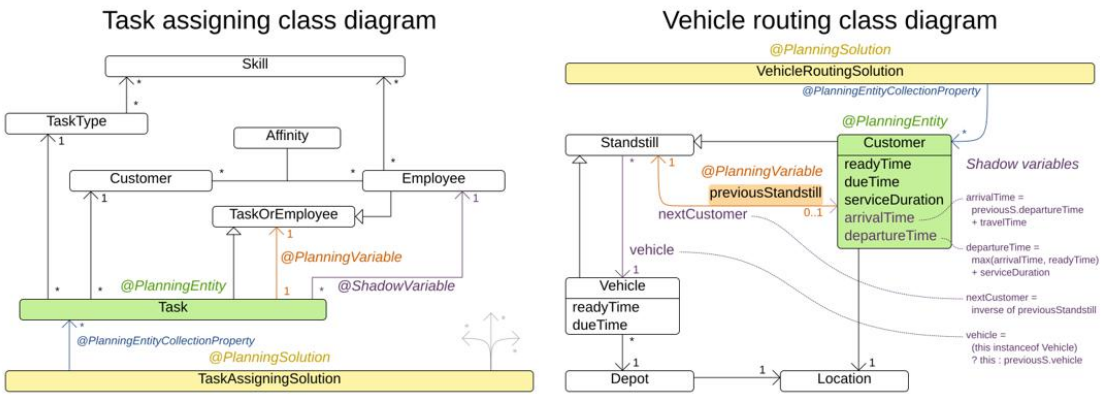


Fig. 6. OptaPlanner – application areas
Source: https://www.optaplanner.org

To feed the data into the structures of the Vehicle Routing Problem (VRP) algorithm, data on technical equipment under supervision and inspection plans resulting in large part from tables specifying the dates of periodic and ad hoc control inspections for individual types of equipment were used. The table (Table 2) presents selected items specifying the dates of periodic and ad hoc check-ups for material handling equipment (UTB).

Table 2. Forms of UTB technical supervision and dates of periodic and ad hoc control inspections – selected items

No.	Material handling device	Form of technical supervision	Date of the examination	
			Periodic	Ad hoc control
1	2	3	4	5
1	UTB is made in whole or in part in an explosion-proof version	full	every year	-
…	…	…	…	…
5	General-purpose hoists and winches with mechanical drive	limited	-	every two years
…	…	…	…	…
13	Hand-driven cranes of all mechanisms with a lifting capacity of more than 2000 kg	limited	-	every three years
…	…	…	…	…
21	Stationary mobile platforms	limited	-	every two years
22	Mobile loading platforms	limited	-	every three years

Source: Regulation of the Minister of Entrepreneurship and Technology of 30 October 2018 on the technical conditions of technical supervision in the field of operation, repair, and modernization of material handling equipment (Journal of Laws of 2002, item 2176)

In the case of route optimization, the basic algorithm is CVRP – i.e., an extension of the VRP problem that considers the load capacity of vehicles. This is an extension of the VRP problem, which is designed so that the amount of goods that need to be delivered to the customer using the available fleet is additionally considered. In our case, this will be used to include in the algorithm the equipment (quantity, weight) that should be available to inspect the technical device at the customer's site.

Results and discussion

The presented concept has been pre-validated using OptaPlanner and Java implementation. Below are selected code snippets that present important aspects of the implementation.

```
@Override
public Constraint[] defineConstraints(ConstraintFactory constraintFactory) {
    return new Constraint[] {
            noMissingSkills(constraintFactory),
            minimizeMakespan(constraintFactory),
            criticalPriorityBasedTaskEndTime(constraintFactory),
            majorPriorityTaskEndTime(constraintFactory),
            minorPriorityTaskEndTime(constraintFactory)
    };
}

private UniConstraintStream<Task> getTaskWithPriority(ConstraintFactory constraintFactory, Priority priority) {
    return constraintFactory.forEach(Task.class)
            .filter(task -> task.getPriority() == priority);
}

private Constraint noMissingSkills(ConstraintFactory constraintFactory) {
    return constraintFactory.forEach(Task.class)
            .filter(task -> task.getMissingSkillCount() > 0)
            .penalize( constraintName: "No missing skills",
                    BendableScore.ofHard(BENDABLE_SCORE_HARD_LEVELS_SIZE, BENDABLE_SCORE_SOFT_LEVELS_SIZE,
                     hardLevel: 0,  hardScore: 1),
                    Task::getMissingSkillCount);
}
```

Fig. 6. Implementation – constraints for job scheduling
Source: Own elaboration

It was also possible to use Python and optimize with the help of the OptaPy package – an OptaPlanner-based AI constraint solver for Python to optimize the vehicle routing problem.

Even on quite small volumes of data, the manufacturer's information that using OptaPy in Python is much slower than using OptaPlanner in Java or Kotlin has been confirmed. It is worth noting that the implementation work and tests covered only the integration aspect while constituting a validation process to assess the quality of the data provided. This focused on the harmonization of system components, including the integration of new elements into existing infrastructure. At the same time, the tests were aimed at verifying the correctness and consistency of the data provided, including their structure and compliance with specific standards and requirements of OptaPlanner. This process only guarantees the system's functionality and consistency with data quality.

Thus, the possibility of using the tool in the automation and optimization of the costs of technical equipment inspections was confirmed. Our research findings provide insight into the potential of OptaPlanner as a tool to support optimization decisions in technical equipment inspection management.

Conclusions

In today's fast-paced business environment, organizations seek to remain competitive, manage resources efficiently, minimize operating costs, and provide excellent service quality. In organizations such as the Office of Technical Inspection, one of the key areas in which these goals can be achieved is optimizing the costs of conducting inspections of technical equipment. Tools such as OptaPlanner solve several problems encountered in organizations that must manage the services and resources offered in the field, commonly referred to as Field Service Management (FSM). This article analyzes the potential of OptaPlanner software in optimizing the costs of technical equipment inspections. Selected aspects related to problem definition, modeling, implementation, and experimentation are presented, showing how this tool can significantly reduce operating costs and improve the efficiency of inspection processes.

The introduction to the topic included identifying the challenges of managing the cost management of technical equipment inspections in today's business environment. The article focuses on specific elements of the optimization process, including defining the problem, modeling it in the context of technical device inspections, adapting the OptaPlanner tool to specific needs, and conducting practical experiments.

In further work, it is worth considering an algorithm that optimizes routes, considering the time intervals in which it is possible to inspect the technical equipment at the customer's site. – the so-called Vehicle Routing Problem with Time Windows (VRPTW). The algorithm that solves the VRPTW problem and minimizes the cost of all routes must find solutions without exceeding time windows. The substantial challenges inherent in the practical functioning of the optimizer can, in part, stem from the sheer magnitude of data, thereby giving rise to an expansive realm of potential solutions. This is particularly evident in instances where the data volume reaches so significant proportions, such as the management of 1.5 million devices, the execution of 1 million inspections, and the involvement of 1300 inspectors. Consequently, it becomes imperative to undertake a comprehensive evaluation of the optimizer's efficacy within the context of real-world conditions. This evaluation should encompass a meticulous scrutiny of its performance across diverse scales and scenarios, ensuring a nuanced understanding of its capabilities and limitations.

Acknowledgments

This work was financed/co-financed by Military University of Technology under research project UGB 22-810.

References

Lichtarski J.M. (2011). Struktury zadaniowe. Składniki, własności i uwarunkowania (*Task Structures: Components, Characteristics and Conditions*). Wrocław: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.

Palmer R.D. (2019). Maintenance Planning and Scheduling Handbook, Fourth Edition, McGraw-Hill Education.

OptaPlanner Engine reference manual 9.44.0.Final https://www.optaplanner.org/learn/documentation.html [access: 01.04.2023].

Rozporządzenie Ministra Przedsiębiorczości i Technologii z dnia 30 października 2018 r. w sprawie warunków technicznych dozoru technicznego w zakresie eksploatacji, napraw i modernizacji urządzeń transportu bliskiego (*Regulation of the Minister of Entrepreneurship and Technology of October 30, 2018 on the technical conditions of technical supervision in the field of operation, repair, and modernization of close transport equipment*) Dz.U. 2018 poz. 2176 (*Journal of Laws of 2002, item 2176*) https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20180002176 [access: 01.04.2023].

Ustawa z dnia 30 sierpnia 2002 r. o systemie oceny zgodności. (*Act of 30 August 2000 on the conformity assessment system*). Dz.U. 2000 nr 122 poz. 1321 (*Journal of Laws of 2002, item 166*, *pos. 1360*) https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20160000655&min=1 [access: 01.04.2023].

Ustawa z dnia 21 grudnia 2000 r. o dozorze technicznym (*Act of 21 December 2000 on technical inspection*). Dz.U. 2000 nr 122 poz. 1321 (*Journal of Laws of 2000, item 122*, *pos. 1321*) https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20001221321 [access: 01.04.2023].

Ustawa z dnia 20 lutego 2015 r. o odnawialnych źródłach energii (*Act of 20 February 2015 on renewable energy sources*) Dz.U. 2015 poz. 478 (*Journal of Laws of 2015, item 478*). https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20160000655&min=1 [access: 01.04.2023].

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.65

Konrad Radomiński[1]

USE OF THE SPATIAL DATA IN THE VIDEO GAMES ENVIRONMENT – INTELLECTUAL PROPERTY LAW ISSUES

Abstract: Article focuses on the problem of copyright protection of spatial data used to create and perform multimedia works. Multimedia are hybrid works because they are constructed from two main layers (audiovisual work and computer program) but should be treated as one product according to the copyright. Thus spatial data included inside such a works have to be protected within them as a one product. Video games were chosen as an example of multimedia (hybrid) works. First chapter shows crucial role of (mostly) artificial spatial data in the creation and usage of video games. Spatial data describe game environment's location of every (audio)visual object but are encoded in, and used by computer program to perform video game properly. As such spatial data are one of the reason for treating video game as unified product, consisting amalgamation of its elements. Because spatial data are binder of the video game both layers, they should not be subject of separated copyright protection. Thus to protect spatial data included in video game, the video game itself needs to be protected properly. However, because video games are hybrid works, they legal nature is not determined yet. There is also no legal definition or specific copyright regulation for video games. Because of this legal loophole, different doctrinal concepts together with European Court of Justice judgements, on the video game's copyright protection, were analyzed. This was analyzed in chapter two. Conclusions consist statement that lack of video games legal nature's determination, and caused by this lack of specific copyright protection of video games may lead to not enough copyright protection of the video game as a whole product as well as spatial data included inside. Specific regulation instead of casuistic judgements is needed, for ensure the video games market grows.

Keywords: video games, multimedia works, hybrid works, artificial spatial data

Received: 15 November 2023; accepted: 27 December 2023

[1] Cardinal Stefan Wyszyński University in Warsaw, Faculty of Law and Administration, Informatics Law Department, Warsaw, Poland, ORCID ID: https://orcid.org/0000-0003-0856-5797, email: k.radominski@uksw.edu.pl

Introduction with analysis of the state of the problems

For the needs of this research paper author focused on the "typical" video games which gameplay is set in the virtual interactive environment with many objects, living creatures and player character. Most of the nowadays games are like these. However video games are complex category of multimedia products. Some of them looks more like interactive scenarios without typical interactive environment. They have "slides" with text and illustrations descripting the plot. Depending on players choices those slides change, leading player to the end of the story (Text games). Video games and spatial data share more commons than it could be expected. For example they share vulnerabilities. Both, as a products recorded and distributed mostly digitally, are vulnerable to violations of copyrights (Matlak, 2007) as their duplication is easy (Gienas, 2008). Beside that, violations include also unauthorized access, usage, and distribution. All those violations together, are often called "Piracy" (Haber et al., 2003; Holm, 2014; Moshirnia, 2018). Pirates actions could lead to loss of developer's profits from the official, legal selling (Greenspan, 2014). Moreover, both, video games and spatial data are expensive in production and in retail sales, so violations of their copyrights may be lucrative for pirates, as they may easy find clients for pirated products. Therefore piracy is very dangerous for those markets (Pekka, 2020). Researches indicate that in 2012 up to 95% of video games for personal computers could come from illegal sources (Darroch, 2012;.Kuehl, 2016; Holm, 2014).

Big value of accurate spatial data assets (not only in terms of money) was indicated by the European Union (EU) law maker in the Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) (Directive 2007/2/EC, 2007). According to the points 1–3 of introduction and article 17 point 4–5 of Directive 2007/2/EC main purpose of Directive was to ensure integration, availability, quality, accessibility, organization, and sharing possibilities of spatial data from different sources, and moreover its opening to the public as much as possible. However in the article 13 point 1 letter (e) of Directive 2007/2/EC, EU law maker pointed out that in some cases, including protection of copyrights, this open access can be restricted. Also development of the video games (especially "AAA" category – "Triple A" video games, are the most complicated, complex and expensive video games) may be very expensive (counted in tens of millions dollars) and takes many years of investments (Targosz, 2015). For example according to the official CD Project Red reports, development of the "Witcher 3" took three and half year and cost around 80 million dollars (Cd Projekt group, 2015). Newest game of this Producer "Cyberpunk 2077" cost approximately 300 million dollars (Cyberpunk jedną z najdroższych gier w historii, 2020). Thus, strong and effective copyright protection of spatial data and video games is needed.

Video games and spatial data share more commons than just vulnerabilities. Spatial data are crucial during the creation and usage of video games. Every visual object in every video game have an exact location in the virtual environment (which can be constant e.g. virtual house or variable e.g. virtual character which moves from one place

to another), depended on artistic vision of developer's team. Video game's engine to screen those objects properly needs data asset regarding to their localization. To meet those needs every object has to be described by spatial data referring to its current in-game's localization. Spatial data from one hand refer to visual objects, but from another hand are part of the source code and may be used by the video game's objects tracking mechanics also encoded in the source code. This makes spatial data a crucial part of any video game, which bind video game's audiovisual and computer program layers. As such, spatial data are inseparable from the video game as a whole product. This leads to the idea of a comprehensive research about their joint copyright protection. Because to protect video game's spatial data from copyright violations, video game as a whole product must be protected properly.

Since video games are intended to be sold in more just one country, the EU copyright regulations have been chosen for analysis. The main indicated problem is the fact that EU copyright regulations are different for the computer programs and for other works, also audiovisual works (Grzybczyk, 2020). Video games however contain both of them bound by spatial data. Thus, legal nature of video games is difficult to determine, and EU law maker still have not done it. In 2014 even the European Court of Justice (ECJ) had to take a stand in this topic (European Court of Justice Judgement from 23rd January 2014. Case c-355/12, 2014), which shows its importance. However lack of specific regulation for video game's copyright protection still exists. Thus, legal nature of video games topic of doctrine's discussions and researches. However there is a lack of a comprehensive research approach to the protection of video games and spatial data included in them, although both those products are inseparable bound. Intention of this paper is to fill this research gap, and verify the hypothesis that present lack of video games legal nature's determination, and caused by this lack of specific copyright protection of video games may lead to not enough copyright protection of the spatial data included in the video games.

Material and methods

To verify the hypothesis the joint analysis of the EU copyright provisions, ECJ judgements and research papers, under the dogmatic method was conducted. To analyze the role of the spatial data in the video games, the case study, about creation of chosen video games and video games creator documentations under the empiric method was conducted.

Results and discussion

Spatial data's role in video games. Inctroduction notes. Before the analysis of the legal provisions applicable to the video games and spatial data included in them, it is needed to analyze the role of spatial data in the creation and usage of video games. Goal of this analysis is to show that spatial data included into video games are bound with them so tight that should be protected within the video game itself as a whole product.

At the beginning of this analysis, the understanding of the spatial data for the needs of this research should be introduced. Article 3 point 2 of the Directive 2007/2/EC, defines Spatial Data as any data with a direct or indirect reference to a specific location or geographical area. In article 4 point 1 letter (a) it is also indicated that spatial data must relate to an area where Member State has and/or exercises jurisdictional rights. This legal definition correspond to spatial data based on the terrestrial coordinate system (0,0,0 point related to cross point of the equator and the zero meridian on the sea level).

For the needs of video game's spatial data analysis, the broader understanding of spatial data is needed, and cover not only terrestrial spatial data but also artificial spatial data (point 0,0,0 in the center of the fictional Cartesian plane). Usually for the needs of video games the artificial spatial data are created within the game creator and later are using by video game's engines to perform the game. In some cases, indicated later, also terrestrial spatial data may be used for the needs of video games.

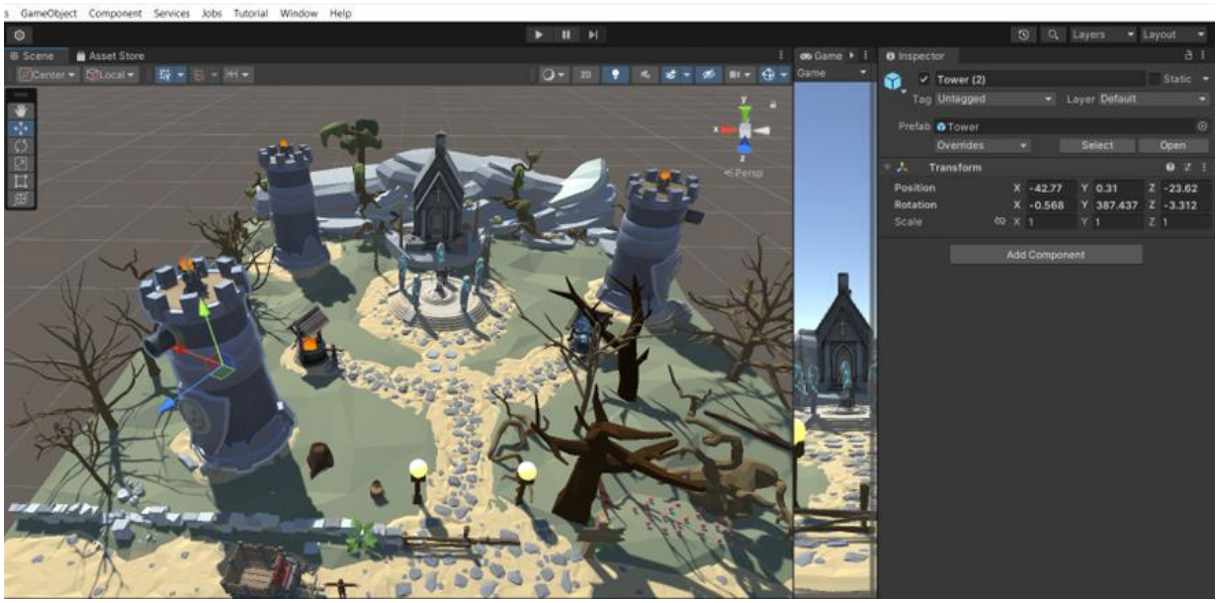


Fig. 1. Example of the artificial spatial data usage for the creation of the video game. On the right side in the "Inspector" window, artificial spatial data of the marked object (tower) are visible
Source: Own study

Among the use of spatial data for the needs of video game two main categories may be distinguish. First category is the use of spatial data for the creation of video game environments. Artificial spatial data (X, Y, Z) are using to set objects with stable location for example: houses, entrances to another location (e.g. dungeons), player character starting location, etc. Spatial data may be also used to set movement path networks of the objects with variable location especially non player character (NPC), for example humans, animals or monsters. Use of spatial data for the creation of video games can be seen by analyzing the cheat codes syntax. To illustrate it, "Teleport" cheat codes from game "Gothic" were chosen. By those codes player character can be moved immediately

to any object or non player character in the game environment, without care of the game rules. Syntax of this "Teleport" cheat code require to provide destination's coordinates (code: "goto pos <X Y Z>"), or object's individual number ("goto waypoint <object or NPC code>") (Lista kodów do Gothic, 2011). Object individual number is enough because every object in video game is described by its own coordinates). Example of cheat codes was used because it shows clearly and in easy way (without the need to use game creation tools) that during the creation of video games every objects gets its own coordinates, which are in use during the usage of the video game. However, cheat codes are not recommended to use, because they may destroy overall perception and fun from the video game. They may lead video game to crush and/or bug, but also (in case of on-line games) are perceived as an unsportsmanlike conduct and may lead to exclusion from competition, or video game's account blockade. Because of that, another examples spatial data rol in creation and usage of video games are provided in the next subsections.

