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The GeoData Intellectual Property Rights Policy

Polityka praw własności intelektualnej na geodanych

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Abstrakt: W niniejszym artykule autorka przedstawia zasady prawa własności intelektualnej rządzące geodanymi. Głównym celem tego artykułu jest otwarcie tego problemu na dalsze badania i dyskusje. Koncepcje geodanych i ich prawnej interoperacyjności nie spotkały się dotychczas z tak dużym zainteresowaniem naukowym, jak powinny. Opracowanie jednego modelu dostępu do geodanych jest szczególnie trudne, biorąc pod uwagę, że geodane są wytwarzane i przechowywane w różnych środowiskach przy całej ich złożoności. Dlatego ważne jest, aby skonfrontować i omówić czynniki wpływające na licencjonowanie geodanych. Na tej podstawie autorka proponuje taksonomię niezwykle różnorodnych licencji na geodane.

Słowa kluczowe: geodane, licencje, geoinformacja, prawo własności intelektualnej, prawo kosmiczne

Abstract: In this paper, the author presents intellectual property law policies related to geodata. The sole purpose of this paper is to open up this problem for further investigation and discussion. The concepts of geodata and legal interoperability have not received as much scholarly attention as they merit. Drafting one single model for geodata access is especially hard, given that geodata is produced and maintained in multifold environments. This makes it important to confront and discuss the factors influencing the licensing of geodata. On this basis the author proposes a taxonomy of the extremely diverse licenses for geodata.

Keywords: geodata, licences, geoinformation, intellectual property law, space law

1. Introduction – how an invention escapes its underlying goal

The development of civilization is immutably connected with inventiveness, which – on the one hand – allows humankind to subjugate its surroundings, but – on the other one – brings about unexpected changes requiring complete re-evaluation of the world as it is already known. At the turn of the twelfth and the thirteenth centuries, Benedictine monks constructed a prototype clock to ensure regularity in their daily routine, seven hours of which were devoted to prayer.[1] When the invention of the clock escaped the walls of the monastery, it gradually emerged as the "cornerstone of capitalism", contributing to the creation of a regulated day's work. Another breakthrough came in the fifteenth century, when Johannes Gutenberg introduced the movable type, enabling mass exploitation of the printing press. His invention contributed to the development of typographic art and literacy among the common people, feeding their hunger for ever more accessible sources of learning.[2] The change in mindset triggered in large part by Gutenberg's printing revolution resulted in the 18th and the 19th century in the establishment of the framework of an intellectual property rights regime. In this way, human inventiveness shaped this understanding of industrial property rights.

It should be noted that, even though Industry 4.0 is very much a contemporary concept, its roots go back to 1784, a turning point at the beginning of Industry 1.0. That concept was based on the invention of mechanization, steam power and the weaving loom. Industry 2.0 began in 1870, the term referring to mass production, the assembly line and the introduction of electrical energy. Then, in 1969, came the dawning of the era of Industry 3.0, dominated by electronics, computers and automation.[3] It was not until the invention of super-fast (and equally small) computers and the Internet that the world was revolutionized anew. It is a well known fact that the foundations of the modern Internet were laid by the USA's Department of Defense in the 1960s, when it decided to establish a resilient computer network to decentralize the management system providing protection against potential nuclear war with the Soviet

[1] M. Glenhaber, *The Invention of the Mechanical Clock and Perceptions of Time in the 13th-15th Centuries,* "The Concord Review", 2013, p. 159 and ff., available at https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=2ahUKEwjv2eGfmfnnAhVro4sKHVYND2IQFjABegQIBRAB&url=https%3A%2F%2Fmodelsofexcellence.eleducation.org%2Ffile%2F3970%2Fdownload%3Ftoken%3D3xnY9JBB&usg=AOvVaw0sNQXOwUDDro84IoeUjC0- (accessed: 10.02.2020).

[2] M. Jankowska, M. Pawełczyk (eds.), *Prawo informatyczne,* Warszawa 2020, in progress.

[3] P.K.D. Pramanik, B. Mukherjee, S. Pal, B.K. Upadhyaya, S. Dutta, *Ubiquitous Manufacturing in the Age of Industry 4.0: A State-of-the-Art Primer*, in: A. Nayyar, A. Kumar (eds.), *A Roadmap to Industry 4.0: Smart Production, Sharp Business and Sustainable Development*, Springer 2020, p. 75-77.

Union. It turned aut, however, that this robust approach to computer networking became an efficient tool in the hands of American and European universities, enabling communication. In the 1980s, there was another breakthrough with the emergence of personal computers and telecommunication modems.[4] The epochs of evolution can therefore be differentiated based on one denomination: Before Google and After Google.

