

ARTIFICIAL INTELLIGENCE AND INVENTORSHIP UNDER THE PATENT LAW REGIME: PRACTICAL DEVELOPMENT FROM COMMON LAW JURISDICTIONS

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Abstract

Artificial intelligence (AI) is gradually becoming not only an emerging technology in the development policies and strategies for the national economy but also a significant challenge posed to various issues of law, including the patent law. Alongside the Industrial Revolution 4.0, the rapid technological and scientific advancement has enabled AI to approach the level of natural intelligence of humans or more. Nowadays, the development of technology has been demonstrated that AI is likely to autonomously generate inventions. In light of the fact that the identification of the inventor impacts the patentability of AI-generated inventions, this poses a new challenge regarding the inventorship of AI, with the most confusing question being whether AI should be recognized as an inventor. This article provides an overview of AI and patentability challenges to clarify the fundamental understanding of AI and material concerns regarding AI-generated inventions. Simultaneously, the authors examine the laws and practices in selected countries to provide the viewpoints of competent authorities on patent protection for AI-generated inventions and the inventorship of AI. Finally, the authors conclude with a discussion of the recognition of AI inventorship, patent protection for AI-generated inventions, an evaluation of the recognizability of Vietnamese patent law, and a call for further research on relevant matters.

Keywords: artificial intelligence, patent protection, inventorship, patentability, AI-generated inventions

The Industrial Revolution 4.0 is having a progressive impact on the evolution of humanity. Specifically, AI is considered one of the most cutting-edge technologies and the primary focus of the Fourth Industrial Revolution's growth. As a result, many countries are continuously enacting policies and promoting technological investment, and Vietnam is not an exception. AI technology plays an important role in the national economy as part of Vietnam's strategy on AI. Vietnam promotes research, development, and application of AI, situating Vietnam as a novel center for innovation, development of solutions and vigorous applications of AI.¹

The advent of AI has posed unprecedented challenges to the legal

1 Prime Minister's Decision No. 127/QĐ-TTg issuing the National Strategy on the Research, Development and Application of Artificial Intelligence until 2030.

system and national governance. In tandem with the advancement of science and technology, AI's capacity to do a growing number of tasks is being expanded. It is likely showed that AI has autonomously generated inventions.² As a result, there have been several inventions that are supposed to have been generated by AI in recent years, and such inventions have been filed for patent applications in some jurisdictions.³ One of the most important questions that needs to be solved is whether or not AI should be recognized as an inventor, because the inventorship of AI is a central concern that impacts the patentability as well as the commercial exploitation of AI-generated inventions. To ensure a substantive evaluation for patentability, an explicit identification of the inventorship of AI is required.

Nevertheless, in the 2022 revision of Vietnamese Law on Intellectual Property, there were no amendments or modifications regarding advanced technology, specifically in relation to AI. Consequently, it can be assumed that the Vietnamese patent law does not contain any AI-related regulations, and the competent authorities in Vietnam therefore would face a significant struggle when being challenged with the mentioned issue. Meanwhile, in the Prime Minister's AI development strategy, establishing and strengthening the legal framework for intellectual property rights, including the patent law related AI, could cause an urgent task that contribute to the advancement of AI research and practical application.⁴ As a result, until 2030, it is certain that Vietnam's legislature would update the current law on Intellectual Property and supplement the sub-law in order to be consistent with the national development orientation and the foundation of technological innovation. Therefore, vital and critical research on the relationship between intellectual property law and AI technology is required to achieve these essential goals. From this perspective, research on the inventorship of AI is preliminary and an essential foundation for future debates.

However, the new development requires new approaches to the legal aspect that diverge from the traditional rules. For this purpose, the article analyzes the following three issues: (i) the inventive ability of AI; (ii) the relationship between inventorship and patentability of AI-generated inventions; and (iii) the perspectives of selected common law jurisdictions,

2 Mathew B. R. (2020), 'Dr. Stephen Thaler speaks on how DABUS can invent', *The Artificial Inventor Project*, 15 July 2020. Retrieved from: <https://artificialinventor.com/467-2/> [accessed 22 September 2022].

3 Dr. Stephen Thaler and his team has filed patent application for DABUS-generated inventions in the United States, the United Kingdom, Australia, Germany, South Africa, Brazil, Canada, China, India, Israel, Japan, New Zealand, Republic of Korea, Saudi Arabia, Singapore, Switzerland, Taiwan, and Europe through PCT application.

4 Prime Minister's Decision No. 127/QĐ-TTg issuing the National Strategy on the Research, Development and Application of Artificial Intelligence until 2030.

including the United States, the United Kingdom, and Australia, on the recognition of AI as an inventor.

1. Overview of artificial intelligence

1.1. Definition of artificial intelligence

AI is one of the most significant scientific and technological breakthroughs of the Industrial Revolution 4.0. Being first discussed in the Dartmouth Summer Research Project, AI is defined as a field of research that “proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it”.⁵ The objective of this research project is to formalize and imitate intelligent human behavior, including processes, in a machine. AI, according to Elaine Rich, is “the study of how to make computers do things at which, at the moment, people are better”.⁶

Another definition for AI is “the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings”.⁷ AI can alternatively be defined as “the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings”.⁸

AI is basically divided into four approaches, including (i) thinking humanly, (ii) acting humanly, (iii) thinking rationally, (iv) acting rationally.⁹ On the basis of its function and technology, AI can be classified in two different ways. First, based on function, AI includes reactive machines, limited memory machines, theory of mind, and self-aware AI. Second, based on technology, AI includes Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Super intelligence (ASI).¹⁰

5 McCarthy J., Minsky M. L., Shannon C. E., Rochester N. (1955), *A proposal for the Dartmouth Summer Research Project on Artificial Intelligence*, Dartmouth Summer Research Project on Artificial Intelligence, Dartmouth College, p. 2.

6 Rich E., Knight K. (1991), *Artificial Intelligence*, 2nd edn, McGraw-Hill.

7 Copeland B. J. (2022), ‘Artificial intelligence’, *Encyclopedia Britannica*, 24 August 2022. Retrieved from: <https://www.britannica.com/technology/artificial-intelligence> [accessed 25 August 2022].

8 Committee on Technology (2016), ‘Executive Office of the President National Science and Technology Council, Preparing for the future of artificial intelligence’, Washington D.C., p. 6.

9 Mueller J. and Massaron L. (2018), *Artificial intelligence for dummies*, 1st edn, John Wiley & Sons, p. 12–13.

10 ANI can only perform a certain task, cannot do more than what they are programmed to accomplish, and hence have a very limited or narrow range of capabilities. This is the most common form of AI in use today. Meanwhile, AGI has the abilities of consciousness, objectivity, self-awareness, perception, and wisdom, and is able to create connections and generalize across domains, hence reducing training time. This type of AI equals human-level intelligence. Eventually, ASI will be more predictable, able to reason in ways that humans cannot comprehend, capable of making decisions and solving problems. This type of AI outpaces human intelligence and cognitive capacity.

As a result, the variety of definitions of AI throughout the globe has been arisen. Every significant AI researcher has proposed a unique definition of AI, and none of them is identical. In general, AI can be defined as software capable of executing behaviors associated with human intellect, such as the ability to perceive, the ability to argue, the ability to learn independently, and the ability to autonomously make decisions or solve issues. AI relies on its algorithms and capabilities to produce outputs that may or may not correspond to human expectations. Nevertheless, the lack of a common understanding and a clear definition of AI is one of the barriers to addressing concerns regarding patent protection for AI-generated inventions that legal scientists and policymakers did not provide when raising related questions. For the purpose of designing a legal framework for AI-generated inventions, the definition and concept of AI is certainly necessary to be determined, and the legal framework should be available in practice thereof, specifically the inventive ability of AI. The central technical concern of AI is whether AI has the ability to autonomously generate inventions; if not, any legal discussion regarding AI-generated inventions is rendered meaningless.

1.2. The autonomously inventive ability of artificial intelligence

In Vietnamese patent law, “personally create” is one of the most essential requirements for an inventor.¹¹ To clarify the patentability of AI-generated inventions, it is necessary to establish the autonomy of AI’s inventive process. If AI cannot autonomously invent and instead relies on humans, AI cannot be considered the subject who created the invention. There are currently contradictory opinions regarding whether or not AI has the ability to autonomously invent.

