International Comparative Jurisprudence 2022 Volume 8 Issue 1
ISSN 2351-6674 (online) DOI: http://dx.doi.org/10.13165/j.icj.2022.06.009

CERTIFICATION AS A REMEDY FOR RECOGNITION OF THE ROLE OF AI IN THE INVENTIVE PROCESS[1]

Liva Rudzite[2]
University of Tartu, Estonia
E-mail: livarud@ut.ee

Received: 1 May 2022; accepted: 30 May 2022
DOI: http://dx.doi.org/10.13165/j.icj.2022.06.009

Abstract. Artificial Intelligence and its subfield Machine Learning have considerable potential to improve the welfare of humans. Due to the specifics of Artificial Intelligence and its enhancing capabilities, there is an increasing incentive to innovate if the role of Artificial Intelligence in the inventive process is recognized not solely as a tool under the patent legal framework. Nonetheless, since the concept of an "inventor" is traditionally attributed to natural persons, there is no consensus on whether the mentioned term should be interpreted as a living instrument. This article focuses on interpreting the concept of an "inventor" under the patent legal framework. It outlines the potential approaches to address an incentive to innovate if the role of Artificial Intelligence in the inventive process not only as a tool is reflected. The main argument developed in the article is that proposals to amend the patent legal framework to address the issue might not be as preferred as introducing the certification system instead.

Keywords: artificial intelligence, inventor, patent, certification.

Introduction

Artificial Intelligence (hereinafter – AI) and its subfield Machine Learning (hereinafter – ML) have a considerable potential to augment the prosperity of humans. Moreover, the capability of AI and ML has already exceeded the abilities of humans, leading toward singularity (European Parliament [EP], 2019). Despite the outlined AI advantages, attempts to patent inventions indicating AI as an inventor before the European Patent Office (hereinafter – EPO) and many other patent offices have been unsuccessful (O'Neil, 2021).

The concept of an "inventor" under the European Patent Convention (hereinafter – EPC) was designed before AI emerged (Lee et al., 2021). In this regard, there exists a tension between an intention for the role of AI in the inventive process to be recognized not solely as a tool and a stance of the EPO on how to interpret the concept of an "inventor" in the context of AI. If the mentioned incentive is not addressed, it leads to opting for other protection methods such as trade secrets. Consequently, those seeking patent protection come across disadvantages, and general public knowledge experiences a deficiency of enrichment.

This article focuses on addressing challenges that stem from the incentive that the role of AI is recognized not only as a tool under the patent legal framework of the EPC. The main argument of the article is that *sui generis* framework, by introducing certification for the recognition of the role of AI in the inventive process not solely as a tool, might be preferable to balance incentives to innovate and the EPC framework instead of incentives to amend the EPC, respectively.

The article relies on analytical, descriptive, comparative, and historical legal methods, and provides examples from other jurisdictions for comparative and substantive purposes.

[1] The author acknowledges the involvement of prof. Aleksei Kelli and prof. Martin Ebers of the University of Tartu, who provided valuable input in proofreading the article and language assistance.
[2] PhD student at the School of Law of the University of Tartu, Estonia.

Scientific literature, primary and secondary legal sources, and case law are referred to evaluate the main argument of the article. Within four sections and sub-sections, aspects of ML and its role in the inventive process, the concept of an "inventor" under the patent legal framework of the EPC, and an incentive to innovate are analyzed. The fifth section focuses on the solutions to address the role of AI in the inventive process, including also a preliminary overview of certification as a remedy for recognizing the role of AI in the inventive process.

The scope of the article is limited to the analysis of patent law within the framework of the EPC. Therefore, considerations on the issues outlined in the article outside the jurisdiction of the EPC beyond comparative purposes exceed the respective framework.

1. Machine Learning and its role in the inventive process

AI and one of its fields, ML, focus on capacitating computers to learn identifying patterns of data, constructing explaining models (mathematical algorithms), and conducting predictions without specifically programmed instructions. Self-learning should be distinguished from self-improvement exceeding human intelligence or singularity (Maini & Sabri, 2017, pp. 9–11). Due to the capacity of ML to generalize and process large amounts of different types of data, it has various applications, including drug discovery (Feldmann & Bajorath, 2020, pp. 1–2), and considerable potential in improving human welfare (European Commission Directorate-General for Communications Networks, Content and Technology, 2020, p. 35).

AI can be divided into narrow or weak intelligence, which refers to the limited task or simulated thinking, and general or strong intelligence, which describes the ability to perform any task that a human can accomplish, including learning, decision-making under uncertainty, and reprogramming itself (Maini & Sabri, 2017, pp. 9–11). Narrow intelligence currently dominates; namely, many applications are created to automate tasks by making computers produce the output from the input or raw data (Sevahula et al., 2020).

ML algorithms (models) range from simple linear regression to complex, such as artificial neural networks. Depending on the type of ML model and the desired outcome, learning methods vary from trivial to sophisticated, such as deep learning (Sevahula et al., 2020).

The developmental process of AI can be divided into stages: 1) formulation of a problem to be solved by applying computation; 2) design of an algorithm, which also comprises the identification of key features (terminals, functions, fitness measure, termination criterion, and result designation) or elements based on which the algorithm should be built; 3) introduction of controlling parameters to measure the accuracy of the output (Koza et al., 2003, p. 10); 4) translation of the algorithm into a programming language; 5) preparation of input and testing data (standardization, normalization); 6) model execution; 7) output verification and application (Kim, 2020, p. 449); and 8) model usage.

It must be outlined that problem formulation is not necessarily a decisive factor in algorithm building, since there can be no issue to be solved at all. For instance, in the DABUS case (Carlson, 2020), the created algorithm provided random outputs based not on the ideas previously conceived by humans but on the programmed general knowledge about the world. Namely, initially deciding whether the generated output can be useful in the real world based on learned knowledge and afterward potentially combining with other revelations.

Nonetheless, no *consensus* exists on the borderline between humans and the role of AI in the inventive process. Namely, there is a stand that a human is always behind all processes related to AI, including building and adjusting a model, choosing relevant data that, simultaneously, involves the direction of a model (stipulating the problem to be solved), predicting the output of inserted randomness, and others. In this regard, AI is solely an automated tool for humans because all AI activities derive from a direction pre-set by humans (Kim et al., 2022).

Conversely, there is a view that models like DABUS, with an architecture of multiple neural network models, allow: 1) not only associate but to generate new patterns; 2) adapt to a variety of scenarios without additional input from humans; and 3) perform self-assembly. Therefore, the model cannot be deemed purely human-made to solve a problem (*Thaler v. Commissioner of Patents*, 2021, para. 37, 41). Consequently, the stand on the role

of AI in the inventive process depends not only on its technical capabilities to act partially or fully autonomously but also on a cognitive position taken on the respective matters (Kim et al., 2022, p. 26).

It can be agreed that since AI and ML do not have built-in functionality and need human assistance, the term "AI Autonomously Generated Inventions" is unfounded for describing the role of AI in the inventive process (European Commission Directorate-General for Communications Networks, Content and Technology, 2020, p. 100). Hence, the proposed term "AI-assisted output" can be accepted to describe cases when AI is applied only as a tool (p. 9). Additionally, the term "AI collaborated/contributed output" could also be used to define situations when the role of AI in the inventive process, not solely as a tool, would be deemed recognized. The respective situations will be discussed in the following chapters.

2. The concept of an "inventor" under the patent legal framework of the EPC

2.1. General overview

Article 62, in conjunction with Article 81 of the EPC (European Patent Office [EPO], 1973), foresees that the inventor and the applicant should be mentioned before the EPO. The inventor must be stated in the application according to the EPC and not under national regulation or case law (Muir et al., 1999, pp. 187).

Furthermore, pursuant to Rule 41(2)(c) of the Implementing Regulations to the EPC (2020; hereinafter – Implementing Regulations), the applicant of the patent must be mentioned, and this can be both a natural and a legal person as well as bodies equivalent to legal persons under the law governing them. Rule 41(2)(j) of the Implementing Regulations also requires the designation of the inventor in the application if the applicant is also the inventor.