In this way, computer technology broke out of military and research confines and allowed the public to build on increasingly rich deposits of information available more and more digitally. The resulting new era of innovation was named Industry 4.0 because of the harnessing of the power of the Internet, cyber technology and data gathered through new tools and devices. As noted by André "the industrial revolution is not just about computer programs. It implies a flexible adaptation of the company's structure."[5] Given that a dynamically developing enterprise consists mostly of intangible goods (such as works of authorship, inventions and utility models, etc., but also including know-how regarding making, marketing and targeting of a product),[6] more attention should be paid to licensing schemes and intellectual property rights (IPR) policy within an enterprise and beyond (commercial and non-commercial relations). Serge Catherineau, Directeur Marketing Marché Automobile Aéronautique et Système-intégrateurs at Schneider Electric, rightly pointed out, "in the industry, we don't do Big Data, we do Smart Data. 'Smart Data' means capturing the right data, transforming it (or contextualizing it) and using it to optimize the manufacturing process".[7] New technology broke out of the intellectual property law paradigms as we knew them, casting doubt on the established frames of protection of data, including geodata and indeed any other kind of non-personal data.[8]

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[4] M. Jankowska, M. Pawełczyk (eds), *Prawo…*

[5] J.-C. André, *Industry 4.0: Paradoxes and Conflicts*, London-Hoboken 2019, p. xxxvii.

[6] It should be admitted that "The software of product planning is part of the main software system that looks after the entire product development process. Software is directly linked to the other parts of the manufacturing unit through cloud computing and this allows for data manipulation in real time. There is direct communication with the different machines involved in the manufacturing process. The technical implementation of the software is easy as the software needs to collect the data from the databases and then make a proper analysis and therefore making the necessary decisions. The major problem is the database on which the software relies. Therefore, it is the development phase of the software that can take more time in comparison to the implementation phase. Developed software should form an integral part of the company's intellectual property." See K. Kumar, D. Zindani, J.P. Davim, *Industry 4.0. Developments towards the Fourth Industrial Revolution*, Singapore 2019, p. 25.

[7] J.-C. André, *Industry 4.0…*, p. xxxvii.

[8] I. Stepanov, *Introducing a property right over data in the EU: the data producer's right – an evaluation*, "International Review of Law, Computers & Technology", 2020, Vol. 34, issue 1, text available at: https://www.tandfonline.com/doi/full/10.1080/13600869.2019.1631621, accessed: 12.02.2020.

2. Data revolution

The emerging deluge of software and devices based on new technology is a phenomenon referred to as the "data revolution", triggered by a few artful leaders, remastered by early adopters and implemented by smaller players. The Big Data landscape, providing for a large volume of data that can be accessed and rendered with relatively low levels of computing skills and low software expenditures, gives rise to an array of new, data-driven business models.[9] The last 30 years have witnessed an exponential growth in computing power, Information and Communications Technology infrastructure and domestic devices. The great promise of today's burgeoning volume of data portends a new approach to IPR among entrepreneurs and public authorities. Therefore, there is an inescapable question about the shape of contemporary realities of gathering and disseminating data from the perspective of IPR, which in fact constitute the joint capital of both entrepreneur and public authority. And because the catalog of intangible goods recognised for IPR protection is fixed, when new technologies arise, they may find themselves unprotected or face uncertainty related to their protection. In order to ascertain the legal protection available for data and data sets these have to be gauged from the copyright and database law perspective. An insightful analysis shows that as copyright and database law have not been designed to protect data itself, it is not of much use here.[10]

3. Data- and innovation-driven economy

3.1. Innovative drive

The iterative digital transformation of the economy was made possible due to the availability of efficient IT infrastructure (cloud processing), the capacity to acquire and use increasing volumes of data (Internet of Things, Internet of Humans), and the development of analysis techniques (artificial intelligence). Our prior perception of data and innovation and the related process for making and implementing technical developments has undergone a far-reaching change. The 21st century was hailed as the "age of innovation", in which everybody indifferent to the creativity and the new technology race would end up in the so-called "evolutionary dead end" of the global economy,[11] with all its consequences, scaring them in particular with the prospect of economic and financial

[9] G. Koloch, K. Grobelna, K. Zakrzewska-Szlichtyng, B. Kamiński, D. Kaszyński, *Data utilization intensity and economic performance – a diagnostic analysis*, 2017, available at https://mc.bip.gov.pl/rok-2017/analiza-diagnostyczna-intesywnosc-wykorzystania-danych-w-gospodarce-a-jej-rozwoj.html, accessed: 10.02.2020.

[10] M. Jankowska, *Digital Maps. IP Paradigms and New Technology,* Warsaw 2017.

[11] M. Jankowska, M. Pawełczyk, *Czarna dziura technologii w innowacyjnej gospodarce a dobra własności intelektualnej.* [The Black Hole of Technology in the Innovative Economy and Intellectual

banishment. In Europe, there is currently a debate at both national and international level as to how to use the data to make the potential of its owner grow.