The first point of view is that there is no inventive ability in AI based on inventive activity, which is to create new things that have never existed before. By analyzing human thought processes mathematically and using experience-based learning, AI is able to create something novel. Since this method’s foundation is fundamentally algorithmic, it cannot be considered inventive.¹² The AI’s algorithm is, in its most fundamental form, merely an evolution of the original data input; it does not generate completely new outputs that are completely distinct to the data it receives.¹³ AI has absolutely no inventive ability and depends entirely on humans. Furthermore, the input data will serve as a guide for AI. Consequently, the results generated by the AI will depend on the input data – what the AI is learning — and will be constrained by

11 Law on Intellectual Property 2005, s 122 (1).

12 Mueller J. and Massaron L. (2018), *Artificial intelligence for dummies*, 1st edn, John Wiley & Sons, p. 226.

13 Mueller J. and Massaron L. (2018), *Artificial intelligence for dummies*, 1st edn, John Wiley & Sons, p. 227.

human orientation.¹⁴ Moreover, Professor Marcus du Sautoy views AI in a different way, as a “kind of catalyst to push our human creativity”.¹⁵

In contrast, the second point of view should be mentioned is that AI has the ability to be inventive, and depends on many factors. AI has creative and cognitive ability based on what it learns, even though it cannot achieve human levels of creativity. Consequently, AI retains the ability to generate inventions independently.¹⁶ AI will require self-awareness and introspective intelligence to reach this point.¹⁷ In other words, AI has the ability to invent within a given framework, because AI systems require input data for operation to perform all activities in general and inventive activities in particular. As a result, input data is the most fundamental foundation for AI to function. However, the input data will not be the determining factor for AI’s inventive output; rather, the technological advancements in AI are likely to have the most significant impact on the inventive process. Consequently, AI can still be considered to have inventive ability at present.

Regarding the autonomy of the inventive process of AI-generated inventions, the second point of view is likely consistent with current technological practice. Accordingly, AI will invent based on, but not dependent on, input data. Being programmed and supplied with data will not cause AI to lose its ability to autonomously invent. Input data is merely the most fundamental information necessary for AI to learn, remember, and thus engage in the inventive process, so AI should be regarded as autonomous. Moreover, it is AI technology, not input data, that plays a crucial role in such inventive processes. With the advancement of technology, AI is becoming less reliant on input data and increasingly capable of autonomously generating inventions. As a result, the autonomy of AI in the inventive process becomes more evident. In point of fact, AI has generated a plethora of novel, unexpected, and historically significant concepts. The development of AI technology has made significant and beneficial contributions to society, with applications in fields ranging from healthcare to self-driving vehicles and the creation of works of art. Notwithstanding, there is currently a lack of comprehensive research regarding the autonomously inventive ability of AI, which makes identifying relevant legal concerns ambiguous. Therefore,

14 Anantrasirichai N., Bull D. (2021), ‘Artificial intelligence in the creative industries: a review’, 55(1) *Artificial Intelligence Review*, pp. 589, 590.

15 Marr B. (2020), ‘Can Machines And Artificial Intelligence Be Creative?’, *Forbes*, 28 February 2020. Retrieved from: <https://www.forbes.com/sites/bernardmarr/2020/02/28/can-machines-and-artificial-intelligence-be-creative/?sh=64c9c19e4580> [accessed 21 September 2022].

16 Abbott R. (2016), ‘I Think, Therefore I Invent: Creative Computers and the Future of Patent Law’, 57(4) *Boston College Law Review*, pp. 1079, 1103.

17 Mueller J. and Massaron L. (2018), *Artificial intelligence for dummies*, 1st edn, John Wiley & Sons, p. 10.

no legal science research would be conducted in a rigorous manner unless the technical fundamentals of AI in autonomously inventive processes were clarified.

2. The impact of inventorship on patentability of AI-generated inventions

Patent law is based on a variety of legal theories, but the fundamental purpose of the patent system is to protect intellectual achievements, offset investment costs, encourage investment in the innovation process, and give owners the right and ability to commercially exploit the output from this process. Throughout the lengthy history of progress, when a new type of inventorship emerges, such as AI, certain theories may be no longer sufficient for patent protection. Nevertheless, based on the theory of contracts and the theory of incentives, it appears that the goal and motivation to protect AI-generated inventions still exist.¹⁸ In short, patent protection for AI-generated inventions ensures that the owner, the creator, or the investor of AI will get the benefits from the patented invention. Therefore, AI-generated inventions are still in need of protection. In addition, human-made invention or AI-generated invention is both an invention. If an AI-generated invention meets the patentability requirements, it should also be protected under the patent law regime. There is likely no reason to reject patent protection for an invention simply because it was generated by AI.

Besides, the most important moral right of an inventor is to be granted the title of their name as inventor. Meanwhile, in case AI is granted the inventorship, the only right it receives is the right to be named as an inventor, which does not significantly affect the exclusive rights of the patent owner or the patentability of inventions. In point of fact, the patent owner holds the fundamental and material rights of the patent. In the case of AI, the owner cannot be the AI itself, but must be other relevant subjects.¹⁹ These subjects will have ownership of the invention and exclusive rights of the patent. Therefore, recognizing AI as an inventor will help ensure the patentability of AI-generated inventions.

It should also be noted that the patentability of AI-generated inventions is affected by various factors. Nevertheless, the inventorship of AI has direct and important effects on the patentability of AI-generated inventions.

First, granting AI inventorship means treating AI-generated inventions

18 Under patent law, the incentive theory contends that patent must be granted to inventor(s) as a reward for their effort and as an incentive to maximize inventive activity. Meanwhile, the contract theory contends that patent gives the owner the exclusive right to the cost, effort, and time engaged in the inventive process, in exchange for disclosure to the public and society.

19 Schwein R. L. (2021), 'Patentability and Inventorship of AI-Generated Inventions', 60 *Washburn LJ*, pp. 561, 583-584.

as equal to human-made inventions. Therefore, an invention to be registered for protection only needs to meet requirements for patentability, including novelty, inventive step, and industrial applicability, without regard to the inventive process' establishment or involvement.²⁰ This means that AI-generated inventions will not be rejected for patent protection solely on the basis that the inventor is AI. Therefore, it is likely that AI-generated inventions would be able to be protected by patent law. Nevertheless, this does not mean that AI-generated inventions are automatically protected; they still need to fulfill patentability requirements other than the inventorship requirement. Inventorship is not a decisive factor in patent protection; rather, it is meant to prevent this aspect from becoming a barrier in the patentability assessment.

Second, while not decisive, inventorship still plays a fundamental role in patentability. When AI is not recognized as an inventor, an AI-generated invention cannot be protected because it does not satisfy the inventorship requirement. In Vietnam, the inventor is defined as a "person",²¹ that means only natural person or human being would satisfy the inventorship requirement. Therefore, a patent application for an AI-generated invention filed in Vietnam is highly likely to be rejected according to Vietnamese law. The patent applicant could therefore (i) name AI as the inventor, (ii) not name the inventor, or (iii) name the inventor wrongly.

In the first situation, there is a very high probability that the patent application would be rejected. As mentioned above, the inventor is a "person", which refers to natural persons, or human beings, and not any other subject. Since AI is a machine and not a natural person, patent applications may be denied due to the lack of a legal inventor.²²

In the second situation, if the name of the inventor is not listed in the application, the patent will not be granted. It should be noticed that no patent will be granted without the inventor, and due to the lack of inventor(s), the patent applications also would be rejected.²³

In the third situation, when the inventorship of AI is not recognized, it may be necessary to include the name of another person in order to ensure patentability, and the name of the inventor will be listed wrongly. It is a concern since this behavior constitutes an infringement of the moral rights of being named as the inventor and a violation of the fundamental principle of the law regarding inventorship.²⁴ The legal consequences

20 Schwein R. L. (2021), *supra* note 19, pp. 561, 578.

21 Law on Intellectual Property 2005, s 122 (1).

22 Circular No. 01/2007/TT-BKHCHN, s 13 (7).

23 Circular No. 01/2007/TT-BKHCHN, s 13 (7).

24 Law on Intellectual Property 2005, s 122 (2).

arising in this situation may vary from country to country. For example, in Vietnam, if there is an error, confusion, or inaccuracy in the name of the inventor, the patent owner has the right to request the state management agency in charge of industrial property rights to make amendments to the information in such a protection title, provided that the prescribed fees and charge are paid.²⁵ Meanwhile, in the United States²⁶, the United Kingdom²⁷ or Australia²⁸, misrepresentation of the inventor's name is likely to result in invalidation of the patent. To put it another way, if the name of the inventor is not correctly listed in the patent application or the patent, then the invention cannot be protected and exploited for commercial purposes.