Use of spatial data in creation or modification of video games. Example of "The Elder Scrolls IV Oblivion". Game environment of "The Elder Scrolls IV Oblivion" has been chosen to illustrate the crucial spatial data role in the video game creation and modification. Environment of this game was divided into external world and internal locations.

Fig. 2. World map of "The Elder Scrolls IV. Oblivion"
Source: https://en.uesp.net/wiki/file:ob-map-cyrodiil.jpg [access: 06.11.2023]

Entire external world has been divided by a rectangular "geographic" artificial grid along the meridians and parallels. This grid created squares with coordinates (X,Y) (The Elder Scrolls Construction Set, cell co-ordinates, 2006) (According to the owner of The Elder Scrolls Construction Set, "Bethesda Softworks": *The Elder Scrolls: Oblivion Construction Set is provided AS IS and technical support is not available for it. For more information on The Elder Scrolls: Oblivion (TES) Construction Set, visit TES Construction Set Wiki* (BETHESDA SUPPORT). Because of that references to this wiki where made in this research)). Like in real world coordinates refer to the zero point (0,0) however in

case of the game this point is fictional and set on the cross of the red lines in the map above. Also similar to the terrestrial system there are four geographical directions, but instead of naming them north, south, west and east, the game creator use Cartesian plan where negative values (-) are used to describe South and West, and positive (+) for North and East. As it is visible on the map presented in the figure 2, zero point is set exactly in the middle (cross of the red lines) of the whole virtual world (both light and dark brown). However only the light brown part of the world if available for the Player (around 2/3 of the game world). Rest of the world (dark brown, around 1/3 of the game world) was left empty, probably for later additions to the game (The Elder Scrolls Construction Set, cell co-ordinates, 2006). This lead to the specific situation, where zero point is exactly in the center of the virtual world but it is not in the center of the Player's available world.

Designing the game environment with the coordinates system gives many advantages to the development of the game.

Firstly, every object, animals, or non player character have its own location's coordinates.

Fig. 3. Screen from "The Elder Scrolls Construction Set", showing coordinates of the object marked by the mouse (white lines)
Source: http://www.skyrim.pl/images/stories/TES4_Kurs/rys3_4_zaznacz_obiekty.jpg [access: 06.11.2023]

For example on the figure 3 the rock formation (visible object) inside the white frame is set stable on the square with coordinates (-3,19), which is information for the game engine (computer program) where the object should be rendered and where physical engine should enable collision model for object (the green and red frame around the trees in the figure 3).

Secondly in video games like the analyzed "Oblivion", coordinates of the external world are used to settle links between objects in the external world (e.g. door to the house. figure 4) and the internal worlds (e.g. interior of the house).

Fig. 4. Screen from "The Elder Scrolls Construction Set", showing placement of the door connecting external and internal worlds of "Oblivion"
Source:
http://www.skyrim.pl/images/stories/TES4_Kurs/rys3_8_drzwi_po_str_zewn.jpg
[access: 06.11.2023]

Interaction with door_1 on coordinates (X, Y) will moved player to the interior of the house which is linked to those door_1. In reversed way it will work similar, after interaction with the door_2 inside the house player will be moved to the external world in front of the door_1 on coordinates (X, Y). Doors are "connection" points between internal and external worlds (The Elder Scrolls Construction Set, linking, 2006). Linking allows developers to set empty maquettes of the building in the exterior world and set their interior as another small "world" out of the main map. This has a positive effect on the game performance, because rendering and physic engines would have less calculation to do at once.

Thirdly, use of in game coordination system allow developers to set movement path network of humans and animals and track their movement (e.g. figure 5).

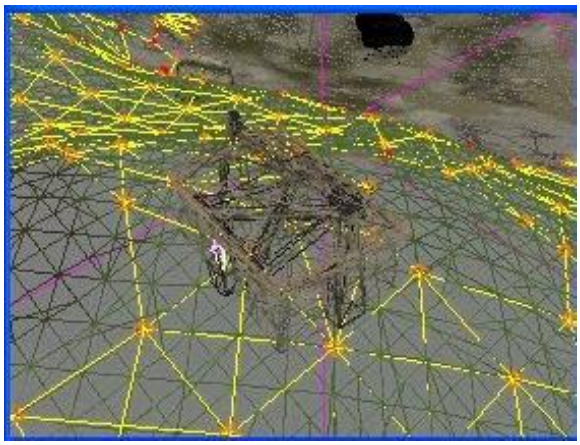


Fig. 5. Screen from "The Elder Scrolls Construction Set", showing movement path network of some NPCs In "Oblivion"
Source: http://www.skyrim.pl/images/stories/TES4_Kurs/rys3_9_gridpath_na_zew.jpg
[access: 06.11.2023].

As seen moving object goes from one yellow point to another one using the yellow lines as a path. Every yellow point has its own coordinates. Thanks to it, game engine knows how to move living creatures without the need of human interaction, which help developers to create living and more immersive game environment (The Elder Scrolls Construction Set, path grids (simple), 2006; The Elder Scrolls Construction Set, path grids, 2006).

Use of GIS tools (QGIS) to modify game world of "The Elder Scrolls II Dagerfall". Another example of spatial data importance, and also GIS tools in the development of video game is "The Elder Scrolls II Dagerfall".

Fig. 6. World Map of "The Elder Scrolls II Dagerfall"
Source: https://i.redd.it/lzx6y4ngcjc61.png [access: 07.11.2023]

"Dagerfall" world is One of the biggest game world ever created (figure 6). Crossing its environment from the most South-East point to the most North-West point takes around 70 real world hours. For such a big world it was hard for developers to create immersive, living environment. That is why fans start to do modifications to fulfill this huge, but empty world with more life. Size of this world is to big to work also with conventional modding tools. To solve this problem QGIS extension was created (GIS construction set description, 2021) (e.g. figure 7).

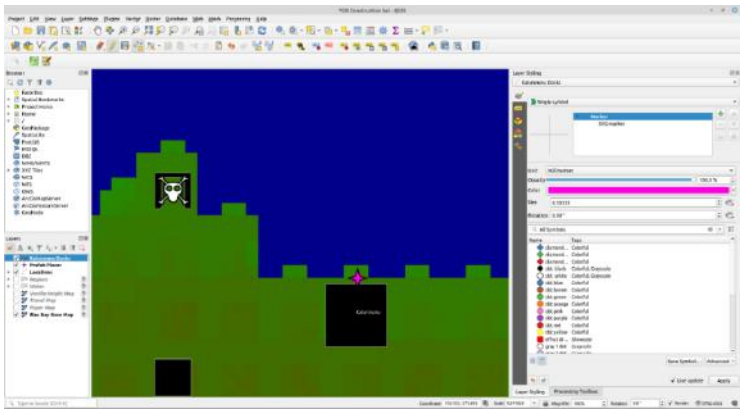


Fig. 7. Screen from QGIS "GIS Construction Set". Visible fragment of "Dagerfall's" map loaded into QGIS
Source: https://imgur.com/u90Ay6Q [access: 07.11.2023]

Thanks to the game's coordinates system Modders can use serious spatial data tools like QGIS to easily hand-settle single objects with considerable precision by coordinates. Or they can use QGIS's random and algorithmic point placement functions to place objects by the dozens, hundreds, thousands, or tens of thousands. Effect of object's placement by the QGIS in the game world is visible on the figure 8.

Fig. 8. Screen from the "Dagerfall" game showing the object (harbour)
set by the use of QGIS
Source: https://imgur.com/e25xizf.png [access: 07.11.2023]

Spatial data usage during gameplay. Spatial data are crucial also during the usage of video games. Thanks to the fact that every object is described by coordinates, its movement in the game environment can be tracked in the real time. This leads to many in-game features important for the gameplay. For example in strategic games, and player-vs-player (PvP) on-line games, enemies and allies movement is under constant tracking. This allow players to plan strategy, respond to changes on the battlefield which are visible in the environment itself but also on the real time mini-map. Constant tracking affects also another gameplay features, like range of enemies spotting and sending this information to allies which position is close enough. For on-line games constant tracking of objects is crucial, because players have on their computer only game itself with coordinates of stable objects. Coordinates of player character, allies and opponents as well as information about places of hits or information which objects are destructed are uploaded from players computers and stored on game's server from where other players download it. All those spatial data needs to be upload and download so players could see changes in environment on their screens.

Object's tracking helps player to navigate the game environment. Thanks to spatial data, player and mission objectives location can be marked on the map. In some games developers include even working navigation system, which indicates and shows the shortest route to the mission objective.

In some games, for example "Heroes" series most of the gameplay takes place on the "map". Whole world with its elements is settled on the rectangular grid hidden beneath

the artistic map. Grid and spatial data are use to settle object on the map and to calculate for example player's and NPC's range of movement. Similarly augmented reality games for example "Pokemon GO", takes place mostly on the "map". However in this case map is based on Google map and terrestrial coordinates system is in use to set objects location and track player movement in the real world.

Protection of spatial data included in the video game. Inctroduction notes. Previous chapter illustrated that spatial data are actually binder between source code which includes them and the audiovisual part which is described by them in order to be properly screened. This crucial role as a binder of video games layers however lead to potential copyright protection problem. As a binder video game's spatial data can not be separate subject of trade or infringement and possible protection actions or court dispute. As an integrated, crucial part of the video games spatial data can be only subject within and together with video games itself, as a whole product. Thus in order to protect video game's spatial data properly, the whole video game needs to be protected properly. This leads to the need of video game's protection copyrights analysis in order to also determine video game's spatial data copyright protection.

EU Copyright doesn't express directly if video game is work and if so, what specific kind of work it is and what copyright's provision should be applied to it. Also legal nature of video games (and spatial data incorporated into them) as a whole product is not determined by law. There is also no legal definition of video games. In order to analyze EU copyright to find which provision could be applicable to the video games, firstly the analyze of the video games nature and attempt to define them should be done.

Video game nature. Spatial data usage in the video games helps to understand doctrinal concept of video game's dual: artistic and technical nature, which can be illustrated as an iceberg (figure 9).

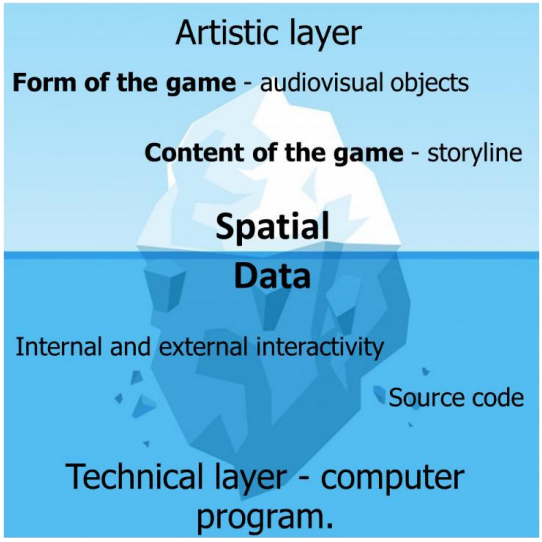


Fig. 9. "Iceberg scheme" presenting video games construction from the legal point of view
Source: Own study

Above the surface is the artistic layer visible to the player. It contains graphical objects, music, cutscenes etc. (Wąsowska, 2013; Szpyt, 2018) In terms of copyright theory, this should be perceived as a form of the video game. Form of the work is used to expresses its content, which, in case of video game, is interactive storyline. "Beneath the surface", invisible for the player, is technical layer which consist game engines (rendering and physic engines as well as other scripts), which for the need of this research are together treated as one computer program. This part of the video game is responsible for communication between the player and the game which is called "external interaction". Computer program is also responsible for "internal interaction" so for the fusion and proper interaction between video game's all, visible and invisible, elements – so that the player can perceive video game as a whole product correctly. As it was analyzed in the previous chapter interaction is possible also thanks to the spatial data's use. Every visible object (which belong to the artistic layer) is described by its own spatial data which are encoded and possible to read and use to execute tasks by game engines (which belong to the technical layer). That is why in the figure 9 spatial data are placed exactly in the middle between two layers – like a binder which bond both video game's layers together as a one product. Moreover, also according to the law doctrine, video game should be perceived by the law as an united product, despite its double-layers construction (Matusiak, 2013; Wachowska, 2015). Firstly, players mostly do not percept and do not want to use just one element but they want to play game as a whole product. Thus usage of the video game as a whole product (to play the game) is the main business purpose of the video game's development. Secondly, both video game's layers strictly cooperate and refer to each other and video game as a final product amalgamate (Barta, Markiewicz, 1998; Ramos et al., 2013) all those elements with the synergy effect. The game as a whole working product made by join cooperation of its elements has much bigger value, quality and complexity than just separate elements uploaded in one catalog without any cooperation between them. Thus video games are sale as an one product (Wiśniewski, 2012; Wąsowska, 2013; Greenspan, 2014; Grosheide et al., 2014; Ramos, 2014; Piechówka, 2014; Stein 2015; Wachowska, 2015; Barta, Markiewicz, 2016; Szpyt, 2018; Corbett, 2019; Markiewicz, 2019; Biliński, 2021).

Copyright protection of every elements under its own regime, would lead to big problems with construction of agreements for development and publishment of the video game (Targosz, 2015). However there are some exceptions, of the video game as a united product rule. Independent exploitations of video game's particular elements, where they are protected independently exist. For example video game's logo can be protected separately as a trademark when it is sell on the collectible items like t-shirts, cups etc. Video game's soundtracks, as a musical work are often released and sell separately from the game as a music albums (Tarkowska, 2019). Video game's screenshot and/or concept arts are often publish in as book called "artbook", and are protected as a literature work and pictures. Some of video game's assets like 3D models of player character, allies or enemies, monsters etc. are releasing in the real world as a figurines or illustration on t-shirts, cups etc. In those cases assets may be protected separately by the intellectual property law for example as an industrial designs

(registered in different categories beside the video games and electronic use); Nowadays streaming and/or lets-playing became very popular. In both of those categories one person plays the game on its own device, and in case of streaming, lets other people watch it on-line in real time (live), and in case of lets-playing, record its screen and himself while playing and later upload it to some hosting platform ("Let's play") (Ostrowska, 2019). In this case only artistic layer of video game is shared with the audience, so there is no need to protect technical layer. Thus those materials could be protected as a audiovisual works. Similarly, in case of Cloud-gaming (e.g. Geforce Now or Google Stadia) in which game is running in the datacenter and player see on its home screen only the live streaming of audiovisual layer of video game (Krysińska, 2019; Barta, Markiewicz, 2021). Those exceptions however will not be analyzed more deeply in this research, as every of them could be material for separate analysis. In this paper only the use of the video game as a whole unified product will be further analyzed in terms of its copyright protection.

Legal loophole. Despite complex video game's construction, which consist two different specific kinds of works in one product, no legal definition or specific regulation for video games exist in EU law. The only mention about video games in the EU law is tax law.

Lack of definition and specific copyright regulation for video games may be reasoned by the concern of rapid obsolescence of the new technology's law (European Court of Justice Advocate Generale Yves A'bot, 2010; Polański, 2016). For example, computer program's EU copyright regulations does not define computer program although it is already more than 30 years old. However, it could have had define it because computer programs core concept has not changed since the first regulation in Directive on the legal protection of computer programs, 91/250/EWG, from the 14th May 1991 (91/250/EWG, 1991).

Another possible reason for the lack of video game's definition is "gamediversity". Video games as a category of multimedia product is very complex and diverse. Because of that for most of arguments trying to define game, other person can find examples of game which can be used as a counterargument. For example, in general it is true that every video game have graphic, but existence of text games (e.g. games made by Twine tool) which show its content only in form of interactive text with choices hyperlinking to the next slide with text and links.

Because of that, law doctrine instead of define video game, only determined its characteristic features, which help to understand its nature for the need of legal analysis. This consensus covers following video games features:

- Interactivity of video games.
- Qualification of video games as a source of entertainment (however some games, are also use for the need of education).
- Computer program based product. This feature is sometimes misunderstood as video game's qualification as a computer program, which is not correct according

to the most of doctrine representatives and will be discussed in the next subsections (Radomiński, 2021).

Video Game – an artistic work under the copyright protection. First problem is identify whether video games are works protected by copyright or not. Video games are not literally expressed in the legal catalogue of works in article 1.2 of the Act of 4 February 1994 on Copyright and Related Rights (Act of 4 February 1994 on Copyright and Related Rights, 1994). Polish legal act was mentioned because there is no legal catalogue of works in the Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society (Directive 2001/29/EC, 2001). Legal catalogue of works is open, which means that any artistic product can be found as a work if only meets prerequisites expressed in article 1.1 of Polish Copyright Act. According to legal literature, video games are considered as an artistic works, because they meet those prerequisites, which means that:

- They are created by a human being. The hardware and software are just an artist's tools.
- They has an independent creative character because their elements are created and then combined into whole coherent product in an artistic manner, according to the creators' pre-planned vision.
- Every video game has its individual character because developers create it in such a way that, despite similarities to other video games, it stands out of them thanks to its innovative plot development and/or distinctive graphics (Wiśniewski, 2012; Matusiak, 2013; Wąsowska, 2013).

