



Emergence of Digitalization and Artificial Intelligence in the Intellectual Property System

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Abstract

This paper was set to address to what extent intellectual property law is prepared for keeping pace with the rapid development of artificial intelligence and digitalization? We examined, by way of using empirical methods, the relationship between artificial intelligence, its regulation and the current trends in intellectual works. The overall conclusion of our research findings demonstrates that current legislation is well suited to support the requirements of technological progress. Nevertheless, there are some new dimensions in terms of worthy proposals that may also be considered. This paper stresses that given AI is capable of bringing significant transformations in our daily lives about, a major paradigm shift in legislation may soon be inevitably required.

Keywords

artificial intelligence, intellectual property, industrial property, copyright

1 Introduction

Nowadays, technology is evolving at an unprecedented exponential rate. Little more than four decades ago, when the first email messages were sent, people were anxious to receive a reply arriving to their inboxes. However, by now this has definitely changed. The development of technology is also aimed at improving the standards of human life, increasing the efficiency of daily activities and solving daily problems and hardships. As the famous scientist Ede Teller put it, “science, technology does not solve all problems, but without science and technology you cannot solve any problem”. That may well be applied to the nexus of technological development and legal regulation, especially within the field of the rapidly changing domain of intellectual property law. This paper was designed to describe the intellectual property system in a way that highlights its relationship with information technologies. Our research aims to take an interdisciplinary approach towards both the instruments for legal protection of intellectual property and the understanding of the peculiarities of the subject-matter, namely that of artificial intelligence and the phenomenon of digitalization. We elaborate on these areas from a legal, economic and technical point of view.

1.1 Research question and hypotheses

This paper poses the following research question: to what extent is intellectual property law prepared for supporting the development of artificial intelligence and digitalization? This may be formulated in terms of three hypotheses, namely:

- H1: Are the current rules on intellectual property rights capable of solving the challenges posed by technological developments?
- H2: Is digitalization likely to raise issues beyond the current rules on intellectual works?
- H3: Will efficient and cost-effective future enforcement of rights be more likely to occur through cross-border regulation?

1.2 Research methodology

The groundwork carried out in preparation for this paper is twofold. First, we examined domestic and international scholarly literature and applicable case law besides reviewing a wide range of qualified statistic data related to the field. In the second phase, we elaborated on theoretical definition-making by way of conducting in-depth interviews with theorists and practitioners in various professional forums who are considered experts in their field. We chose in-depth interviews as a qualitative research method to explore specific sub-questions and to explore the diversity of professional views.

1.3 Conceptual delimitations

Defining the terms precisely was an indispensable requirement of the paper, since the study of the subject in general raises many new and interesting questions, which cannot be examined in a paper of this length. Our work was carried out with a view to completeness, but still within the boundaries of the theoretical subject.

Let us begin with defining the concept of digitalization. The digital revolution was born to replace the world of analogue technologies and make operations more efficient and accessible. According to the Gartner definition, “digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.”¹ It is worth mentioning the Digital Economy and Society Index (DESI),² created by the European Union to measure the digital competitiveness of its member countries. Basically, the DESI index is made up of five dimensions (European Commission, 2018a), these being (i) connectivity, i.e. the coverage, penetration and price of fixed and mobile broadband; (ii) human capital, i.e. the proportion of internet users and ICT professionals, as well as the level of basic and advanced digital skills; (iii) use of internet services, i.e. access to online content, digital communication and online transactions; (iv) the integration of digital technologies, i.e. the relationship between business digitalization and e-commerce; and (v) digital public services, i.e. the digitalization of government, public administration and healthcare. Today, the DESI index focuses on four key areas: human capital, connectivity, integration of digital technology and digital public services. All this shows that digitalization can be classified as a conceptual framework for improving the efficiency of a task based on the information society and the achievements of information technology.

¹ <https://www.gartner.com/en/information-technology/glossary/digitalization>

² <https://digital-strategy.ec.europa.eu/en/policies/desi>

In many cases, the definition of artificial intelligence is problematic not only in the technological field, but also in other areas. For example, the issue has been the subject of active research in the legal scientific context. In legal terms, artificial intelligence is considered as software, despite the fact that it can perform tasks that other previously known software cannot do at all – in fact, as far as we know, only humans can do. Artificial intelligence cannot be treated as a “thing”, since it lacks a physical appearance (a physical object that can be possessed), although this could be remedied by analogy or fiction, and the rules governing the object could be applied in this way. The identification of artificial intelligence as a legal entity is problematic from both a moral and ethical point of view. A new conceptual scope could be defined, but this would raise further questions in terms of differentiation according to technological development (Stefán, 2020).

<p style="text-align: center;">Systems thinking humanly</p> <p>“The exciting new effort to make computers think... machines with minds, in the full and literal sense.”</p> <p style="text-align: center;">(Haugeland, 1985)</p> <p>“[The automation of] activities that we associate with human thinking, activities such as decision-making, problem-solving, learning...”</p> <p style="text-align: center;">(Bellmann, 1978)</p> <p style="text-align: center;">Systems acting humanly</p> <p>“The art of creating machines that perform functions that require intelligence when performed by people.” (Kurzweil, 1990)</p> <p>“The study of how to make computers do things which, at the moment, people do better.”</p> <p style="text-align: center;">(Rich and Knight, 1991)</p>	<p style="text-align: center;">Systems thinking rationally</p> <p>“The study of mental faculties through the use of computational models.”</p> <p style="text-align: center;">(Charniak and McDermott, 1985)</p> <p>“The study of the computations that make it possible to perceive, reason, and act.” (Winston, 1992)</p> <p style="text-align: center;">Systems acting rationally</p> <p>“Computational intelligence is the study of the design of intelligent agents”</p> <p style="text-align: center;">(Poole et al., 1998)</p> <p>“AI... is concerned with intelligent behaviour in artifacts.” (Nilsson, 1998)</p>
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Figure 1 – AI definitions [source: Mesterséges Intelligencia Elektronikus Almanach]

In this paper we employ the European Commission’s (2018b) definition of artificial intelligence.