Consequently, an invention that was generated by AI will not be protected under the patent system in any of the three situations. Therefore, it can be seen that inventorship has a direct impact on the patent protection of AI-generated inventions. The protection of AI-generated inventions is not guaranteed even if the AI is granted inventorship. Nevertheless, if AI does not qualify as an inventor, the inventions it generates will be rejected for patent protection.

AI appears, from a legal perspective, to share similarities with the inventor under the employment contract when compared to certain inventor subjects in specific cases.

First, in the case of an inventor under a contract of employment, the patent owner will be the subject who has invested funds and provided the inventor with the material facilities to generate the invention. In point of fact, contract inventors are not allowed to carry out the inventive process independently or in accordance with their own preferences; rather, they are required to adhere to the instructions and expectations of the patent owner. AI is provided with data and instructions by scientists. As a result, the inventive output of AI is born within a certain framework. Accordingly, these two scenarios are essentially the same; discussing AI inventors is equivalent to discussing inventors under employment contracts. In the general principle of patent law, the person simply carries out the instructions of others, or even contributes, but that contribution depends entirely on the contribution of the original inventor, and cannot be considered the inventor. Conversely, when the person works through his or her inventive process to develop original ideas, or makes significant contributions to the conception of the invention, he or she may qualify as an inventor. As such, if AI involves and

25 Law on Intellectual Property 2005, s 97 (1).

26 35 U.S Code, s 102 (f).

27 Patent Act 1977, s 72.

28 Patent Act 1990, s 138.

significantly contributes to the conception in the inventive process, the AI should be considered qualified to be an inventor.

Second, the inverse question arises as to who will be recognized as the inventor if AI independently performs the inventive process and generates an invention, but is not recognized as the inventor. In this case, the inventor cannot be the one who provided the input data to the AI. This implies that a person cannot become an inventor simply by providing AI with input data. This is also one of the most fundamental and significant legal principles in patent law. In general, a person who participates in consultations only before and after the establishment of invention, or even when providing material facilities, but does not contribute to the research or the conception of the invention during the invention process, is not considered an inventor. Therefore, when the AI is not the inventor, it is likely that there is no other reasonable person who can become the sole inventor, even the person who also provided the input to AI.²⁹

As a result, it is essential to determine whether the output of the AI has evolved significantly compared to the input that it is provided with. The AI's inventive process needs to be analyzed from a human perspective. In other words, when comparing the autonomously inventive ability of AI to that of humans, it is necessary to determine what level of AI input data development process is required to produce outputs and whether it is sufficient to determine whether or not the process requires inventiveness. To put it another way, compare the creative processes of humans and AI, assuming that when given the same input, humans also need to be inventive in order to produce an output similar to AI. If it is certain that humans need to be inventive in order to produce outputs from a given input, then when AI performs the same task, it should also be considered to be engaging in a directly inventive process. Consequently, it is of the utmost importance to evaluate the "personally create" (or "directly invent") element in the inventive process under the patent law regime.

3. Laws and practices in selected countries on recognition of the inventorship of artificial intelligence

This section compares and analyzes the laws of selected countries in light of a common practice, namely the patent application of Dr. Stephen Thaler. Besides, it should be noted that Dr. Stephen Thaler created DABUS. In the patent application, the scientists specified that DABUS was the sole inventor and that no other individuals engaged in the inventive process.

²⁹ In the inventive process of AI-generated inventions, there may be involvements of software programmers, data suppliers, trainers or feedback suppliers, operators of the AI systems, owners of the AI systems, investors, and the AI system itself. These categories sometimes overlap, or separate.

Explaining the creativity of DABUS, Dr. Thaler said that DABUS “goes beyond mere design optimization, now allowing machine intelligence to fully conceptualize”.³⁰

These patent applications are a part of the Artificial Inventor Project by the scientific team of Dr. Stephen Thaler and his associates. This group of scientists consists of more than 20 leading experts in patent law. This project implements a series of professional legal examination programs to seek intellectual property protection for AI-generated products in the absence of a human author or inventor. The purpose of this project is to promote dialogue about the social, economic, and legal implications of emerging technologies such as AI and to provide guidelines for evaluating the protectability of AI outputs.

Dr. Thaler and his associates filed patent applications for DABUS inventions in numerous legal systems. Subsequently, some countries, including the United States, the United Kingdom, Germany, Australia, South Africa, and the European Union, have made decisions related to the issue of recognition of inventions generated by DABUS. Regarding the protection of AI-generated inventions and the inventorship of AI, the application assessment process and judicial proceedings in each country appear to have various opinions from a legal perspective. For the purposes of analysis and comparison, the authors will concentrate on three central issues: (i) the laws and regulations on inventorship; (ii) the decisions regarding the invention generated by DABUS; and (iii) the arguments made.

3.1. Laws and practices in the United States of America on recognition of the inventorship of artificial intelligence

As one of the most industrialized nations with the world's longest history in intellectual property law, the United States has a system of legal regulations and case law that governs the protection of intellectual property rights for inventions. Inventors as defined by Section 100 of this Act are “the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention”. “Inventor” is a natural person who forms “a definite and permanent idea”³¹ of the invention claimed. Simply described, an inventor is a natural person who significantly contributes to the conception of inventions. Patent applications must be filed on behalf of the inventor (or all inventors if there are many inventors), even if the invention is owned by a commercial or nonprofit organization.³²

30 Thaler S. (2019), ‘DABUS in a nutshell’, 19(1) *APA Newsletter on Philosophy and Computers*, p. 42.

31 Manual of Patent Examining Procedure, s 2138.04. See also *Bosies v. Benedict*, 27 F.3d 539, 543, 30 USPQ2d 1862, 1865 (Fed. Cir. 1994).

32 Stim R. (2022), *Patent, Copyright & Trademark: An Intellectual Property Desk Reference*, 17th edn, NOLO, p. 76.

However, inventors are not legal entities such as companies or business organizations. Additionally, the assignee, manager, or supervisor who either executes the inventor's instructions or merely discovers a problem (but does not solve it) disqualifies them from being regarded as inventors.³³ Moreover, even when contributing to the invention, an individual does not become an inventor when (i) only contributes to the reduction of the invention to practice by performing common skills, (ii) only contributes the obvious elements to create the invention, (iii) only contributes by participating in patent consultations before or after the invention, (iv) only imagine an outcome without an idea of how to achieve it, and (v) make suggestions or improvements but fail to work appropriately to achieve the proposal or improvement.³⁴

A filed patent application will include the name of the inventor for any invention claimed in the application. Each individual who is the inventor or joint inventors of an invention claimed in a patent application shall make an oath or declaration regarding the application. An oath or declaration must contain statements that (i) the application was made or was authorized to be made by the affiant or declarant; and (ii) such an individual believes himself or herself to be the original inventor or an original joint inventor of a claimed invention in the application.³⁵

On July 29, 2019, Dr. Stephen Thaler filed two patent applications No. 16/524,350 and 16/524,532 to the United States Patent and Trademark Office (USPTO). In these two patent applications, DABUS is the sole inventor named, with the surname being "invention generated by artificial intelligence". Dr. Thaler also asserts that he did not contribute to the conception of these inventions and that any person skilled in the art can use the output of DABUS and put it into practice. He drafted the Inventor's Declaration that is included in the patent application. However, because DABUS was unable to oath or declare as an inventor on its own as required by the Patent Act, Dr. Thaler submitted an additional Declaration instead. As the applicant and owner of DABUS, he has signed this statement.

In the Decision dated December 17, 2019, the USPTO has denied protection for these two patent applications.³⁶ In its argument, the USPTO gave several reasons for denying this application. First, the inventor, according to the US Patent Act, must be a natural person. Second, DABUS cannot

33 Degnan D. A., Huskey L. A. (2006), 'Inventorship: What Happens When You Don't Get It Right?', Holland Art. Retrieved from: <https://www.hollandhart.com/files/InventorshipWhatHappens.pdf> [accessed 29 September 2022].