3.2. What is data? Where does it belong in the IPR schema?

To establish our terminology, we must, as always, begin with an analysis of the basic concepts of the topic, such as, in this instance, data and information. In the literature, some attempts have been made to define and categorize these terms.[12] Considerations of this kind centre around a few basic terms that can be hierarchically summarized in the following order: data – information – knowledge – wisdom. In spite of the diverse set of definitions of "data", it is safe to say that data is the oil of today's economy. Polish language dictionaries define 'data' as 'things, facts on which you can rely in making claims; information, news'[13] or 'basic, unchangeable facts, information, news.'[14] As the terms 'data' and 'information' are incorrectly used interchangeably, mostly due to the lack of words suited to describe the phenomena in sufficient detail, 'information' rather means 'a notice about something, communicating something; news, tips, instructions'.[15] This perplexing hotchpotch is a result of the lack of uniform terminology, as well as the lack of explanation of the meanings of the terms outlined, a fact which can be observed when consulting legal dictionaries. Just as this arises for such terms as 'data'[16] and 'information,'[17] similarly we see the same blurring between 'knowledge' and 'wisdom'.[18]

Property Assets], in: *Znaczenie wyceny własności intelektualnej.* [Proving the Worth – Putting a Value on Intellectual Property], Warszawa-Dąbrowa Górnicza 2019, p. 113-114.

[12] More cf. M. Jankowska, M. Pawełczyk, *The notion of geospatial information – several preliminary remarks, spatial information and public information* [in:] M. Jankowska, M. Pawełczyk (eds), *Geoinformation. Law and practice*, Warsaw 2014, p. 1-18, open access at: iip.edu.pl/en.

[13] M. Szymczak (ed.), *Słownik Języka Polskiego*, Warsaw 1978, p. 360; W. Cienkowski, *Praktyczny słownik wyrazów bliskoznacznych*, Warsaw 1993, p. 27.

[14] E. Wierzbicka (ed.), *Słownik Współczesnego Języka Polskiego*, Vol. I, Warsaw 1998, p. 155.

[15] M. Szymczak (ed.), *Słownik…*, p. 788.

[16] M Jankowska, *Digital Maps…*, Warsaw 2017, p. 56; G. Cornu (ed.), *Vocabulaire juridique*, Paris 2011, p. 367; R. Cabrillac (ed.), *Dictionnaire du vocabulaire juridique*, Paris 2008, p. 154; S. Bissardon, *Guide du langage juridique. Les pièges à éviter*, (in cooperation with R. Burel), Paris 2002, p. 155; N. Delecourt, *Le dictionnaire du droit*, Hericy 2000, p. 118; S. Guinchard, T. Debard, *Lexique des termes juridiques*, Paris 2012, p. 324; J. Law, E.A. Martin, *Oxford Dictionary of Law*, Oxford 2009, p. 152; K. Weber (ed.), *Rechtswörterbuch*, München 2007, p. 255.

[17] R. Cabrillac (ed.), *Dictionnaire…*, p. 228.

[18] So noted by R. Cabrillac (ed.), *Dictionnaire...*, p. 365; S. Bissardon, *Guide…*, p. 267 and 264; N. Delecourt, *Le dictionnaire…*, p. 228 and 226, S. Guinchard, T. Debard, *Lexique…*, p. 777; P.H. Collin, *Dictionary of Law*, Teddington Middlesex, p. 256, cf. L.B. Curzon, *Dictionary of Law*, Essex 2002, p. 452; K. Weber (ed.), *Rechtswörterbuch…*, p. 671, 1385.

We will now turn to an attempt to settle some key concepts within the structural framework, put them in some order, and assign them to well-known legal categories. The motivation to do so becomes even greater given that the axiological pyramid (data-information-knowledge-wisdom) has been applied in the teaching of cartography for a very long time, but has not been translated into theories and structures familiar in legal sciences.

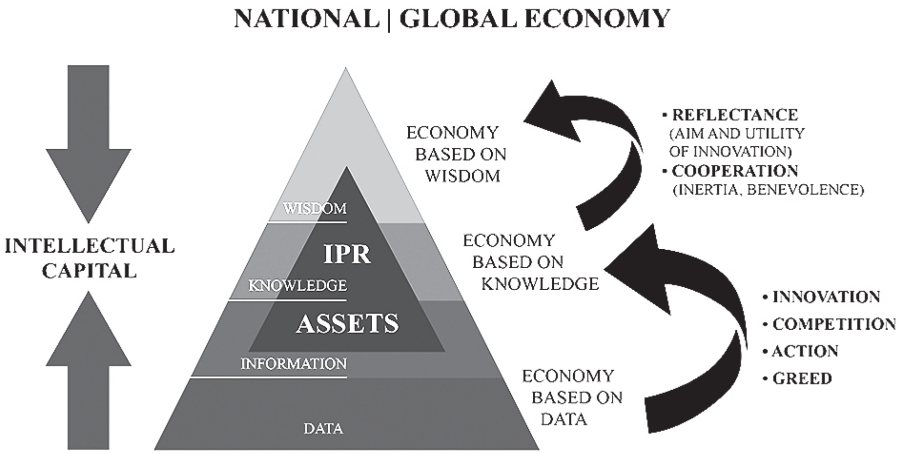

Figure 1. Cognitive pyramid and IPR assets
Source: own work based on available resources, cf. M. Jankowska, M. Pawełczyk, *Czarna dziura…/The Black Hole…*, pp. 143–144.