Artificial intelligence (AI) refers to systems that display intelligent behavior by analyzing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications).

However, for the sake of completeness, we believe it is important to note that this definition needs to be supplemented in view of the specificities of the subject, and that two sub-groups need to be defined at the conceptual level. In the paper, we will specifically mention the concept of high-level artificial intelligence, which we understand to be characterized by the ability to identify genuine problems and develop schemes for solving them, that is to think through and formulate solutions. Whereas we describe the non-natural intelligences below this level low-level artificial intelligences.

2 The history of digitalization and artificial intelligence

When looking at the history of digitalization, it is basically worth looking at the development of information technologies in line with the conceptual delimitations. According to them, digitization is nothing more than the conversion of analogue data into digital form, i.e. the transformation of physical data into electronic form in order to increase efficiency. As a preliminary, its history coincides with the advent of computers and the development of information technology.

Calculating instruments have been around almost since the dawn of humanity and it is almost impossible to say when, for example, the abacus first appeared as such. It is well known that the abacus was actively used in the Roman Empire and was the most important calculating device until the 16th century. A radical change came to pass only with the introduction of the logarithmic function, described by John Napier in the 16th century. Napier used rods to operate the logarithmic system, of which the logarithmic slide rule was the direct successor.

When learning about the history of artificial intelligence, one cannot forget the theory of the Turing Test (Turing, 1950), published by Alan Turing in 1950 in the philosophy journal *Mind* under the title *Computing Machinery and Intelligence*, which still informs our thinking today.

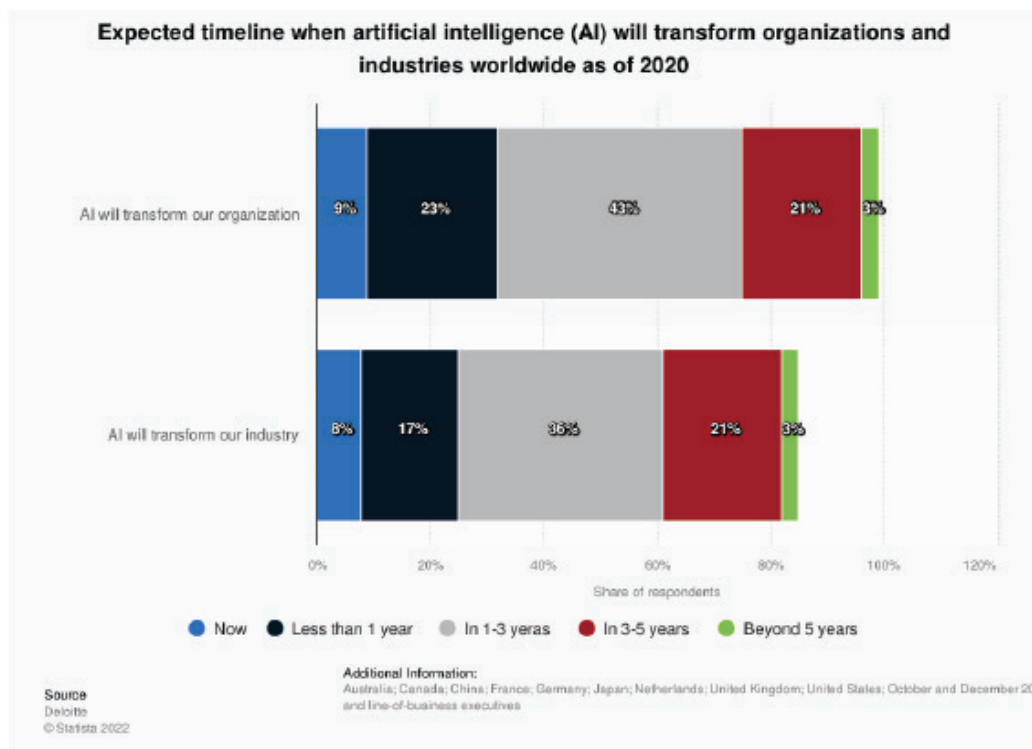


Figure 2 – Artificial intelligence for the transformation of organizations and industries

As illustrated in the figure above, artificial intelligence could lead to a transformation of the corporate organization and of the industry as a whole, according to senior corporate executives surveyed by Deloitte (Mittal et al., 2022). In itself, the question arises that an industrial company with operations that are based on modern technologies and inventions is typically protected by certain instruments of industrial property protection.

3 The historical and legal basis for the protection of intellectual works

Generally speaking, intellectual works can be divided into two main categories: copyright on the one hand, and industrial property rights on the other hand.

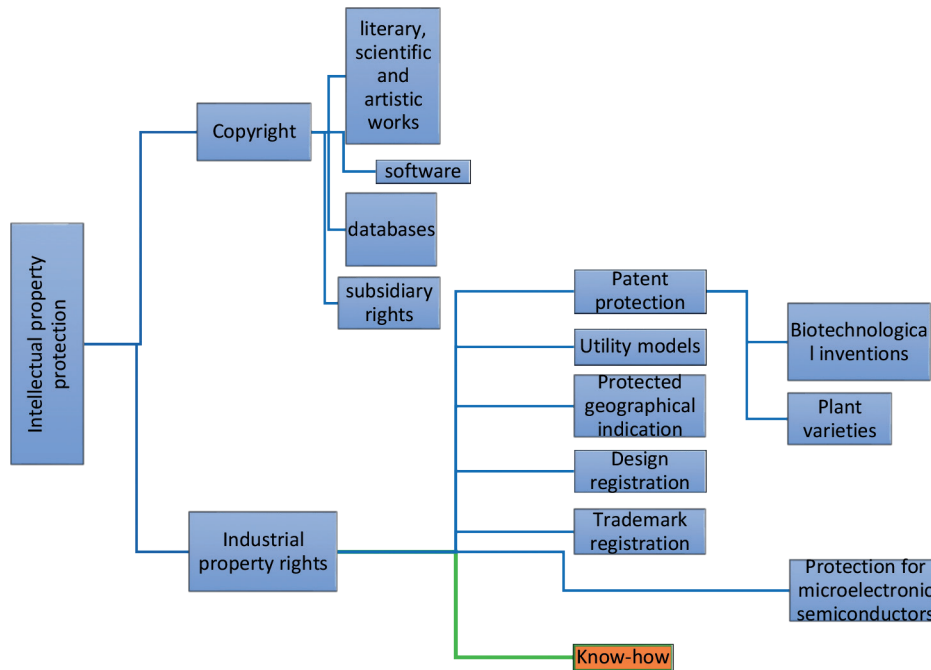


Figure 3 – System of intellectual property protection source: authors' own figure

Between the two forms of protection, copyright is a homogeneous field that cannot be further divided into subgroups, but some specific types of works can be identified. Industrial property, as shown in the figure above, can be further divided into sub-groups (types of protection) and is a heterogeneous field of rights. Their main differences are illustrated in the figure below. The subject of know-how, i.e. proprietary knowledge, is a special area, but we shall still touch on it briefly.