Rule 19 of the Implementing Regulations refers to the name, surname, country, and place of residence of an inventor. Additionally, Rule 20(1) of the Implementing Regulations allows an inventor to waive the rights to be mentioned as an inventor and to inform the EPO. Subsequently, that means excluding it from the inspection under Rule 128 Paragraph 4 according to Rule 144(c) of the Implementing Regulations. According to Rule 60(1), Rule 163(1) and (6) of the Implementing Regulations, non-compliance with Rule 19 can lead to the refusal of the application.

Article 60(3) of the EPC stipulates that the applicant is automatically deemed entitled to exercise the right to a patent (CARDIAC/Correction of mistake, 1997, para 38). Nonetheless, Article 80(c) of the EPC requires that the applicant is identified even by name (WARHEIT/Identity of applicant, 1987, para 40).

It should be noted that the concept of an invention is intrinsically linked with the concept of an inventor. It is outlined that the legal meaning of an "inventor" is not only recognition of a creator of an invention but also possession of the rights to invention and entitlement to execute deriving rights (EPO, 2021). In other words, the inventive right provides the right of an inventor that contains: 1) rights to patent as the economic right (ownership); 2) rights to be called an "inventor" as the personal right. The inventive right originates not from the applicant of the invention but from the inventor as a person (Haedicke & Timmann, 2014).

Furthermore, under Article 60(1) of the EPC, an inventor and owner can only be one or multiple natural persons that have created the invention, not a company. The EPO in the so-called DABUS case (EPO, 2020; 2022; Boards of Appeal of the European Patent Office [EPO BA], 2021), where AI was indicated as an inventor in the patent application, stated that only a human being could be considered an inventor in the scope of Article 60 of the EPC. Nevertheless, the succession of rights is possible, requiring the inventor to transfer the respective rights by disposal (Haedicke & Timmann, 2014, p. 244).

The right to a patent rises from the creation process of the invention that a patent application recognizes. Inventing requires a physical process, not a legal transaction. Namely, the assignment of an agent, intent without physical, personal labor, does not embody physical action in the sense of the invention. In this regard, a person that lacks legal competence can also invent. Thus, an intellectual, inventive process is the main precondition that enables an

inventor right. The right of an inventor also requires technical usability or completion of the invention and official public announcement (Haedicke & Timmann, 2014, pp. 244–245).

Another aspect is that the personal rights of an inventor are much less personal and, subsequently, transferable than copyright law. Nonetheless, Article 62 of the EPC stipulates that the rights to be declared as an inventor are strictly in-transferable, or personal. Furthermore, the right to invention arises as soon as a person generates the invention, irrespective of patentability. In contrast, the right to a patent is accorded to an inventor or its legal successor, allowing an application of a registered right to a patent (Haedicke & Timmann, 2014, pp. 246–247).

Furthermore, economic rights or the right to own a patent guarantee the commercial exploitation of an invention and exclude others from the utilization of the invention. The economic value of an invention is identified by: 1) a desire to realize the value by the holder of rights; 2) the ability to realize the value by the holder of rights; 3) the desire to pay for the value by others. In this regard, control over the product by the owner should also be recognized by others.

2.2. Co-inventorship

Co-inventorship requires: 1) an intellectual contribution (identification of a new, non-obvious technical aspect) – support for only physical, construction, and financial activities does not qualify as an intellectual contribution; 2) resulting in individualistic creative contribution – "creativity" is viewed as an activity and a degree of intellectual participation that corresponds to the average capability of a person skilled in the art assessed interrelated to the invented concept, in turn, "individualistic" corresponds to independency that should exceed pure assistance or implementation of activities that are attributed to the specified instructions; 3) to resolve a particular technical issue (in this regard, personal thoughts of novel solutions for a technical problem are relevant to determine "individualistic creativity" or impact on the result – this may also encompass the prevention of errors); 4) commonly (whether, objectively, co-inventorship can be identified as related to the same subject matter) (Haedicke & Timmann, 2014, pp. 248–251).

Similar to single inventorship, joint inventorship also gives rise to both personal and property rights. Each inventor enjoys non-transferable personal rights to be called a co-inventor. Property rights or rights to a patent are owned collectively (Haedicke & Timmann, 2014, p. 252).

Furthermore, property rights can be assigned in whole as a derivative. An example is the derivative acquisition of property rights in employment relationships. Therefore, only property rights but not personal rights can be transferred in the case of co-inventorship and owned commonly by shares based on the significance of the respective, individualized contribution (Haedicke & Timmann, 2014, pp. 252–253).

As it derives from the aforementioned, the concept of an "inventor" under the EPC is intrinsically linked with the underlying philosophy of elements that identify products as intellectual. It appears that, under the EPC, only a natural person is deemed an inventor. Thus, the respective aspects should be analyzed for a comprehensive understanding of the position.

2.3. Notion of an inventor as only a natural person under the EPC

2.3.1. Elements that identify intellectual products

From the travaux préparatoires of Article 60 EPC (1973, pp. 43, 108–110, 114–116), it can be deduced that under the EPC, the concept of only the physical person as an inventor was designed with an autonomous meaning or regardless of the respective interpretation under the national law. The notion was that only a natural person conceives an invention. Nonetheless, there was an intervention by France to also incorporate the legal person as an inventor. The substantiation was based on its respective national case law which foresaw that, after establishment, a corporation becomes an inventor. Discussions resulted in an exception for inventions developed during employment and reference to the national law. It was also accepted that the respective employee who created an invention is only entitled to moral rights.

The travaux préparatoires of Article 81 EPC (1973, p. 32) affirms the notion of the intellectual creation by an inventor. The emphasis is on the role of an inventor and the illegitimacy of profiting from the usurpation of an extraneous invention.

Generally, intellectual products may be identified based on elements: 1) an objectively observable form (visual or otherwise expressive, intangible teaching format). An idea without a concrete form of expression cannot be classified as an intellectual product; 2) properties apart from a form of expression of a product that distinguishes it from other creations. Namely, for the product to be conceived intellectually, the evaluation is made based on – a) qualities of the form of expression; b) intentions of respective creators towards the product as intellectual; c) the perception by the society; and 3) one or multiple human beings to whom the existence of the mentioned elements could be attributed (excluding non-natural actors as machine and animals). No intellectual product could be conceived in the absence of a human element. In this sense, incapacitated natural persons could create intellectual products (Pila & Torremans, 2019, pp. 69–73).

It should be noted that the mentioned criterion could create internal tension. Namely, the second element attributes the product as intellectual also based on the intention of the creator to make something of an intellectual nature. Simultaneously, the third criterion imputes the element of the intellect also to the incapacitated natural persons regardless of the cause of their incapacity (infancy, mental disorder, or other). Thus, depending on its nature, incapacity may wholly or partially deprive a person of the ability of the consciousness of their activities. It also comprises intentions behind the activities of a person, including the incentive to make intellectual products.

Furthermore, as was outlined, non-human actors cannot be perceived as intellectual creators either because of the presence or the absence of direction by a human (Pila & Torremans, 2019, p. 72). In this aspect, it can be deemed that the so-called "human creative consciousness" could similarly result from directions and teaching by other human beings (parents, teachers), external environment, and genetic material. Thus, creations by humans may not necessarily be said to be purely the product of their intellect without any external or internally inherited guidance. In this regard, the interconnection between the mentioned second criterion that defines the intellectual product and the third aspect that refers only to humans regarding products of intellect is blurred.

Hence, it can be concluded that the understanding of an intellectual product under the EPC is not necessarily linked with the incentive to innovate (the second criterion of elements of intellectual products outlined previously), but rather to the involvement of intellectual labor by one or multiple actors. In other words, the EPC *expressis verbis* does not require that the invention should be original. For the explanation of the argument, a parallel could be drawn to the stance towards copyright protection. Namely, creating work is an arduous process where the prevailing is not necessarily an initial concept but whether the intellect conceives something by a particular creation (Eco, 1986). In that regard, a pure execution solely does not necessarily embody an original idea since it can only be a mechanical repetition process. In terms of conception, decisive is the action in the human mind that results in an outcome, not the resulting idea that cannot be supported (Shemtov, 2019, pp. 20). Therefore, the execution could follow the idea and *vice versa*.

As it appears, only an overview of elements that identify intellectual products does not provide clarity of attribution of intellectual products solely to a natural person under the EPC. Thus, for a more comprehensive understanding of the position of an inventor as only a natural person under the EPC, the underlying philosophical concepts of intellectual products should be analyzed.