Figure 1 seeks to depict the relationship between the two sets: the cognitive pyramid and IPR assets and to show that they overlap to an extent, but are not identical. In the theory of private law, the concept of an "enterprise" has received a lot of attention and many have attempted to define it. It can be defined as an organized set of tangible and intangible elements intended for conducting business activity, as it includes in particular: a/ a designation distinguishing the enterprise or its separated parts (the name of the enterprise), b/ patents and other industrial property rights, c/ copyrights and neighboring rights, d/ trade secrets.

In practice, these elements can be broadly understood as data, information and knowledge, which can be created in many ways, ultimately adopting the form of normatively recognized IPR goods: work of authorship, inventions, utility models, industrial designs, trademarks, integrated circuit topography, geographical indications, know-how, breeders' rights and databases (though not data itself).

If data were to be acknowledged somewhere within the realm of IPR goods, one could refer to the IPR schema:

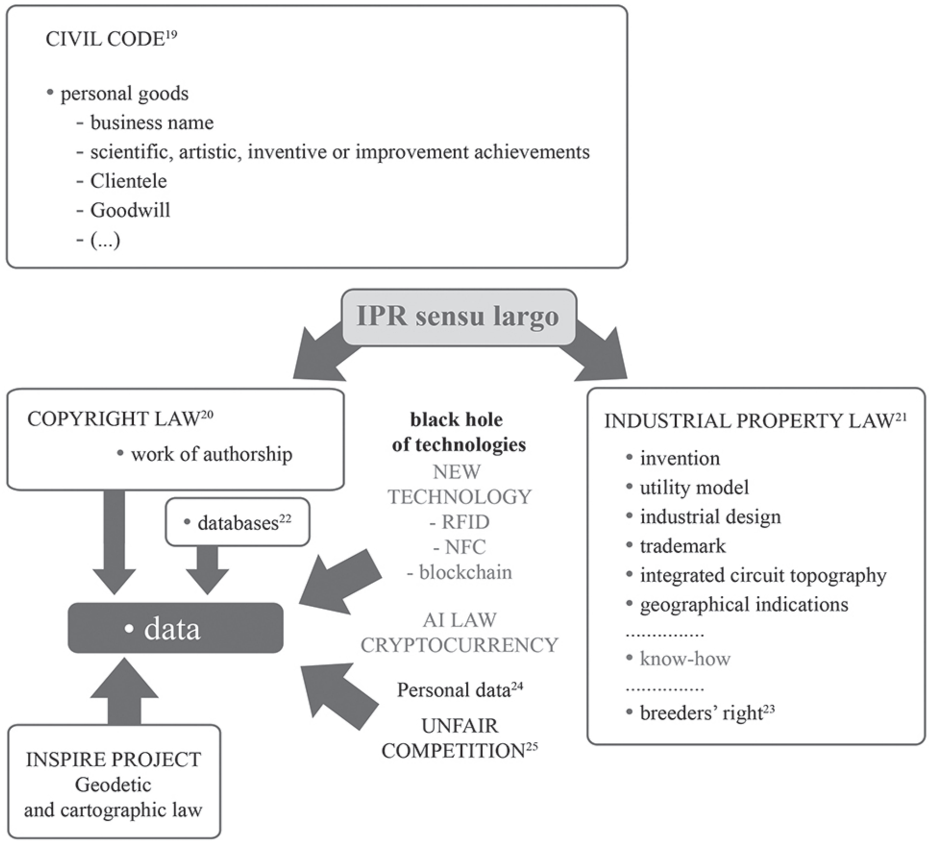

Figure 2. Scope of intellectual property law (marked in grey are the areas which are unregulated, developing, or which have new/fragmentary regulations)
Source: cf. M. Jankowska, M. Pawełczyk, *Czarna dziura…/The Black Hole…*, p. 145.

When looking at the grey areas, it should be noted that the technological progress entwined with the multiplicity of concepts and their lack of systematization preceded by appropriately broad interdisciplinary research means that not only the theory and practice of applying the law find it increasingly

[19] Legal act as of 23.04.1964, Civil Code, JoL as of 2018 pos. 1025.

[20] Legal act as of 4.02.1994, Copyright Law and Neighbouring Rights, JoL as of 2018 pos. 119.

[21] Legal act as of 30.06.2000, Industrial Property Law, JoL as of 2017 pos. 776.

[22] Legal act as of 27.07.2001 on Protection of Databases, JoL as of 2001 r., No. 128 pos. 1402.

[23] Legal act as of 26.06.2003 r. on Protection of Breeders' Rights, JoL as of 2020 pos. 288.

[24] Legal act as of 10.05.2018 on Protection of Personal Data, JoL as of 2019 pos. 1781.

[25] Legal act as of 16.04.1993 on Unfair Competition Suppression Act, JoL as of 2019 pos. 1010.

difficult to order goods and name them.[26] It is, however, important to realise that not everything an enterprise has to offer in an intangible form will fall under copyright protection or will be capable of protection granted by industrial property. From the entrepreneur's perspective, however, it is important to have knowledge in the field of IPR as to what is potentially suitable for protection and of the criteria for obtaining it.