Video Game – does it fit under the general copyright protection or under the protection for the special kinds of works? As artistic works, video games are protected by copyright. However EU law predicts specific protection for specific kinds of artistic works. Because of that, question occurs whether video games should be protected under general regulation as they are artistic works, but no specific regulation for them exist, or if they should be protected by specific regulations designed to protect both or one of their layers (Gry komputerowe – walka o status prawny, 2018)? UE copyright predicts specific protection for audiovisual works (artistic layer of video game), as well as specific protection for computer programs (technical layer of video games). Therefore both layers of one unified product – video game – are subject to two different specific regulations, which differ on important issues for the game developers (also from the point of view of spatial data protection) for example permitted private use, determination of the entity entitled to property copyright, and use of technical protection measures (Grzybczyk, 2020).

To solve this problem doctrine indicated three possible solutions. First, to consider that video game is general work and only the general regulation should be used. However, this solution will not fit the dual nature of video games. Second, to select

specific regulation of one – more important – layer to the game as a whole. Third, to use both specific regulations of both video game's layers together beside their differences.

In order to choose which specific regulation should be use for video game as a whole analysis of both is needed.

Concept of recognizing video game as a computer program. In popular opinion, video games are often qualify as a computer programs. Even developers and publishers often call their products "Computer program", especially in the "End User License Agreement". It is because computer program copyright protection is very strict and limit most kinds of fair use, which is beneficial for publishers, but doubtfully fair for video game's customers. This topic was already subject to previous research , so will not be analyzed deeper here (Radomiński, 2022a, Radomiński, 2022b). Main reason for those publisher's actions is fact that both, video games and computer programs share a lot in common, especially costly production as well as cheap and easy copyright violations possibilities. This is also why publishers want to benefit from their officially sold games as much as possible, and do not want people to for example borrow games from each others (fair use) instead of buying another copy.

In Rusia concept for qualify game as a computer program is supported by statements that computer program is the technical foundation so the crucial part of the video game (Federal Arbitration Court for Moscow District Judgement from 24th February 2009).

In Ukraine is opposite, court and doctrine state that video games suppose to provide entertainment, but computer program is just virtual a tool (Kiev District Court Judgement from 27th October 2003).

Main disadvantage of analyzed concept lays in the fact that computer program is protected like a literary work. Copyright protects sequence of characters containing instructions to be executed directly or indirectly by the computer to achieve a specific result (Polański, 2016). That kind of protection should not be extended to the artistic layer of the game (graphic and sounds). Of course artistic layer is controlled and affected by computer program, and even encoded in it but it is not recorded as a text and does not containing any instructions for the computer to perform (Wachowska, 2015). To overcome this problem an idea to consider the video game's artistic layer as an expression of a computer program, was introduced. However ECJ in the case C-393/09 stated that computer program can be expressed only in a form of source or result code, since it is only way to see the syntax and structure of the computer program and acquainted with its structure to possibly reproduce it. The ECJ also indicated that the program and interface could be protected separately (European Court of Justice Judgement from 22nd December 2010. Case C-393/09, 2010). However this concept could not be used for the video games, which audiovisual part is not simply interface intended to help to control the computer program (Polański, 2016). It is actually opposite, computer program in video games is designed to create interaction possibilities and movement impression for what player see on the screen.

In France doctrine is also against analyzed concept, and states that video game beside computer program consists also an audiovisual layer, which require its own specific protection, and should not be treated as simple interface (Paris Court of Appeal Judgement from 20th September 2007. Case Cryo v. Sesam, 2007). After all it is hard to say that interface with some buttons (thanks to which user does not have to control the program in console) is equal in value and amount of work to the virtual environments, with hundreds of objects, independently moving creatures, working physics (astronomy included), fitted music and sound effects, etc.

Because of all mentioned above, especially because of the presence of the audiovisual layer, video games as a whole should not be considered just as a computer programs. However, some representatives of Polish doctrine think opposite and support the concept of recognizing video games as a computer programs (Rost, 2014; Wasilewski, 2015; Widła, 2017).

Concept of recognizing video game as an audiovisual work. Because main example of audiovisual work is movie, every other work considered as an audiovisual one is compared to it. Thus in order to analyze video game as a audiovisual work it is necessary to compare it to the movie.

As arguments for considering video games as a "movie like" product, doctrine points that video games have "movie like" developing and way of reception (Wąsowska, 2013). Both, video games and movies are made of elements which are synergically amalgamate into one unified product (Targosz, 2015).

Some researchers also point out that players are only interested in artistic layer (how it looks and performs). They are not interested what is happening in the technical part.

However in analyzed conception main dispute focuses about movement impression in movies and in the video games. Mostly if its passive and pre-planed or not. Researchers who supports analyzed concept point out that player can feel movement impression in the frames set by developers while playing video games (Ruling of Stern Electronic and Super Mario (United States Court of Appeals, Second Circuit Judgement from 20th January 1982. Case stern electronic, inc. v. Kaufman, 669 f.2d., 1982)). Opponents of this concept admit that video games give movement impression but they point out that in opposition to the pre-scripted and pre-recorded movie which is watched passively and nothing can change, video games movement depends on player and require its initiative to actively interact with game (Donkey King and Parodius rulings (Göttlich, 2007)). Nowadays this passive and pre-planed character of movies start to blur, because of introducing of the interactive movies like "Black Mirror: Bandersnatch" in which audience can "move" and make choices in pre-set frame just like in some games.

From the other side, because of "Gamediversity" it is possible to point out video games which are not „like a movie” and do not have movie’s movement impression because they are much more static. For example turn-based strategies games or text games.

Beside mentioned dispute, critics of analyzed conception point out that video games, beside they audiovisual part consist also computer program which is foundation of the video game performance. Because of that computer program copyright protection should not be excluded from the video game protection. Thus the movement impression dispute became mostly theoretical and most of the doctrine just point out that video game as a whole should not be considered just as an audiovisual work, because of the presence of the computer program which is very vulnerable for copyright violations and requires its own specific protection (Traple, 2015).

Concepts of parallel use of the both specific regulations. Both concepts of using only one specific regulation does not meet video games needs. Both layers need to be protected specifically for its needs, so nor regulation for computer programs nor for audiovisual works can be omitted. Moreover the presence of spatial data which bind both layers into one product also excludes those concepts. Also USA Copyright Office, states that video games are one product and should be protected by copyright in both aspects: audiovisual one and the computer program one (United states copyright office circular 61 – copyright registration of computer programs, 2021).

Thus concepts of parallel use of both specific regulations need to be analyzed.

First concept assumes separate protection of the artistic and technical layers (Angry birds należy objąć ochroną, 2013; Gry komputerowe – walka o status prawny, 2018). However this concept skips the fact that video game should be treated as an unified product (also because of the binding role of spatial data). As such this concept should not be taken into further considerations.

Second concept assumes that video game consists both artistic and technical layers. Neither of them can be omitted, so both regulations should be applied together. This concept is use for example in USA, Japan, Germany and France (Ramos et al., 2013). However because Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs (Directive 2009/24/EC) is declared as a Lex Specialis (also by ECJ (European Court of Justice Judgement from 3rd July 2012. Case C-128/11, 2012) to the Directive 2001/29/EC, comprehensive legal evaluation for example during the dispute in court would lead to priority of the Lex specialis Directive 2009/24/EC, which will lead to legal evaluation of the video game just like it would be a computer program.

Third concept introduced by the Italian Supreme Court assumes that a video game is a hybrid work of its own kind so called sui generis work. It is because video game is something more complex than just a computer program or just an audiovisual work. This concept is supported by most of the doctrine (Wiśniewski, 2012; Ramos et al., 2013; Matusiak, 2013; Markowski, 2016; Barta, Markiewicz, 2016). However this concept do not indicate which specific regulation should be apply when comprehensive evaluation of video game is necessary and the regulations for the two layers are contradictory. For example in case of video game's fair use, audiovisual part could be subject of it, but computer program could not. So in case of comprehensive evaluation of video game there is no good answer if it can be a subject of fair use as a whole product

or not. However there are some exceptions like streaming or sharing of screenshots and screen video. In those case only audiovisual layer is subject of fair use, so the choice of specific regulation is possible.

Video game as a sui generis work concept. ECJ C-355/12. In the Nintendo judgment c-355/12, the ECJ adopted the Italian conception of video game as a sui generis work. According to some doctrine, simple adoption of Italian concept without further analysis was lost opportunity to consider different possibilities of legal qualification of such a hybrid works like video games (Laskowska-Litak, 2019).

As a result of video game's qualification as a sui generis work, ECJ placed it under the protection of Directive 2001/29/EC so for the general works (and audiovisual ones). Protection under the 2009/24/EC for computer programs was rejected because the ECJ held that only works that are exclusively computer programs as a whole are entitled to be protected under the Directive 2009/24/EC (European Court of Justice Judgement from 23rd January 2014. Case c-355/12, 2014). The ECJ's Advocate General Eleonor Sharpstone, in her opinion preceding the judgment, indicated moreover that the rights of creators of sui generis works should be protected by a regulation that protects their works better and is more favorable to them (concept of more favorable regulation (effet utile))(European Court of Justice Advocate Generale Eleonor Sharpston, 2013).

This judgement however, may lead to interpretation problems in other disputes, such as those concerning fair use. From one hand, the ECJ has ruled that sui generis works should be protected under the provisions of Directive 2001/29/EC, while from the other hand, for example fair use protection is more favorable for the developers and publishers under the Directive 2009/24/EC. This is because fair use is generally prohibited under this regulation. Thus, in such potential case, another conflict of directives could appeared. This was just example of what may happens if copyright nature of video games would be analyzed from case to case only through the interpretation made by the ECJ.

Conclusions

Problem analyzed in this research paper applies not only to video games (which were used as an example) but to widely understood multimedia works combining computer program with complex audiovisual layer. As such, it may apply not only to the spatial data included in video games but also to some tools created within and for the framework of spatial data science.

For all multimedia products lack of the specific regulation may results in uncertainty about the law. Which is problematic for the potential developers and/or publishers who need to decide whether invest their money and time in product or not. For such investors interpretations of law made as late as at the stage of proceedings before the ECJ are not sufficient. Also judgements made by courts do not always correctly reflect the essence of the works under evaluation, which can lead to unfair treatment of developers and publishers or legal users, for example in terms of technical protection measures (Mayer-Schonberger, 2006; Radomiński, 2022b) or reselling of second-hand

games (Radomiński, 2022a). For example, since the ECJ judgment in case C-355/12, the ECJ and other EU authorities systematically recognizes multimedia works as sui generis works under the protection of Directive 2001/29/EC – and thus refers to this regulation in its other rulings on sui generis works, without some deeper technical analysis. Sometimes this leads to very "brave" theses, for example equating video games with ebooks (European Court of Justice Judgement from 19th December.2019. Case c-263/18, 2019), just because both products have and "visual layer" and computer program which controls it. However thesis like this ignore the issue of the complexity of video games. Both layers of video games are much more complicated and complex than ebook. Visual layer in case of ebook consist just letters on some one color background while in case of game visual layer is complicated environment composed in artistic way from hundreds of audiovisual objects). Similar, computer program for controlling ebooks is very simple while computer program for controlling video games is responsible for, proper interactions between elements and human with game, graphic rendering, physics rules and many, many more.

Because of that, the hypothesis stated in the introduction should be find as confirmed. Lack of video games legal nature's determination, and caused by this lack of specific copyright protection of video games truly may lead to not enough copyright protection of the video game as a whole product as well as spatial data included inside. This leads to the de lege ferenda postulates. Specific provisions dedicated to multimedia works are necessary to end present uncertainty about the law, which may stops a lot of potential investor from enter into multimedia market, as well as it may affects those who are already in it. Postulated regulation should be subject to the future analysis. However it can be pointed out already now that regulation should include at least: legal definition of multimedia works and video games; regulation on technical protection measures; regulation on fair use; regulation on determining the entity that holds the economic copyright of the game as a whole.

References

Act of 4 February 1994 on Copyright and Related Rights (Dz.U. 2022, item 2509). https://https-sip-lex-pl.pulpit.uksw.edu.pl/#/act/16795787 [access: 02.11.2023].

Angry birds należy objąć ochroną (*Angry birds should be protected*). https://serwisy.gazetaprawna.pl/prawo-autorskie/artykuly/671638,angry-birds-nalezy-objac-ochrona.html [access: 10.11.2023].

Barta J., Markiewicz R. (1998). Internet a prawo (*The Internet and the law)*. Towarzystwo Autorów i Wydawców Prac Naukowych UNIVERSITAS, Kraków.

Barta J., Markiewicz R. (2016). Przedmiot ochrony (*The Subject of the Protection*). In: J. Barta, R. Markiewicz (ed.), Prawo autorskie (*The Copyright*). Wolters Kluwer Polska, Warszawa, pp. 464–467.

Barta J., Markiewicz R. (2021). Regulacje szczególne (*Special regulations*). In: J. Barta, R. Markiewicz (ed.), Prawo autorskie i prawa pokrewne (*The Copyright and related rights*), Wolters Kluwer Polska, Warszawa, pp. 120–126.

Bethesda support, where do I get help with the oblivion construction set? https://help.bethesda.net/?fbclid=iwar37ugbmgjrnftqgsbjedujtyhfz1gcxwfnx1crzikm-i-bcimdswgy8eym#en/answer/17829 [access: 09.11.2023].

Biliński M. (2021). Znaczenie statusu gry komputerowej w prawie autorskim w obszarze sportu elektronicznego (*The importance of the status of a computer game in the copyright in the field of electronic sports*). In: M. Biliński (ed.), Sport elektroniczny. Charakter prawny (*Electronic Sports. Legal nature*), C.H. Beck, Warszawa, pp.161–204.

Cd Projekt group – first half of 2015. https://www.youtube.com/watch?v= mymit4ouy4 [access: 08.11.2023].

Corbett S. (2019). Computer game licences: the eula and its discontents. Computer Law & Security Review, vol. 35, no.4, pp. 453–461.

Council Directive 91/250/EEC of 14 may 1991 on the legal protection of computer programs. https://eur-lex.europa.eu/eli/dir/1991/250/oj [access: 03.11.2023].

Cyberpunk jedną z najdroższych gier w historii (*Cyberpunk one of the most expensive games in the history*). https://www.pb.pl/cyberpunk-jedna-z-najdrozszych-gier-w-historii-dm-bos-1100486 [access: 08.11.2023].

Darroch C. (2012). Problems and progress in the protection of videogames: a legal and sociological perspective. Manchester Review of Law, Crime and Ethics, vol. 1, no. 136, pp. 136–172.

Directive 2001/29/EC of the European parliament and of the council of 22 may 2001 on the harmonisation of certain aspects of copyright and related rights in the information society. https://eur-lex.europa.eu/eli/dir/2001/29/oj [access: 05.11.2023].

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). https://eur-lex.europa.eu/eli/dir/2007/2/oj [access: 06.11.2023].

Directive 2009/24/EC of the European parliament and of the council of 23 April 2009 on the legal protection of computer programs. https://eur-lex.europa.eu/eli/dir/2009/24/oj [access: 05.11.2023].

European Court of Justice Advocate Generale Yves A'bot Opinion from 14th October 2010. Case C- 393/09. https://eur-lex.europa.eu/legal-content/en/all/?uri=celex%3a62009cc0393 [access: 04.11.2023].

European Court of Justice Advocate Generale Eleonor Sharpston Opinion from 19th September 2013. Case C-355/12. https://eur-lex.europa.eu/legal-content/en/txt/?uri=celex%3a62012cc0355 [access: 04.11.2023].

European Court of Justice Judgement from 22nd December 2010. Case C-393/09. https://eur-lex.europa.eu/legal-content/en/txt/?uri=celex%3a62009cj0393 [access: 04.11.2023].

European Court of Justice Judgement from 3rd July 2012. Case C-128/11. https://eur-lex.europa.eu/legal-content/en/txt/?uri=celex%3a62011cj0128 [access: 04.11.2023].

European Court of Justice Judgement from 23rd January 2014. Case c-355/12. https://eur-lex.europa.eu/legal-content/en/txt/?uri=celex%3a62012cj0355 [access: 04.11.2023].

European Court of Justice Judgement from 19th December.2019. Case c-263/18. https://eur-lex.europa.eu/legal-content/pl/txt/?uri=celex:62018cj0263 [access: 08.11.2023].

Federal Arbitration Court for Moscow District Judgement from 24th February 2009. Case n kt-a40/12176-08. http://www.garant.ru/products/ipo/prime/doc/archive/2009/04/06/ [access: 07.11.2023].

Gienas K. (2008). Systemy Digital Rights Managment w świetle prawa autorskiego (*Digital Rights Management systems under the copyright*). Wolters Kluwer Polska, Warszawa.

GIS construction set description. https://github.com/drcarademono/gis-construction-set#description [access: 06.11.2023].

Göttlich P. (2007). Online games from the standpoint of media and copyright law. Iris plus a supplement to IRIS, legal observations of the European audiovisual observatory, vol 10, pp. 1–12.

Greenspan D. (2014). Intellectual property in the videogame industry. In: D. Greenspan (ed.), Mastering the game: business and legal issues for video game developers, WIPO, Geneva, pp. 72–106.

Greenspan D. (2014). Video games and IP: a global perspective. WIPO Magazine, vol. 2, pp. 6–11.

Grosheide F.W., Roerdink H., Thomas K. (2014). Intellectual property protection for video games. A view from the European Union. Journal of International Commercial Law and Technology, vol. 9, no. 1, pp. 1–13.

Grzybczyk K. (2020). Od Mario Bros do e-sportu (*From the Mario Bros to the e-sport*). In: K. Grzybczyk (ed.), Rozrywki XXI wieku a prawo własności intelektualnej (*Entertainment of the 21st century and intellectual property law*). Wolters Kluwer Polska, Warszawa, pp. 211–238.

Gry komputerowe – walka o status prawny (*Computer games – fight for their legal status*). https://legalnakultura.pl/pl/prawo-w-kulturze/prawo-w-praktyce/news/3020,gry-komputerowe-walka-o-status-prawny?fbclid=iwar0isegtmpivjgr2m1k-i1yb3kid8pnrd3y7ivrpagilvbu128lkqzxynga [access: 05.11.2023].