34 Gattari P. G. (2005), 'Determining Inventorship for US Patent Applications', 17(5) *Intellectual Property & Technology Law Journal*, p. 16.

35 35 U.S. Code, s 115.

36 US Patent and Trademark Office Decision on Petition: In Re: 16/524,350.

fulfill the oath itself, so the application does not qualify under Section 115(a) of the Patent Act. Third, inventorship is fundamentally a basic requirement of patentability under US patent law, so a refusal due to the inventive element is not guaranteed to be entirely consistent with the law. Fourth, the protection of DABUS as an invention does not mean that the law recognizes DABUS as an inventor. Finally, the USPTO asserts that, although Dr. Thaler and his team have outlined numerous policy considerations to complement the notion of recognizing an AI as an inventor, these considerations cannot go beyond the obvious in patent law enacted by the United States Congress or interpreted by judicial systems.

Disagreeing with this decision, Dr. Thaler and his associates sued USPTO and Mr. Andrew Hirshfeld to court. He said that the decision made by the USPTO was “arbitrary, capricious, an abuse of discretion and not in accordance with the law; unsupported by substantial evidence, and in excess of Defendants’ statutory authority”. In its petition, Dr. Thaler’s team claims (i) the defendants to reinstate the patent applications and to revoke the denial, (ii) the patent application for an AI-generated invention will not be denied on the basis that no individual can be identified as an inventor; (iii) a patent application for an AI-generated invention should list an AI where it has met the criteria for inventorship.

In the decision *Thaler v. Hirshfeld* on February 9, 2021, the Court denied the entire request of Dr. Thaler’s team and simultaneously, supported the defendant’s decision.³⁷ Accordingly, the Court held that, (i) USPTO’s interpretation was entitled to Skidmore deference; (ii) Congress’s use of the term “individual” in the Patent Act strengthened conclusion that an “inventor” must be a natural person; (iii) applicant’s policy arguments did not override overwhelming evidence that Congress intended to limit definition of “inventor” to natural persons.

The case continued to be brought to the United States Court of Appeals for Federal Circuit. In his remarks, Judge Leonard P. Stark further reaffirmed the position of both the USPTO and the Eastern District Court of Virginia, that the definition of “inventor” set forth in the United States Patent Act should be “natural persons”.³⁸ Therefore, AI cannot be recognized as an inventor. The Court also found that this was the viewpoint of Congress when enacting the Patent Act, and was widely supported through the judicial practice of the US court system. As a result, the Court of Appeal upheld the first-instance decision and denied DABUS as inventor for both patent applications filed to the USPTO.

37 *Thaler v. Hirshfeld*, 558 F. Supp. 3d 238 (E.D. Va. 2021).

38 *Thaler v. Vidal*, 43 F.4th 1207 (Fed. Cir. 2022).

Thus, according to US law, both theoretically and practically, the inventor must be a natural person. This is the most powerful and sufficient argument used by both the USPTO and the courts to deny DABUS inventorship and deny patent protection to inventions generated by DABUS. Remarkably, this view has been reaffirmed by numerous precedents in the United States. However, the common point of these precedents is that their main purpose is not to identify the inventor as a “natural person” but to exclude entities such as states and corporations from the scope of regulations on inventorship.

In the primary judgment, the Court said that the purpose of the Congress in using the word “individual” in the Patent Act was to emphasize that the inventor must be a natural person. This is reflected not only in the definition in Section 100 of the Patent Act but also in the relevant regulations. Specifically, the Patent Act provides that, “such individual believes himself or herself to be the original inventor or an original joint inventor of a claimed invention in the application”.³⁹ The Court argued that the use of terms in this provision such as “himself or herself” or “believes” was intended to identify the individual as a “natural person”. On the basis of “there is a presumption that a given term is used to mean the same thing throughout a statute”, the Court held that the term “individual” was used consistently throughout the Patent Act.⁴⁰ Therefore, when an inventor is defined as an individual, it also means that the inventor must also be a “natural person”.

In the appellate judgment, the Court invoked a number of precedents to confirm that the inventor was a “natural person”. The United States Supreme Court in *Mohamad v. Palestinian Auth* explained that “individual” ordinarily means “a human being, a person”.⁴¹ The court in this case used the Oxford dictionary wording to interpret the term “individual”. Because, in the legislation promulgated by Congress, there is no definition for “individual”. At the same time, they also emphasized that the term “individual” usually denotes a natural person, and specifically to distinguish between a natural person and a corporation. In the case of *Univ. of Utah v. Max-Planck-Gesellschaft Zur Forderung Der Wissenschaften EV* the Federal Court of Appeal held that creators must be natural persons and cannot be businesses or sovereign entities.⁴² In the *Beech Aircraft Corp. v. EDO Corp*, the court also made the assertion that “only a person can be an inventor”.⁴³ On 24 April 2023, as the last resort competence, the US Supreme Court issued a decision denying

39 35 U.S Code, s 115 (b) (2).

40 *Thaler v. Hirshfeld*, 558 F. Supp. 3d 238 (E.D. Va. 2021) [8].

41 *Mohamad v. Palestinian Auth.*, 566 U.S. 449, 132 S. Ct. 1702, 182 L. Ed. 2d 720 (2012).

42 *Univ. of Utah v. Max-Planck-Gesellschaft Zur Forderung Der Wissenschaften E.V.*, 734 F.3d 1315 (Fed. Cir. 2013).

43 *Beech Aircraft Corp. v. EDO Corp.*, 990 F.2d 1237 (Fed. Cir. 1993).

Dr. Thaler's appeal against the appellate judgment in the DABUS case. For the final statement, it is evident that the US patent law does not recognize a non-human inventor and as a consequence, this decision can be considered as the officially final and non-appealable refusal of patent protection for AI-generated inventions and the inventorship of AI in the US.

It is showed that U.S. law is not sufficiently prepared to recognize AI as an inventor. Under the Patent Act, an inventor can only be a "natural person" due to the plain language of the statute, the legislative intent of the U.S. Congress, and the interpretation in case law. However, it is evident that there is a substantial difference between the case precedents referenced by the court and the case of DABUS. DABUS is an artificial entity that is neither a corporation nor an organization. Therefore, AI can still be considered to be an individual. The important consideration is that the definition of "individual" in US law is currently not capable of covering subjects other than "natural humans", hence excluding AI from the scope of inventors. Perhaps, when initially enacting the Patent Act, US legislators did not foresee a time when non-humans would be able to create inventions. To be able to grant inventorship of AI, however, the US legislative and judicial systems will be required to make extensive, comprehensive, and adaptable modifications to the Patent Act as well as the current case law system's reasoning and interpretation.

3.2. Laws and practices in the United Kingdom on recognition of the inventorship of artificial intelligence

The Patent Act 1977 governs the patent protection system in the United Kingdom. In general, the act is divided into three sections: the first section covers national law provisions pertaining to substantive matters such as patent conditions, patent infringement, and registration; the second section covers international affairs; and the third section covers general provisions regarding the implementation of the Act and related matters. The provisions concerning inventors are included in the first section of this act. Article 7(3) of the Patent Act 1977 defines the term "inventor" as "the actual deviser of the invention".

Determining who actually devised the invention is therefore the most fundamental element of identifying an inventor under the Patent Act. In judicial practice, the Court of Appeal adopted a two-step test to identify the status of an inventor: first, the inventive concept; second, determining who devised the concept.⁴⁴ Consequently, a subject can be considered an inventor if he or she (i) forms the initial ideas that define the research contributing to the invention; (ii) he or she originally created the experiments or products

44 *Henry Brothers (Magherafelt) Ltd v. The Ministry of Defence and the Northern Ireland Office* [1999] RPC 442.

upon which the patent application was based; and (iii) he or she performs any test or other process described in the patent application that requires initiative to conceive and/or complete, for instance, because of obstacles or undesirable complexities that must be resolved; (iv) interpreted the data disclosed in the patent application and recognized the significance of the results.