3.3. Origins of data

In 2013, UNECE's Big Data Task Team created a typology of data and grouped it into three categories according to their sources:

1. Social networks – human-sourced information, loosely structured and often ungoverned; available via: social networks, e.g. Facebook, Twitter; blogs and comments; personal documents; pictures, e.g. Instagram, Flickr, Picasa; videos, e.g. YouTube; Internet searches; mobile data content, e.g. text messages; user-generated maps; e-mail.

2. Traditional business systems – process-mediated and thus usually highly structured; often stored in relational database systems; produced by both public agencies (e.g. medical records) and businesses (e.g. commercial transactions, banking/stock records, e-commerce, credit cards, mapping and satellite activities).

3. Internet of Things – machine-generated and well structured; data from sensors: a/ fixed sensors (home automation, weather/pollution sensors, traffic sensors/webcams, scientific sensors, security/surveillance videos/images); b/ mobile sensors/tracking (mobile phone location, cars, satellite images); c/ data from computer systems (logs, web logs).[27]

4. Innovation: a non-legal perspective

In order to make the best use of IPR knowledge and to profit from it – an entrepreneur also has to be innovative, in a sense that he has to be prescient and act protectively. Many attempts to define innovation have been encapsulated into one globally approved definition provided by the OECD Oslo Manual for measuring innovation.[28] The Oslo Manual defines four types of innovation: product innovation, process innovation, marketing innovation and organizational innovation.

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[26] Cf. M. Jankowska, M. Pawełczyk, *Czarna dziura technologii…*, p. 141.

[27] P. Struijs, *BIG data for official statistics*, Eustat, 2016; available at: http://www.eustat.eus/productosServicios/datos/58_Big_Data_for_Official_Statistics_Peter_Struijs.pdf, pp 5-6; https://statswiki.unece.org/display/bigdata/Classification+of+Types+of+Big+Data, accessed: 06.02.2020.

[28] OECD (2005), Oslo Manual, Guidelines for Collecting and Interpreting Technological Innovation Data, OECD/Eurostat Paris; definition available at: https://www.oecd.org/site/innovationstrategy/defininginnovation.htm, accessed: 06.02.2020.

(a) Product innovation: a good or service that is new or significantly improved. This includes relevant improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics.

(b) Process innovation: a new or significantly improved production or delivery method. This includes vital changes in techniques, equipment and/or software.

(c) Marketing innovation: a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

(d) Organisational innovation: a new organisational method in business practices, workplace organisation or external relations.

However, regardless of the definition of innovation, IPR does not acknowledge such a conceptual category, although it will actually provide legal protection to entrepreneurs' intangible assets. From the practical point of view, the conceptual relationship between innovation intellectual capital and IPR (including intangible goods) becomes important.

Nowadays, not only technology is defined as innovative, but also social phenomena and the economy. Innovativeness in the economy means "continuous striving to successfully introduce new products, processes and forms of functioning of entities" which is "a means of building significant competitive positions and achieving economic benefits".[29] Social innovations can be understood in a narrow way as non-technological innovations, including improved organizational and management methods, but also as part of technological innovations, being, for example, organizational and marketing tools for their implementation, e.g. zero-stock management strategies, just-in-time (delivery on time) and others, like customer care.

5. The data policy in Poland

Somewhat less attention is drawn to the intricate legal sphere of IPR protection and licensing. To some extent, however, every potential player – be it a public authority or a private entity – may apply some degree of latitude, not to mention outright creativity in using legal tools, inventiveness in applying business models and creating their own IPR strategy. The temptation to exploit the discretion given to each player can be observed in recent years by the example

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[29] K. Prucia, *Efektywność finansowania innowacji za pośrednictwem Narodowego Centrum Badań i Rozwoju* [Effectiveness of financing innovations by menas of the National Centre for Research and Development], in: A.A. Janowska, R. Malik, R. Wosiek, A. Domańska (eds), *Innowacyjność i konkurencyjność międzynarodowa. Nowe wyzwania dla przedsiębiorstw i państwa*, Warsaw 2017, p. 55.

of US cities' municipal IPR policies and the litigation triggered by them due to breaches in the municipalities' licensing terms. The question arises as to what model of data policy should be followed and as to the assumed objectives. At the national level, in Poland, for example, it has been *explicite* articulated that, taking into account the specificity of Poland's economy (a large share of foreign investments, large public sector, a significant number of small and medium-sized companies), it is necessary to develop an independent concept for the digital transformation of one's economy. The basis of this model is openness and interoperability. In practice, to allow Polish companies to participate in European and global value chains the following should be ensured:

I. **The use of the potential of the state treasury companies** through application of digitization to strengthen key infrastructure networks (transport and energy) through intelligent network technologies and implementation of horizontal solutions and platform,

II. **Building of cooperation and communication platforms for small and medium-sized enterprises**, enabling virtualization of production processes, their combining into complex economic organisms in order to make production more flexible and the building of new business models. Platforms of this kind should ensure access to open machine data (before algorithmization) to provide an environment for further innovation,