2.3.2. Philosophical concepts of intellectual products

2.3.2.1. Labor theory

Previous considerations also emphasize that the EPC legal framework is based on the Lockean Labor theory (Article 60 E Travaux Préparatoires, 1973; Mueller, 2020). This theory supports the attribution of natural property rights of previously unowned or common resources to a person who labors upon those resources in a proportionate amount so that it does not deprive others of similar rights (Locke, 1980). Hence, it constitutes the possession of a labored property as a reward for the efforts of a person but does not support monopoly rights. Patents for non-

naturally occurring genetic data such as gene sequences could serve as examples (*Association for Molecular Pathology v. Myriad Genetics*, 2013). It can be concluded that Lockean theory only supports reward for personal labor, not reward for the labor that, in reality, was made by others.

The EPC does not reward a pure idea without execution since it has adopted the labor theory literarily. Namely, for the EPC framework, whether an idea or execution was first is indifferent as long as the invention fulfills the patentability criteria. It can be approved, for instance, in cases of patents for the second medical use where the first is the initial medical use, after which only comes an idea of the second medicinal use (*AP-1 complex, SALK INSTITUTE*, 2004).

At the same time, the EPC also stands toward the reward of personal labor, either solely or collectively. Nonetheless, the EPC, in the sense of the right to be called an inventor, does not account for who performed a pure execution but who had some role in a creative concept. Simultaneously, the EPC does not exclude that a creative concept could result from a team effort, and it may be a set of random interrelated factors that leads toward the final idea.

In terms of involved labor, it pertains to inventions involving AI in the sense that humans are always behind the AI since it was a human or a team who programmed the set of steps which the algorithm follows, reads, interprets the results, and applies them (Shemtov, 2019, p. 35). This statement can be supported only partially. Namely, as was outlined before, the EPC approved only true and personal labor, or solo or co-inventorship, respectively. In regard to co-inventorship, there is no requirement that all co-inventors should equally conceptualize the creative concept or have an identical consciousness of their idea at the moment of the ultimate invention. It may be so that one idea leads towards another that eventually leads to the result. For example, it might be that the first actor does not even have the same awareness of the impact of an idea as the second, who uses the borrowed idea and manipulates it towards the outcome. The same goes for execution, where changes of a small fraction by one actor might lead to a different outcome as initially conceptualized by others. Creative contribution to the ultimate result of all the actors cannot be denied. In the example, co-inventorship might be attributed to all of the actors.

The same goes for inventions created by incapacitated persons. Newborns do not have "built-in" instructions apart from their genetic material. Besides, a child is nurtured by legal guardians, other persons, and the external environment from birth (Rutter, 2006, p. 153). The obstacle that the person might not be aware of what they are doing does not change the fact that they might have created an invention that only others could comprehend, interpret, and apply. In addition, nurture by others *per se* does not automatically and necessarily mean that these persons could have ever created or even conceptualized or come across the same phenomenon as the incapacitated person. A different situation occurs when other persons actively aided in creating a particular invention.

Interestingly, in cases, J 8/20 (*Food container*, 2021), J 9/20 (*Devices and methods for attracting enhanced attention*, 2021) (hereinafter – cases J 8/20 and J 9/20), the EPO refused appeals for the so-called DABUS application. Amongst others, the EPO stipulated that the inventor could only be a person with a legal capacity and that the machine cannot transfer any rights to a human; thus, a human cannot be a successor in title (EPO BA, 2021). Although those decisions are not available yet, there is an ambiguity regarding the amplitude of the meaning of the words "a person with a legal capacity": namely, whether the words should be interpreted narrowly as only excluding non-humans, or even more restrictively – excluding even legally incapacitated humans from inventorship. The narrowest meaning could be revolutionary since, as mentioned above, legal incapacity is hardly related to intellectual creation, even by accident, because legally incapacitated persons can also invent.

Similarly, in the case of AI, although humans are the ones that created the set of instructions, trained and applied the model, this does not necessarily mean that those creators could have ever reached the same outcome. It is undeniable that AI outperforms human capacity in many areas, and it might take numerous years for a human to conduct equal calculations and computations (Kim, 2020). Nevertheless, if the approach that humans in all activities, including inventive processes, are always behind AI is accepted, identical conclusions should then be drawn for creations made by incapacitated persons and in cases of co-inventorship. Namely, the fact that, for instance, the parent that nurtured the child did not create the invention does not necessarily mean that it could not eventually, or even its descendants, achieve the outcome. Analogous is the fact that the author of the initial idea

did not comprehend "the bigger picture" of the potential of their idea at the time does not mean that the person could not have ultimately reached the same outcome. In this regard, solo inventorship should have been granted to the parents and the author of the initial idea.

However, the EPC legal framework does not support this kind of "usurpation" of the reward, but instead follows the "first-come, first-served" principle. If the person who nurtured AI did not have an idea of all of the ultimate inventive outcomes, the reward for the respective labor, subsequently, *mutatis mutandis*, should not be attributed to said human. For instance, genetic programming is a systematic method that applies an evolutionary approach or a Darwinian theory of natural selection to automatically solve the problem by computer programs (Koza et al., 2003, p. 1). Genetic programming is also used in the field of AI. Nevertheless, a fitness measure (that has to be measured amongst the candidates) does not comprise all the conditions, conscious or unconscious, that may have crossed a human mind (Koza, 2010, p. 273). Hence, considering adaptation to changing external conditions, genetically evolved solutions may encompass features that would never occur to humans (Koza et al., 2003, p. 22).

Another aspect that has been outlined is that humans are always behind the invention, since a human pre-programmed also randomness and because AI *per se* does not have any built-in instructions; therefore, it could not deviate from those programmed by humans (Kim et al., 2022). It should be noted that AI might also display an output by mistake that has not been pre-programmed by a human. The erroneous output could be an invention as well, and could be used as a step towards the ultimate result.

Hence, human labor and consciousness might not be behind the entire conception. It might be perceived that all inventorship might not be referable only to the respective humans, but the role of AI should also be reflected. Otherwise, the EPC legal framework should be re-conceptualized if the labor that cannot be entirely attributed as own could be left unrecognized.

It can be concluded that contrary to tangible property rights, the EPC legal framework stipulates that the invested labor should be rewarded only for twenty years with a possible extension (Article 63). Thereby, the EPC rewards intellectual work with limited ownership despite the actual time that has been involved in creating an invention, even if it exceeds twenty years. That could be the case, for instance, for drug development as was with the treatment for Alzheimer's (Lalli et al., 2021). The EPC does not consider the actual labor put into creating an invention but has incorporated the limited reward time. Hence, the EPC adjustment serves to enrich common general knowledge instead of the proper reward for the involved labor.

2.3.2.2. Personality theory and the theory of value-added labor

According to Personality theory, the justification for the reward of the extension of personality in the form of intellectual creation (Drahos, 2016; Hughes, 1988) would not answer for the balance of the interests since the personality of an inventor is not limited to the short patent protection time.

Analogously, the theory of Value-Added Labor could not justify the EPC legal framework for the reward concept. According to the theory, the efforts of creators that enhance the public good are rewarded by granting intellectual property rights (*mutatis mutandis Mazer v. Stein*, 1954, para. 35). Generally, unlike real estate, intellectual property may grant a benefit to its subject only through its commercial utilization or disposal to another person (Pretanar, 2009). However, the patent owner could use the patent only to deprive others of the utilization of the invention (*mutatis mutandis Continental Paper Bag. v. Eastern Paper Bag*, 1908, para. 424–425). Moreover, the patent information could even be rendered confidential based on the law, as is the case with inventions for defense purposes as foresees the agreement by the member states of the North Atlantic Trade Organization (Agreement for the Mutual Safeguarding, 1960). The principle of secrecy has been subsequently incorporated within the national law, for instance, in Estonia (Patents Act, 1994, Article 18.1), Latvia (Patent Law 2007, Article 11, 69(2)), and Lithuania (Patents Act, 1994, Article 26).