However, if the subject (i) merely carried out the task following instruction (regardless of how much skill and effort the work required), especially if the task is uninitiated and does not require modification to follow instructions; (ii) had no role in the research, regardless of whether they funded it, were otherwise associated with it, owned the facilities used for the research, or had previously published relevant work; (iii) contributed extremely general work or support; or (iv) was a project manager or supervisor, but made no technical contributions to the invention.⁴⁵

Article 13 of the Patent Code provides that the inventor has the right to be named in both the patent application and the patent granted. The inventor's full name must be listed in the patent application. Moreover, the patent application must contain a statement about the inventor by the applicant. This statement must identify the individual or individuals the applicant considers to be the inventor or joint inventors. In the case that the applicant is not the sole inventor, or the applicants are not co-inventors, the applicant must specify the foundation upon which the patent right derives. If the inventor(s) is not named correctly or sufficiently, or if the statement is not backed by the relevant details, the patent application may be withdrawn⁴⁶, or the granted patent would be invalid⁴⁷.

Patent applications No. GB1816909.4 and GB1818161.0 were filed in the UK by Dr. Stephen Thaler on October 17 2018 and November 7 2018, respectively. This application clearly states that the applicant is not the inventor. Accordingly, the inventor credited to this application is an AI machine called "DABUS" and the applicant has the right to grant the claimed inventions derived from "ownership of the DABUS creation machine".

The UK Intellectual Property Office (UKIPO) has responded that naming a machine as the inventor does not comply with the Patent Act and that the inventor must be a natural person. UKIPO also requires Stephen Thaler to provide sufficient evidence that the inventor's rights to apply and obtain the patent have been transferred. The application will be denied if the necessary information is not provided within the stipulated time limit.

45 Ellis M., 'Inventorship and Ownership'. Retrieved from: <https://www.mewburn.com/law-practice-library/inventorship-and-ownership#:~:text=The%20inventors%20are%20the%20%E2%80%9Cactual,determine%20who%20actually%20devised%20it> [accessed 27 September 2022].

46 Patent Act 1977, s 13 (2).

47 Patent Act 1977, s 72.

Several arguments were made in Dr. Thaler's team's filings to UKIPO in support of recognizing DABUS as an inventor. First, they argued that the definition of "deviser" in Article 13 of the Patent Act 1977 should not be limited to "natural person" but should be interpreted in a broader sense. Second, the purpose of Articles 7 and 13 of the Patent Act 1977 is to discover who actually devised the invention, regardless of whether they are a natural person or a legal entity. Thus, attributing DABUS as the inventor satisfies Articles 7 and 13's most crucial requirement. In this instance, there is no human inventor, as the invention was not made by a person. In point of fact, the recognition of DABUS as an inventor also means that no one other than DABUS is eligible to become an inventor. Thirdly, the moral rights of the inventor must be respected, hence it is impossible to arbitrarily name another person as the inventor. Likewise, this is the fundamental legal basis of the inventorship. Fourth, it would be absurd if the invention was not disclosed to the public merely because the patent application was denied based on the inventor's characteristics. Finally, the absence of a limitation on patents generated by AI systems would vary from the Act's specific patent exclusions for certain types of patents for inventions. Therefore, there are no grounds to refuse to grant patents for AI-generated inventions.

In Decision BL O/741/19 dated 4 January 2019, UKIPO denied applications for both DABUS inventions.⁴⁸ In light of Articles 7 and 13 of the Patent Act 1977, UKIPO's Deputy Director, Huw Jones, argued that the inventor must be a natural person. The definition of "deviser" in Article 13 of the Patent Act 1977 has always been understood to refer to a natural person, as this Act was never intended to recognize a subject other than a natural person as an inventor, and court interpretations have always upheld this understanding. Furthermore, within the scope of the legislative intent of the Patent Act 1977, either Article 7 or Article 13 is addressed at devisers or inventors who are exclusively subject to natural persons. Because DABUS is not a human, it cannot be considered an inventor. Moreover, he emphasized that the applicant in this instance does not have the right to apply for a patent due to DABUS's ownership. In any case, this application will be denied since the petitioner cannot show sufficient derivation for the right to apply.

Dr Stephen Thaler and associates filed a lawsuit against UKIPO's Comptroller-General for Patents, Designs and Trademarks. The lawsuit filed by Thaler's team on the grounds that (i) Mr. Jones predetermined the results and Thaler did not receive a fair hearing, (ii) Mr. Jones himself used an improper approach to interpret relevant legislation, and (iii) Article 13 of

48 UK Intellectual Property Office Patent Decision BL O/741/19 In re Application of Application No: GB1816909.4/GB1818161.0.

the Patent Act was used illegally to deny Dr. Stephen Thaler the right to patent a patent.

In the decision *Thaler v. The Comptroller-General of Patents, Designs And Trade Marks*, Judge Marcus Smith denied Thaler's petitions.⁴⁹ Simultaneously, he rejected the arguments related to DABUS's inventorship and concluded that DABUS could not meet the conditions. However, the majority of this judgment's argument concentrates on the question of whether Dr. Stephen Thaler possesses patent rights and does not aim to prove that DABUS is not the inventor. Furthermore, the primary reason for rejecting the DABUS patent application was Dr. Thaler's right to apply for and obtain patents. Consequently, the Court in this decision only briefly concluded that DABUS is not and cannot be an inventor as defined by the Patent Act 1977, since DABUS is not a natural person.

In the appellate judgment, the non-recognition of inventorship of DABUS was emphasized.⁵⁰ Three Court of Appeal Judges, including Judge Colin Briss, Judge Richard Arnold, and Judge Elisabeth Laing, participated in the review of this case. Through legislative history and case law, all three reaffirmed the Court's conclusion that DABUS was not an inventor. Article 7 of the Patent Act 1977 stipulates that an inventor must be a natural person. Moreover, only human beings are permitted to be named under Article 13 of this Act. Even though DABUS created the invention, this does not make DABUS the inventor. Furthermore, there are no further rules and regulation regarding the identification of machines or other non-human entities as inventors, therefore it is not recognized as the inventor and cannot be recognized as an inventor. The final conclusion of the ruling remains to reject the plaintiff's appeal – Dr. Stephen Thaler – and uphold the judgment of first instance.

However, in their arguments, the Judges held various opinions regarding the protection of DABUS-created inventions. Only Judge Colin Briss, out of the three judges present, consented to hear the plaintiff's appeal. While he agrees that an inventor under the Patent Act 1977 must be a natural person, he asserts that Dr. Stephen Thaler has fulfilled his requirements under Article 13(2) for identifying the person(s) he believes to be the inventor and establishing the derivation of the patent right. Consequently, the plaintiff satisfied Article 13(2)(a) and Article 13(2)(b) of the Patent Act 1977. Simultaneously, he asserted that the inventor in this case is a machine and that there is no impediment to granting this patent to the applicant.

49 *Thaler v The Comptroller-General of Patents, Designs And Trade Marks* [2020] EWHC 2412 (Pat) (21 September 2020).

50 *Thaler v The Comptroller-General of Patents, Designs And Trade Marks* [2021] EWCA Civ 1374.

Meanwhile, both Judge Richard Arnold and Judge Elisabeth Laing determined that Dr. Stephen Thaler's application did not comply with Article 7 regarding inventors, Article 13(2)(a) about naming inventors, and Article 13(2)(b) with the derivations for establishing the right to apply an invention for patent protection. First, in accordance with Article 7 of the Patent Act 1977, as stated previously, the DABUS is a machine and, as such, is not an inventor. Second, with respect to Article 13(2)(a), this clause requires the applicant to precisely identify who he believes to be the inventor. Regarding Article 7, this criterion was not met because the applicant assumed that the creator of the invention was a machine and not a human. Judge Elisabeth Laing noted further that, since the application did not name a person as the inventor of the invention, it was in violation of Article 13(2)(a) since it did not identify the inventor. Third, according to Article 13(2)(b), Dr. Stephen Thaler is ineligible to file a patent application for an invention made by DABUS. Dr Thaler's ownership of DABUS does not grant him this right, as there is no regulation addressing this matter.

Dr. Thaler's team has continued to challenge the judgment in recent times. The Supreme Court of the United Kingdom considered and accepted the plaintiff's right to appeal on August 12, 2022. This has prolonged the proceedings, necessitating further comments and perspectives from the Supreme Court judges. Nevertheless, given the legislative and judicial history of the term "inventor" in the United Kingdom, it appears that the ruling that a "inventor must be a natural person" has been firmly established certainty derived from court case precedents. Therefore, it is not difficult to foresee that the possibility of the Supreme Court overturning the judgments of the lower courts and appeal courts is indeed very low.