	Copyright	Industrial property rights
Origin of the protection	Automatically created by the creation of the work	Requires official registration (national, EU, international)
Object of protection	Original individual artistic, literary or scientific creation	Varies depending on patent type
Term of patent	In the author’s life and 70 years from the next year after death	Varies depending on patent type
Territorial scope	Legal protection is established in almost all countries on the basis of reciprocity	Only valid in a specific geographical area (depending on patent type)
What is eligible for protection?	Any individual original work of art, literature or science, regardless of its quality	Only works that meet certain requirements (depending on patent type)

Figure 4 – Comparison of copyright and industrial property protection source: authors own figure

3.1 Historical and legal foundations of copyright

Looking at the history of copyright, it is clear that creative activity has never been far from humanity, manifesting itself in tangible form and showing individual originality even without specifically defined protection. However, there are three indicators of the institutionalization of legal protection. First of all, the circumstances under which works can be reproduced, brought about by the development and rapid progress of book printing techniques, and even more so since the advent of Johannes Gutenberg's printing press. Second, the ever-growing emphasis placed on individualism since the late Middle Ages. Breaking with the anonymity that had previously characterized arts and science, the man of the Renaissance rediscovered himself as an intellectual individual. From then on, artists sought to make themselves as widely known as possible. This second aspect can be called the subjective side of copyright, looking at its formation, and third, we must mention the human need, namely the social need arising from the fact that people want to be the "owners" of intellectual works. However, there has also been a trend towards an increasing demand for copyrighted works, which in turn led to the development of property protection alongside intellectual property rights (Nótári, 2010).

In Hungary, the first copyright law was Act XVI of 1884, which extended the scope of copyright to previously published works. However, it was not up-to-date even at that time, as it was entirely based on the earlier German Copyright Act, and while it was being drafted, the Berne Convention was already being prepared, which was not taken into account in the Hungarian legislation (Legeza, 2017).

Today, the basic rules of copyright are regulated by Act LXXVI of 1999 on Copyright (hereinafter: the Copyright Act). It provides that the author is "the one who created the work" (Section 4(1)). In other words, copyright belongs to the creator, and the creator can only be a natural person (human being), as indicated by the term "who".

3.2 Historical and legal foundations of industrial property protection

For a long time, the first step in the universal history of industrial property protection was to keep the idea secret. From the 14th and 15th centuries, this was taken over by the privileges and prerogatives granted by the monarch who held the imperial title. Of course, these cannot be considered as industrial property solutions in the modern sense of the word, since they were monopolies, in fact, granted only to a certain incoherent group of subjects. Generally speaking, both in Antiquity and in the Middle Ages, social relations regarding intellectual works were formulated and remained outside the legal framework (Lontai et al., 2004).

The next big moment in the study of evolutionary issues were the immediate predecessors of today's industrial property systems, where the conditions for obtaining exclusivity were set out in a transparent manner by direct acts of state legislation, and anyone who met them could obtain it, the granting of a patent was no longer at the discretion of the ruler (Papp, 2015).

The first legislation on intellectual property in Hungary was passed in 1733 which provided protection against reprinting, some 300 years after Gutenberg's invention of printing press, whereas the first law on industrial property protection was the extension of the scope of the first Austrian imperial patent to Hungary in 1810 (Tattay, 2001). However, the joint history of Austria and Hungary provides some additional insights to the history of copyright and industrial property law. There existed, as it were, privileges, not qualifying as patents, but similar to them – the first of which was granted in 1672 by King Leopold I to Christian Sind's woolen weaving mill in Linz, known as the "factory patent". Later in the development of the law, there were

so-called “invention patents”, which are closer to modern patents, but granting them was not regulated by law, but only by the exercise of royal patronage. Subsequently, a series of court decrees and imperial patents led to the Austrian Patent Act of 1832, which was also decisive for Hungary. In Hungary, Act XLI of 1893 amended the customs and trade treaty with Austria and enabled the first independent patent law to be enacted after the restoration of legislative freedom (Act XXXVII of 1895), which entered into force on 1 March 1896 (Szarka, 1996).

4 The relationship between intellectual works, digitalization and artificial intelligence

4.1 The relationship between copyright, digitalization and artificial intelligence

As a preliminary remark on the relationship between artificial intelligence and copyright, the current scientific discourse is essentially about the ability of current information technology systems to create works that comply with currently applicable copyright requirements, and what will happen when we reach that technological level. Another difficulty in understanding the issue is that information technology and software have traditionally been understood in terms of human action, carrying out human-directed and defined instructions. As long as software and hardware only mimic the human thought process, our theoretical thinking will not become significantly more complex, but a paradigm shift may be required from the moment we start using predefined parameters to the point where they are characterized by an autonomous ability to self-learn and adapt.

The scientific importance of the topic was particularly high, as the decade between 2010 and 2020 was dominated by the technological development of artificial intelligence, and experts expected and still expect significant developments in copyright regulation (Bond & Cox, 2021).

With regard to copyright, we have established that, under the current rules, only human beings, i.e. authors, can be protected by copyright. However, it cannot be denied that algorithms and artificially intelligent machines may also be able to create original works of an individual nature. In this respect, works of art can be divided into two groups: on the one hand, *computer-assisted works* and, on the other hand, *computer-generated works* (Maggiore, 2018).