2.3.2.3. Utilitarian theory

Furthermore, even the Utilitarian theory that stands toward the maximization of social welfare enshrined in the criteria of industrial application of the invention in the patent context (Pila & Torremans, 2019; Lee et al., 2021) cannot be a justified basis for the EPC patent legal framework. The essence of the theory is that the patent system must be seen in the context of economics and not philosophy (*mutatis mutandis Brenner v. Manson*, 1966, para. 386). It can be argued that the welfare of society cannot be based solely on economic gain without regard to moral and ethical considerations. Being guided solely by economic considerations, especially regarding granting patents for biotechnological inventions, may have severe consequences for human development (Kim, 2020, p. 447). For instance, this was the case with the so-called Onco-mouse patent application (*Transgenic animals/HARVARD*, 2004).

Thus, from the previously explored philosophical concepts, it can be concluded that the philosophical approach *per se* does not justify he right to be called "inventor" under the EPC only for humans. Despite the aforementioned, the DABUS case has outlined that the EPO does not support the attribution of an inventive role to machines due to the lack of their legal capacity. What can be concluded as a result of analyses incorporated within section 3 of this article is that, although the term "legal capacity" entails ambiguity regarding its interpretation, it would seem to be too revolutionary to also exclude from its scope persons that lack legal capacity, such as minors. Although legally incapacitated persons may lack consciousness or understanding of their activities, that does not necessarily mean that these persons cannot invent. In these situations, the inventive role would be attributed to the incapacitated person and not the persons that provided nurture. Analogous observations are also attributed to "co-inventorship".

Nevertheless, the EPO has not taken a similar approach regarding recognition of the role of AI in the inventive process, not beyond solely as a tool. Namely, contrary to the position of the inventive role of legally incapacitated persons, the EPO takes a stand that there is always a human behind AI; thus, the role of AI in the inventive process cannot exceed more than just a tool. Hence, it appears that the EPC entails a plurality of aspects defining the concept of an "inventor", seemingly addressing an incentive for innovation of creators.

The understanding of the concept of "inventor" in general also depends on cognitive position (Kim et al., 2022, p. 26). As was outlined, the current stand for an "inventor" under the EPC as only a human lies in the aspect that only humans may have incentives to innovate. Hence, only the role of a human in the inventive process should be recognized. Thereby, considering whether the accepted meaning of an "inventor" under the EPC still addresses the incentive to innovate, it should be determined what constitutes an incentive for innovation and whether the reflection of the role of AI in the inventive process would impact the incentive to innovate.

3. An incentive to innovate

The general stance is that the inventor is the first owner of the invention (Shemtov, 2019, pp. 11). Nonetheless, there exist exceptions within the national jurisdictions; for instance, in the Netherlands (The Dutch Patent Act, 2009), France (Intellectual Property Code, 1994), and Japan (Patent Act, 1959), where the law attributes the first ownership to an employer in the employment relationships. Therefore, jurisdictions without assignment of ownership rights or based on law leave the discretion for the respective employees and employers to agree on whether the first owner of the invention should be an employee instead.

The monopoly theory stipulates that the incentive to innovate stems from the moral and financial reward since the purpose of the patent is to promote scientific development by ensuring the protection of the rights of the inventor and the owner. The mentioned social contract represents the disclosure of the working principles of the invention, promoting scientific development in return for monopoly rights (Carlson, 2020).

Another theory stipulates that the incentive to innovate does not depend on the possibility of obtaining monopoly rights but rather on the chance of gaining any benefit that, in turn, increases competition. It is attributed to the fact that no barriers exist to entering the market to various patent approaches that solve an identical technical problem for inventions involving, for example, natural resources. Thus, the patent framework facilitates fair competition,

not allowing a patent to be granted without personal innovative efforts. In this regard, anyone can be an inventor, not only the one with a monopoly of resources (Pretnar, 2009, pp. 847–851).

There is a stance that recognition of the role of AI in the inventive process would benefit only those with considerable resources constituting monopoly rights (McLaughlin, 2018, p. 26). Nevertheless, an opposing view reflects that due to the involvement of AI, on the contrary, especially in the biotechnology field, the number of researchers has increased (Lee et al., 2021, p. 44). This is also attributed to the reduction of costs for large-scale computation exceeding the amount of genetic data processing which could most efficiently be done by applying deep learning (Ravid, 2018, p. 2241). The mentioned contradicting view could also be supported by the fact that, for instance, the EPC does not limit the number of inventions per actor, actors per invention, or co-existence of similar inventions by multiple actors. Thus, it derives that everyone has an equal opportunity to be an inventor under the EPC. Besides, the EPC does not preclude the *modus operandi* of creating an invention – whether by accident, luck, lengthy efforts, circumventing existing patents, or others. Hence, it appears that, amongst both of the mentioned theories, the incentive of the involvement of AI in the inventive process lies not in the monopoly purposes but rather in gaining any benefit that, in turn, increases competition.

The view exists that the role of AI in the inventive process should not be recognized since AI does not need more than electricity (Samuelson, 1985, p. 1199). However, it can be deemed that in the patent framework, the needs of an inventor are equally important as the needs of the general public. In other words, the benefit for an inventor should correspond to the benefit for society. Namely, the goal of the patent is also to enrich general knowledge. However, for instance, there could exist the legitimate aim for an inventor not to render an invention public, such as in cases of inventions for defense purposes (Agreement for the Mutual Safeguarding, 1960), which prevails in the public interest to gain publicly available information about the invention. In this case, the primary benefit for the society would be not obtaining available information about an invention but rather public defense.

Analogous to this, there could exist an interest of an inventor not to gain a personal benefit but to enrich general knowledge as a primary goal to obtain a patent. Thus, instead of personal financial benefit, an incentive for an inventor is to provide a benefit for society. For instance, the incentives behind the DABUS case were not to obtain monopoly rights but: 1) to enrich the common general knowledge; 2) to facilitate scientific progress; and 3) not to dilute the patent legal framework by allowing humans to usurp the reward, thus creating economic stability (Abbott, 2020, pp. 12, 72).

In conclusion, the incentive to invent is not intrinsically linked to a desire to obtain ownership. Instead, ownership follows from a created invention, but does not automatically indicate possession since there are also concepts stipulating attribution of ownership not to a creator but, for instance, to the employer or contractor without a separate assignment (Intellectual Property Code, 1994; The Dutch Patent Act, 2009; Patent Act, 1959). In addition, in the field of innovations involving AI, there exists both: 1) the incentive to innovate in general; and 2) the desire for the recognition of the AI role in the inventive process. Furthermore, in the case of inventions created by incapacitated persons, the legal representative is obliged to pursue the best interests of the respective person. This may also comprise submitting the patent application on behalf of an incapacitated person. Similarly, it appears that an incentive for the role of AI in the inventive process to be recognized appears to be rather primarily related to enriching general public knowledge, facilitating scientific progress, and providing stability by not allowing humans to usurp unrelated rewards for labor conducted by AI. Hence, financial reward due to gaining a patent does not seem to be the main reason behind an incentive to innovate in these cases.

Therefore, due to the development of new technologies, the concept of an “inventor”, at least in the industry, is shifting towards pluralism. Since the mentioned incentives are present, the potential solutions to address the incentive should be observed.

4. Solutions to address the inventive role of AI

4.1. Solutions that involve amendments to the EPC legal framework

As outlined in previous sections, the decisions by the Board of Appeals of the EPO (hereinafter – EPO BA) in cases J 8/20 ruled that under the EPC, only a human can be an inventor mentioned in the application and that machines do not have the legal capacity to transfer rights to a human. In this regard, the mentioned decisions signalize that EPO treats AI solely as a tool under the existing EPC legal framework. Moreover, the wording by the EPO BA does not even presume that recognition of the inventive role by a subject other than a human could be compatible with the EPC. Hence, the approach by the EPO differs from its stand toward products of nature. In other words, according to Article 52(1)(a) EPC, a purely natural phenomenon is not patentable (cannot be usurped) because it lacks an innovative element or technical teaching. However, concerning inventions involving AI, the EPO does not follow a similar path allowing usurpation of creations.