As a result, the leading argument used by UK courts to reject patent protection for AI-generated inventions is that inventors must be human, and AI is not human; therefore, AI is not an inventor under the Patent Act 1977. The fact that AI is not an inventor precluded the patent application from meeting the requirements of Articles 7 and 13 of the Act; and UKIPO and The Court had enough justification to reject Dr. Stephen Thaler's application. During litigation, however, the United Kingdom's judicial system also reflected advanced and innovative perspectives. Specifically, Judge Colin Briss stated that a machine-created invention should not be denied patent protection. In other words, the fact that the inventor is not human will not impact the patentability of the invention and will not prohibit its protection. However, there appears to be no legal precedent to support this position. Furthermore, Judge Elisabeth Laing stated if grating patent for inventions made by machines, the Patent Act 1977 need to be

modified. The UK's patent law system is currently not prepared to protect AI-generated inventions, nor has it adjusted to law for new technology in a prompt and suitable manner. These considerations will serve as the foundation for establishing a promising future for the Patent Act 1977, in order to push the legislation to have the essential innovation and keep pace with technological advancement.

3.3. Laws and practices in Australia on recognition of the inventorship of artificial intelligence

Australia is one of the countries with an advanced level of legislation in the world, especially for policies and regulations related to intellectual property rights, in the context of significant development of technology. Basically, the Patent Act 1990 will govern patent protection for inventions in general and inventorship in particular. Although "inventor" is mentioned frequently in related matters, the term is not defined in the Patent Act. If only based on legislation, it is difficult to determine what conditions must be met to become an inventor, and under what circumstances a person will become an inventor or joint inventor. Consequently, the determination of inventorship will be left to the Australian judicial system to interpret on a case-by-case basis.

Article 15 of the Patent Act 1990 is the first provision to refer to this term, according to which an inventor is one of the eligible subjects that can be granted a patent. Although not explicitly mentioned in the Patent Act 1990, the Court in *JMVB Enterprises Pty Ltd v. Camoflag Pty Ltd* has determined that inventors must be the actual or "real inventor".⁵¹ In addition, the term inventor must be relevant to the invention being claimed. In the case *University of Western Australia v. Gray*, the Court adopted and used a two-step testing process to identify specific inventors.⁵² This test requires the courts during the review of inventors to (i) determine the distinct conception of inventions and (ii) determine the verification or reduction to practice. On one hand, in the first step, it is essential in determining who significantly contributed to the concept of invention underlying the claims in the specification. On the other hand, the purpose of the second step is to identify actions that are not considered to contribute to the invention process. However, reduction of a concept to practice might indeed be a part of the overall invention.⁵³ Some cases of not being considered an inventor can be counted as someone who (i) contributes but that contribution comes from genuine inventors, or (ii) assists in the creation of a viable alternative

51 *JMVB Enterprises Pty Ltd v Camoflag Pty Ltd* (2006) 154 FCR 348, [67]–[72].

52 *University of Western Australia v Gray* (2009) 179 FCR 346, [221], [237]. See also *Kafataris v Davis* (2016) 120 IPR 206, [62].

53 *Poluwood Pty Ltd v Foxworth Pty Ltd* (2008) 165 FCR 527, [33].

of the invention but does not yield an undesired result or advantage; (iii) suggest only another example of the invention in action; (iv) only follow the instructions of others in performing the experiments.⁵⁴

Under Regulation 3.2C(2)(aa) of the Patent Regulations 1991, a patent application filed through PCT system must include the name of the inventor in relation to the invention listed in the application.⁵⁵ This is one of the important information requirements for a patent application to be considered valid. However, under Australian law, there are serious legal consequences for not properly listing the inventor, such as naming a non-inventor, not listing the actual inventor, or not listing fully all of the joint inventors. If a new patent application is only in the assessment stage, the parties concerned will have valid objections to the application, which could lead to the possibility that the Australian Patent Office will rely on it or take its own initiative to refuse to grant the patent.⁵⁶ If the patent has been granted, it will result in being declared invalid.⁵⁷

Patent application No. 2019363177 was filed in Australia through the PCT system by Dr Stephen Thaler. The inventor in this application is identified as “DABUS, an invention generated automatically by artificial intelligence”. Furthermore, Dr. Thaler is regarded to have “received the right to the invention from the inventor” in accordance with Article 15(1) (c) of the Patent Act 1990.

In response to Dr. Stephen Thaler’s patent application, the Australian Patent Office (APO) Commissioner has set a two-month period for the submission of the name of a natural person who is the inventor or an explanation as to why DABUS can be lawfully recognized as the inventor. Moreover, the applicant must describe how a machine with AI can transfer or disclose an invention to a human.

Dr. Stephen Thaler and his team provided a reply to the APO Commissioner’s response. DABUS can and should be listed as an inventor in accordance with Regulation 3.2C (2)(aa). Because, the sole contributor to the concept of invention is DABUS, which is an AI machine consisting of programs written by the applicant. DABUS has the ability to create inventions without the involvement of a natural person who is inherently granted inventorship. Next, Dr Stephen Thaler is the owner and creator of DABUS, and hence benefits from its outputs. This means that Dr. Thaler owns full ownership of the DABUS invention. The regulations

54 Davison M. J. , Monotti A. L. and Wiseman L. (2020), *Australian Intellectual Property Law*, 4th edn, Cambridge University Press, p. 406.

55 Patent Regulations 1991, Reg 3.2C (2) (aa).

56 Patent Act 1990, s 59.

57 Patent Act 1990, s 138.

stipulate merely that the patent application must receive the legal rights from the inventor, not that the inventor must transfer or disclose the invention to the applicant. Furthermore, the owner of an object also owns ownership rights to the object's outputs or creations. While Dr. Stephen Thaler is the owner of DABUS, he also owns the invention that DABUS generated. On that basis, Dr. Thaler has the right to file a patent application.

On February 9, 2021, however, the APO issued a decision refusing protection for this patent application.⁵⁸ Among these, the two most significant questions raised are (i) whether the Patent Act 1990 specifically addresses whether an AI machine is capable of becoming an inventor, and (ii) whether the language of the Act is appropriate for the inclusion of an AI machine as an inventor. The APO Commissioner concluded that none of these arguments was justified by the Patent Act 1990 or the Patent Regulations 1991. Treating AI as an inventor is inconsistent with Article 15 of the Patent Act 1990 because it is impossible to determine who the patentee is. Consequently, the application does not satisfy the requirements of Regulation 3.2C of the Patent Regulations 1991.

Thaler's team did not agree with this decision, so they filed a lawsuit against the APO Patent Commissioner in Federal Court. In their decision, the Court rejected the Commissioner's whole conclusion and argument and stated that "an inventor as recognized under the Act can be an artificial intelligence system or device".⁵⁹ Judge Jonathan Barry Rashleigh Beach relied on the following arguments to reach this conclusion: First, nothing in the Patent Act contradicts the premise that AI can be an inventor. Second, the Patent Act has no clause that precludes non-human inventors. Third, "inventor" is simply an agent noun, and so can apply to either a person or a thing. If AI is the agent that created the invention, then AI is an inventor. The term "inventor" should be interpreted to refer to machines that perform activities equivalent to humans. Fourth, the term "inventor" should be defined in a more flexible and innovative manner within the context of patent law. This understanding on inventorship is also consistent with the purpose of the Patent Act, which is to incentivize technological innovation, disclosure, and dissemination by protecting rights holders. Simultaneously, he says, this will promote the development of computer scientists in the field of creative machines, as well as other advancements in output facilitation and utilization, resulting in new scientific advantages.

Furthermore, with regard to Article 15 of the Patent Act, Judge Jonathan Barry Rashleigh Beach stated that this provision is insufficient to (i) specify

⁵⁸ Australian Patent Office Decision In re Application of Application No: 2019363177, Stephen L. Thaler [2021] APO 5.

⁵⁹ *Thaler v Commissioner of Patents* [2021] FCA 879.

that the inventor must be a natural person and (ii) deny Dr. Stephen Thaler's patent entitlement. Article 15(1)(a) states, therefore, that only humans can be granted patents. In light of this, it is reasonable to conclude that DABUS in particular and AI in general (i) cannot be granted patent, (ii) cannot be a patent applicant, and (iii) cannot lawfully own or transfer the invention. He contended that the concept of "person" is distinct from "inventor" under Article 15(1)(a). Consequently, it would be fallacious to assume from Article 15(1)(a) that non-human subjects cannot become inventors. In addition, the judge ruled that Dr. Stephen Thaler has the right to file a patent application under both Article 15(1)(b) and Article 15(1)(c) of the Patent Act.