There are many debates in academic discourse on how to accommodate the phenomenon of artificial intelligence within the framework of copyright law. In principle, however, there are two possible approaches: a positive one, which means that artificial intelligence should be accommodated in copyright law, and a negative or skeptical one, which means that it should be rejected (Mezei, 2021a). If adopted, however, it is important to consider whether the works created by artificial intelligence will be perceived as the target, subject or object of copyright regulation.

The biggest challenge with the emergence of artificial intelligence is that we cannot distinguish between what is machine-made and what is human made. And if we cannot decide what is machine-made and what is human made, how can we encourage the creator, or does it even make sense to grant copyright to the artificial intelligence or its creator? If the human author as creator loses its relevance the legal rules shall follow (Grad-Gyenge, 2022).



Figure 5 – Painting of Budapest in rococo style created by artificial intelligence called DALL-E source: DALL-E (based on the authors' instructions)

The current state of copyright law is that only natural persons can be authors, and the copyright status of such generated images is of interest (Pogácsás & Ujhelyi, 2022). The scientific literature suggests that in most cases AI only appears to compete with copyright. In the other cases, its position is clear. It would be fortunate if the further development of the copyright toolbox could provide a powerful tool for resolving some of the issues raised, even by creating a new neighboring right (Grad-Gyenge, 2023). If one just asks one specific question, one might also ask whether AI that synthesizes data to create new news can be considered a journalist. If so, is it protected by copyright law (Trapova & Mezei, 2022)?

4.2 The relationship between industrial property protection, digitalization and artificial intelligence

Industrial property is a heterogeneous area of law which, as described above, consists of several different forms of protection. Overall, it is difficult to draw a general conclusion about the relationship with artificial intelligence, so we intend to highlight correlations in the context of each form of protection.

The relationship between artificial intelligence and patent law is perhaps the most controversial area in the field of industrial property protection. Both in scientific discourse and in terms of everyday life, the question arises as to whether an algorithm can create an invention that appears to meet the requirements for patentability. The emergence of artificial intelligence in the field of patent law is not a recent development, with an increasing number of such patents appearing (Fujii & Managi, 2018). This is illustrated in the figure below, which shows an exponential increase in the number of these, perhaps most strikingly in the data from the European Patent Office (EPO).

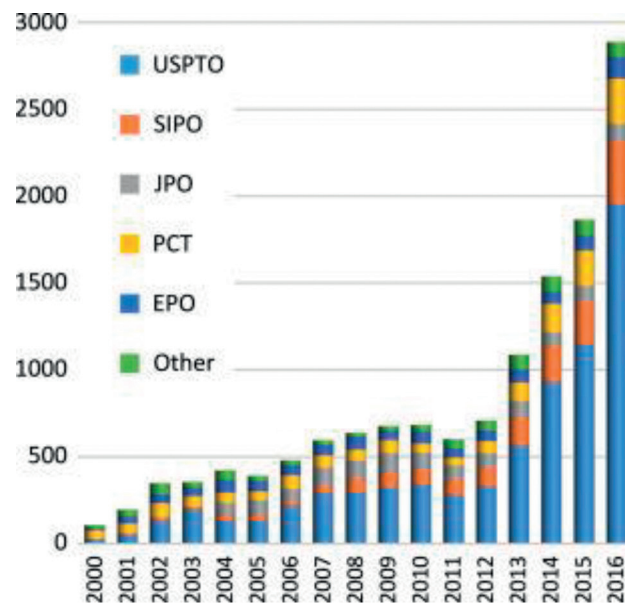


Figure 6 – Distribution of granted patents related to artificial intelligence by patent office source: Fujii & Managi, 2018

If we look at other forms of industrial property protection, similar issues may arise in the area of utility models (i.e. small patents). We should also consider design registrations, where it is questionable whether the requirements of novelty and individuality can be met by an artificially intelligent creation. Another interesting issue is the area of trademark protection, where it is conceivable that the protected work could be created by an artificial intelligence without any particular legal anomalies, although designating the AI itself as the owner of the work could raise problems. For this very reason, we shall address the thorny questions of patents.

Pursuant to Section 7(1) of the Patent Act, “the inventor is the person who has created the invention”. As is the case with copyright, the inventor must be a natural person, a human being. However, in 2021, after considerable scientific and public debate, it was announced that the South African Patent Office had registered the Dabus artificial intelligence patent “for inventions created by it” (HVG, 2021). The invention by artificial intelligence called Dabus was a particularly eye-catching flashing beacon and a soda can based on “fractal geometry” (Papdi-Pécskői, 2021). Nevertheless, the United States Patent and Trademark Office clearly refused to recognize the Dabus as the author creator of an invention (Origo, 2022).

5 Empirical research: in-depth interviews

5.1 Empirical research methodology

We intended to use in-depth interviews with professionals to elaborate on our initial research question and to get the opinions of experts and stakeholders who are familiar with the topic. The in-depth interviews were conducted in a semi-structured format, with some subjects in person and others via online video calls. In defining the sample, we tried to select as wide a range of subjects as possible to ensure that several industry players were represented in the research at the same time. However, the sample was limited to professionals whose job description brings them into contact with intellectual property solutions in which artificial intelligence is

already present or very closely related. The semi-structured in-depth interviews were analyzed using analogue content analysis methods. The results complemented the results of the literature review, partly deductively and partly inductively, as a basis for further sub-questions.