III. **Transformation of industry towards solutions of fourth generation**, which will generate huge data volumes and will open new possibilities to create value,

IV. **Building of trust in the digital world** through creation of appropriate safety standards and value protection as well as a system of incentives and support for benefits for participants in digital platform teamwork.[30]

6. Geodata-driven decision making, geodata representations and legal interoperability

6.1. Technical interoperability

Recently, more and more attention has been accorded to geoinformation (GI) as today's progress depends on at least two factors, such as space and time. A set of urban data or any Geographical Information System (GIS), is a hybrid, especially when we realise how it is created, at how many different stages the creative process takes place, of how many components it consists and what legal effects it has as a whole.

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[30] M. Borowik, R. Kroplewski, L. Maśniak, H. Romaniec, *Przemysł+. Gospodarka oparta o dane* [Industry+. The economy based on data], Warszawa 2018.

Currently, the environment in which decisions are made is rich in information. This is especially so when the decision relates to the spatial aspect in such a way that the data necessary for its adoption are included in maps, aerial and satellite photographs, tables. Not to mention when a number of technological solutions are necessary to acquire them, such as remote sensing, digitization or photogrammetry. It turns out, however, that information obtained from data is not always sufficiently full or precise. As Y. Leung[31] also points out, information becomes dynamic with constant changes in space and time. Furthermore, to gain weight and usefulness it should be supplemented or organized by the human factor in the form of knowledge and expertise. Research into geospatial information used to be limited to working towards a common conceptual, technical, and interoperational framework in which data were created and combined into collections. Legal aspects were mainly limited to working out the principles of data platform functionality, for which open licenses were recommended that allowed the use of data both commercially and non-commercially. The Open GIS Consortium and the International Organization for Standardization contributed heavily to creating the standards of technical interoperability.[32] A Decision Support System (DSS) is an interactive, computer-based system that aids users in judgment and decision-making activities. They provide data storage and retrieval but enhance the traditional information access and retrieval functions with support for model building and model-based reasoning. They support framing, modeling, and problem solving.[33] With the development of GIS, DSS has evolved into Spatial Decision Support Systems (SDSS). This is characterized by the fact that spatial data properties are analyzed and play the major role in the decision-making process. This results from the assumption that the GIS includes the set and structure of data used by the person making the decision. The first and most basic function of GI systems was to create visualization of spatial data, so it resembled a map much more than an application to predict business needs and to model appropriate solutions.[34] In the literature, it is pointed out that the system in most cases works on standard computers and

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[31] Y. Leung, *Intelligent Spatial Decision Support Systems*, Belin Heidelberg 1997, p. 1-2.

[32] C. Reed, *OGC standards: Enabling the geospatial web*, in: Li S, Dragićević S., Veenendaal B. (eds), *Advances in Web-based GIS, Mapping Services and Applications*, London 2011, p. 327.

[33] M.J. Druzdzel, R.R. Flynn, *Decision support systems: Encyclopedia of library and information science*, New York 2000, p. 794; L. Yu, X. Tan, J. Huang, *Distributed decision-support GIS application based on web-service*, Proc. SPIE 6754, Geoinformatics 2007: Geospatial Information Technology and Applications, 675436 (6 August 2007); doi:10.1117/12.765255; http://dx.doi.org.wwwproxy1.library.unsw.edu.au/10.1117/12.765255, accessed: 06.02.2020.

[34] P.J. Densham, *Spatial decision support systems*, "Geographical Information Systems: Principles and applications" 1/1991, p. 403-412.

open licenses.[35] The GI system provides the so-called value-added information and is designed to allow the analysis of spatial information. In literature, this phenomenon is also referred to as geographical information analysis (GIA), spatial multiple criteria decision making (SMCDM) or spatial multi-criteria evaluation (SMCE).[36]

6.2. Usability

Although there is no need to prove that spatial data is widely used, this description of technological development would not be complete without a more precise indication of the main areas of real GIS application. A synthetic description in this respect is made by S. Faiz and S. Krichen.[37] Firstly, state administration collects information about land, owner identification, cadastral maps, spatial development plans, sun exposure studies, plans and models of land relief, planning and management of land development, area calculation and land management, e.g. green areas and parks. Secondly, it is applied in statistical mapping, e.g. statistical, demographic, socio-economic, epidemiological, tourist maps, maps and management tools, city asset management, natural hazards maps and crime risk, simulation of fire propagation mapping, landslides, floods, mapping of rational use of natural resources, forest management, agriculture, air and water quality; including geomarketing, that is, the study of the implementation of a new facility or agency, a network of advertisements for a project, information in the pages of newspapers and regional dailies. Thirdly, the network management provides for maps of roads, bus routes, trains, river networks, water intakes, gas, electricity and telephone infrastructure. A spatio-temporal connected database generates plans and allows control of a network situation and reflects the size of existing phenomena. Also, it provides support in everyday life and in gathering and displaying information about significant events. Finally, remote sensing benefits from surveying, environmental, mineral range, natural phenomena, pollution and excavation data.