Haber S., Horne B, Pato J., Sander T., Tarjan R.E. (2003). If piracy is the problem, is DRM the answer? Lecture notes in computer science, vol. 2770, pp. 224–233.

Holm P. (2014) Piracy on the simulated seas: the computer games industry's non-legal approaches to fighting illegal downloads of games. Information & Communications Technology Law, vol. 23, no. 1, pp. 61–76.

Kiev District Court Judgement from 27th October 2003. http://www.scourt.gov.ua/clients/vs.nsf/0/19387847da85b73fc3257179002ba6dd

?opendocument&collapseview&restricttocategory=19387847da85b73fc3257179002ba6dd&count=500& [access: 07.11.2023].

Krysińska J. (2019). Art. 77. In: W. Machała, R.M. Sarbiński (ed.), Prawo autorskie i prawa pokrewne. Komentarz (*The Copyright and Related Rights. Commentary*). Wolters Kluwer Polska, Warszawa, pp. 1123–1210.

Kuehl J. (2016). Video games and intellectual property: similarities, differences, and a new approach to protection. Cybaris: an Intellectual Property Law Review, vol. 7, no. 2, pp. 313–349.

Laskowska-Litak E. (2019). Treść prawa czy ochrona – zabezpieczenia techniczne utworu – wyrok trybunału sprawiedliwości z 23.01.2014 r., c-355/12, nintendo co. Ltd i in. Przeciwko pc box srl i 9net srl. (*Content of the law or protection – technical Protection Measures of the work – judgment of the European Court of Justice of 23.01.2014, c-355/12, nintendo co. Ltd et al. Against pc box srl and 9net srl.*). In: S. Biernat (ed.), Kamienie Milowe Orzecznictwa Trybunału Sprawiedliwości Unii Europejskiej (*Milestones of the Case Law of the European Court of Justice*). Wolters Kluwer Polska, Warszawa, pp. 763–774.

Lipson A.S., Brainem R.D. (2009). Computer and video game law. Cases, statutes, forms, problems & materials. Carolina Academic Press, Durcham.

Lista kodów do Gothic (*List of cheatcodes for the Gothic*). https://gothic.fandom.com/pl/wiki/Lista_kod%C3%B3w_do_Gothic [access: 09.11.2023].

Markiewicz R. (2018). Status gier komputerowych i multimediów (*Status of computer games and multimedia*). In: R. Markiewicz (ed.), Ilustrowane prawo autorskie (*Illustrated Copyright*). Wolters Kluwer Polska, Warszawa, pp. 476–480.

Markowski J. (2016). Dozwolony użytek gier komputerowych (*Permitted use of computer games*). Palestra, vol. 7 no. 8, pp. 36–40.

Matlak S. (2007). Charakter prawny regulacji dotyczących zabezpieczeń technicznych utworów (*Legal nature of the regulations on technical protection measures of works*). Wolters Kluwer Polska, Zakamycze.

Matusiak I. (2013). Gra komputerowa jak przedmiot prawa autorskiego (*Computer game as a subject of the copyright*). Wolters Kluwer Polska, Warszawa.

Mayer-Schonberger V. (2006). Beyond copyright: managing information rights with DRM. Denver University Law Review, vol. 84, no. 1, pp. 181–198.

Moshirnia A.V. (2018). Typhoid Mario: Video game piracy as viral vector and national security threat. Indiana Law Journal, vol. 93, no. 4, pp. 976–1032.

Ostrowska M. (2019). Let's play – działalność internautów a gra komputerowa z perspektywy prawa autorskiego (*Let's play – Internet users' activities and computer game from the perspective of the copyright*). Zeszyty Naukowe Uniwersytetu Jagiellońskiego. Prace z prawa własności intelektualnej, vol. 2, no. 144, pp. 58–79.

Paris Court of Appeal Judgement from 20th September 2007. Case Cryo v. Sesam. https://www.droit-technologie.org/actualites/la-cour-dappel-de-paris-prend-position-concernant-la-qualification-juridique-du-jeu-video/ [access: 07.11.2023].

Pekka J. (2020). Fighting IPR infringements. In: J. Pekka (ed.), How to enable digital growth in Europe? European Games Developer Federation, Stokholm, pp. 1–2.

Piechówka A. (2021). When video games meet IP law. WIPO Magazine, vol. 2, pp. 8–13.

Polański P. (2016). Ochrona stron internetowych jako programów komputerowych (*Legal Protection of websites as computer programs*). In: K. Flaga-Gieruszyńska, J. Gołaczyński, D. Szostek (ed.), Media Elektroniczne. Współczesne Problemy Prawne (*Electronic Media. Contemporary Legal Problems*). C.H. Beck, Warszawa, pp. 299–310.

Radomiński K., (2021). Gry Komputerowe (*Computer Games*). In: L. Grochowski, G. Szpor (ed.), Wielka Encyklopedia Prawa. Tom XXII Prawo Informatyczne (*The Great Encyclopedia of Law. Volume XXII Informatics Law*). Fundacja "Ubi Societas, Ibi Ius", Warszawa 2021, pp. 185–187.

Radomiński K. (2022a). Prawne i techniczne problemy dalszego obrotu grami wideo przez konsumentów (*Legal and technical problems of resseling of video games by consumers*). In: G. Szpor, A. Gryszczyńska, W.R. Wiewiórowski (ed.), Internet. Globalne gry. Global games. C.H. Beck, Warszawa, pp. 69–96.

Radomiński K. (2022b). Zabezpieczenia techniczne gier komputerowych a uprawnienia graczy w prawie unii europejskiej (*Technical measures to protect video games and players'rights under European Union law*). Zeszyty Prawnicze, vol. 22, no. 3, pp. 143–172.

Ramos A. (2014). Video games: computer programs or creative works? WIPO Magazine, vol. 4, pp. 25–29.

Ramos A., Lopes L., Rodriguez A., Meng T., Abrams S. (2013). The legal status of video games: comparative analysis in national approaches. WIPO, Geneva.

Rost W. (2014). Glosa do wyroku TSUE z dnia 23 stycznia 2014 r. C-355/12, Wolters Kluwer Polska, Warszawa.

Stein J. (2015) The legal nature of video games – adapting copyright law to multimedia. Press Start, vol. 2, no. 1, pp. 43–55.

Szpyt K. (2018). Obrót dobrami wirtualnymi w grach komputerowych. Studium cywilnoprawne (*Circulation of virtual goods in computer games. The civil law study*). C.H. Beck. Warszawa.

Targosz T. (2015). Umowy dotyczące gier komputerowych – zagadnienia prawa autorskiego (*Computer game contracts – the copyright issues*). In: E. Traple (ed.), Ochrona gry komputerowej. Aktualne wyzwania prawne (*Computer game protection. Current legal challenges*). Wolters Kluwer Polska, Warszawa, pp. 63–82.

Tarkowska A. (2019). Ochrona prawna warstwy dźwiękowej gry komputerowej (*Legal protection of the sound layer of a computer game*). Zeszyty Naukowe Uniwersytetu Jagiellońskiego. Prace z prawa własności intelektualnej, vol. 2, no. 144, pp. 37–57.

Traple E. (2015). Wprowadzenie – gry komputerowe w świetle prawa (*Introduction – computer games under the law*). In: E. Traple (ed.), Ochrona gry komputerowej. Aktualne wyzwania prawne (*Computer game protection. Current legal challenges*). Wolters Kluwer Polska, Warszawa, pp. 11–18.

The Elder Scrolls Construction Set, cell co-ordinates. https://cs.elderscrolls.com/index.php?title=a_beginner%27s_guide,_lesson_3_-_the_external_world [access: 09.11.2023].

The Elder Scrolls Construction Set, linking. https://cs.elderscrolls.com/index.php?title=a_beginner%27s_guide,_lesson_3_-_the_external_world [access: 09.11.2023].

The Elder Scrolls Construction Set, path grids. https://cs.elderscrolls.com/index.php?title=category:path_grids [access: 09.11.2023].

The Elder Scrolls Construction Set, path grids (simple). https://cs.elderscrolls.com/index.php?title=a_beginner%27s_guide,_lesson_3_-_the_external_world [access: 09.11.2023].

United states copyright office circular 61 – copyright registration of computer programs. https://www.copyright.gov/circs/circ61.pdf [access: 07.11.2023].

United States Court of Appeals, Second Circuit Judgement from 20th January 1982. Case stern electronic, inc. v. Kaufman, 669 f.2d. https://casetext.com/case/stern-electronics-inc-v-kaufman [access: 07.11.2023].

Wachowska A. (2015). Problematyczny status gier komputerowych na gruncie prawa autorskiego – czy gra komputerowa to utwór audiowizualny, program komputerowy, czy inny utwór? (*Problematic status of computer games under the copyright - is a computer game an audiovisual work, a computer program, or another work?*). In: E. Traple (ed.), Ochrona gry komputerowej. Aktualne wyzwania prawne (*Computer game protection. Current legal challenges*). Wolters Kluwer Polska, Warszawa, pp. 19–62.

Wasilewski P. (2015). Ochrona zabezpieczeń technicznych gier komputerowych w ujęciu trybunału sprawiedliwości unii europejskiej (*Protection of technical protection measures of computer games under rulings of the European Court of Justice*). In: E. Traple (ed.), Ochrona gry komputerowej. Aktualne wyzwania prawne (*Computer game protection. Current legal challenges*). Wolters Kluwer Polska, Warszawa, pp. 83–107.

Wąsowska M. (2013). Umowa o stworzenie gry komputerowej (*Contract for the creation of a computer game*). In: K. Grzybczyk (ed.), Prawo w wirtualnych światach (*Law in virtual worlds*). Difin, Warszawa, pp. 35–55.

Wąsowska M. (2013). Historia gier komputerowych i gier wideo (*History of computer games and video games*). In: K. Grzybczyk (ed.), Prawo w wirtualnych światach (*Law in virtual worlds*). Difin, Warszawa, pp. 7–17.

Widła B. (2017). More than a game: did nintendo v. Pc box give manufacturers more control over the use of hardware? Computer Law & Security Review, vol. 33, no. 2, pp. 242–249.

Wiśniewski S. (2012). Prawnoautorska kwalifikacja gier komputerowych – program komputerowy czy utwór audiowizualny? (*The Copyright qualification of computer games - computer program or audiovisual work?*). Zeszyty Naukowe Uniwersytetu Jagiellońskiego. Prace z prawa własności intelektualnej. vol. 1, no. 115, pp. 43–67.

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.89

Małgorzata Ganczar[1]

NEW SPATIAL DEVELOPMENT RULES IN POLAND

Abstract: Spatial development involves planning, organizing, and managing physical spaces in cities, regions, or countries, aiming to optimize efficiency, sustainability, and quality of life through land arrangement, resource allocation, and infrastructure management. This study examines spatial management in Poland, guided by the 2003 law on spatial planning and development, exploring its hierarchical structure ensuring spatial order and policy implementation. Recent legislative amendments on July 2023, are scrutinized, impacting spatial planning by emphasizing public participation and introducing tools like the municipal general plan and Urban Register. The study delves into the evolving process of issuing WZ Decisions and integrating public consultations. It assesses amendments' effects on stakeholder involvement and legal framework changes in practice. Public participation principles are analyzed, detailing stakeholder roles, engagement nature, and legal mechanisms in spatial planning processes. Furthermore, the study investigates the introduction of the general municipal plan, zoning categorization, and the new WZ Decisions' compliance procedure. The creation of the Urban Register is discussed, highlighting its functionalities and intended role as a comprehensive spatial planning and development information source. In summary, this study offers a comprehensive analysis of recent legislative changes in Poland's spatial planning and development, focusing on practical implications and the evolving landscape of public participation and spatial governance within the country.

Keywords: spatial development, public participation, municipal general plan, Urban Register

Received: 28 November 2023; accepted: 27 December 2023

[1] Catholic University of Lublin John Paul II, Faculty of Law, Canon Law and Administration, Lublin, Poland, ORCID ID: https://orcid.org/0000-0003-0880-4647, email: mganczar@kul.pl

Introduction

Spatial development refers to the planning, organization, and management of physical spaces within a particular area, whether it's a city, region, or country. It encompasses the arrangement, distribution, and utilization of land, resources, infrastructure, and human activities in a way that optimizes efficiency, sustainability, and quality of life. Spatial development can be defined as structured activities aimed at the efficient use of space, reconciling the interests of the various users of space and pursuing social and economic objectives (Brzeziński, 2013, p. 106). Spatial management – i.e. the implementation of spatial policy – takes place in Poland at the municipal level in accordance with the 27 March 2003 Law on spatial planning and development (Uniform text, Journal of Acts of the Republic of Poland 2023, item 977 as amended). It directs the allocation of land for specific purposes and establishes the rules for their development and use. A hierarchy in spatial development, related to the hierarchy of power, is present in Poland. The coherence of this system is intended to guarantee spatial order and the implementation of fundamental spatial policy objectives. Decisions taken at each level must support the decisions of the superior one, which also have priority for implementation. However, it is important to cooperate horizontally, i.e. between units with the same level of planning authority and competence. A lack of cooperation can result in the opposite – i.e. apparent spatial order or chaos.

At the national level, the tasks of the government administration include, among others: developing government strategic documents defining the basic goals of social and economic development, developing the Concept of National Spatial Management (current until 2030)1, and preparing and analyzing periodic reports on the state of national spatial management. The tasks of government administration at the provincial level include conducting analyses and studies, developing concepts and programs relating to areas and problems of spatial development in accordance with the needs and objectives of the work undertaken in this regard; conducting periodic reviews of changes in spatial development and preparing periodic reports on the state of spatial development in the province; implementing the province's spatial policy and drawing up a strategy for the development of the province. Spatial planning at the local level is related to the creation and enforcement of documents such as the study of the conditions and directions of spatial development of the municipality and the local spatial development plan. The former is the basis for the creation of the latter. Decisions on development conditions ("WZ Decisions") played an important role for investors.

Material and methods

On 24 July 2023 the President of the Republic of Poland signed the Amendments to the Law on Planning and Spatial Development and Certain Other Laws of 26 March 2023 (the "Act"). Therefore, this is one of the largest amendments to the laws governing planning and spatial development. Spatial development requires interdisciplinary collaboration involving urban planners, architects, economists, environmentalists, policymakers, and community members. It aims to create sustainable, inclusive, and

well-functioning spaces that cater to the needs of present and future generations while considering environmental, social, and economic factors. Therefore, the 2023 spatial planning reform envisages changes in terms of increasing public influence on spatial planning decisions – new forms of public consultation, as well as the introduction of a new planning tool – the municipality's general plan. The findings of the general plan will be binding at both the stage of drawing up local plans and issuing zoning decisions. The amendment also introduces a new form of local plan – an integrated investment plan. An Urban Register will also be introduced.

In view of the changes in the legislation concerning the introduction of a simplified procedure for the enactment of spatial planning acts and the repeal of the regulations on the study of the conditions and directions of spatial development of municipalities, the subject of the analysis is covered by the statutory provisions and includes both an analysis of the provisions of the spatial development law and an analysis of various other legal provisions to be taken into account in order to determine the analyzed provisions, in addition, the analysis includes an evaluation of the planned legal solutions. The main research method used for the relevant conclusions will be the analysis of literature and legal acts.

Principles of public participation

The planning and zoning reform in question was designed to implement the commitments of the Republic of Poland in the National Plan for Reconstruction and Increasing Resilience. The entry into force of the law is a milestone in the reform, which, among other things: will define the process by which stakeholders can participate in the development of strategies and master plans in municipalities. In the provisions introduced in the law, Chapter 1a defines the rights of stakeholders to be informed about the process of preparing planning acts and opportunities to participate in these processes (Okolski, 2024). The explanatory memorandum of the draft explains that, along with the changes to the procedure, it was proposed to separate the provisions on public participation as a separate chapter, with the aim of raising the standards for conducting discussions with residents, organizing, expanding and opening up the catalog of possible participation tools to include new techniques, including those related to digitization, and modernizing the vocabulary used in accordance with the development of this field of knowledge. The effect of the changes, declared by the drafters, is to facilitate the development of compromises in spatial management that are accepted by at least the majority of stakeholders in the process. According to the authors of the amendment, this will also increase investment certainty, as conflicting positions and interests will be disclosed already in the consultation procedure, and not only at the stage of proceeding with investment.

Social participation is an ambiguous concept with no uniform definition, as it occurs at the intersection of various sciences (Daniel et al., 2023). Various methods are used to facilitate public participation, including public meetings, surveys, focus groups, citizen advisory committees, online forums, and participatory workshops. The level and extent

of public participation can vary depending on the context, the issues at hand, and the willingness of decision-makers to involve the public in the process (Brewer, 2008). Issues of public participation will be addressed by sociology, political science, as well as legal science. The understanding of this concept in the science of administrative law comes to the fore (Fogel, 2017, p. 630). Public participation is a manifestation of the currently gaining popularity of non-managerial forms of public administration. The concept of participation in public administration abolishes the previous division into the administered and the administered, since the administered become at the same time the participants, on certain terms, in administration (Niżnik-Dobosz, 2014, p. 42–43). Public participation presupposes different levels of public participation in the decision-making process. The decisive feature of the existence of participation is whether the authority realistically takes into account the directly reported interests of its citizens at the time of decision-making (lawmaking), and whether these citizens have the opportunity to verify whether these interests have been taken into account.

Article 8e specifies that the preparation of spatial planning acts must be carried out in a way that ensures public participation. Section 2 introduces the concept of stakeholders in spatial planning. The provision explicitly mentions that stakeholders are: natural persons, legal persons, organizational units that are not legal persons, to which the law grants legal capacity, local government units and their organizational units, public authorities, as well as other entities, in particular auxiliary units of the municipality and advisory and consultative bodies of the municipality. An important issue is the precise and exhaustive definition of the various stakeholder groups for a given area. It is worth noting that in some cases, stakeholders will be entities that are not necessarily based or domiciled in the area covered by a given draft planning act (Okolski, 2024). The term stakeholder itself means an interested person, that is, one who has an interest. It is a person directly involved in a given process. Stakeholders can be both individual entities, as well as groups or organizations interested in the area, whose interests may be affected by the decisions and actions of the planning authority.

Article 8g regulates the procedure for the submission by stakeholders of applications for the preparation of a spatial development act, applications and comments on spatial development acts and applications for the transmission of information for publication in the Urban Register. According to the amended Law, the necessary minimum is to enable written communication, both in paper and electronic form. Article 8i, however proposes a catalogue of tools through which public consultations can be carried out. According to the new Act it is obligatory to: collect comments on the project, hold at least one meeting allowing for the presentation of the project and discussion of the findings. Among the newly added forms were activities enabling direct contact with the project developers in the area covered by this project and forms of consultation involving the collection of opinions on the project through surveys or geo-surveys. The developer of the spatial planning act shall prepare a document summarising the collection of applications in the form of a list and the public consultation in the form of a report.