Company/sector	Respondent’s job title
AI company Europe’s largest innovation platform	Senior executive manager
Higher education, university	Lead IP Strategist
Higher education, university	university lecturer in the field of intellectual property
Ministry of Justice	Chief Government Advisor
Hungarian Intellectual Property Office (HIPO)	Head of Department
Office of the Patent Attorney	European and Hungarian Patent Attorney

Table 1 – Job title of interviewees

Source: authors' own editing

5.2 Results of the in-depth interviews

The first interview (I1) was conducted with the director of Europe’s largest innovation platform, who has a degree in economics and has been working in the field of digitalization for years. On the subject of artificial intelligence, the interviewee said that more and more databases and data sets are suitable for analysis by machine algorithms, which can produce new – unexpected – correlations. The interviewee sees a real opportunity in the near future for algorithms to “invent” new technical solutions, but the most interesting question is who will be able to patent the “invention” and who will be able to use or exploit it. In the course of the interviewee’s work, there has been a very strong digitalization and artificial intelligence-based development in the industry, which can, for example, generate very significant predictions in the field of weather forecasting, and the more effective a company’s prediction is, the more market share it can gain, and the algorithms and hardware solutions it uses are kept secret to protect its intellectual property. The role of trade secrets in this area is therefore enhanced. One area to consider, however, is whether the creator of the “original algorithm” should be entitled to any protection when a system evolves in a self-learning way and can draw conclusions, and this is of particular interest when algorithms interact with other algorithms, even partially open-source ones, during their operation. In principle, the interviewee considers it acceptable that artificial intelligence today could be an “inventor or creator” and would in principle grant certain rights to the creator of the original software in respect of the intellectual creations it produces.

When examining this area, interoperability should play a key role, as perhaps one of the most important requirements for the development of artificial intelligence is the data on which it can build, the size and scope of “clean”, ready to cooperate data and databases available as input. This is essential for algorithms’ learning processes of and for the correct discovery of correlations. At the European level, there have been many isolated developments, but there is no interoperability between them, which is therefore not conducive to the development of technology. The interviewee argues that digitalization is still very poorly understood. Even within the same industry, a completely different approach may be required to exploit it in practice rather than to simply carry out some work with the support of information technology.

A review of the intellectual property system may also suggest that a fundamental paradigm shift may be required, but the issue is not straightforward and a number of aspects beyond the law may need to be examined. Let us suppose, for example, that humans create scientific results (inventions) and that artificial intelligence synthesizes these inventions and creates a much more efficient tool. Of course, we could say that artificial intelligence is just a tool, but the question is how long can it be treated as one? We have to split the question in two: on the one hand, if smart algorithms produce results (output) from the data (input) with which they are fed, and these are interpreted by humans, we can clearly talk about a tool. On the other hand, what if we do not use the algorithms as a target tool, and yet, as a quasi-collateral result, correlations, new and unexpected partial results may be obtained that were not intended in the first place. Moreover, these are becoming increasingly frequent, which in turn inevitably leads to the need for a change of mindset. The economic role of this area is a key driver for the future, as demonstrated by the international innovation group where projects are being developed, and this year 40% of the 750 projects are already dealing with artificial intelligence. This figure is also remarkable given that around 50% of project requests come from the industrial sector. The interviewee sees the biggest challenge of digitalization in the coming years as a systemic understanding of what “digital” is and what opportunities it offers, which is always crucial for economic and public actors.

The second interview (I2) was conducted with a leading innovation strategist at a Hungarian university holding a law degree and who has been working for many years on intellectual property, specifically in the field of copyright, and is pursuing a PhD in that very field. In the context of artificial intelligence, digitalization and intellectual works, the interviewee would first of all draw attention to the importance of innovation and, as an area of expertise, to the aspects of copyright. Artificial intelligence creations can be observed today, but it is important to note that they cannot be considered authors, and therefore no protection can be obtained for the product they create. Discussions have also begun in both scientific and industrial circles on how to deal with creations made by artificial intelligence – whether they are inventions or copyright works. The main question is whether the author of artificial intelligence can be the right holder of the works created by the artificial intelligence. Based on the current state of science and technology, there is no perfect solution to the problem. Several theories have emerged that would create some kind of neighboring right in copyright law and some kind of reduced protection for the creator of artificial intelligence in patent law, although these are mostly market-based “expectations” for legislators. Although these are not unacceptable on a theoretical level, their introduction is not necessarily considered justified on a legal-dogmatic basis. In the field of copyright, the issue of the emergence of artificial intelligence is often raised. For example, the creation of new works of art by artificial intelligence that reproduce paintings along certain stylistic lines, or the creation of new works of art by reproducing the literary styles of literary works that are entirely individual in character, but obviously not in the sense in which they would have been created by a natural person. The current regulation of intellectual works in continental legal systems is perceived as an obstacle to technological development, particularly in the area of copyright. The sectors most affected by innovation are software and databases, where the possibility of transferring property rights is of course open, although the term of protection is not particularly realistic. In the case of Anglo-Saxon countries, a market approach based on the marketability of copyright can be very helpful in terms of innovation, or the patentability of software can be seen as an advantage. It can also be observed that economic actors in the process of obtaining protection are in principle paying close attention to the different national, community or higher cooperation

level regulations and the protection that can be obtained there. The strategy of the applicants (entitled parties) is determined by the possibility of obtaining potential benefits from the diversity of regulations, so it could be stated that, in the long run, the states/communities which benefit the most are those which support the protection of innovative solutions. Design registration is a perfect example of this, with applicants filing a community application instead of a national application, because there is no “novelty search” as with a national application, so it is quicker and its scope extends to the Member States anyway – it should be noted that national protection is much more stable and secure, but this is not the market’s main interest. An effective system of support for innovation at international level also seems important in practice, although knowing the international legislative processes and the problems of cooperation, it appears almost impossible to achieve in practice. The Unified Patent Court, if it becomes operational, could possibly set a good example for other areas. However, it should also be mentioned that the written law needs to be complemented by its practical application, which is likely to be a priority in this area as well. Looking ahead, no major changes in the relationship between artificial intelligence and intellectual property are expected at the legal level in the next ten years. However, economic players are becoming more aware of the management of their intellectual property, and a growing number of market players are entering the field, and perhaps regulations will have to monitor their needs more closely.