What should be borne in mind here is that GIS allows for: 1) storage of a large amount of geographic data at low cost, 2) lower cost production of maps and plans, 3) fast mapping with interactive data selection, 4) creating maps and plans impossible to be produced by hand, 5) improving product presentation.[38]

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[35] J. Delaney, *Geographical Information Systems. An introduction*, Melbourne 2001, p. 10-12.

[36] G. de Tré, J. Dujmović, N. van de Weghe, *Supporting Spatial Decision Making by Means of Suitability Maps*, in: J. Kacprzyk, F.E. Petry, A. Yazici (eds), *Uncertainty Approaches for Spatial Data Modeling and Processing. A Decision Support Perspective*, Berlin Heidelberg 2010, p. 10.

[37] S. Faiz, S. Krichen, *Geographical Information Systems and Spatial Optimization*, Boca Raton, London–New York 2012, p. 9-10.

[38] S. Faiz, S. Krichen, *Geographical Information…*, p. 16 ff.

At the same time, GIS entrepreneurs suffer from: 1) high cost and technical problems of data acquisition, 2) high cost of maintaining and administering updated data, 3) the cost of maintaining software and products, and finally, 4) lack of legal certainty as to product copyright protection, or compatibility of licenses within product components, 5) lack of transparent IPR business strategies.

Many GIS software packages also provide tools for displaying data as histograms, bar charts, point charts, and box plots. Some GIS software packages provide more advanced statistical tools, enabling factor analysis, cluster analysis, regression analysis and correlation. In other words, there is a variety of possible external forms of data presentation and multiple rendering options. SDSS is characterized by such features as: 1) allowing the ingestion of spatial data, 2) enabling the presentation of complex spatial relations as well as structures typical of spatial data, 3) providing analytical techniques that are unique and characteristic of spatial and geographic analysis (including statistics), 4) providing results in a variety of spatial forms, including maps and other, more specialized, characters.[39] Knowledge, in turn, implies reasoning and analysis based on organized information and principles of inference gained through experience and learning. Knowledge in this approach is a factor allowing for the conversion of information into a form that is organized and readable.

6.3. Legal interoperability

Legal interoperability is aimed at establishing a transparent legal framework of norms regulating the use of copyrighted material. It covers the sharing and reuse of works of authorship (e.g. maps) and their components (other materials and data) based on uniform or at least non-contradictory licences, applied for the various components, respectively. It must be kept in mind that constituent components of a map come from many sources and are covered by different licenses. This sort of interoperability is known as legal or licensing interoperability.

7. Intellectual property rights business strategies

7.1. Appropriability mechanisms and strategy

In economic terms, there are appropriability mechanisms (mechanisms of protection against the loss of knowledge) and appropriability strategy (strategy of knowledge protection). In the legal sense these are simply referred to as IPR policy.

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[39] P.J. Densham, *Spatial decision…*, p. 405.

Among the available protection mechanisms, legal, technical and factual ones can be distinguished.[40]

1. Legal

A. Copyright protection for works of authorship and unregistered trademarks;

B. Database protection for databases meeting the legal premises of protection;

C. Registration: a) invention – patent, b) utility model – right of protection, c) industrial design – registration right, d) trademark – right of protection, e) topography of integrated circuit – registration right, f) geographical indication – registration right, g) exclusive right to plant varieties;

D. Contracts: a) NDA (non-disclosure agreement), b) confidentiality clauses; c) non-competition clauses, d) licences;

E. Company secrets (know-how);

F. Measures resulting from the act on combating unfair competition;

G. Other: sending correspondence by regular mail, where the postmark will serve as an authenticated date (evidence purposes); security of proof at a notary (for example, a certificate of conformity with the original, a printout with a website, etc.).

2. Technical

A. Technical security (including DRM);

B. Product designation (visible, e.g. logo, or invisible),

C. Steganography (e.g. intentional errors in the product, e.g. copyright traps);

D. Blockchain (used for authorization purposes).

3. Factual

A. Secrets;

B. Priority of placing on the market;

C. Complexity of a product/service.

7.2. Closed vs. open strategies

For many years there was only one, traditional (stereotypical) approach, also described as a closed strategy. It relied heavily on having and developing an entrepreneur's own R&D department responsible for conducting long-lasting and costly research or looking for legal mechanisms protecting the intellectual capital of the entrepreneur. The paradigm of "open innovation" was introduced by H.W. Chesbrough,[41] who in 2003 noticed that a company in the innovation process should use internal (own) and external (third parties') ideas and external and internal paths of introducing innovations into the market. It

[40] M. Jankowska, M. Pawełczyk, *Czarna dziura…*[*The Black Hole…*], p. 146-147.