In conclusion, the most significant aspect of this judgment is that AI can be acknowledged as an inventor under the Patent Act 1990, which is regarded as an historic decision by the Australian court. Shortly, the APO Commissioner of Patent filed an appeal against the first-instance decision, requesting an appellate trial in this case. Consequently, the Patent Committee invoked its right of appeal based on two primary grounds. First, the trial judge misinterpreted Article 15 of the Patent Act 1990 and Regulation 3.2C(2) (aa) of the Patent Regulations 1991. Second, the primary judge erred by reaching factual findings not supported by the evidence before the court.

In the appellate judgment, the Full Court totally approved the Patent Commissioner's appeal on the first issue.⁶⁰ Furthermore, the Federal Court determined that only the first appeal should indeed be considered, and not the second. In this case, the appellate justices disagreed with the primary court's arguments. The conclusion is that, according to the Patent Act, the inventor must be a natural person. First, the inventor, under the Patent Act, is the person or persons who are substantial contributors to the invention as described in the specification and claimed subject matter. Second, if based on Article 15(1) and Article 138(3)(d) of the Patent Act, a patent will be invalid and unenforceable if the inventor misrepresents the material information underlying the invention for patenting. Thirdly, in previous disputes involving the identification of inventors, Australian courts tended to establish tests to determine if a specific person may qualify as an inventor based on participation in the inventive process. Fourthly, the goal of the Patent Act 1990 is to govern inventions conceived by one or more persons. As a reward for their intelligence, patents may be granted to those who have contributed to or involved in the invention. Fifth, in many instances in Australia, it is assumed that human involvement is necessary for the development of a viable invention and that only a human being may become an inventor. Therefore, it can be reasonably concluded from the

60 *Commissioner of Patents v Thaler* [2022] FCAFC 62.

Patent Act and the interpretation of the relevant case law that the inventor in Article 15(1)(a) must be a natural person. The Court agreed completely with the Patent Commissioner's determination that the patent application did not meet the requirements of Regulation 3.2C(2)(aa) regarding the inventor's name, and for that reason, patent protection is denied.

Furthermore, considering Sections 15(1)(b) and 15(1)(c) of the Patent Act 1990, these requirements do not apply to inventors who are not natural persons. Specifically, under Article 15(1)(b) of the Patent Act, the right to apply and obtain a patent is based on an assignment of the right, and the first assignment comes from the inventor, who is required to be a natural person under Article 15(1)(a), because an entity lacking a legal identity cannot make a valid right assignment. Moreover, Article 15(1)(c) of the Patent Act 1990 addresses the inventor in Article 15(1)(a) and the assignee in Article 15(1)(b), resulting in equivalent consequences. On the basis of both Article 15(1)(b) and Article 15(1)(c), it also implies that Dr. Stephen Thaler has no right to apply and obtain a patent for the invention created by DABUS.

In Australia, the discrepancy between the interpretation of the law by the courts of primary and the court of appeal is enormous. Specifically, even though the appellate judges agreed with the Patent Commissioner's decision, they did not agree with the whole reasoning for defining the inventor's concept. The absence of a plain definition in the Patent Act 1990 is the primary cause of the discrepancy. This makes the identification of inventors more controversial than ever before. In most decisions, judges must reference a substantial amount of relevant case law to explain the term "inventor". There is, however, no precedence establishing that the inventor must be a natural person. In the evolution of patent law in Australia from 1624, the question of whether an inventor could be an entity other than a natural person has never been challenged. Consequently, the Patent Act and case law are considered to have assumed that only natural persons can be inventors. Moreover, the appellate judge stated that whether AI should be recognized as an inventor is a pressing issue for Australian law. As a result, the courts also are considering this possibility, despite the fact that it is currently inconsistent with the Patent Act 1990. Although the appeals court reached a well-known judgment that because AI could not be an inventor, the inventor-related statements were not met, and the patent application was therefore denied, the arguments about patent protection for AI-generated inventions made by the Australian courts are more consultative than ever.

Dr. Stephen Thaler and his associates made a special leave application to the High Court seeking to overturn the decision of the Full Court immediately after the announcement of the judgement. The Australian High Court has

denied Dr. Stephen Thaler's application for special leave to appeal this decision. Australia is the first country in the world to issue a non-appealable, final rejection. This decision officially concludes the dispute over patent protection for AI-generated inventions and recognition of AI inventorship in Australia.

4. Discussion on the inventorship of artificial intelligence and patent protection

The controversy over AI inventorship and the patentability of AI-generated inventions is currently taking place not only within the judicial systems of mentioned legal systems, but also in both public and private forums by various legal science herds. Most legal systems in the Common law tradition hold that AI should not be recognized as an inventor, but only recognize natural persons as inventors; therefore, AI cannot become a legitimate inventor. On the other hand, scholars argue that giving AI the inventorship likely leads to an important change in the concept of human and the relationship between technology and society, thereby posing new challenges, raising other ethical questions, and creating ethical dilemmas.⁶¹ Finally, some advocates argue that AI-generated inventions should belong to the public domain for other pragmatic or political reasons.

Notwithstanding, the concept of patent protection for AI-generated inventions is likely to be considered and recognized. There are apparently some rational justifications supporting granting patents for AI-generated inventions. First, the demand for patent protection for AI-generated inventions is genuine and essential, regardless of whether it is recognized by law or not. Denial of the protection for a completely patentable invention merely because it was generated by AI is not a reasonable basis for denial. Second, granting a patent would incentivize the disclosure and commercialization of innovative and valuable inventions.⁶² Therefore, AI-generated inventions should be patented for the purpose of commercial exploitation and public disclosure of inventions, contributing to the technological advancement of humanity.⁶³ Third, the progress of AI technology development is evolving more rapidly than ever.⁶⁴ Patent law should also keep up with the advancement of technology, particularly AI technologies by the way of granting protection for AI-generated outputs. The implementation of national technological development policies necessitates a precise and stable legal framework as a foundation. Finally, in the process of investing in research, development and application of AI, investors expect to receive

61 Van A. L. (2021), 'Is it time to recognise AI inventorship in patent law?', *Intellectual Property Law* et al., p. 20 November 2021. Retrieved from: https://www.vananhle.net/?p=907#_ftn3 [accessed 7 October 2022].

62 Schwein R. L. (2021), *supra* note 19, pp. 561, 575.

63 Abbott R. (2016), *supra* note 16, p. 1079, 1104.

64 Comer A. C. (2021), 'AI: Artificial Inventor or the Real Deal?', *22 NCJL & Tech*, p. 447, 469.

both the output of AI and the resulting profits.⁶⁵ Failure to protect AI-generated inventions will cause developers to lose motivation to innovate new technologies, because the output of AI is not protected by patent law.

As analyzed above, the inventorship has a significant impact on the patentability of AI-generated inventions. In most cases, the invention is denied because the AI is listed as the inventor. The only country that has granted patents for inventions generated by DABUS is South Africa.⁶⁶ Australia, the country with the most heated arguments concerning the patentability of AI-generated inventions, and South Africa, the first country to protect AI-generated inventions, are shown to share a lack of a defined, direct definition of an inventor in their legislation. These factors have provided sufficient legal space for courts and competent authorities to determine whether AI should be considered an inventor or not. When it comes to the US or UK legal systems, the situation is rather different. These two countries have enacted statutes defining the concept of an inventor. Similarly, the court systems of these two countries have so far established rules that the inventor must be a natural person. In contrast, there is not such a similar rule in Australian case law that indicates the same.

As mentioned above, in Vietnam, the inventor is defined as “persons who have personally created such industrial property subject matters”.⁶⁷ Therefore, at present, inventors in Vietnam still have to be persons, specifically natural persons, or human beings, and cannot be other subjects such as enterprises, corporations, or machines. Therefore, according to Vietnamese law, AI cannot be the inventor. Because AI is a machine, not a human, a natural person, and does not meet the requirements to be an inventor. In Vietnam, an application without sufficient information about the inventor is considered invalid.⁶⁸ As a result, in this case, the patent application requires information about the person who created the invention. Therefore, there is a very high possibility that, if Dr. Stephen Thaler applies for patent protection for invention generated by DABUS in Vietnam, the application will be rejected due to not meeting the inventorship requirements.