General plan of the municipality

One of the most important, even groundbreaking changes in the spatial planning system is the introduction of a new act at the municipal level – the general plan. Based on Article 13a, sec. 4, the scope of the general plan is defined. Its normative part will concern the most important arrangements for zoning the area of the municipality and the setting of not-to- exceed conditions for the realisation of investments in terms of the urban planning parameters and indicators defined in the municipal urban planning standards. The general plan will be able to set out the boundaries of development supplement areas – i.e. areas where decisions on development conditions will be permitted, and of inner city development areas, for which additional rules on the shaping of development and land use will be introduced. An optional element of the municipal urban development standards will be standards concerning the accessibility of social infrastructure facilities. The legislator distinguishes two obligatory and two optional parts of the general plan. The obligatory ones include: planning zones (taken into account when drawing up local development plans and issuing zoning decisions); and municipal urban planning standards (taken into account when drawing up local development plans and issuing zoning decisions). The optional parts of the general plan are areas of development additions (taken into account when issuing zoning decisions); and areas of downtown development (taken into account when drawing up local development plans and issuing zoning decisions). The unambiguous intention of the legislator was to increase the influence of municipal authorities on development and the nature of development. The indicated regulations should also be interpreted in this direction (Nowak, 2023, p. 4).

Article 13c categorises the planning zones of the general plan. The zoning will be the foundation for formulating the findings of the general plan (Stawiarz, 2023). The following zones were distinguished: multifunctional zone with multi-family residential development; the multifunctional zone with single-family housing; multi-functional zone with farm buildings; service zone; zone of large-area trade; economic zone; agricultural production zone; infrastructure zone; green and recreation zone, cemetery zone; mining zone; open space zone; communication zone. Thus, the legislator does not rule out the multifunctionality of spatial planning. However, the requirement for disjunctive zoning leads to the conclusion that this is possible only within the limits explicitly set by the legislator (which can be assessed as unfavorable from the point of view of the challenges of expanding flexibility in planning).

In terms of the planning procedure for adopting a general plan, the possibility was introduced for residents to take the initiative to develop amendments or new planning acts. Until now, such applications by residents were not voted on by councilors, the decision was left to the municipal authorities. The possibility to proceed simultaneously with a general plan and a local plan for the same area was introduced. However, a sequencing requirement has been introduced to ensure that the new local plan is compatible with the new general plan. The procedure for drafting the plan is set forth in Article 13i, which stipulates the subsequent actions to be performed by the mayor of

a municipality in connection with the drafting of a general plan. A resolution to accede to the drafting of a general plan may be adopted either by the municipal council on its own initiative or at the request of the executive body. The subject of the resolution on accession to the preparation of a local plan is only the determination of the boundaries of the area covered by the future zoning plan, and the role of this resolution is only to communicate the initiation of the relevant planning process and to designate in a graphic annex the boundaries of the area to which the arrangements of the future plan will apply. Land use, on the other hand, is determined at the stage of enacting the plan itself. A new obligation in the plan preparation procedure is the obligation to make the draft general plan available in the Urban Register, along with an explanatory memorandum and an environmental impact forecast, if required. The provision stipulates the need to amend the draft general plan as a result of the opinions obtained and arrangements made, and then only to conduct public consultations in the mode referred to in the regulations on public participation. The result of these may be the introduction of amendments to the draft master plan resulting from these consultations. In such a case, it is necessary to repeat the consultations (but no longer opinions) and make another amendment, this time already resulting, if any, from the consultations. After this stage, public consultations are no longer repeated. The procedure for drafting the general plan is crowned by the presentation of the draft general plan to the municipal council together with a report on public consultations.

It is worth mentioning Article 13l, according to which the costs of preparing a general plan are charged to the municipal budget. On the other hand, the costs of drawing up an amendment to the general plan resulting from the placement of public purpose investments of national, provincial, metropolitan or district importance shall be charged to the state budget, the budget of the province, the budget of the metropolitan association or the budget of the district, respectively. Local governments are already warning that due to a lack of funds, they will not have time to implement the regulations and this means the inability to start construction projects (The amendment of the spatial management is one of the milestones enshrined in the National Reconstruction Plan. That is why municipalities were originally supposed to receive 243.6 million zloty to enact new planning documents. To date, the money is still missing).

Changes to the process of issuing WZ Decisions

The upcoming changes stipulate that WZ Decisions will need to adhere to the guidelines outlined in the general plans, a departure from the current practice where decisions are not bound by zoning study provisions (currently WZ Decisions do not have to comply with the provisions of the zoning study). Furthermore, the issuance of a WZ Decision will depend on the identification of the completion build-up area (Polish: obszar uzupełnienia zabudowy) within the general plan. Consequently, if a municipality fails to designate such an area in the general plan, there will be no avenue for issuing a WZ Decision under this category. In such cases, the investor's alternative would be to apply for an Integrated Investment Plan, as discussed below. Additionally, the legislation

specifies that the maximum width of the plot's frontage for consideration in WZ Decision-making will be 200 meters. This parameter also determines the maximum area to be assessed for the purpose of issuing the decision. Hence, if there are no facilities within 200 meters of the investment plot that would facilitate the assessment of new development requirements aligned with the planned investment, issuing a decision under this context will not be feasible. Municipalities, within the general plans, will have the option to establish municipal social infrastructure standards (Polish: gminne standardy infrastruktury społecznej), such as distance from schools or public green areas, as part of their discretionary power. Consequently, obtaining a WZ Decision will be contingent upon proposed developments meeting the aforementioned municipal infrastructure accessibility standards. The new legislation introduces a stipulation that WZ Decisions under this category will expire within 5 years of becoming non-appealable. However, this rule will not be applicable to WZ Decisions that attained non-appealable status before the enactment of the Act. Therefore, final WZ Decisions that do not achieve non-appealable status by the Act's effective date may fall under this new rule.

Urban Register

The Act provides for the creation of a publicly accessible online urban planning register, which will contain, among other things, documents produced during the preparation of planning acts, public consultation reports, as well as applications for WZ Decisions and final WZ Decisions. The overriding goals of continuous, widespread and unfettered public participation are also to be served by making available, upon individual request by a stakeholder, information on the inclusion of new entries in the Urban Register. This will be an obligation incumbent from the filing of the request until the provision of such information is abandoned. The entity responsible for reliable and timely information on new entries will be the minister responsible for construction, planning and spatial development and housing. Significantly, such sharing does not have to take place through an electronic delivery box correlated with a trusted profile, but through generally used e-mail, which does not require identification of the addressee (Daniel et al., 2023). The data collected in the Urban Register will be made available with the assurance of its interoperability, i.e. full compatibility with other elements of the entire public information system (existing or to be created); free of charge; openly except for personal data. As of January 1st, 2026, the Registry is intended by the legislator to become a reference source of information and data in the field of planning and spatial development. According to its intentions, the Registry will be ICT in nature and, in accordance with Article 67d, will collect information and data on planning and land use. It is necessary to ensure cyber security of the processed data (Besiekierska et al., 2022). The regulation contained in Article 67d stipulates that in the footsteps of the digital tools introduced in the Construction Law, the processes related to space management will also undergo gradual digitization. Consequently, the entire investment and construction process will be based on modern tools, which are expected to facilitate

and accelerate investment and construction processes (Niewiadomski et al., 2023). Digitization of space management processes is another stage of a broader process in the creation of public e-government, as well as the formation of an information society. This is because both public administration and society are the subjects of transformations related to the use of modern technologies in space planning. Both of these parties are also its beneficiaries.

Conclusions

The analysis of the spatial planning reform in Poland, introduced through the July 2023 amendment to the law, shows the main changes and their impact on various aspects of the spatial management process. The aim of the amendment is to simplify the procedure for adopting general and local plans, which is expected to reduce the chaos in spatial development in Poland. According to the Law, the master plan will be in digital form. This is to solve the current problems in that the lines drawn in the paper version of the study and development plans, e.g. marking the boundaries between different zones, are not so precise that they can be interpreted down to the square metre on the ground. The digital version will allow the map to be zoomed in at will, so it will be much more accurate. The reform introduces significant changes to the process of issuing Decisions on development Conditions (DODC), requiring compliance with the master plan's objectives.

The new legislation also provides for greater public participation in planning processes, through the introduction of new forms of public consultation and a municipal master plan. Increased communication between residents and decision-makers is intended to better address the needs of local communities and increase acceptance of decisions.

Some of the changes come into force on 1 January 2025, i.e. the provisions on the publication of spatial data created for the master plan. The remaining part comes into force on 1 January 2026, i.e. the amendments concerning the Urban Register (and the obligation to publish the data of the Data Register) and the amendment concerning the 5-year validity period of zoning decisions. Implementing the changes comes at a cost to municipalities, which creates challenges in implementing the regulations. Local authorities are already warning that they will not have time to implement the regulations and this means that construction projects cannot start. Insufficient number of urban planners for 2477 municipalities – fear that plans will be of poor quality, created on the basis of copied feasibility studies.

Summing up, the new regulations are aimed at increasing public participation, facilitating investment processes and increasing consistency in spatial management. However, their effective implementation will require adaptation and financial resources, which poses challenges for local governments in implementing the new regulations.

References

Andrzejewska A., Baranowski M., Fiedziukiewicz K., Kowalska A., Matuszkiewicz J.M., Rusztecka M., Roo-Zielińska E., Solon J. (2007). O partycypacji społecznej w planowaniu przestrzennym. Zastosowanie geowizualizacji w celu wzmocnienia udziału społecznego w planowaniu przestrzennym (*On social participation in spatial planning. The use of geovisualization to strengthen public participation in spatial planning*). GRID Warszawa, IGiPZ PAN, Warszawa.

Besiekierska A., Czaplicki, K. (2022). Cybersecurity of spatial information. GIS Odyssey Journal, 2(2), pp. 23–30.

Brzeziński C. (2013). Wybrane problem planowania przestrzennego w Polsce (*Selected problems of spatial planning in Poland*). Acta Universitatis Lodziensis, Folia Economica, 289, pp. 105–114.

Daniel P., Kafar D., Pawlik K. (2023). Systemowe zmiany w planowaniu przestrzennym (*Systemic changes in spatial planning*). Warszawa.

Dietz T., Stern P.C. (2008). Public Participation in Environmental Assessment and Decision Making. National Research Council, pp. 305.

Fogel A. (2017). Aksjologiczny wymiar partycypacji społecznej w planowaniu przestrzennym (*Axiological dimension of social participation in spatial planning*). In: J. Zimmermann (ed.), Aksjologia prawa administracyjnego (*Axiology of administrative law*), Warszawa, pp. 629–636.

Krajowy Plan Odbudowy i Zwiększania Odporności (*National Recovery and Resilience Plan*), https://www.gov.pl/web/rolnictwo/dokumenty-do-pobrania2 [access: 15.11.2023].

Niewiadomski Z., Jaroszyński K., Kucharski K., Szmytt A., Złakowski Ł. (2023). Planowanie i zagospodarowanie przestrzenne. Komentarz (*Spatial planning and development. Comment*). Warszawa.

Niżnik-Dobosz I. (2014). Partycypacja jako pojęcie i instytucja demokratycznego państwa prawnego i prawa administracyjnego (*Participation as a concept and institution of a democratic state of law and administrative law*). In: B. Dolnicki (ed.), Partycypacja społeczna w samorządzie terytorialnym (*Social participation in local government*), Warszawa, pp. 21–43.

Nowak J.M. (2023). Plan ogólny – nowy instrument w planowaniu przestrzennym (*General plan – a new instrument in spatial planning*). Nieruchomości, no. 11, pp. 3–7.

Okolski D. (2024). Ustawa o planowaniu i zagospodarowaniu przestrzennym. Komentarz (*Act on spatial planning and development. Comment*). Warszawa.

Stawiarz M., Filipowicz T. (2023). Plan ogólny – przepisy wykonawcze do nowelizacji ustawy o planowaniu i zagospodarowaniu przestrzennym z 7.7.2023 r. (General plan – implementing provisions to the amendment to the Spatial Planning and Development Act of July 7, 2023). Nieruchomości, no. 11, pp. 8–11.

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.99

Adam J. Buczkowski[1]

METHODS OF CONDUCTING SPACE TOURISM ACTIVITIES IN THE LIGHT OF INTERNATIONAL LAW – HOW TO REMEDY POTENTIAL CONFLICT OF LAWS?

Abstract: This paper analyses the concept of space tourism in terms of methods required to conduct such activities within the scope of international law. It highlights challenges that emerge for the international space law, especially regarding the suborbital flights. It's not clear from the point of view of international law which legal regime might be applicable to such endeavor. Unlike any other space flights, suborbital flights consists both of elements from international aviation law and international space law. This paper discuss hypothetical solutions to potential conflicts of law that may arise in connection to such activities. It also aims to provide clarity to ambiguities regarding international law in this area.

Keywords: international space law, international aviation law, space tourism, suborbital flights, orbital flights

Received: 26 November 2023; accepted: 28 December 2023

[1] Cardinal Stefan Wyszyński University in Warsaw, Faculty of Law and Administration, Poland, ORCID ID: https://orcid.org/0000-0001-8743-7325, email: a.buczkowski@uksw.edu.pl

Introduction

On 4th of October 1957 a breakthrough event took place in the history of mankind. On this day mankind for the first time penetrated the veil of the cosmos due to the launch of Sputnik-1 satellite to Earth's orbit. Since then, the outer space has been seen not just as an object of philosophical reflections, but as a resource that can be used.

The emergence of this completely new area of human activity, like no other in many respects, gave rise to the need to provide it with special legal regulation, which would define the rules for the use of techniques enabling activities in outer space (Górbiel, 1985). It resulted in establishment of entirely new field of international law – the international space law. The whole international space law system is composed of many treaties. Nevertheless, the most important of them all is Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 1967, commonly known as the Outer Space Treaty. This treaty introduced the main principles which countries must abide in their use of the outer space. Most of them are aimed at ensuring that space wouldn't become the next frontier of super powers aggressive rivalry during the cold war era and promoting the exploration of space, such as the principle of non-appropriation or that outer space and celestial bodies shall be used for peaceful purposes.

Nowadays, space is being used in ways that haven't been envisioned by the scope of the treaties. This applies specifically to the commercial use of space, a subject absent from the regulations of the Outer Space Treaty. Therefore many researchers claim that current international space law system is outdated (Meyers, 2015). One of these ways is space tourism. It is currently the most dynamically developed type of commercial use of space. Due to the way in which this activity is conducted, doubts may arise as to which legal regime is applicable to their assessment.

This article will indicate, based on a comparative analysis, the potential conflict with another regime of international law, i.e. international aviation law. It will also consider the directions in which international space law might evolve to ensure proper protection of participants in outer space activities.

Discussion

The term "space tourism" has been defined as "any commercial activity offering customers direct or indirect experience with space travel" (Freeland, 2010). Although there were previous examples of individuals engaging in such activity, it was only recently, in the year 2021 which marked the breakthrough in space tourism.

On 11th of July 2021, the "spaceplane" V.S.S. Virgin Galactic's Unity detached from the carrier vehicle of the "mothership" (another, larger craft) and went to the upper parts of the atmosphere, and then allowed the crew, i.e. the pilots and other people on board to see the curvature Earth and feel the zero gravity conditions for a few minutes. After that time, the suborbital craft descended in a controlled manner and landed on the runway at the Virgin Galactic mission operations center in the state of New Mexico, USA (National Geographic, 2021).

On 20th of July 2021, Blue Origin launched tourists into space using a reusable rocket called New Shepard, with a crew capsule installed above it. The rocket took off from the launch site in the US state of Texas and rose to an altitude of 107 km above sea level, after which the crew capsule was detached and the rocket itself returned to the launch site. After disconnection, the tourists in the capsule (including the company's owner, Jeff Bezos) remained in space for some time, able to observe the planet, space and experience the effect of lack of gravity. The capsule then descended back to the Earth's surface and, using parachutes, landed at its final destination, close to the launch site (Space.com, 2021).

The flight of the New Shepard rocket is significantly different from the previously carried out Unity 22 mission, primarily in terms of technology (Wood, 2022). The main difference was that New Shepard crew was launched into space by a rocket, not a suborbital plane. This means another way of launching into the outer space, where the elements of regular aviation travel, as were present during Unity 22 mission, are absent.

The next step towards mass and accessible space tourism was the Inspiration4 mission, carried out by SpaceX on 15th of September 2021. As part of this mission, a reusable rocket belonging to SpaceX carried the Dragon capsule with the crew to an altitude of 590 km above sea level. The crew spent three days in orbit during this flight, at a higher altitude than the ISS (approx. 400 km above sea level). After this time, on 18th of September of the same year, the Dragon capsule and its crew returned to the Earth's atmosphere and landed in the ocean, off the coast of Florida.

It is worth noting that space tourism in particular has benefited from the development of GPS technology, even more than any other type of tourism. The GPS was developed to increase US military capabilities. Security considerations which were the major emphasis in its development (Lyall & Larsen, 2017). Although it began as military project, the GPS is also now common in civilian use. International co-ordination and interoperability of GPS is arranged through the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), the International Telecommunication Union (ITU), a COPUOS International Committee on GNSS (ICG), and by bilateral arrangements with the EU, Russia, China, India and Japan (Lyall & Larsen, 2017). Regarding space tourism, the GPS can be used to provide entry locations for civilian space flights.

Taking the above into account, it should be concluded that we can currently distinguish two types of space tourism:

- the suborbital space tourism; and
- the orbital space tourism.

Suborbital flight is a type of space tourism defined as travel into space that does not involve the flight of a launched craft in orbit. This means that this kind of space flights do not fully reach the orbital height and this is related – in simple language – to flights up and down, to an altitude of approximately 100 km above sea level, where, after stopping the engines of the craft, people present on it can experience weightlessness for approximately three to six or ten minutes. After this time, the vehicle re-enters the Earth's atmosphere and returns to the surface. The type of flight indicated may resemble

a jump from point A to point B, which is why it is also referred to as a "suborbital jump" (Kumar Pandey & Tiwari, 2014).

Orbital flight is a further step compared to suborbital flights. It is a type of space tourism that takes place at an altitude that allows to enter Earth's orbit and stay there for a certain period of time (Kumar Pandey & Tiwari, 2014). In this type of space tourism, an object launched from the Earth's surface is required to be able to cross the barrier of 100 km above sea level and continue flying along the curvature of the planet (Polkowska, 2021). The object must reach the appropriate orbital velocity to stay in orbit, depending on the height of the orbit.