[41] H.W. Chesbrough, *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Boston 2003.

entwines "processes of creating economic value: external acquisition (external exploration of knowledge) and external use of knowledge (external exploitation of knowledge). External acquisition (intended inflow) of knowledge determines to what extent enterprises gain access to external knowledge resources – ideas or intellectual property – to complement their knowledge and create a unique value for recipients. On the other hand, external utilization (intended outflow) of knowledge means commercialization of the possessed internal knowledge by its flow from the enterprise to the environment, which is accompanied by a contractual obligation of monetary or non-monetary kind."[42] Depending on which direction of flow dominates, centripetal, centrifugal or mixed patterns (strategy) are distinguished.

A number of features differentiate a closed innovation from the open one. The closed strategy is more centralized, meaning that the entrepreneur hires specialists, creates an in-house R&D department and introduces the work or invention to the market on a priority basis. It also has a strong IPR policy that keeps competitors at bay. The open strategy, on the contrary, relies on the exchange of ideas, information and innovation. The entrepreneur benefits from the knowledge of specialists who do not work exclusively on the initiative, the research is often conducted outside, whereas inside of the entity it is decided what data and knowledge are used. In the open strategy, the entity often benefits from opening the intellectual goods to others in many ways, financial or social.

7.3. GeoData license policy

Since geodata has become a kind of "currency", it is important to establish the correct data policy, which differs from agency to agency and from enterprise to enterprise. Among the issues requiring a closer look are those whether the commercial use will ensure payback of the infrastructure investment costs, or whether data should be made accessible without too many restrictions to make it possible for private entities active in the geoinformation and space sectors to grow. The cost of producing geodata is so high that the purpose of collecting them has become more a matter of cognition, science and politics than a matter of profit. The other issue is whether data are a public good, and, if so, to what end?

Drafting one single model for geodata access is especially hard, given that geodata are produced and maintained in multifold environments, such as:

1) public (as part of the public service),
2) private (strictly commercial purpose),

[42] A. Sopińska, P. Dziurski, *Otwarte innowacje. Perspektywa współpracy i zarządzania wiedzą* [Open innovations. The perspective of cooperation and knowledge management], Warszawa 2018, p. 12.

3) internauts, in a fashion that is private *and* open (utilitarian purpose of gathering data).

Already one can see a variety of interests and possible schemes for making data available. This has given rise to a deluge of different licensing models, whose licences are not necessarily compatible, as legal interoperability is typically not considered.

In the literature, R. Harris pointed out seven different licensing types that serve as a starting point for establishing general frames of licensing:[43]

1. Free data for all users (e.g. EUMETSAT, OpenStreetMap),
2. Marginal cost price for all users (e.g. Landsat 7, ERS, Envisat),
3. Market driven, affordable prices for all users (e.g. SPOT),
4. Full cost pricing (e.g. Earthwatch, GMES),
5. Two tier pricing (a symbiosis of market driven policy and marginal cost price for selected users, e.g. ESA, SPOT);
6. Information content pricing (e.g. Landsat, SPOT, ERS, IKONOS; this varies depending on the kind of information and its value, or the quality of data);
7. Access key pricing (data is free, the key to decode data is payable).

The analysis of licensing policies shows that there are three main licensing models: 1) open model, 2) cost recovery model, 3) business model. The factors influencing the selection of model are: 1) public (exchange of data among public agencies at national and international level), 2) private but non-commercial, 3) commercial, 4) scholarly, 5) NGO, 6) emergency. The multitude of licenses for geodata can be grouped as: 1) private, 2) open-typical, 3) half-open (mixed), 4) open-atypical (similar to open-typical but with some dissimilarities), 5) open with extra elements.[44]

Summary

Emerging technologies have enabled the creation of all kinds of data. Data itself has become a kind of currency in Industry 4.0 merely because most contemporary business models, productions and sales are based on data and information. The research undertaken already in the last few years has proved that the cognitive pyramid: data-information-wisdom-knowledge, a concept generally known in technology and economics, maps quite poorly to the scheme of IPR goods. Moreover, the IPR scheme, created in the 19th and the 20th centuries, proves to be of hardly any use for protection of non-personal data,

[43] R. Harris, *Earth observation data pricing policies*, in: *Earth Observation Data Policy and Europe*, eds. R. Harris, Lisse–Abingdon–Exton–Tokyo 2002, p. 116-125.

[44] M. Jankowska, *Charakter prawny mapy cyfrowej* [The legal character of a digital map], Warszawa 2017, p. 599-600.

as data themselves have never been labeled as an independent good worthy of protection. As copyright and database law are not suited for protecting data, it is worth examining which tools can help protect data in their own right. The study shows that the most convenient means of protecting data is through licenses, which come in a variety of forms. A degree of protection can be obtained by introducing distinctive indicators, possibly including tiny unimportant errors, that could readily be identified as the data to be misappropriated. The available technical protection mechanisms are: 1) technical security (including DRM), 2) product designation (visible, e.g. logo, or invisible), 3) steganography (e.g. intentional errors in the product, such as copyright traps), 4) blockchain (used for authorization purposes).

In conclusion, if we accept that our long-established models of IPR protection arose because of the recognized need to protect an originator's creation against exploitation by others, we must recognize the case for proportionate protection for the new kinds of asset which originators create today.

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