Thus, it appears that unless AI reaches a singularity level, it is hardly likely that the inventive role of a machine, regardless of its legal form, would be recognized under the EPC legal framework. Thereby, none of the following approaches would be potentially recognized by the EPO: 1) *sui generis* electronic personhood for AI (EP, 2017). Nonetheless, there is opposition to the approach of AI as a legal person (presumably, in the sense of Commercial Law) by other actors in the field of AI, for instance, UNESCO (2021, p. 16); 2) personhood for AI similarly as for inanimate objects (*Sierra Club v. Morton*, 1972) for the purposes of being recognized as a "co-inventor" or "co-contributor" only in a moral sense (proposed by the author); and 3) status as a legal person for AI similar as is under the Inheritance Law (proposed by author), for instance, in Latvia (Civil Law, 1937, Provision 383), according to which an estate is a legal person that may acquire rights and assume obligations. A human acts as a legal guardian or a trustee of an estate to guarantee civil stability. *Mutatis mutandis*, the approach could embrace only the ability for AI to have the right equated with a "co-inventor" in a moral sense. A human would act as an owner of the invention based on the law without additional succession. Besides, a human would also have to act as a trustee and legal guardian for AI in other legal matters based on law.

Another approach that could be taken but most likely will not be supported by the EPO for the reasons mentioned previously would be recognition of the role of AI as a "contributor" or "co-contributor" in output generation. Germany has taken the direction of this approach in DABUS applications DE 10 2019 128 120 (*Food container*, 2020) and DE 10 2019 129 136.4 (*Devices and methods for attracting enhanced attention*, 2020) (hereinafter – applications DE 10 2019 128 120 and DE 10 2019 129 136.4). In delineating, the patent office, similarly to the EPO, stated that an "inventor" mentioned in the application could be a human. However, conversely to the EPO, the German Federal Patent Court, in a decision that is not yet publicly available, took the stance that the involvement of a computer represented by a human could be mentioned in the application (O'Neil, 2021).

Interestingly, Germany was one of the countries that took an active role in designing the concept of an "inventor" under the EPC (Article 60 E Travaux Préparatoires, 1973; Article 81 Travaux Préparatoires, 1973). However, the EPC was implemented before the emergence of AI. Thus, the fact that Germany took an approach also may signal that there is a development of pluralism in the AI role in the inventive process.

It should be noted that the German Federal Patent Court (hereinafter – GFPC), similarly to the EPO BA, dealt not with the substance of an "inventor" but with the designation of the inventor in the application (O'Neil, 2021). Nevertheless, considering discussions reflected in the travaux préparatoires (Article 60 E Travaux Préparatoires, 1973; Article 81 Travaux Préparatoires, 1973), the substance of an "inventor" under the EPC refers only to a human. Hence, the motivation of the GFPC could be to find a compromise between an incentive for the role of AI in the patent framework to be recognized and not diluting the respective legal system. However, as mentioned before, the GFPC dealt only with aspects of the formal side of an application. Considering that the GFPC also stated that an "inventor" could only be a human, the approach suggested by the GFPC that the involvement of a computer could be mentioned in the application would still not address an incentive for the role of AI in the inventive process to be recognized not only as a tool.

Alternatively, proposals to leave the block of the designation of the inventor in the patent application blank and to mention only a legal person as an owner have been suggested (O'Neil, 2021). None of these approaches might be supported under the EPC despite the incentives. Namely, Rule 20 EPC allows an inventor to waive rights to be mentioned as an inventor. In this regard, even if a human has been partly involved in the inventive process, a waiver of rights would still not provide information on the role of AI in a particular inventive process, not addressing the incentive to innovate. Hence, the solution would not address the previously mentioned incentive to innovate.

Furthermore, the designation of a legal person as an owner would also require conceptual amendments to the EPC. In other words, the EPC, as also reflected in the travaux préparatoires (Article 60 E Travaux Préparatoires, 1973; Article 81 Travaux Préparatoires, 1973), precludes the designation of a legal person as an attributer of personal rights. Hence, conversely to countries that by law allow for an employer (Intellectual Property Code, 1994; the Dutch Patent Act, 2009; Patent Act, 1959) to be an inventor also in personal rights, the EPC does not follow a similar path. This suggestion would not correlate with the ruling by the EPO BA in cases J 8/20 and J 9/20 that a machine is not entitled under the EPC to transfer rights, including rights to apply for a patent on behalf of a machine. Thus, it appears that the EPO would hardly likely support the proposal.

Moreover, the DABUS application has also been denied in the United Kingdom (*Thaler v. The Comptroller-General of Patents, Designs And Trade Marks*, 2020) and in the United States of America (*Thaler v. Hirshfeld*, 2021), stipulating similar reasoning as the EPO BA in cases J 8/20, J 9/20. Conversely, the patent for DABUS indicated as an inventor has been granted in South Africa (DABUS, 2021, p. 255) and ruled in favor of in Australia (*Thaler v. Commissioner of Patents*, 2021).

It is worth mentioning that the Federal Court of Australia (hereinafter – FCA) initiated to interpret the term "inventor" not grammatically but as a living instrument in the present-day context to fulfill the social contract between an incentive to innovate and patent protection. The court also recognized that algorithms with such a complex architecture as the DABUS could be deemed semi-autonomous or even autonomous. Furthermore, the FCA ruled that AI can be an inventor but not an applicant or a patent grantee. It was also noted that the "derivation" of rights is not limited to "assignment" since the owner can be entitled to fruits yielded by its possession (*Thaler v. Commissioner of Patents*, 2021, pp. 124, 126, 189, 198, 226).

It derives that the judgment by the FCA follows the direction of proposals two and three outlined above – recognition of moral rights for AI as an inventor and ownership rights for a human. Simultaneously, the FCA takes an approach to the derivation of rights based on possession of AI, not based on law. In this regard, the FCA proposes an approach different from that existing under the employment relationships for possession of inventions. Instead, it seems that the path of the FCA is a mixture between property rights and intellectual property rights. The EPO BA has not followed this approach, since it enacted its ruling in cases J 8/20 and J 9/20 after the FCA.

Therefore, it appears that under the current patent framework evolves legal pluralism toward the role of AI in the inventive process. Considering that the concept of an "inventor" is a subject of the national law (European Commission Directorate-General for Communications Networks, Content and Technology, 2020, p. 9) and following the outcomes of observed DABUS patent applications, the decentralized approach to the role of AI in the inventive process prevails. Thus, it seems that the role of AI in the inventive process not only as a tool could be more likely recognized: 1) in patent systems that intend to interpret the concept of an "inventor" as a living instrument like in Australia (*Thaler v. Commissioner of Patents*, 2021); and 2) under national patents in countries that do not attribute the concept of an "inventor" solely to a natural person – for instance, Cyprus, Monaco (EPO, 2019, p. 4).

4.2. Certification

Considering that most likely none of the previously mentioned approaches would be currently supported under the EPC or the concept of an "inventor" broadened, the author proposes certification as an alternative path to solutions mentioned in the former sub-section that would require conceptual amendments of the EPC for the role

of AI in the inventive process to be recognized not only as a tool. Namely, certification as a *sui generis* mechanism could be an alternative to the protection under the EPC in countries of its territorial jurisdiction. This approach could be introduced as a voluntary primary for inventions where the role of AI not only as a tool in the inventive process is desired to be recognized, but also available for other inventions involving AI if chosen.

In more detail, the certification could be introduced as *sui generis* mechanism similarly as, for instance: 1) in the electricity market (Norwig, 2020), where a certificate approves the possession of a particular amount of generated electricity by the owner (Karakosta & Petropoulou, 2021, p. 2); 2) for medical devices also comprising medical devices applying AI (EP, 2017); and 3) as suggested by the so-called AI Act (European Commission, 2021). Despite the criticism towards the specifics of the certification proposed in the AI Act (Ebers, 2021; Ebers et al., 2021, pp. 589, 595), it can be deemed that the proposal emphasizes the extraordinariness of AI from other phenomena due to which there is a necessity to introduce an AI-specific, *sui generis* legal framework.

In this regard, analogous to electricity, a certificate could *mutatis mutandis* affirm the role of AI in creating a particular invention. Simultaneously, a certificate could act as a tracking mechanism for the state-of-the-art and prior art for AI involvement in the inventive process. Thus, it could provide legal certainty on the extent of human input in the inventive process. At the same time, the certification could address the increasing incentive to innovate if the role of AI in the inventive process is recognized not only as a tool. Namely, it would be possible to alienate the certificate as other assets, depriving others of obtaining the certificate for the same invention. Additionally, it would be possible to allow others to use the certified invention in return for compensation or as gratuitous, similar to patents under the EPC. Hence, the certification would also, simultaneously, provide a financial benefit for its owners in the respective area if desired. Additionally, rendering public all the inventions to which certificates will be issued could also promote scientific development and enrich general public knowledge.