Achieving such velocity is naturally much more difficult in technical terms and at the same time more expensive in terms of costs, which constitutes a clear barrier between orbital space tourism and suborbital space tourism. Due to these differences, different solutions are needed for orbital flights than for suborbital flights. Therefore, to conduct this type of activity, it is necessary to launch the object from the ground using a rocket system, not a lifting aircraft.

The types of space tourism indicated above prompt consideration of the application of appropriate legal regimes relating to suborbital space tourism and orbital space tourism respectively. Particularly in the context of conducting activities within the framework of suborbital space tourism, there are arguments pointing to the need to create a new branch of international law, i.e. aerospace law, which would combine some elements of aviation and space law.

In academic discourse, the topics of conflict of legal regimes caused by suborbital flights are negligible. However, due to the current undertakings of large, cross-border enterprises, this is a niche that requires development.

Creating a separate branch of international law would solve the complicated issue of categorizing certain activities, including: entities already indicated in the text and the nature of their activity, which, thanks to the development of technology, cannot be definitely classified as space or air activity. However, it is difficult to expect the emergence of new treaty regulations similar to the Outer Space Treaty in the current international climate. These types of activities should therefore be considered on the basis of the existing framework of international law, without attempting to design new treaties.

In the context of suborbital flight, as described above, it can be performed in two ways. The first is to release the capsule to an altitude of approximately 100 km above sea level, using a launch rocket. The second is the launch of a suborbital aircraft equipped with rocket engines from the deck of another aircraft that was used to carry this craft to the appropriate height. As for the first method of lifting the object to approximately orbital altitudes, there is no doubt that in this case the usual methods of launching the object into space are used. However, the use of a suborbital aircraft effectively uses two areas to fulfill its function, i.e. air, in the case of the mothership, and space, in the case of the suborbital aircraft. This means that this type of suborbital flight in its first phase of flight is subject to the provisions of the Convention on International Civil Aviation of 1944 and in the second phase to the provisions of the Outer Space

Treaty, which consequently results in different requirements for conducting the flight and forms of liability for the same flight.

What is the easiest to point out in the above case is the different view on the issue of territoriality in airspace and outer space. In the case of international space law, firstly, there is no treaty regulating the delimitation of outer space, and secondly, in accordance with art. II of the Outer Space Treaty, the outer space does not constitute the territory of any state. The provisions of the treaties constituting international space law system repeatedly contain provisions confirming the lack of national jurisdiction in outer space.

However, in the provisions of the Chicago Convention of 1944, unlike in international space law, there are numerous references to the extension of a state's sovereignty into air space beyond its land and water territory. The regulations in question are already included in art. 1 of this treaty: "The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory". Moreover, the entire Chicago Convention of 1944 is much more precise than the Outer Space Treaty, which confirms its narrow definitions. According to art. 2: "For the purposes of this Convention the territory of a State shall be deemed to be the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State".

Another confirmation of the contrast between international aviation law and international space law in the context of territoriality is the issue of overflight in a given zone. In the international space law treaties, in line with the principle of non-appropriation of outer space, there are no provisions regulating flight over the territory of other countries.

The Chicago Convention of 1944 on the other hand, devotes its entire second chapter to the rules of flight in the airspace (which, in accordance with articles 1 and 2 of this treaty, is part of the territory of a state) by aircraft of other states. Particular mention should be made of art. 5 paragraph 1 of this treaty: "Each contracting State agrees that all aircraft of the other contracting States, being aircraft not engaged in scheduled international air services shall have the right, subject to the observance of the terms of this Convention, to make flights into or in transit non-stop across its territory and to make stops for non-traffic purposes without the necessity of obtaining prior permission, and subject to the right of the State flown over to require landing. Each contracting State nevertheless reserves the right, for reasons of safety of flight, to require aircraft desiring to proceed over regions which are inaccessible or without adequate air navigation facilities to follow prescribed routes, or to obtain special permission for such flights".

The above provision means, if a country's consent is required to fly over its territory, such a flight may also be refused. Examples of such behavior include numerous sanctions against specific countries caused by their i.e. internationally wrongful acts. As a result, the aircrafts of these countries cannot cross the airspace of another country that has imposed these sanctions, making it necessary to find another route.

A contrario, in outer space, the consent of states is not required for the flight of space objects. It is confirmed by the treaties regulating the international space law.

There are no provisions in treaties relating to the outer space analogous to art. 5 of the Chicago Convention of 1944. On the contrary, art. I and art. II of the Outer Space Treaty provide for free access of outer space for all states, and because no state can exercise control over it, it cannot prohibit space flights.

This means that objects making a flight as part of a suborbital space tourism in a manner where more than one craft is used, will be subject to two legal systems, separately during different stages of the flight. To illustrate this situation in practice, the object in question will start flying in the airspace, and then would be launched to space. It is worth noting that one of these crafts composing the whole flight system would remain in the airspace for the whole duration of the flight.

Considering every step of mentioned suborbital flight, there are not only additional challenges regarding the use of new technologies, but also the application of a specific type of law. There are several theoretical possibilities to solve this issue.

One of them is to create an entirely new field of law that would combine elements of international space law and international aviation law to the extent necessary to conduct such a flight. The "aerospace" law would definitely facilitate the conduct of the activity in question, provide protection for entities performing it and offer transparency in resolving disputes. Creating such a law might be the most beneficial solution for all actors involved in activities in this area. Moreover, it would solve a number of problems related to the choice of applicable law, including: assessment of the entity's jurisdiction, liability issues or entity registration.

A somewhat hybrid solution would be, as the name suggests, a combination of the above-mentioned provisions in the form of a new treaty that would apply to objects flying in both airspace and the outer space. Such a treaty would include the most important provisions on the registration of space objects and aircraft. Particular attention should be paid to the issues of the place of registration of facilities, their marking and notification of registration, as these are elements common to both treaties. Moreover, the provisions of such a treaty should also include technical data of such objects, such as orbital period, inclination angle and other orbital parameters, i.e. information provided for by art. IV Convention on the Registration of Space Objects of 1975.

That particular solution would improve legal transactions related to activities using space objects, as well as prevent a conflict of two legal regimes. Thanks to that solution the operator would avoid uncertainties related to the correct choice of applicable law, which would consequently facilitate issues related to conducting commercial activities in space and the protection of intellectual property. and pursuing claims for compensation.

However, agreeing on a treaty combining elements of international space law and international aviation law could prove to be a significant challenge. It would also be hard in the end to distinguish such a solution from the previously proposed due to the fact that it might to the creation of a completely new branch of international law, regardless. Therefore, another solution that could improve commercial activities in outer space in this field could be to propose a new international space law treaty.

In the context of space tourism, using the example of suborbital space flights, such a treaty should cover the issues of registration of space objects and liability for damages of the space flight operator. The above analysis has shown that the Chicago Convention of 1944 and treaties in the field of international space law differ significantly, especially in terms of detail and lack of specific definitions. Therefore, the new treaty should contain a number of definitions explaining the terms used in the regulations, and should also include elements from international aviation law, so that this treaty would constitute a kind of extension of the provisions regulating the flight in airspace. Thus, despite the existence of two legal regimes, in the event of a conflict of laws, determining the law applicable after i.e. the occurrence of a hypothetical in-flight event giving rise to a claim for compensation or the appropriate classification of such an object could prove simpler and produce the same result in the case of international aviation law, as well as international space law.

Consequently, this would result in the equalization of international air law and international space law in the areas in which they share their application to the entity taking flight. For example, in the case of a suborbital space flight, which takes place using two separate objects – the mothership and the suborbital plane – the applicable law would provide for the same rights and obligations for both of these objects, despite the fact that they move in zones governed by different legal regimes.

Conclusions

The emergence of space tourism creates new challenges for over half a century old treaties of the international space law (Blount, 2011). Whereas the means to perform activities associated with orbital space tourism don't differ from the currently known means of space travel, the suborbital space tourism uses entirely new methods of travel (Garapich & Piotrowski, 2017). Although space tourism still isn't commonly available, due to its costs, if it becomes widely accessible, it would procure conflict of law issues between international law regimes, such as international aviation law and international space law.

When considering the legal nature of such a space flight, it is first of all necessary to determine what legal regime should be applied to suborbital flights. As analyzed in this article, based on currently applicable international aviation and international space law treaties, this will vary depending on the technology used.

In a situation where we are considering objects that move in a controlled manner in space, such as the case of suborbital craft that begin their flight in airspace, detaching from the mothership, two different regimes will apply to determine their legal status. These would be the Chicago Convention of 1944 for the latter and the treaties that constitute international space law, such as the Outer Space Treaty or Convention on the Registration of Space Objects of 1975, for the former.

Solutions proposed in this paper are only hypothetical assumptions. The current climate in the international community, as well as the decision to draw up the Artemis Accords, suggests that no new provisions of international space law can be expected in

the near future, and the factual situation will remain unchanged. Therefore, the space tourism activities that have been analyzed must still be assessed through the prism of current treaties, and the only solutions to the problems posed by the application of these treaties must be sought in the operators' practice and any resulting precedents.

Current system will most likely continue to be used. This means that whenever a space object performs a suborbital flight, especially if it has characteristics similar to a Virgin Galactic craft, the assessment of its jurisdiction after crossing the recognized boundary of the outer space wouldn't be obvious. If no other legal norm emerges, it would always be based on imperfect acts of international space law.

References

Blount P.J. (2011). Renovating Space: The Future of International Space Law. Denver Journal of International Law and Policy, vol. 40, no. 1–3, 515 – [ii].

Convention on International Civil Aviation of 7th of December 1944.

Convention on Registration of Objects Launched into Outer Space of 14th of January 1975.

Freeland S. (2010). Fly Me to the Moon: How Will International Law Cope with Commercial Space Tourism. Melbourne Journal of International Law, vol. 11, no. 1, pp. 90–118.

Garapich K., Piotrowski M. (2017). Loty suborbitalne – aspekty prawne (*Suborbital flights – legal aspects*). In: K. Myszona-Kostrzewa (ed.), Kosmos w prawie i polityce, prawo i polityka w kosmosie (*Cosmos in law and politics, law and politics in cosmos*). Wydawnictwo Naukowe SCHOLAR, Warszawa, pp. 155–187.

Górbiel A. (1985). Międzynarodowe prawo kosmiczne (*International space law*). Wydawnictwo Naukowe PWN, Warszawa.

Kumar Pandey A., Tiwari H. (2014). Space Tourism: Expanding the Horizon. Indian Journal of Law & Public Policy, vol. 1, no. 2, pp.103–121.

Lyall F., Larsen P.B. (2017). Space Law. A Treatise. Routledge, New York.

Meyers R. (2015). The Doctrine of Appropriation and Asteroid Mining: Incentivizing the Private Exploration and Development of Outer Space. Oregon Review of International Law, vol. 17, no. 1, pp. 183–204.

National Geographic (2021). What Virgin Galactic's milestone flight means for the future of tourists in space, https://www.nationalgeographic.com/science/article/what-virgin-galactic-milestone-flight-means-for-the-future-of-tourists-in-space [access: 21.11.2023].

Polkowska M. (2021). Space Tourism Challenges. Review of European and Comparative Law (RECoL), vol. 45, pp. 153–182.

Space.com. (2021). Space tourism took a giant leap in 2021: Here's 10 milestones from the year https://www.space.com/space-tourism-giant-leap-2021-milestones [access: 21.11.2023].

Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 27th of January 1967.

Wood C. (2021). Blue Origin brought the first official tourists to space https://www.popsci.com/science/blue-origin-space-tourism [access: 21.11.2023].

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.107

Kamil Czaplicki[1]

USE OF ARTIFICIAL INTELLIGENCE IN REMOTE BIOMETRIC IDENTIFICATION SYSTEMS

Abstract: Work is currently underway to regulate the use of artificial intelligence. The article presents the ideas and principles of creating remote biometric identification systems using AI technologies. Risks to privacy and possible scenarios for the use of such systems are presented.

Keywords: biometrics, artificial intelligence, remote biometric identification systems

Received: 27 November 2023; accepted: 22 December 2023

[1] Cardinal Stefan Wyszyński University, Faculty of Law and Administration, Department of Informatics Law, Warsaw, Poland, ORCID ID: https://orcid.org/0000-0002-3777-4339, email: k.czaplicki@uksw.edu.pl

Introduction, material and methods

The article uses the method of analyzing legal texts and scientific publications. The historical method was also used to illustrate technological changes. The materials used in the article are legal acts created at the European Union level and English-language scientific articles.

The idea of artificial intelligence. Artificial intelligence is a topic that has been widely discussed in recent times. Although the idea itself emerged in the 1950s, when John Mc Carthy first used the phrase at the Dartmount Conference, it is only in recent years that the development of digital transformation has made a wide audience aware of the possibilities of using this tool. The literature indicates that artificial intelligence (AI) is the science of how to produce machines equipped with some of the characteristics of the human mind (Sheikb et al., 2023), such as the ability to understand language, recognize images, solve problems and learn. Jerzy Cytowski, in the Great Encyclopedia of Law (Wielka Encyklopedia Prawa, 2021), pointed out the synergy of artificial intelligence with the environment in which it operates, stressing that artificial intelligence is a device or computer system capable of analyzing the environment in which it operates and learning and acting in response to stimuli acquired from the environment (Szpor et al., 2021). Artificial intelligence broke through into the general public consciousness in the second half of 2022, when the so-called GPT chat appeared (Oguz et al., 2023). Because it is a text generator designed to converse with the user, for many people it has become the epitome of a viable conversation partner, a helper who writes papers for us, translates text, or solves problems such as climate problems at a very fast pace (Biswas, 2023). The GPT chat, despite the fact that it has contributed to the popularization of artificial intelligence, is not an example of its strict application. More and more research and scientific centers are conducting research on the use of artificial intelligence, more and more complex models and algorithms are being created, and new applications and implementations are emerging. Global companies, seeing its potential, are commercializing many of its applications in their own operations. Artificial intelligence algorithms are used in banking, information technology, communications, medicine, law, customer service, architecture, logistics, spatial information systems or the military, among others (Bramer, 2004). Recently, there has also been a growing role for artificial intelligence algorithms used in the process of identifying identities, including those carried out in real time without the consent or awareness of the person being identified. More and more applications of artificial intelligence, raise legitimate concerns about their security and violation of, for example, our privacy. Unfortunately, this is a new technology, largely ahead of current regulations. The European Commission, in an effort to maintain the technological superiority of the European Union countries, while at the same time ensuring the harmonious development of artificial intelligence technology while protecting the fundamental rights of European residents, has taken the initiative to create a separate piece of legislation regulating the most important issues of artificial intelligence.

Legal regulation of artificial intelligence systems. On April 21, 2021. The European Commission submitted a proposal to adopt a Regulation of the European Parliament and of the Council laying down harmonized rules on artificial intelligence and amending certain legislative acts of the union (Com 2021) 206 final 2021/0106 (COD) (https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=CELEX%3A52021PC0206). As indicated in the preamble to the regulation, "The purpose of the regulation is to improve the functioning of the internal market by establishing a single legal framework, in particular for the development, marketing and use of artificial intelligence in accordance with the values of the Union". The draft regulation seeks to regulate a number of issues related to the use of artificial intelligence in the European Union area. Importantly, it was stressed that technological development necessitates rational legislation that supports the development of technology while guaranteeing respect for fundamental rights.

The draft regulation envisages basing the regulation of artificial intelligence on risk analysis, imposing a number of restrictions on high-risk systems. The originators of the project considered the use of a risk-based legal framework to be a better solution than general regulation of all artificial intelligence systems. The types of risks and threats should be determined on a case-by-case and sector-by-sector basis. Risks are also to be calculated, taking into account the impact on rights and security. The draft explicitly prohibits some particularly harmful practices using artificial intelligence, which are contrary to EU values (e.g. social categorization). In the case of high-risk systems, the use of which may be a threat to health and safety or fundamental rights, a number of specific restrictions and safeguards have been proposed, which the originators assume should contribute to the sound protection of citizens' interests. Before such systems can begin to be used, they will have to meet a number of horizontal mandatory requirements and will have to undergo procedures for assessing their compliance. In the draft regulation, a number of definitions have been introduced, including, among others, the definition of artificial intelligence, user and provider, purpose of training data validation data, biometric data, effective operation of the artificial intelligence system, post-market monitoring, test data, emotion recognition system or national supervisory authority.

Biometric data – concept and types. The draft regulation includes remote biometric identification systems in the catalog of high-risk artificial intelligence systems. Biometrics is a technique for measuring living beings, aimed at methods of automatically recognizing people based on their physical characteristics (Vacca, 2007). Biometric systems use so-called biometric data in the process of identifying (or verifying) identity. Recital 7 of the preamble to the draft Regulation indicates that the concept of biometric data used in this Regulation is consistent with the concept of biometric data as defined in Article 4(14) of Regulation (EU) 2016/679 of the European Parliament and of the Council, Article 3(18) of Regulation (EU) 2018/1725 of the European Parliament and of the Council, and Article 3(13) of Directive (EU) 2016/680 of the European Parliament and of the Council, and should be interpreted in a manner consistent with this concept. Despite this, the legislator decided to reinsert the definition of biometric data into the draft regulation. Article 3(33) indicates that "biometric data" means personal data

resulting from special technical processing that relates to physical, physiological or behavioral characteristics of a natural person and enables or confirms the unambiguous identification of that person, such as facial image or dactyloscopic data.

We divide biometric data into two categories: anatomical data called genotype and behavioral data called phenotype. Anatomical data is related to a person's physical characteristics and includes fingerprint, iris of the eye, vein pattern of the hand or wrist, voice color, odor, facial geometry, hand geometry, facial temperature distribution, retina, DNA identification, ear geometry, skin surface analysis. Behavioral data is related to our behavior and requires movement for verification. Behavioral traits include the movement of the mouth, eye movement, the way we type, including the way and speed of typing, voice characteristics or the way we walk (Nanavati et al., 2002). A biometric trait, in order to be used in an identity confirmation system, must be characterized by five factors: immutability, uniqueness, indestructibility, measurability and acceptability. In addition, the European Commission, in Biometrics at the Frontiers: Assessing the Impact on Society, indicated that a biometric trait must be characterized by universality, uniqueness, immutability, retrievability, efficiency , acceptability and resistance to fraud. (Biometrics AT the Frontiers: Assessing the Impact on Society, Technical report series EUR 21585 EN, p. 37).