The third interviewee (I3) is a lecturer at a Hungarian university and vice-president of the Intellectual Property Rights Research Group, who holds a law degree, also works with intellectual property in practice and has a PhD in copyright law. Intellectual property rights, and copyright in particular, are largely determined by technology, and although there are so-called technology-independent rules in the field of intellectual works, new uses always upset the balance that the legislator is trying to create and maintain. However, this observation is not a recent one, stemming from the field of intellectual property rights; the emergence of innovation and new technologies is obviously closely linked to this area of law, and the ability of the legislator to respond to them is therefore not a recent one either. However, it is true that digitalization stands out among them and has already had a significant impact on practice, and artificial intelligence is expected to have a significant impact in the future. This is reflected in the volume of legal literature. The most interesting question, however, is which direction to take if a new regulatory approach is needed, with many sub-issues and regulatory directions being identified. However, it is also important to note that the emergence of each new technology raises the question of whether a paradigm shift is needed in the particular area of law. This phenomenon is now being observed with the spread of artificial intelligence, but probably, by analogy with previous technological changes, there will be no need for radical change. However, it must also be argued that while the paradigm can deal with the issue, this does not mean that the legislation cannot require changes – some fine-tuning. In the field of copyright, there already exists software that, after various inputs – textual descriptions – generates an output that becomes an image, a “visual work”, but the question arises under what conditions this image is used. An example of such famous software using artificial intelligence is mid-journey. Is it even possible to speak of authorship or a work protected by copyright? The terms and conditions of use of the software very often prohibit the commercial use of the work by users who provide input, in the absence of permission from the creator of the software. This raises concerns about the basis on which the creators of the software base their right to authorize the use of the image generated, since there is no direct legal basis for copyright, as the image is created by the artificial intelligence and therefore cannot be a work of authorship. It is also possible, as in the example above, that

the software user's contribution to the creation of the image is such that the resulting image will be considered to be the user's own intellectual creation. The question may also arise as to whether it is necessary to look at this area in such a way that the creator of the software is granted a separate circle of protection, or some kind of neighboring rights, or whether no intervention is necessary at all. These issues are not yet fully explored in science, and there are several arguments for and against each view. If we look at previous technological innovations, market practice has set the direction and this has been followed by legislation, as we have seen with the CDSM Directive (Directive 2019/790/EU). By analogy, it is also worth considering that, when we think of artificial intelligence in the creative process, we can see the same thing as when we think of a work created with commercially available graphics software such as Photoshop. In the case of artificial intelligence-generated images, however, software creators reverse the logic by saying that the software is free to use, but that there is a charge for commercial use of the resulting "work". However, in the case of autonomous artificial intelligence creations, authorship of the work is conceptually excluded, since the creator can only be a human being. The artificial intelligences we encounter today are not yet capable of such breakthrough activity as to justify a systemic paradigm shift. On a theoretical level, it is of course not impossible that, in the future, artificial intelligences will develop to a level of sophistication that can no longer be separated from human intelligence, or even surpass it, but this will have to be considered as a much higher political issue than intellectual property rights. The current development of artificial intelligence does not specifically stand in the way of the legal regulation of intellectual works, if only because of the function of the legal field, although it may be necessary to resolve some of the issues that arise, but this is a phenomenon that can be observed in any technological development. Taking into account international trends, there is no breakthrough in the nature of regulatory change, either in domestic legislation or in the field of law. Given the current state of technology, the rational need for this paradigm shift is not yet justified and the legislation can meet the requirements – with minimal fine-tuning. In the European Union, there is considerable debate, and guidelines are being developed in this area, but it is important to note that these are not intended to bring about a systemic overhaul of intellectual property law, but to help address practices that have become established over the years. If technological progress moves to a much higher level, a systemic rethink of the issues at both national and international level may be required, but this is still some way off.

The fourth interview (I4) was conducted with a lawyer who works as an intellectual property expert at the Hungarian Ministry of Justice. In the context of intellectual property law and the relationship between digitalization and artificial intelligence, the interviewee considered it important to mention that this issue may not be new. A popular phrase in much of the academic literature of the last twenty years has been that "technological change has brought significant advances in the development of intellectual property law", or "the technological revolution is expected to have a major impact on legal regulation", or "the digital revolution is imminent and could change much of the law". It is worth remembering that in Hungary in 1998–1999, at the beginning of the Internet era, we saw the last part of the codification of the copyright law that is still in force. The technological development provoked heated debates and dialogues, and many people talked about the fact that copyright activity will be manifested in a different way in the world of computers and the Internet. The new technical challenges and phenomena pose a very serious – one might say eternal – dilemma as to whether a paradigmatic change in the legal regulation of their effects is necessary. The WIPO (World Intellectual Property Organisation) Treaties, as the first multilateral

conventions, were the forerunners of the digital age and were intended to provide a possible normative response to the technological challenges of Internet use. Looking at the field of digitalization and artificial intelligence, perhaps the most interesting issues are the growing and expanding range of concepts that are being given content. In terms of technological developments, the phenomenon of artificial intelligence is expected to have a major impact on the intellectual property system as a whole. In the field of patents, there are already many applications in this area. However, it is also noticeable that the scientific and practical discourse in this field, but perhaps especially in the field of patents, raises deeper questions, such as whether artificial intelligence can be considered an inventor. This may also raise fundamental questions about patentability. However, similar debates are already emerging in the area of copyright. The WIPO has been working on artificial intelligence for many years, and it is important to highlight the area of the data economy, as well as the European Union's Artificial Intelligence Regulation, which was presented by the European Commission as a regulatory proposal in April 2021 and affects intellectual property rights at the EU level. The most interesting differences in approach between thinkers and theories are well reflected in both fiction and literature. In the case of Asian authors, the robot is man's helper, with man and robot working together. European and American authors, on the other hand, see robots as more frightening creatures. This approach can also be observed in the regulation of intellectual property. A number of principles have been laid down in EU legislation that reflect this distancing attitude.