As was mentioned before, an incentive to innovate if the role of AI is recognized not only as a tool lies not primarily in a financial benefit but rather: 1) to complement the general public knowledge; 2) to improve scientific progress; and 3) to maintain economic stability or not to impair the patent legal framework by permitting natural persons to usurp undeserved reward of labor conducted by AI (Abbott, 2020, pp. 12, 72). Considering the aforementioned, certification would allow addressing all the outlined incentives. Namely, certification would not require one to settle for recognition of the role of AI in the inventive process, as would opting for protection under the EPC. Additionally, certification would also not require one to reconcile with a "covered" role of AI in the inventive process that would still not provide the complete disclosure as suggested by the GFPC (applications DE 10 2019 128 120 and DE 10 2019 129 136.4); thus, would not address the mentioned goals above. Opting for the stipulated approaches that would not allow for recognizing the true role of AI in the inventive process would instead disregard the respective, long-standing incentives to innovate (O'Neil, 2021).

Therefore, the *sui generis* certification could exist in parallel with the EPC patent legal framework, similar to the possibility of registering a utility model in many countries, for instance, Germany (World Intellectual Property Organization, n.d.). Furthermore, similarly to the utility models, choosing a certification would deprive patentability since an invention would already become state-of-the-art. However, *vice versa*, the certification would also prevent others from patenting an identical invention since the creation would already become public. Therefore, certification would not dilute the EPC but would provide economic stability by not allowing humans to usurp the undeserved reward for labor that, in reality, would be deemed conducted by AI. Certification would also provide a benefit by facilitating fair competition. Namely, certification would allow humans to "compete" with humans and AI with AI. Hence, it would entail economic stability by disclosing to the public the true role of humans and AI in the inventive process, not permitting usurpation of the reward for non-conducted labor. Thus, certification would provide a choice as to whether to reconcile with the recognition of the role of AI as not more than a tool and to apply for a patent under then EPC or to opt for certification.

Additionally, unlike the utility model, the evaluation criteria for *sui generis* certification could require equally stringent criteria of the invention as a patent under the EPC except for the possibility of recognizing the role of AI in the inventive process, not solely as a tool. The protection period or validity of a certificate could be less than for a patent depending on the extent of the role of AI in the inventive process. At the same time, certification could provide a proper and justified reward for the creative efforts of a human, not diminishing the incentive to

innovate. The justification is that inventive activity for AI could require less effort than is required for a human. Hence, the protection time could be diminished accordingly.

In turn, the evaluation period to issue a certificate could be equal to or lower than for a patent depending on the evaluation criteria, namely, whether, for instance, the "non-obviousness" element would be equally stringent since AI will act as a "co-contributor" in the inventive process. Furthermore, certification fees could be equal to or less than for a patent depending on the designated competent authority – patent office or other – to evaluate the invention and grant a certificate. One approach could be to unify the certification proposed in the article with the certification suggested by the AI Act and performed by a legitimized body. Namely, the certification proposed in the AI Act could be a starting platform and could be adjusted to evaluate the role of AI in the inventive process. A variety of certificates could be issued depending on necessity.

The proposed certification is suggested as voluntary and not an additional, mandatory procedure, especially in fields with already existing certifications as for medical devices (Regulation (EU) 2017/745 and (EU) 2017/746). Thus, no additional, objectionable administrative onus would be imposed on the involved parties by the proposed certification. Moreover, the AI Act foresees compulsory certification for AI algorithms of a particular risk that are also intended to be placed in the market in the European Union (hereinafter– EU). Besides, many member states of the EPC (EPO, 2022) are also bound by the AI Act. Thus, a unified certification approach could save resources for all the involved stakeholders due to the ability to conduct centralized certification.

During the proposed certification, the main focus would be evaluating technical aspects of the role of AI in a particular inventive process, not examining the ethical and moral justification of the output. Nevertheless, those additional observations could be verified if desired by those that would opt for it. This option could aid in alleviating the administrative burden of undergoing multiple certifications for several purposes. In other words, it appears that the AI Act renders said regulatory framework for AI as a part of the novel public order. Hence, if the AI Act is enacted, then certain-risk algorithms intended to be placed in the market in the EU would also have to comply with the introduced moral and ethical considerations. Hence, an opportunity to undergo unified certification could relieve the onus.

Furthermore, the role of AI in the certificate would be recognized in a moral sense, mentioning it, for instance, as a "co-contributor" in the inventive process along with the respective humans. The owner and applicant for a proposed certificate would be a human. Similarly, a human would also exercise other legal matters, thus, acting as a trustee, legal guardian for AI based on law. Hence, no additional contractual assignment of rights would be required.

This approach could primarily be of interest to actors that would want to place the invention in the market in the EU and, at the same time, for the AI inventive role to be recognized not only as a tool. Nonetheless, this suggestion could also be considered for territories outside the scope of the EPC. Furthermore, a combined approach could be considered for territories with utility models.

The incorporation of certification would require both political *consensus* and also respective legal adjustments. Nevertheless, certification would not require amending the EPC. Therefore, incorporating certification would not impair the current legal framework of the EPC. Instead, certification would provide an opportunity not to hide the role of AI in the inventive process. Hence, certification would allow maintaining economic stability by providing trustworthy information on the role of AI in the inventive process. Thus, certification would not permit humans to usurp the reward of labor, in reality, conducted by AI, publicly disclosing it. In this regard, certification would facilitate the enrichment of general public knowledge since the society would obtain comprehensive information about the invention and involved actors. Thereby, certification would: provide a proper reward in cases of inventions involving AI; not deprive an incentive to innovate toward those that desire the role of AI to be recognized in the inventive process not solely as a tool; and not dilute the existing EPC legal framework.

Conclusions

AI and its sub-field ML have a considerable capacity to improve various aspects of society. Due to increasing computation power and decreasing respective expenditures, AI and ML have numerous applications, for instance, in health care, drug discovery, and others. Consequently, augmentation of the complexity of ML models leads closer to the singularity of AI.

More and more incentives to innovate are related primarily not to gaining either monopoly rights or any benefit that aids in diminishing losses. Instead, an increasing incentive exists to enrich common general knowledge and promote economic stability by recognizing the role of AI in the inventive process beyond its use solely as a tool. In other words, usurpation of reward is not supported by labor conducted by AI by indicating a human either or also as an inventor.

Nevertheless, the EPC was designed before the emergence of AI and also incorporated labor theory, recognizing only humans with a legal capacity as inventors. The author deems that the EPC *per se* incorporates legal pluralism since even legally incapacitated humans, for example, minors, could invent without consciousness of innovative conception.

During the development process of Articles 60, 81 of the EPC, the proposal to cover legal persons under the concept of an "inventor" was not supported. The EPO BA in cases J 8/20 and J 9/20 basically reaffirmed the approach reflected in the respective travaux préparatoires. In this regard, contrary to the FCA, the EPO BA has not opted for the interpretation of the concept of an "inventor" as a living instrument in the present-day context. Based on the above, most likely, none of the following listed approaches proposed in the literature and intended for the role of AI to be recognized in the inventive process not solely as a tool under the EPC would be supported:

1) *sui generis* electronic personhood for AI; 2) in parallel with a human inventor, where the involvement of a computer represented by a human could be mentioned in the application; 3) to leave the block of the designation of the inventor in the patent application blank and to mention only a legal person as an owner; or 4) designation of a legal person as an owner.

An analogous argument is attributed for approaches that the author has added to address the role of AI in the inventive process under the EPC not only as a tool: 1) personhood for AI similarly as for inanimate objects for the purposes of being recognized as a "co-inventor" or "co-contributor" only in a moral sense; 2) status as a legal person for AI similarly as is under the Inheritance Law, for instance, in Latvia. This approach could embrace only the ability for AI to have the right equated with a "co-inventor" in a moral sense – a human would act as the owner of the invention based on the law without additional succession and as a trustee or legal guardian for AI in other legal matters based on law; and 3) recognition of AI as a "contributor" or "co-contributor" in output generation. The role of a human would be similar to that mentioned in the previous clause.