Biometrics, despite being considered one of the top ten technologies that could revolutionize the world (Pugliese, 2010), is also considered a highly privacy-invasive technology that could infringe on citizens' fundamental rights. Much attention has been paid to biometric technology in the RODO Regulation, which has largely regulated the processing of biometric data. It is commonly used in identity documents, in securing sensitive areas requiring access control or in banking. In addition, biometrics is one of the three main methods of identity identification. The other two methods are: based on what we know (passwords, pin codes) and based on what we have (cell phone, access card) (Walte, 2014). Biometric identity identification is characterized by speed, non-invasiveness, simplicity and certainty of result.

As a rule, it proceeds in a flowchart, where the first block is the collection and recording of the master feature. In this process, it is necessary to acquire the best possible sample of the biometric trait, since any distortion of the trait will affect subsequent processes. In the second block of processes, the user's identity is declared (e.g. by entering an individual number or applying a card with stored data). In the next block of processes, the reader takes the biometric characteristic of the person who previously declared his identity, and in the fourth block of processes, a comparison of the collected characteristic with the stored pattern takes place, and a decision is made about the positive or negative result of identity identification (verification).

Results and discussion

Remote biometric identification systems. Nowadays, one can increasingly observe the trend of creating remote identity identification systems. This is largely due to the need to carry out the process of identity identification efficiently and quickly,

without having to take out documents, magnetic cards, stand in queues, or even touch devices that can carry viruses and bacteria. Also important in this is the process of fighting terrorism or even widely understood threats (including kidnapping and search for missing persons). Remote identification is used by both police authorities and private companies. In the latter context one can point to, among other things, the identification of employees and customers to improve customer service. Remote identity identification is also the basis of many smart city and smart house services. It serves as part of the fight against homelessness and theft (Tan, 2020).

Technological developments, including the creation of cameras with increasingly better quality parameters, have made it possible to take biometric patterns and distinguish them from a greater distance than before. Biometric features that can be collected from a distance are, in particular, photos (image) but also iris of the eye, or even the way of movement. Such systems, compared to systems based, for example, on RFID technology or device identification (e.g. phones), guarantee the identification of a person, not a device. The device can be carried by someone else and then the identification result will be falsified. It is worth noting at this point that biometric identification based on the image (photos of the face) has many technical limitations and, compared to other biometric features, is more susceptible to external influences (Bharadwaj et al., 2013). Systems based on the facial image, use the pursuit of a natural way in everyday interactions to identify people based on anatomical differences in the face, are non-invasive and do not require the cooperation of the person being identified. On the other hand, however, the face is characterized by variability, flowing from natural grimaces and facial expressions triggered by conversation, emotion or illness. The face is subject to aging processes, which can change it to a great extent over a lifetime. In addition, using simple ways, we can easily change its appearance, for example, by using a beard, mustache, glasses. The impact of social changes after the coronavirus pandemic, where covering one's face with a mask no longer surprises anyone and can be considered a natural way to shuffle around in public, is also not insignificant. An additional problem is the environment of the face under examination, the influence of lighting, the reflections created or its movement.

The creation of remote identity identification systems, mainly those based on biometric identification, raises many controversies. Such systems perform processing of personal data without the knowledge and, more importantly, without the consent of the person subjected to the identification process. It is worth noting here that one of the main ideas of the data protection law reform expressed in the RODO Regulation was data autonomy and informed decision-making of citizens about the processing of their personal data (Vold & Whittleston, 2019). Being subject to a continuous identification process modeled on China's Public Trust System (Social Scoring System) raises many concerns about citizens' privacy and the preservation of their fundamental rights. There is no doubt that the legal regulations in the European Union and China regarding the protection of personal data are quite different, but more importantly, the awareness of data protection and privacy among Europeans and Chinese is quite different. In China,

the public attaches much more importance to the development of the state and overall prosperity than to the protection of their own privacy (Lucero, 2019).

Remote identity identification processes have been accelerated by the emergence of artificial intelligence algorithms, supporting work in large volumes of data. Able to quickly analyze uploaded photos and recordings and compare extracted biometric characteristics with stored patterns. This solution is revolutionary from the point of view of speed and non-invasiveness, while bringing a very high level of efficiency to identity identification processes. It is worth noting, however, that this solution can invade the privacy of people unaware of the identification process and their identity in a huge and uncontrollable way. Such tools allow tracking, recording the route of movement, analyzing the way and mode of operation. It is a tool of remote and widespread social surveillance. Such systems can create a sense of constant surveillance and indirectly discourage the exercise of freedom of assembly and other fundamental rights.

The European Commission has recognized this risk of using remote biometric identification for the rights set forth in the Charter of Fundamental Rights, among others (OJ EU. C. 2007 No. 303, p. 1 as amended). In the draft regulation of the act on artificial intelligence) (https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=CELEX%3A52021PC0206) introduced in Article 5 a general rule prohibiting the use of real-time remote biometric identification systems in public spaces. As defined in Article 3 para. 36 of the proposed regulation, "remote biometric identification system" means an artificial intelligence system for identifying individuals remotely by comparing a person's biometric data with biometric data contained in a reference database, without the user of the artificial intelligence system knowing in advance whether the person will appear in the system and can be identified; and according to Art. 3(37) of the proposed regulation, "remote biometric identification system in real time" means a remote biometric identification system in which biometric data collection, comparison and identification take place without significant delay. Such a system is considered to be one in which identification occurs immediately, but also with a slight delay. The term remote biometric identification system as used in the proposed regulation is functionally defined as an artificial intelligence system for identifying individuals remotely by comparing a person's biometric data with biometric data contained in a reference database, without prior knowledge of whether the person will be in the database and can therefore be identified, regardless of the specific technology and the specific processes or types of biometric data used. The service provider has distinguished between two systems: the "real-time" remote biometric identification system and the "post-factual" remote biometric identification system, taking into account their different characteristics and modes of operation, and most importantly the different risks associated with them. With "real-time" systems, biometric data collection, comparison and identification occur immediately or without significant delay. "Real-time" identification systems involve the use of "live" or "near real-time" recorded material, such as video generated by a camera or other device with similar functionality. In contrast, with "post-factual" identification systems, biometric data has been taken earlier, and comparison and identification occur

with a significant delay. This applies to materials, such as photos or video generated by closed-circuit television cameras or private devices, which were recorded before the system was used on an individual.

The mentioned general rule prohibiting the use of real-time remote biometric identification systems in public spaces applies to systems used for law enforcement purposes. The legislator used the general formulation of law enforcement, which should be interpreted as the general task of ensuring that people behave in accordance with the regulations set forth in the law. In the absence of an indication by the legislator, it should be broadly assumed that it refers to both generally applicable laws and internal regulations.

The legislature has adopted three exceptions to the general rule prohibiting the use of real-time remote biometric identification systems in public spaces for law enforcement purposes:

1. targeted search for specific potential victims of crime, including missing children;
2. to prevent a specific, serious and imminent threat to the life or physical safety of individuals or a terrorist attack;
3. to detect, locate, identify or prosecute the perpetrator of a crime or suspected perpetrator of a crime referred to in Article 2(2) of Council Framework Decision 2002/584/JHA and punishable in the Member State concerned by a custodial sentence or a security measure involving deprivation of liberty for a maximum period of at least three years, in accordance with the law of the Member State concerned.

The legislator has indicated that these exceptions may be applied only if and to the extent that such use is absolutely necessary for the purposes indicated above. This exception, therefore, is defined very generally, and each use must be in accordance with Article 5 of the proposed regulation. Control of compliance with the purposefulness of the exception as well as its absolutely necessary nature is carried out in accordance with Article 5, para. 3. the competent judicial or administrative authority which shall issue each time a permit to perform remote real-time biometric identification. This authority shall issue permission before the biometric identification processes have even been initiated , unless there is an emergency and justified case of using the system without the approval of the judicial authority, in which case such approval shall be issued during or after the process. The competent judicial or administrative authority shall grant permission only if it is convinced, on the basis of objective evidence or clear grounds brought to its attention, that the use of the "real-time" remote biometric identification system in question is necessary and proportionate to achieve one of the objectives set forth in the Regulation. The judicial or administrative authority shall also take into account:

1. the nature of the situation necessitating the possible use of the system, in particular the severity, probability and scale of the damage caused if the system is not used;
2. the consequences of the use of the system on the rights and freedoms of all persons concerned, in particular the severity, likelihood and scale of such consequences.

It is worth noting here that the draft regulation only regulates the use of biometric systems for real-time remote identification of identity for law enforcement purposes.

Any other systems using remote processing of biometric data must still comply with all requirements under Article 9(1) of Regulation (EU) 2016/679, Article 10(1) of Regulation (EU) 2018/1725 and Article 10 of Directive (EU) 2016/680, as applicable.
According to Annex III to the draft regulation, artificial intelligence systems intended to be used for remote biometric identification of individuals "in real time" and "post factum", qualified as high-risk systems.

June 14, 2023. The European Parliament passed the negotiating position on Artificial Intelligence Act by a large majority (499 votes in favor, 93 abstentions by 29 votes against). During the discussion, a great deal of space was devoted to the issue of using artificial intelligence systems in biometric identity identification processes. Despite a number of amendments (https://www.europarl.europa.eu/doceo/document/A-9-2023-0188_PL.html) by MEPs and appeals from organizations defending fundamental rights and privacy, MEPs and decided not to completely ban the use of biometric identity identification systems in real time, and decided to deepen judicial review of applications for its use.

Conclusions

Artificial intelligence is a technology that is becoming increasingly important. It can be used in many systems based on large data sets (including GIS systems). Attempts to regulate artificial intelligence are made both at the state level and at the level of international organizations. The remote biometric identification systems described in the article and the use of artificial intelligence algorithms in them may violate the privacy of people and therefore must be subject to strict legal control.

References

Bharadwaj S., Vatsa M., Singh R. (2014). Biometric quality: a review of fingerprint, iris, and face. EURASIP Journal Image and Video Processing, no. 34. https://doi.org/10.1186/1687-5281-2014-34

Biometrics at the Frontiers: Assessing the Impact on Society (2005), Technical report series EUR 21585 EN, p. 37.

Biswas S.S. (2023). Potential Use of Chat GPT in Global Warming. Annals of Biomedical Engineering, vol. 51, pp. 1126–1127. https://doi.org/10.1007/s10439-023-03171-8

Bramer M., Devedzic V. (2004). Artificial Intelligence Applications and Innovations, IFIP 18th World Computer Congress TC12 First International Conference on Artificial Intelligence Applications and Innovations (AIAI-2004), 22–27 August 2004, Toulouse, France.

Lucero K. (2019). Artificial Intelligence Regulation and China's Future, Columbia Journal of Asian Law, vol. 33, no. 1, pp. 109–110.

Nanavati S., Thieme M., Nanovati R. (2002). Biometrics Identity Verification in a Networked World, p. 10.

Oğuz F.E., Ekersular M.N., Sunnetci K.M., Alkan A. (2023). Can Chat GPT be Utilized in Scientific and Undergraduate Studies? Annals of Biomedical Engineering. https://doi.org/10.1007/s10439-023-03333-8

Pugliese J. (2010). Biometrics, Bodies, Technologies, Biopolitics. New York, p. 1.

Sheikh H., Prins C., Schrijvers E. (2023). Artificial Intelligence: Definition and Background. In: Mission AI. Research for Policy. Springer, Cham.

Tan M., China: Facial recognition and its legal challenges, https://www.taylorwessing.com/en/insights-and-events/insights/2020/05/china---facial-recognition-and-its-legal-challenges [access: 25.11.2023].

Vacca J. (2007). Biometric Technologies and Verification System, Elsevier, p. 3.

Vold K., Whittleston J. (2019). Privacy, Autonomy and Personalised Targeting: rethinking how personal data is used. In: C. Veliz (ed.), Raport on Data, Privacy, and the individual in the Digital Age.

Walter W. (2014). Security for Service Oriented Architectures, CRC Press, p. 4.

Wielka Encyklopedia Prawa, tom XXII Prawo Informatyczne (*The Great Encyclopedia of Law, volume XXII Information Technology Law*). (2021). In: G. Szpor, L. Grochowski (ed.), Fundacja Ubi Sociatas, ibi ius, p. 435.

GIS Odyssey Journal

2023 • Volume 3 • Number 2

https://doi.org/10.57599/gisoj.2023.3.2.117

Aleksandra Syryt[1]

THE PANDEMIC DIMENSION OF NEW EDUCATION AND POST-PANDEMIC TRENDS: TECHNOLOGY IN THE SERVICE OF EDUCATION?

Abstract: The COVID-19 pandemic, which swept across the globe, has left an indelible mark on various aspects of human life. Schools and educational institutions worldwide have had to adapt rapidly to the challenges posed by the pandemic. As a result, "new education" became a necessity, predominantly characterized by utilizing technology as an integral part of the learning process. This article examines the pandemic's impact on education, focusing on its transformation. It also explores post-pandemic trends, particularly emphasizing how technology continues to reshape and serve the educational landscape.

Keywords: education, pandemic, new education, e-learning, technologies, GIS

Received: 29 November 2023; accepted: 28 December 2023

[1] Cardinal Stefan Wyszyński University in Warsaw, Faculty of Law and Administration, Warsaw, Poland, ORCID ID: https://orcid.org/0000-0002-7501-0786, a.syryt@uksw.edu.pl

Introduction

The COVID-19 pandemic tremendously impacted all aspects of our lives, including education. Schools at all levels, including higher education institutions, worldwide had to adapt to a new reality in which remote learning became necessary. As society faced the challenges posed by the pandemic, education had to transform itself to keep up with the rapidly changing conditions. The COVID-19 pandemic forced educators and learners into a new reality, disrupting conventional in-person education norms. A shift towards "new education" became inevitable, wherein technology played a pivotal role in facilitating remote learning, connecting students and educators, and redesigning teaching methodologies. This article delves into the pandemic's influence on education and investigates emerging trends, highlighting the role of technology in this transformative journey. The analysis will be based on relevant literature and selected reports related to the titled issue concerning the directions for developing the education and learning process.

Discussion

Analysis of the state of the problems: Education Yesterday and Today: Changes and New Challenge. Education is an integral part of our lives and society. However, its face changes significantly over time. Comparing education from a few decades ago to today, one can observe numerous changes and transformations.

In the past, it was often said that all you needed for effective education was a chalkboard, chalk, and a good teacher. However, modern times show that these elements are no longer sufficient. It would not be easy to defend such a statement in today's world. In a changing reality, students' expectations and requirements are different.

Under the influence of new information and communication technologies, the world has greatly expanded and become closer. It has become a global village. Technological development has increased the quantity and significance of information delivered through the Internet and mobile phones. It has also created virtual spaces and worlds where Internet users interact. Further research and reports (such as the Norton Online Living Report) confirm that we bring real-world behaviors into the online environment. The emergence and development of a new concept of the Internet after 2001 (Web 2.0), where everyone can be both a creator and a consumer, has unleashed unprecedented communication and intellectual activity among young people.

These processes do not leave education untouched. The "new education" is not a product of the COVID-19 pandemic. We had already encountered the new learner and, in a way, a new educational world in which reaching the student required a completely different set of tools than in the 20th century. A new educational world has emerged, with its wealth of interactive, collaborative, and community tools – naturally used every day by young people, the "digital natives".

That's why, nowadays, chalk, a chalkboard, and a good teacher may prove insufficient to ensure the effectiveness of the education process. The new student in the

information society requires an entirely new approach to teaching, allowing them to transform the information reaching them into knowledge.

In 2006, Scottish scientists from the University of Abertay Dundee, in collaboration with the company DTI, presented a comparison between the old and new world of education. They published a report titled "Beyond e-Learning: Practical Insights From the USA", outlining the fundamental differences between these worlds. They considered criteria such as the auditorium, the learning process, and the design of the learning process (Bull et al., 2006).

Regarding the criterion of the audience, they noted that in the old world of education, it relied on a single source of knowledge. The education recipient was the educational team, consisting of the school or university community. Attention was paid to individual tasks and point thinking. In-depth knowledge was required, and teaching emphasized showing a clear result. On the other hand, in the “new education,” multiple sources of knowledge are utilized. The recipients of education are various clients, partners, and public opinion. It goes beyond the school desks and university walls. Education is directed towards multitasking and global thinking. Broad knowledge is conveyed, although it does not have to be deep. Education presents various possible solutions. The offering is aimed at communities of learners rather than individual recipients (Keith, 2006).

As for the learning process, in the old education, the focus was on transmitting information. Knowledge was to be acquired throughout one’s life through formal education. Emphasis was placed on the quality of acquired and processed knowledge (Polak, 2008).

In the "new education", attention is directed towards processes. This is a result of the belief that acquiring knowledge alone is ineffective. Knowledge becomes outdated, so education is an ongoing, lifelong process. It can be carried out through formal and informal means because it aims to enable individuals to function in society and the market. Therefore, education in this new perspective is focused on action, searching, and processing information. It emphasizes the quantity of processed knowledge (Keith, 2006).

Finally, when it comes to designing the education process, in the old education, trainers and lecturers were the masters of this process. The system was uniform and the same for everyone according to established, usually through legislation models. It had a comprehensive character and rich educational content (Polak, 2008).

In the "new education", various actors shape the educational process. The process is more personalized and scalable, considering the expectations and needs of learners, educators, and the socioeconomic environment. It has a fragmented and practical character. Education focuses on access to specific content or information and its utilization rather than information itself (Keith, 2006).

The mentioned contexts of “new education” and their differences from what can be considered classical education necessitate the development of new learning and teaching methods. Since these actions are to be focused on processes, lifelong learning,

and the acquisition and processing of information, technology will play a supporting role in facilitating the achievement of these goals (Polak, 2008).

Various entities participate in promoting and supporting the new education. Particularly noteworthy is the association EDUCAUSE, which helps higher education increase the impact of IT on education. It engages in expert, scientific, and educational activities and supports the educational process. The annual EDUCAUSE Horizon Report provides a diagnosis of the education system, describes trends in education, and sets directions for future actions. It also points out scenarios for the future. Since 2004, reports have been created concerning educational changes under the influence of new technologies. According to the report from 2019, modern education was supposed to look as follows:

Devices are intended to teach since they can communicate with humans. The Internet will be a ubiquitous communication and a place for knowledge processing. Teaching will be an ongoing process based on sharing knowledge regardless of age. Learning will involve processing a stream of information, focusing on practical, continuously updated knowledge rather than creating a resource for use throughout one's life. It will require accepting change and quickly assimilating new knowledge (2019 Horizon Report).