The fifth interview (I5) was conducted with the Head of Division of the Hungarian Intellectual Property Office, who graduated as an engineer and, due to the nature of the interviewee's field, deals with a large number of patent applications, many of which are related to information technology. It is clear that there is a great deal of intersection between the field of intellectual property and computer programming, particularly from an industrial property protection point of view. Most patent applications already have some form of digital connection. There is definitely a copyright aspect to it, if only because if one wants to make a working technical creation that involves some software then written program code, which inherently contains the copyright aspect of it, is needed. It should be noted that in this technical field, the source code behind the software is actually hidden, it is a trade secret and there is a lot of know-how involved in its operation. There are very few new technical solutions that do not have software behind them, as almost all hardware today has software behind it. The presence of digital devices in inventions has become so commonplace in patent applications that it can no longer be considered a feature in itself. Most of the applications we come across involve some kind of data linking solution implemented by some kind of intellectual creation that is protected in its own right, or a standardized solution once protection has been obtained – these are of course also digital in nature. They cannot therefore be taken into account as independent features because they are so common that it is considered to be professional knowledge to use them, but this is not a new phenomenon and has been the case for at least ten years. As far as the legal framework is concerned, the presence of a digital feature is not a problem when examining applications for novelty, inventive activity and industrial applicability. Such applications fall into two broad categories. On the one hand, there are inventions specifically relating to digital solutions, where the solution that is the subject of the invention is specifically to create some kind of digital solution, for example an encryption or communication protocol or a database manager. On the other hand, there are those inventive solutions that simply apply these digital solutions in an inherently digital way, such as a measuring device. In the latter case, the data collected needs to be analyzed,

presented to the investigator, processed in a given situation – either using big data, artificial intelligence, deep learning or data mining methods – and conclusions need to be drawn. This area should be distinguished from the previous group, because here the solutions use available tools, which are mostly already known solutions, ready-made products, so that the question of novelty and inventive activity does not arise. In this case, it is not necessary to examine the exact structure and functioning of the artificial intelligence. In the former case (i.e. for digital solutions), there are no difficulties in examining the inventive concept, since the inventive activity can be assessed by a more precise delimitation of the inventive characteristics. The exclusions in Section 1(2) of Act XXXIII of 1995 on the Patent Protection of Inventions can easily be overcome by including some hardware in the scope of protection. There is no evidence that innovation based on digitalization is hampered by the current regulation of intellectual property. For the time being, artificial intelligence is treated as a computer program, and until it has an active effect in the “real world”, it should be treated as an algorithm, computer program or mathematical algorithm and therefore not protected. There are, of course, opposing views that it should be treated as a separate field, although these are still in the minority. Patent offices in Europe, the US, Japan and China represent the majority view. It is important to emphasize that technological progress in this field is so rapid that the statute of limitations for these technologies is very short, which means that there is no problem with the lack of separate – *sui generis* – protection for these technologies, as industry protects them along the lines of trade secrets and know-how. In the field of copyright, the speed of technological development is likely to make independent protection unnecessary, since by the time a copyright case reaches the evidentiary stage, the technologies involved are often obsolete. It is likely that industry players, particularly the academic sector, will be the most likely to demand new rules as they are motivated by the need to obtain protection – exclusivity and market advantage in a rapidly evolving field – for as many intellectual products as possible across as wide a spectrum as possible. If artificial intelligence were a designated, dedicated field of technology in its own right, the number of applications in this area would probably grow exponentially. In patent law, the role of inventor could only be taken over by artificial intelligence – in theory – if it is a strong artificial intelligence, which is much more advanced than current technology. Inventive activity goes beyond the idea of an invention being conceived by someone (something), as it involves identifying an existing technical problem, considering it and creating a solution to it. Today’s technology may be able to come up with a problem as a kind of random word generator, but it requires separate activities to identify and solve the answer. It could be argued that artificial intelligence is still a tool for the inventor in the invention process, but not a replacement. Think of the various deep learning algorithms already being used in pharmaceutical research to simulate potential drug compounds alongside huge databases. In this simulation phase, artificial intelligence is more efficient than humans, but it is still only a tool for the inventor. If, at some point, there is a machine capable of performing the full inventive function, the issue will no longer be a matter for intellectual property offices or legislation, but rather for constitutional courts. In fact, if an artificial intelligence is able to carry out the entire inventive process for solving technical problems, it will also be able to do so for other problems – such as economic and social problems – and this will be a matter for society as a whole. Today’s artificial intelligences, being weak examples, do not reach this level, and even if they are involved in invention, they appear as tools used by humans for their inventive activity.

The sixth interview (I6) was conducted with a European and Hungarian patent attorney who graduated as an engineer and has been working on IT-related inventions for many years. Regarding the relationship between intellectual property, artificial intelligence and digitalization, there is an increasing number of professional debates and discussions in the scientific and professional discourse on the various aspects of these issues. Many theories and regulatory concepts have been developed, but there has been no clear move towards major systemic change by legislators, either at national or international level. Regarding the current state of the art of artificial intelligence, Europe and the major countries of the world generally consider that it can be covered by existing legislation. Inventors, developers and companies are increasingly using artificial intelligence to perform tasks at a much higher level of efficiency than humans can. Looking at technical applications, most solutions already have some form of digital content or solution related to software, if only because they are already part of the basic engineering knowledge of the state of the art. Artificial intelligence and “self-learning” algorithms also rely on huge databases. Data and databases are one of the most valuable parts of today’s research and development sector, and companies protect them as a priority and spend considerable sums on developing them. Artificial intelligence performs a wide range of modelling on databases and creates correlations between data across a broad spectrum. Today, when we look at the industrial property aspect of this, especially in the patent area, it is still just a tool in the hands of the inventor, but it is a very valuable tool. The inventors, as well as the companies and institutions that employ them, would naturally be interested in some kind of *sui generis* protection to ensure a higher level of protection for their intellectual property, because at the moment the only protection they have in this area is as trade secrets, which is a completely organic expectation on their part. Stakeholders who invest significant amounts of money and intellectual capital in research and development want to realize a return on their investment as soon as possible, assuming it produces a truly useful outcome. It must also be recognized that a significant proportion of research does not produce the expected results, or that considerable resources are often expended to prove a thesis wrong. Researchers and applicants should be protected at the highest possible level, as this will increase the propensity to innovate, which is in the well-considered interest of all states. The idea of artificial intelligence replacing the inventor is not yet justified by the current state of the art, and the same can be said in the field of copyright, although there are undoubtedly more questions that may arise even today to which the legislator will have to provide adequate answers. The current system of intellectual property law is still able to provide answers to the questions of digitalization and artificial intelligence, even without a major paradigm shift. Science also points to the need for one (Keserű, 2020). Non-man-made copyright works also raise a number of moral issues. This also underlines the need for paradigmatic thinking. (Mezei, 2021b). In the event of significant and disruptive technological change, the whole system may need to be rethought, but this is not yet foreseeable. In the meantime, however, care must be taken to ensure that companies investing in innovation processes are not disadvantaged by technological change. Even so, the issues today are internationalization, harmonized unitary protection and cross-border enforcement of rights, which would truly help innovators and technology development.