Namely, the outlined proposals would require conceptual amendments to the EPC. Nevertheless, the so-called DABUS case has reflected that the stance of the EPO is not in favor of the respective amendments. Hence, none of the listed suggestions would serve as a solution to balance an incentive to innovate if the role of AI is recognized not solely as a tool in the inventive process with the legal framework of the EPC.

Consequently, under the existing patent frameworks, the role of AI in the inventive process could be more likely recognized: a) in patent systems that intend to interpret the concept of an "inventor" as a living instrument like in Australia; and b) under national patents in countries that do not attribute the concept of an "inventor" solely to a natural person – for instance, Cyprus, Monaco.

It derives that under the current EPC legal framework, AI is, and probably will be until it reaches singularity, considered solely as a tool in the hands of a human inventor. As a remedy for recognizing the role of AI in the inventive process and addressing the respective incentive to innovate, the author proposes certification. The *sui generis* voluntary approach could exist in parallel with the EPC primarily to recognize the role of AI in the inventive process and could be available for others as well if desired. The certification suggested in the AI Act

could be used as a starting point to diminish administrative burden. It should be adjusted and rendered centrally, with certification as proposed in the article. Said certification could exist along with the systems of utility models, or a unified system could even be considered.

The suggested certification would require respective political choices and legal amendments. However, simultaneously, it would not dilute the EPC legal framework and would remedy an incentive to innovate if the role of AI as not only a tool in the inventive process was recognized.

References

Abbott, R. (2020). *The reasonable robot. Artificial intelligence and law*. Cambridge University Press

Agreement for the Mutual Safeguarding of Secrecy of Inventions Relating to Defense and for Which Applications for Patents Have Been Made, No. 5664 (1960). *UNTS*, *394*. Retrieved on May 1, 2022, from https://treaties.un.org/doc/Publication/UNTS/Volume%20394/volume-394-I-5664-English.pdf

AP-1 complex, SALK INSTITUTE, European Patent Office Boards of Appeal T 0609/02 (2004). ECLI:EP:BA:2004:T060902.20041027. Retrieved on May 1, 2022, from https://www.epo.org/law-practice/case-law-appeals/recent/t020609eu1.html

Article 60 E Travaux Préparatoires (1973). European Patent Office. Retrieved on May 1, 2022, from https://www.epo.org/law-practice/legal-texts/epc/archive/epc-1973/traveaux

Article 81 E Travaux Préparatoires (1973). European Patent Office. Retrieved on May 1, 2022, from https://www.epo.org/law-practice/legal-texts/epc/archive/epc-1973/traveaux

Association for Molecular Pathology v. Myriad Genetics, 569 U.S. 576 (2013). Retrieved on May 1, 2022, from https://supreme.justia.com/cases/federal/us/569/576/

Brenner v. Manson, 383 U.S. 519 (1966). Retrieved on May 1, 2022, from https://supreme.justia.com/cases/federal/us/383/519/.

CARDIAC/Correction of mistake, European Patent Office Boards of Appeal J 0018/93 (1997). ECLI:EP:BA:1994:J001893.19940902. Retrieved on May 1, 2022, from https://www.epo.org/law-practice/case-law-appeals/recent/j930018ep1.html

Carlson, E. K. (2020). Artificial intelligence can invent but not patent – for now. *Engineering*, *6*(11), 1212–1213. https://doi.org/10.1016/j.eng.2020.09.003

Civil Law, Latvijas Vēstnesis, 41 (1937). Retrieved on May 1, 2022, from https://likumi.lv/ta/en/en/id/225418

Continental Paper Bag v. Eastern Paper Bag, 210 U.S. 405 (1908). Retrieved on May 1, 2022, from https://supreme.justia.com/cases/federal/us/210/405/

DABUS. (2021). (ZA2021/03242). *Patent Journal*, *54*(7), 255. Retrieved on May 1, 2022, from https://iponline.cipc.co.za/Publications/PublishedJournals/E_Journal_July%202021%20Part%202.pdf

Devices and methods for attracting enhanced attention (2020). (DE 10 2019 129 136.4). Deutsches Patent- und Markenamt. Retrieved on May 1, 2022, from https://register.dpma.de/DPMAregister/pat/register?AKZ=1020191291364

Devices and methods for attracting enhanced attention, European Patent Office Boards of Appeal J0009/20 (2021). Retrieved on May 1, 2022, from https://register.epo.org/application?lng=en&number=EP18275174

Drahos, P. (2016). *A philosophy of intellectual property*. Australian National University eText. Retrieved from https://press-files.anu.edu.au/downloads/press/n1902/pdf/book.pdf

Ebers, M. (2021). Standardizing AI – The case of the European Commission's proposal for an Artificial Intelligence Act. In L. A. DiMatteo, C. Poncibò,niversità degli Studi di Torino, Italy, Michel Cannarsa (eds.), *The Cambridge Handbook of Artificial Intelligence: Global Perspectives on Law and Ethics*, forthcoming. Advance online publication retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3900378

Ebers, M., Hoch, V. R. S., Rosenkranz, F., Ruschemeier, H., & Steinrötter B. (2021). The European Commission's proposal for an Artificial Intelligence Act – A critical assessment by members of the Robotics and AI Law Society (RAILS). *J*, *4*(4), 589–603. https://doi.org/10.3390/j4040043

Eco, U. (1986). *Art and beauty in the Middle Ages*. New Haven: Yale University Press

European Commission. (2021). Proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain union legislative acts. COM (2021) 206 final. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0206

European Commission Directorate-General for Communications Networks, Content and Technology. (2020). *Trends and developments in artificial intelligence: Challenges to the Intellectual Property Rights Framework: Final report.* Publication Office of the European Union. Retrieved from https://op.europa.eu/en/publication-detail/-/publication/394345a1-2ecf-11eb-b27b-01aa75ed71a1/language-en

European Parliament. (2017). European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)). Retrieved on May 1, 2022, from https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_EN.html

European Parliament. (2019). *Report on a comprehensive European industrial policy on artificial intelligence and robotics (2018/2088(INI))*. Retrieved on May 1, 2022, from https://www.europarl.europa.eu/doceo/document/A-8-2019-0019_EN.html

European Patent Office. (2019). Legal aspects of patenting inventions involving artificial intelligence (AI). Summary of feedback by EPC contracting states. Retrieved on May 1, 2022, from http://documents.epo.org

European Patent Office. (2020, January 28). *EPO publishes grounds for its decision to refuse two patent applications naming a machine as inventor* [Press release]. Retrieved from https://www.epo.org/news-events/news/2020/20200128.html.

European Patent Office. (2021). *Inventorship of AI Inventions.* Artificial Intelligence. Last updated May 1, 2022, retrieved from https://www.epo.org/news-events/in-focus/ict/artificial-intelligence.html