Education during a pandemic. Moments of global crisis have an enduring ability to drive technological advancements and the widespread implementation of technology in previously considered impossible ways. This situation is also evident in the case of the coronavirus pandemic. A positive outcome of crises is their recurring ability to transform something once deemed impossible into an accepted aspect of a new reality. The need for a rapid response to threats or unusual situations stimulates action.

Discussions about remote learning or education using technology in 2020 were not something new. They had been ongoing for over a decade. The pandemic merely accelerated certain processes and allowed for their verification. What phenomena could be observed during the pandemic? Primarily, remote learning was developed, increasing virtual learning opportunities and efforts to bridge the so-called digital divide.

In just a few days, educational institutions were forced to make significant strategic changes that had been in the works for years. China created a national cloud-based learning platform that provided learning materials to all junior high and high school students. They also incorporated public teaching programs into their national educational strategy through dedicated public television broadcasting materials for primary schools (Vinayak, 2020).

While these implementations are not seen as a substitute for the one-to-one physical classroom learning experience, the Chinese government invested significant resources in the short-term profitability of these supplementary programs. In the first week, 169 lessons involving 12 students each were introduced on the e-learning platform. Major Chinese telecommunications companies, such as China Mobile, China Unicom, and China Telecom, joined tech giants like Baidu, Alibaba, and Huawei to

strengthen the digital education network with 7,000 dedicated servers and 90 terabytes of bandwidth (Frankfurt, 2020).

What we have witnessed in a short period since the onset of the pandemic is the virus's impact on driving widespread innovations in the higher education sector. For example, Common Sense Media responded to the demand by establishing its openly accessible school: a free online resource supported by over 25 organizations. Wide Open School provides educational experiences encompassing all major subjects for teachers and students, connecting families with affordable internet access programs and technical assistance (Frankfurt, 2020).

The attitude and motivation inherently linked to these and other experiences can broadly impact the world of higher education. Just like the Chinese cloud-based learning platform, creating a deep well of educational materials that are freely available to students provides another knowledge base for their future success. It enhances the viability of the online learning experience.

Traditional classroom learning is unlikely to disappear entirely. Still, with the advent of 5G technology, there is an even greater opportunity for enhanced virtual solutions to complement the in-class experience. The negative consequences of this divide intensify during times of crisis, leading to a lack of information, education, and opportunities for those offline. Now, more than ever, we must collectively strive for more accessible technology and bypass physical limitations in favor of virtual solutions (Frankfurt, 2020).

Online education requires the right tools and levelling the playing field for all students regarding access to technology. To address this, Calbright launched a lending library with over 500 Chromebooks and WiFi hotspots for students who lack economic stability or have been negatively affected by the new coronavirus. The readiness of educational institutions to provide tools and reduce the digital divide demonstrates their understanding that online teaching is about much more than just technology. It's about offering support to those who teach and those who learn. This supportive mindset is crucial for our short-term and long-term return to "normalcy" (Toczauer, 2023).

Therefore, the pandemic has led to the development of hybrid and remote learning and the expansion of virtual learning opportunities. Tools and applications for remote education have evolved. At the same time, the pandemic has highlighted issues related to digital exclusion and the need to create policies and solutions to address them. Embracing this new way of learning has required a change in the mindset of teachers, students, and learners, as well as the broader education of digital skills in society.

Directions of "New Education" in the Post-Pandemic Time. The COVID-19 pandemic has profoundly impacted education systems worldwide, forcing educators, policymakers, and institutions to adapt and innovate. As we move into the post-pandemic era, several directions or trends are emerging in education. These directions aim to address the challenges posed by the pandemic and build a more resilient and effective education system. Here are some key directions for "New Education" in the post-pandemic time. They use technology in the service of education.

Rapid Adoption of Online Learning. The most apparent manifestation of the pandemic's influence on education was the widespread adoption of online learning. Schools and institutions worldwide quickly transitioned to online platforms, necessitating a paradigm shift in pedagogical approaches (UNESCO, 2020).

The primary motivation behind the rapid adoption of online learning was to ensure the continuity of education. Closing schools and universities indefinitely posed a serious risk of disrupting students' academic progress. Online learning emerged as the most viable solution to bridge this educational gap and remotely provide students access to instructional content. Online learning offers flexibility and accessibility that traditional classrooms cannot match. Students can learn at their own pace, from anywhere with an internet connection. This flexibility has particularly benefited students previously facing geographical or logistical educational barriers (Nguyen, 2015; Zhao et al., 2005).

Advancements in technology played a crucial role in facilitating the rapid transition to online learning. Video conferencing platforms, Learning Management Systems (LMS), and various educational apps allowed educators to conduct virtual classes and deliver course materials seamlessly (Aljawarneh et. al., 2010).

The swift embrace of online learning during the pandemic has far-reaching educational implications. Online learning blurred the geographical boundaries of education. Students gained access to courses and resources from institutions worldwide, enabling them to choose the best educational experiences that suit their needs. Both educators and students were compelled to enhance their digital literacy skills. Proficiency in navigating digital tools and platforms became an asset, and these skills will likely remain relevant in the post-pandemic education landscape.

Online learning platforms can gather data on students' progress and engagement. This data can be used to tailor instruction to individual needs, providing a more personalized learning experience.

While the pandemic necessitated the rapid adoption of online learning, its impact will continue to shape the future of education. The experiences gained during this transformative period have opened new avenues for integrating technology into education.

The Rise of Hybrid Learning. Combining traditional in-person classes with online instruction, hybrid learning emerged as a pragmatic solution. It allows for flexibility in teaching methods and gives students access to educational materials regardless of their location. Hybrid learning (blended learning) represents a dynamic educational approach integrating face-to-face and online instruction. This method aims to harness the strengths of both traditional classroom learning and digital platforms, offering students a comprehensive and adaptable educational experience. One of the key benefits of hybrid learning is its flexibility. Students can access course materials and engage in learning activities at their own pace and convenience, regardless of physical location. This flexibility caters to diverse learning styles and individual schedules, making education more accessible (Raes, 2022).

Hybrid learning models incorporate technology that can track students' progress and engagement. This data can be used to tailor instruction to individual needs, providing a more personalized and effective learning experience. Educators can identify areas where students need additional support and adjust their teaching strategies accordingly. Hybrid learning encourages collaboration and interaction among students and educators. Online discussion forums, virtual group projects, and collaborative online tools foster teamwork and critical thinking skills, promoting a more engaging learning environment.

The rise of hybrid learning has profound implications for education. Educators have had to adapt their teaching methods to blend online and in-person instruction effectively. This transformation has led to the development of innovative pedagogical strategies that harness the strengths of both modalities. Both students and educators have been compelled to enhance their digital literacy skills to navigate the digital tools and platforms integral to hybrid learning. These skills have become essential in the modern educational landscape. Institutions have recognized the importance of ensuring equitable access to technology and Internet resources for all students. Efforts have been made to bridge the digital divide, enabling underserved populations to participate fully in hybrid learning experiences. Many educational institutions consider integrating hybrid learning into their curricula, recognizing its ability to provide flexibility and personalized learning experiences (Miao & Li, 2019).

Blended learning encompasses diverse modalities, allowing educators to create a customized learning experience. It combines traditional classroom interactions, synchronous online sessions, asynchronous digital resources, and interactive activities. This diversity enables educators to cater to various learning styles and adapt to individual needs (Picciano, 2009; Olivers et al., 2018).

Blended learning is not a temporary response but a long-term commitment to enhancing education. As it continues to evolve, several trends will likely shape its future. Advancements in educational technology will drive the evolution of blended learning. Augmented and virtual reality, artificial intelligence, and advanced analytics will provide new opportunities for enriching the learning experience.

Blended learning can transcend geographical boundaries, allowing institutions to reach a broader audience. Institutions will increasingly offer courses and programs that cater to a global student base, promoting diversity and inclusivity in education.

Augmented Technologies. Augmented Technologies, including Virtual Reality (VR) and Augmented Reality (AR), have emerged as transformative tools in hybrid learning. These technologies bridge the gap between traditional classroom experiences and the digital world, offering students immersive and interactive educational opportunities.

VR technology creates computer-generated environments that allow students to immerse themselves in simulated educational scenarios. This immersive experience can transport learners to historical landmarks, far-off galaxies, or inside the human body, providing an unparalleled understanding of complex subjects. For instance, VR can recreate historical events, allowing students to witness history firsthand or simulate

science experiments, fostering a deeper grasp of scientific principles (Sheela et al., 2023).

AR technology overlays digital content onto the real world, enhancing the physical environment with digital elements. This technology is particularly promising in hybrid learning, as it seamlessly blends the physical and digital realms. Students can use AR apps on their devices to access additional information, animations, or interactive elements during traditional lessons or while exploring physical spaces (Sheela et al., 2023).

Augmented technologies captivate students' attention and stimulate curiosity. The immersive and interactive nature of VR and AR experiences fosters active participation in the learning process. Integrating augmented technologies, specifically VR and AR, into the hybrid learning environment offers exciting opportunities for educators and students. These technologies provide immersive and interactive experiences that enhance engagement, comprehension, and collaboration. As educational institutions continue to embrace hybrid learning models, augmented technologies will play an increasingly crucial role in shaping the future of education.

Customized Learning Experiences. Technology, including machine learning algorithms, enables the customization of education to cater to individual student abilities and needs. It allows educators to adapt materials and learning pace accordingly.

Customized learning, also known as personalized learning, is an instructional approach that tailors the learning journey to meet individual students' unique needs, preferences, and abilities. It shifts the focus from a one-size-fits-all model of education to one that adapts to the diverse requirements of learners. At the core of customized learning experiences lies technology and data analytics. Educational technology and software applications are harnessed to collect and analyze data on students' learning patterns, progress, and areas of strength and weakness. This data-driven approach allows educators to create individualized learning paths (NC State University).

The adoption of customized learning experiences has several significant implications for education. When students have control over their learning experiences, they are more engaged and motivated to learn. Customization increases student ownership of their education.

Customized learning experiences represent a significant shift in educational paradigms. By focusing on individual needs and preferences, these experiences enhance engagement, improve learning outcomes, and promote inclusivity. As technology and data analytics continue to evolve, customized learning will play an increasingly crucial role in shaping the future of education, ensuring that every learner can succeed.

Geographic Information Systems (GIS) in Education. Geographic Information Systems (GIS) have gained prominence in geography education. GIS tools allow students to interactively explore spatial data, create maps, and perform spatial analysis, enhancing geographic understanding (Bernhäuserová et al., 2022).

The integration of GIS into geographic education has yielded several transformative benefits. GIS enables students to engage in hands-on learning experiences. They can explore real-world geographic phenomena, conduct spatial analyses, and create maps, fostering a deeper connection with the subject matter. GIS transcends traditional disciplinary boundaries, making it a valuable tool for students studying geography, environmental science, urban planning, and many other fields. It promotes interdisciplinary exploration of complex spatial issues.

Geographic education enhanced by GIS promotes spatial thinking, a critical skill in understanding and addressing global challenges such as climate change, urbanization, and natural disasters. It encourages students to think critically about spatial relationships.

The future of geographic education is closely intertwined with GIS. Advancements in GIS technology will continue to provide educators and students with enhanced digital tools, facilitating more sophisticated spatial analyses and data visualization. GIS promotes collaboration on a global scale. Students can connect with peers and experts worldwide, working together to address pressing global issues. GIS will play a crucial role in citizen science initiatives, allowing students and the general public to contribute valuable geographic data to scientific research and environmental conservation (McCloughlin, 2015).

Geographic Information Systems have revolutionized geographic education by providing powerful tools for exploration, analysis, and spatial understanding. As technology evolves, GIS will remain a cornerstone of geographic education, fostering spatial thinking, interdisciplinary exploration, and career readiness for students worldwide.

Conclusions

The coronavirus pandemic has changed how millions of people worldwide approach education. "New education" solutions can bring much-needed innovation. Considering the digital divide, new changes in the approach to education may widen disparities in equality.

Within a few weeks, the coronavirus (COVID-19) has altered how students are educated worldwide. These changes provide insight into how education may change for better – and worse – in the longer term.

At the beginning of the PANDEMIC, on March 13, the OECD estimated that over 421 million children were affected by school closures announced or implemented in 39 countries. Furthermore, another 22 countries declared partial "local" closures.

These decisions regarding risk control have led millions of students to temporary "home learning", especially in some countries hardest hit by the crisis, such as China, South Korea, Italy, and Iran. These changes have certainly caused some inconveniences but have also resulted in new examples of educational innovation. Although it is too early to assess how responses to COVID-19 will impact education systems worldwide, signs suggest that it may have a lasting influence on educational innovation and

digitization trajectory. Below, we track three trends that may indicate future transformations.

Firstly, the demands on education and learning in the face of change can contribute to surprising innovations. The slow pace of change in academic institutions worldwide is regrettable, with centuries-old lecture-based teaching approaches, entrenched institutional biases, and outdated classrooms. However, COVID-19 has prompted educational institutions worldwide to seek innovative solutions relatively quickly.

Secondly, the importance of public-private partnerships in education may increase. During the pandemic, the formation of consortia and coalitions within the education sector to develop guidelines for crisis management, including the use of digital platforms, could be observed.

Thirdly, the current situation may deepen digital inequalities and lead to exclusion.

If access costs do not decrease and access quality does not improve in all countries, the education quality gap and socioeconomic equality will continue to deepen. The digital divide may become more extreme if access to education is dictated by access to the latest technologies.

The COVID-19 pandemic catalyzed a transformation in education, ushering in the era of "new education" characterized by increased reliance on technology. Blended learning, personalized instruction, and the proliferation of e-learning and online courses are among the post-pandemic trends shaping the future of education. GIS tools have revolutionized geographic education, enabling interactive spatial data exploration. Integrating technology in education offers flexibility, accessibility, and personalized learning experiences, heralding a promising future for the field.

The COVID-19 pandemic has complicated education and accelerated educational technology development, including GIS. Blended learning, personalized learning, e-learning, and the use of GIS are just some of the post-pandemic trends shaping the future of education. GIS in geographic education allows students to interactively explore spatial data, greatly enhancing their understanding of geographic concepts. Thanks to technology, education has become more flexible and tailored to individual student needs, opening up new opportunities in the learning process. The question remains whether society is prepared for and needs this direction of educational development.

References

2021 Norton Cyber Safety Insights Report. https://www.nortonlifelock.com/us/en/newsroom/press-kits/2021-norton-cyber-safety-insights-report/ [access: 10.08.2023].

Aljawarneh Sh., Muhsin Z., Nsour A., Alkhateeb F., AlMaghayreh E. (2019). E-learning Tools and Technologies in Education: A Perspective, DOI: 10.13140/2.1.1017.9847.

Bernhäuserová V., Havelková L., Hátlová K., Hanus M. (2022). The Limits of GIS Implementation in Education: A Systematic Review. ISPRS International Journal of Geo-Information, vol. 11, no. 12:592, pp. 1–27.

Bull G., Gardner D., Hyland L., Jennings Ch., Keith A., Mackenzie E., TerKeurs J., Turner S., Woolard A. (2006). Beyond eLearning: practical insights from the USA Report of A DTI Global Watch Mission. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://cedma-europe.org/newsletter%20articles/misc/Beyond%20e-Learning%20-%20Practical%20Insights%20from%20the%20USA%20(May%2006).pdf [access: 1.09.2023].

Frankfurt T. (2020). How The Pandemic Could Forever Change Higher Education, Forbes, 8.05.2020, https://www.forbes.com/sites/forbestechcouncil/2020/05/08/how-the-pandemic-could-forever-change-higher-education/#257a911b7b93 [access: 25.06.2023].

Horizon Report (2019). https://library.educause.edu/resources/2019/4/2019-horizon-report [access: 13.05.2023].

Keith A. (2006) The Future of Blended Learning. In: G. Bull, D. Gardner, L. Hyland, Ch. Jennings, A. Keith, E. Mackenzie, J. TerKeurs, S. Turner, A. Woolard, Beyond eLearning: practical insights from the USA Report of A DTI Global Watch Mission. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://cedma-europe.org/newsletter%20articles/misc/Beyond%20e-Learning%20-%20Practical%20Insights%20from%20the%20USA%20(May%2006).pdf [access: 1.09.2023].

McCloughlin T.J.J. (2015). The Role of Global Positioning Systems in Education: science, mathematics, geography and history – a tool for integration. ResearchGate, pp. 1–5. https://www.researchgate.net/publication/323918536_GIS_in_Education#fullTextFileContent [access: 1.09.2023].

Miao Y., Li H. (2019). Artificial intelligence in education: Issues and trends. Educational Technology & Society, vol. 22, no. 3, pp. 222–237.

NC State University, Teaching Resources. https://teaching-resources.delta.ncsu.edu/customize-learning-experiences/ [access: 23.07.2023].

Nguyen T. (2015) Effectiveness of Online Learning: Beyond No Significant Difference and Future Horizons. MERLOT Journal of Online Learning and Teaching, vol. 11, no. 2, pp. 309–319.

Olivers A., Herrero A. (2018). Hybrid learning: Models, strategies and applications. Springer.

Picciano A.G. (2009). Blending with purpose: The multimodal model. Journal of Asynchronous Learning Networks, vol. 13, no. 1, pp. 7–18.

Polak M. (2008). Stary i nowy świat edukacji (*The Old and New World of Education*). edunews.pl, 30.09.2008, https://www.edunews.pl/nowoczesna-edukacja/innowacje-w-edukacji/467-stary-i-nowy-swiat-edukacji [access: 1.09.2023].

Raes A. (2022). Exploring Student and Teacher Experiences in Hybrid Learning Environments: Does Presence Matter? Postdigital Science and Education, no. 4, pp. 138–159.

Sheela Ch., Selvalakshmi V., Doss A. (2023). Perspectives on Augmented and Virtual Reality (AVR). In: Education: Current Technologies and the Potential for Education, pp. 48–69.

Toczauer Ch. (2023) How has Calbright Evolved Throughout the Pandemic?, OnlineEducation, https://www.onlineeducation.com/features/the-impact-of-pandemic-on-calbright [access: 1.09.2023].

UNESCO (2020). Education: From disruption to recovery. https://en.unesco.org/covid19/educationresponse [access: 13.07.2023].

Vinayak G. (2020). Six ways the pandemic has changed education, 31.07.2020, https://news.yahoo.com/covid-19-six-ways-the-pandemic-has-changed-education-043142525.html?fr=sycsrp_catchall [access: 23.07.2023].

Zhao Y., Lei J., Yan B., Lai C., Tan S. (2005). What makes the difference? A practical analysis of research on the effectiveness of distance education. The Teachers College Record, vol. 107, no. 8, pp. 1836–1884.