	H1: Are the current rules on intellectual property rights up to the challenges posed by technological developments?	H2: Is digitalization likely to raise issues beyond the current rules on intellectual works?	H3: Will efficient and cost-effective future enforcement of rights be more likely to occur through cross-border regulation?
I1	basically, no	definitely yes	yes, international cooperation is essential for the efficiency of the technology
I2.	partly yes, but somewhat hinders development	yes	would be essential for efficiency, but in practice a common international regulation is almost unfeasible
I3.	yes	not in the near future, but in the case of major technical progress	in the case of major technical progress, yes
I4.	apparently able to meet the challenges currently visible	in the case of some technical progress, yes	it would probably be more efficient
I5.	yes	with appropriate technical progress, definitely yes	theoretically, yes
I6.	basically, yes	not today, but it could happen in the long term	it would definitely be more efficient

Table 2 – Results of in-depth interviews in relation to the research hypotheses

Source: authors' own editing

6 Empirical research: observations of a professional forum

In order to learn more about the results of the empirical research and to understand the scientific discourse, we participated in an online professional lecture on intellectual property, focusing on the challenges of artificial intelligence from a legal perspective.

The presentations at the professional forum fell into two broad groups of opinion basically. We can speak of artificial intelligence optimists and artificial intelligence pessimists (Mezei, 2020). However, this approach should be interpreted in terms of whether works or technical solutions created by AI are suitable for replacing the creative role of humans and whether they should be subject to some form of intellectual property protection. AI optimists accept the partial or full creative activity (in terms of copyright), and say that it may be reasonable to recognize either the creator of the artificial intelligence as the copyright holder, or some other related right holder, or even, in abstract cases, the artificial intelligence itself. AI pessimists on the other hand argue that the protection claims of artificial intelligence creations cannot be interpreted within the current legal framework and that a radical change in the legal system is not necessarily required, at least not in the short term. At the heart of the debate, if we want to highlight one context, is the extent to which artificial intelligence could radically change our lives, and here the theories differ considerably. AI optimists tend to imagine a scenario in which algorithms and artificial intelligence bring unprecedented changes to the everyday aspects of our lives, which will inevitably have an impact on intellectual property issues as well.

With regard to our three hypotheses, we may, thus, make the following observations in light of the professional forum. Regarding H1, whether current regulations are adequate, opinions were divided according to whether each thinker had an AI pessimistic or AI optimistic view. For H2, there was some sort of a consensus, but there was a sharp division between those speakers who were looking at the current state of the art and those who focused on possible future developments. Regarding H3, cross-border enforcement of rights would in principle be perceived as more efficient, but it would require a firm political intention to implement.

7 Summary: conclusions and implications

In an unusual way, we thought it appropriate to find out what AI “thinks” of our conclusions; hence, we decided to ask ChatGPT to summarize the nexus of artificial intelligence, digitalization and intellectual creations.

The legal relationship between artificial intelligence (AI) and intellectual property is a particularly relevant and complex issue in today’s digitalized world. AI offers technological solutions that can simulate human thinking and decision-making, and are capable of self-learning, self-improvement and self-operation.

However, such devices are also capable of creating a range of intellectual works, such as software, databases and algorithms, which are protected by property rights. This means that it is important for creators and rights holders to protect such intellectual works and to ensure that they are adequately protected by law.

The development of AI poses new challenges for the legal protection of intellectual works, for example in relation to who is the right holder when works are created by AI. In addressing such issues, stakeholders need to strike a balance between legal regulation and technological developments.

Solutions to legal challenges in the use of AI include data protection, addressing ethical and social issues, and developing a legal framework to regulate responsibility and legal liability for AI.

Overall, the legal relationship between AI and intellectual property is a complex and changing area, evolving with technological developments and related legislation. Legal and regulatory bodies need to keep pace with technological advances to ensure effective protection of intellectual property and the sustainable promotion of innovation.

(ChatGPT)

Concerning our posed research question, it came out that the opinions are roughly balanced, both in terms of the in-depth interviews and the professional presentations. Professionals with an essentially technical background tend to see more radical changes that artificial intelligence is causing or could cause. Those with a marked legal background, on the other hand, tend to believe that legal regulation can keep pace adequately with technological change. Breaking our results down to the hypotheses, the following conclusions can be drawn. Concerning the idea (H1) about the current regulation of intellectual works, the existing regulations are state of the art. However, there are also some voices that consider the regulatory environment as a barrier to technological progress and would like to see more radical change. In any case, the question should be divided into two parts, depending on whether we see artificial intelligence as a potential subject of intellectual creation, or, alternatively, we could consider the possibility

of integrating its emergence as a revolutionary new tool into the system of intellectual property rights.

According to H2, digitalization is expected to raise issues beyond the current regulation of intellectual works, which could justify the application of all research methods. It should be stressed, however, that this statement does not refer to the present, but to a future state, when the development of artificial intelligence has reached a certain level. A number of policy issues may need to be discussed then, and these shall be dealt with similarly to intellectual property rights law.

Regarding H3, we observed that this was the question on which respondents were most likely to agree. Almost all would like to see more effective cross-border enforcement of rights. However, it should be stressed that this response was considered by the research participants even without the context of digitalization and artificial intelligence. In other words, the need for internationalization is not exclusively linked to the development of artificial intelligence.

Finally, let us formulate some practical advice to future legislation. Based on the results of the research and our personal opinions, it would be advisable for the legislator to examine the current state of artificial intelligence in more details, perhaps by way of consulting professional working groups, and to consider in which areas may significant developments be expected. And then shall the issue at a conceptual level be dealt with.

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