It is crucially noticed that Vietnamese patent law is significantly influenced by Soviet legal systems.⁶⁹ It is the explanation for the legislative technique of

65 Graham S. J.H., Merges R. P., Samuelson P. and Sichelman T. (2009), ‘High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey’, *Berkeley Technology Law Journal*, Vol. 24, No. 4, pp. 1255, 1283–87.

66 Naidoo M. (2021), ‘In a world first, South Africa grants patent to an artificial intelligence system’, *The Conversation*, 5 August 2021. Retrieved from: <https://theconversation.com/in-a-world-first-south-africa-grants-patent-to-an-artificial-intelligence-system-165623> [accessed 7 October 2022].

67 Law on Intellectual Property 2005, s 122 (1).

68 Circular No. 01/2007/TT-BKHCN, s 13 (2) (b).

69 Thanh K. T. (2009), *Implementing the Agreement on Trade-Related Aspects of Intellectual Property Rights in Vietnam*, PhD thesis, Victoria University, p. 78.

Article 122 of the Law on Intellectual Property, including the reason explaining why inventor is often defined as “author of inventions” in Vietnamese patent law, due to the term used in Civil Code of the Russian Soviet Federated Socialist Republic 1964.⁷⁰ Contrary to other countries, Vietnamese law clearly defines that inventors must be “persons”, meaning natural persons or human beings. This is a special, highly distinctive, and quite unique regulation in the international patent law system, and not a typical method of regulation, particularly in selected countries analyzed above, which unambiguously define in their statute law whether the inventor is a natural person. In this case, the interpretations of courts would be appreciated. To get at the conclusion that the inventor must be a natural person, this rule has been reached consistently throughout the history of judicial practice by court systems and are difficult to overrule without modification in statute law. Therefore, it seems that Vietnam has closed the door on the possibility of patent protection for AI-generated inventions. It would be challenging, but not impossible, for AI-generated inventions to be patented in Vietnam. Consequently, if international experience demonstrated the advantages and necessity of patent protection as well as appropriate solutions, the Vietnamese patent law would have the possibility to be amended for complying with the international standards.

Legal principles and technical advancements are always at odds with one another, and any result may have an immediate impact on the future. From a global perspective, Dr. Stephen Thaler’s project has had significant impacts on the legal systems of several countries. The recognition of inventorship for AI should be considered with caution, due to the fact that AI is likely sufficient under legal principles on the concept of inventor. There are currently three options proposed by the international intellectual property community for AI-generated inventions, including (i) amending national laws to enable AI to become inventors, (ii) enacting a new intellectual property law for AI, or (iii) negotiating a new international treaty on AI-generated inventions.⁷¹ The options to amend the national law on inventors should be given priority consideration, depending on the national policy and strategy on technology of countries. If a country deems it necessary to protect AI-generated inventions, that country can choose to recognize AI as an inventor or find other solutions without regard to the subject requirement, or vice versa.

70 In Article 520 of Civil Code of the Russian Soviet Federated Socialist Republic 1964, the inventor was originally defined as “Автор изобретения”, meaning “author of the inventions”. In the Ordinance on the Protection of Industrial Property Rights 1989 of Vietnam, this term was translated to “tác giả sáng chế”.

71 George A., Walsh T. (2022), ‘Artificial intelligence is breaking patent law’, (Nature, 24 May 2022). Retrieved from: <https://www.nature.com/articles/d41586-022-01391-x> [accessed 7 October 2022].

In the context of technological innovation, Vietnam's legislature should prepare some necessary modifications for the purpose of achieving these goals. The inventorship barrier for AI-generated inventions should be eliminated to ensure a substantive evaluation for the patentability of such inventions. Therefore, the exclusion of the current definitions and interpretations as "persons" for the inventor, or author of inventions, in Article 122 of the Law on Intellectual Property is expected. Instead, the term "individuals" should be used to refer to the inventor. Besides, the term "author of inventions" in the Law on Intellectual Property should be transferred to the term "inventor" to determine "who have personally created such industrial property subject matters". This solution appears to be a reasonable approach for Vietnam in light of the possibility of confronting patent applications that list AI as an inventor.

First, in the absence of a strict determination of the inventor, competent authorities, including national courts and intellectual property office, can have more room to interpret with greater flexibility, modernity, and in line with the rapid development of technology. An overly precise regulation is not necessarily appropriate because the current practice might vary too dramatically that the law cannot stay consistent, particularly in the case of technology, where advancements in this field frequently appear earlier than initially expected or even outperform expectations.

Second, this regulation of Vietnamese law appears to be antiquated and inconsistent with the current approach in international patent law. Essentially, this regulation is inherited from the legislative legacy of Soviet law. However, this approach of Soviet patent law is no longer sufficient, practical, and relevant. Concurrently, there is no other model comparable to the Soviet legacy for Vietnam that may serve as a point of reference. Therefore, legal doctrines under Vietnamese patent law can potentially become obsolete if they are not promptly updated.

Third, these amendments will assist in determining the genuine nature of inventorship under Vietnamese law. The term "inventor" is commonly recognized in the majority of national laws in various countries other than the term "author of inventions". In the fundamental principle of intellectual property law, inventor and author are essentially two distinct concepts, utilized for distinct institutions, and entitled to distinct rights. Therefore, the inventor cannot be equated with the term "author of inventions", nor can the term "author" be used to refer to an inventor. Moreover, Vietnam has a unique meaning of the term "person" compared to other legal systems. On the one hand, such usage of this term would be perplexing for those who do not have a legal academic background in Vietnam. Generally, the

term “persons” often comprises both natural persons and legal persons. In Vietnam, however, “person” always refers to a natural person, a human being, and does not hold the same broad definition. On the other hand, this term is not consistent with terms used in general provisions related to civil law and intellectual property law. According to the scope and subject of application of the Civil Code 2015⁷² as well as the Law on Intellectual Property 2005⁷³, subjects engaging in civil law and intellectual property law relations are not “persons” but “individuals”. Consequently, these amendments will unify and standardize the usage of terminology within the same class of legally unified relationships.

Furthermore, all of these modifications will promote innovative, revolutionary, and open-minded discussions on intellectual property law and technology concerns with a level of depth and comprehensiveness. Besides, this solution also encourages Vietnam to demonstrate an independent viewpoint on patent protection for AI-generated inventions, therefore contributing vital perspectives to the ongoing discussion of international community. Finally, this revolution is necessary for the ultimate goal of implementing national strategies for technological development, which can have a valuable impact on economic growth, institutional reform, legal modernization, and national governance.

There is no doubt that national laws are insufficient to recognize AI as an inventor. In some countries, there are also public consultations established by government agencies to solicit opinions on the legal aspects of AI-generated inventions.⁷⁴ Simultaneously, this matter requires a multinational approach, not limited to a specific country exclusively. Therefore, international conversations are also required to clarify concerns regarding patent protection for AI-generated inventions and to seek cooperation and consensus among countries around the world.

Conclusion

There is still a need to protect inventions generated by AI, and if AI is not recognized, inventorship will become a significant barrier. The current legal framework of traditional patent law is insufficiently capable and prepared to recognize AI as an inventor. As a result, AI is breaking the patent protection system, creating unique situations where inventions meet all patentability requirements but are not protected. This has put pressure on the legal systems of many countries around the world, requiring a revolution and innovation

72 Civil Code 2015, s 1.

73 Law on Intellectual Property 2015, s 2.

74 For instance, the United States, United Kingdom have conducted public consultations on AI and intellectual property law.

compared to the traditional patent law that has existed for hundreds of years. International practice shows a majority of non-recognition for the inventorship of AI. In Vietnam, it is even more difficult when it is clearly regulated that the inventor has to be a human being, a natural person. In the current situation, perhaps amendments to national legislation seem to be the preferred option in relation to the international legal aspects of the issue. Consequently, Vietnam should also undertake the required preparations to adapt to the development revolution of technology, especially in the sphere of patent law. However, some related issues have not been clarified yet; it is therefore expected that in-depth research will be conducted on the technical fundamentals of AI systems related to autonomously inventive processes and the patentability requirements for AI-generated inventions. ●

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