European Patent Office. (2022). Member states of the European Patent Organisation. Retrieved on May 1, 2022, from https://www.epo.org/about-us/foundation/member-states.html
Feldmann, C., & Bajorath, J. (2020). Compounds with multitarget activity: structure-based analysis and machine learning. *Future Drug Discovery, 2*(3), 1–2. https://doi.org/10.4155/fdd-2020-0014
Food container (2020). (DE 10 2019 128 120). Deutsches Patent- und Markenamt. Retrieved on May 1, 2022, from https://register.dpma.de/DPMAregister/pat/register?AKZ=1020191281202
Food container, European Patent Office Boards of Appeal J0008/20 (2021). Retrieved on May 1, 2022, from https://register.epo.org/application?lng=en&number=EP18275163
Haedicke, M., & Timmann, H. (2014). *Patent law: A handbook on European and German patent law*. München: Verlag C. H. Beck.
Hughes J. (1988). The philosophy of intellectual property. *The Georgetown Law Journal*, 77. Retrieved on 1 May, 2002, from https://cyber.harvard.edu/IPCoop/88hugh.html
Implementing Regulations to the Convention on the Grant of European Patents of 5 October 1973, 17th ed., (2020). Retrieved on May 1, 2022, from https://www.epo.org/law-practice/legal-texts/html/epc/2020/e/EPC_reg_20200701_en_20201208.pdf
Intellectual Property Code, No. 94-102 (1994). Retrieved on May 1, 2022, from https://www.wipo.int/edocs/lexdocs/laws/en/fr/fr467en.pdf
Karakosta, Q., & Petropoulou, D. (2021). *The electricity market: Renewables targets, Tradeable Green Certificates and electricity trade*. http://dx.doi.org/10.2139/ssrn.3828184
Kim, D. (2020). 'AI-generated inventions': Time to get the record straight? *GRUR International, 69*(5), 443–456. https://doi.org/10.1093/grurint/ikaa061
Kim, D., Alber, M., Kwok, M. W., Mitrovič, J., Ramirez-Atencia, C., Rodríguez Pérez, J. A., & Zille, H. (2022). Clarifying assumptions about artificial intelligence before revolutionising patent law. *GRUR International*, *71*(4), 295–321. https://doi.org/10.1093/grurint/ikab174
Koza, J. R. (2010). Human-competitive results produced by genetic programming. *Genetic Programming and Evolvable Machines*, *11*, 251–284. https://doi.org/10.1007/s10710-010-9112-3
Koza, J. R., Keane, M. A., Streeter, M. J., Mydlowec, W., Yu, J., & Lanza, G. (2003). *Genetic programming IV: Routine human-competitive machine intelligence* (1st ed.). Kluwer Academic Publishers.
Lalli, G., Schott, J. M., Hardy, J., & De Strooper, B. (2021). Aducanumab: A new phase in therapeutic development for Alzheimer's disease? *EMBO Molecular Medicine*, *13*(8), e14781. https://doi.org/10.15252/emmm.202114781
Lee, J. A., Hilty, R. M., & Liu, K. C. (Eds.). (2021). *Artificial intelligence & intellectual property*. Oxford University Press.
Locke, J. (Ed.). (1980). *Second Treatise of Government* (1st ed.). Hackett Publishing Company
Maini, V., & Sabri, S. (2017). *Machine learning for humans*. Retrieved on May 1, 2022, from https://everythingcomputerscience.com/books/Machine%20Learning%20for%20Humans.pdf
Mazer v. Stein, 347 U.S. 201 (1954). Retrieved on May 1, 2022, from https://supreme.justia.com/cases/federal/us/347/201
McLaughlin, M. (2018). *Computer-generated inventions*. http://dx.doi.org/10.2139/ssrn.3097822
Mueller, J. M. (2006). *Aspen Treatise for Patent Law* (6th ed.). Wolters Kluwer.
Muir, I., Brandi-Dohrn, M., & Gruber, S. (1999). *European patent law. Law and procedure under the EPC and PCT*. Oxford University Press.
Norwig, P. (2020, December 9). Bridging AI's trust gaps, fireside chat 'Responsible AI' [Panel discussion]. Reuters Events Virtual Forum Momentum "Overcome Global Challenges and Build a Better Future through Technology". Retrieved on May 1, 2022, from https://reutersevents.com/events/momentum/content-thank-you.php
O'Neil, R. (2021, December 2). German DABUS ruling could plot road to AI inventorship. *Managing IP*. Retrieved on May 1, 2022, from https://www.managingip.com/article/b1vq10wwqkj4pb/german-dabus-ruling-could-plot-road-to-ai-inventorship
Patent Act, 121 (1959). Retrieved on May 1, 2022, from https://www.wipo.int/edocs/lexdocs/laws/en/jp/jp206en
Patents Act, 18 d. No. I-372 (1994). *Valstybės žinios*, 1994-01-28, No. 8-120. Retrieved on May 1, 2022, from https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.5705/asr
Patents Act, RT I 1994, 25, 406 (1994). Retrieved on May 1, 2022, from https://www.riigiteataja.ee/en/eli/511112013016/consolide
Patent Law (2007). *Latvijas Vēstnesis*, 34, 27.02.2007. Retrieved on May 1, 2022, from https://likumi.lv/ta/en/en/id/153574
Pila, J., & Torremans, P. (2019). *European intellectual property law* (2nd ed.). Oxford University Press
Pretnar, B. (2009). Patents and economic incentive to invent. In Pyrmont, W. P. W., Adelman, M. J., Brauneis, R., Drexl, J., & Nack, R. (Eds.), *Patents and technological progress in a globalized world. MPI studies on intellectual property, competition and tax law, Vol. 6* (pp 841–852). Springer. https://doi.org/10.1007/978-3-540-88743-0_58
Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017 on medical devices, amending Directive 2001/83/EC, Regulation (EC) No 178/2002 and Regulation (EC) No 1223/2009 and repealing Council Directives 90/385/EEC and 93/42/EEC (2017). OJ L 117, 5.5.2017, pp. 1–175. http://data.europa.eu/eli/reg/2017/745/oj
Regulation (EU) 2017/746 of the European Parliament and of the Council of 5 April 2017 on in vitro diagnostic medical devices and repealing Directive 98/79/EC and Commission Decision 2010/227/EU (2017). OJ L 117, 5.5.2017, pp. 176–332. http://data.europa.eu/eli/reg/2017/746/oj
Rutter, M. (2006). *Genes and behavior: Nature-nurture interplay explained*. Blackwell Publishing.
Samuelson, P. (1985). Allocating ownership rights in computer-generated works. *University of Pittsburg Law Review*, *47*(1185), 1985–1228. Retrieved on May 1, 2022, from https://lawcat.berkeley.edu/record/1112407
Sevahula, R. K., Au-Yeung, W. M., Singh, J. P., Heist, K. Isselbacher, E. M., & Armoundas, A.A. (2020). State-of-the-art machine learning techniques aiming to improve patient outcomes pertaining to the cardiovascular system. *Journal of the American Health Association*, *9*(4), e013924. https://doi.org/10.1161/JAHA.119.013924
Shemtov, N. (2019). *A study on inventorship in inventions involving AI activity* [Report]. Retrieved on May 1, 2022, from https://www.ml4patents.com/blog-posts/a-study-on-inventorship-in-inventions-involving-ai-activity-commissioned-by-the-european-patent-office
Sierra Club v. Morton, 405 U.S. 727 (1972). Retrieved on May 1, 2022, from https://supreme.justia.com/cases/federal/us/405/727/

Thaler v. Commissioner of Patents, Federal Court of Australia 879 (2021). Retrieved on May 1, 2022, from https://www.judgments.fedcourt.gov.au/judgments/Judgments/fca/single/2021/2021fca0879
Thaler v. Hirshfeld, 1:20-cv-903 (LMB/TCB) (2021). Retrieved on May 1, 2022, from https://artificialinventor.com/wp-content/uploads/2021/09/20210902-Dkt.-33-Memorandum-Opinion-3.pdf
Thaler v. The Comptroller-General of Patents, Designs and Trade Marks. England and Wales High Court 2412 (Pat) (2020). Retrieved on May 1, 2022, from https://www.bailii.org/ew/cases/EWHC/Patents/2020/2412.html
The Boards of Appeal of the European Patent Office (2021, December 21). Press Communiqué on decisions J 8/20 and J 9/20 of the Legal Board of Appeal. Retrieved on May 1, 2022, from https://www.epo.org/law-practice/case-law-appeals/communications/2021/20211221.html
The Convention on the Grant of European Patents, October 5, 1973. *UNTS*, *1065*, 254–509. Retrieved on May 1, 2022, from https://www.epo.org/law-practice/legal-texts/html/epc/1973/e/ma1.html
The Dutch Patent Act (2009). Retrieved on May 1, 2022, from https://www.ipeg.com/wp-content/uploads/2015/05/Dutch-Patent-Act_ROW95_ENG_non-official-translation.pdf
Transgenic animals/HARVARD, European Patent Office Boards of Appeal T 0315/03 (2004). ECLI:EP:BA:2004:T031503.20040706. Retrieved on May 1, 2022, from https://www.epo.org/law-practice/case-law-appeals/recent/t030315ex1.html
UNESCO. (2021). Draft text of the recommendation on the ethics of artificial intelligence. Retrieved on May 1, 2022, from https://unesdoc.unesco.org/ark:/48223/pf0000377897
WARHEIT/Identity of applicant, European Patent Office Boards of Appeal J 0025/86 (1987). ECLI:EP:BA:1986:J002586.19861114. Retrieved on May 1, 2022, from https://www.epo.org/law-practice/case-law-appeals/recent/j860025ep1.html
World Intellectual Property Organization. (n.d.). Utility models. Retrieved on May 1, 2022, from https://www.wipo.int/patents/en/topics/utility_models.html