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ARTIFICIAL INTELLIGENCE (AI) AND INVENTORSHIP

Document prepared by the Secretariat

INTRODUCTION

1. At its thirty-fourth session, held in Geneva from September 26 to 30, 2022, the Standing Committee on the Law of Patents (SCP) decided that the Secretariat would produce a compilation on how jurisdictions around the world address the issue of artificial intelligence (AI) inventorship, through jurisprudence, legislation and practice to be updated on a regular basis, and present it at the thirty-fifth session of the SCP (see document SCP/34/8 paragraph 25).

2. In accordance with the above decision of the SCP, the Annex to this document contains the said compilation of information for the Committee's discussion at its thirty-fifth session, which will be held in Geneva from October 16 to 20, 2023.

3. In the preparation of the compilation, the Secretariat made use of information provided by the Member States[1], including national and regional legislative provisions, and decisions rendered by intellectual property offices and courts. In addition, the Secretariat consulted other sources of information in order to obtain supplementary material on the topic.

4. This compilation contains the following sections:

(i) Artificial Intelligence: A brief overview and underlying technology;
(ii) Human-AI interaction in the invention process;

[1] Member States and Regional Patent Offices were invited, through its Note C. 9141, dated December 7, 2022, to submit to the International Bureau any additional inputs for the preparation of the compilation on on how jurisdictions around the world address the issue of artificial intelligence (AI) inventorship through jurisprudence, legislation and practice. The inputs received are published on the website of the SCP electronic forum at: https://www.wipo.int/scp/en/meetings/session_35/comments_received.html.

(iii) History of inventorship;
(iv) International legal framework relating to inventorship;
(v) National/regional legal frameworks relating to inventorship;
(vi) The “DABUS case”;
(vii) Concept of inventorship in relation to AI inventions.

[Annex follows]

Artificial Intelligence and Inventorship

Contents

I. ARTIFICIAL INTELLIGENCE: A BRIEF OVERVIEW AND UNDERLYING TECHNOLOGY

1. The definitions of Artificial Intelligence (AI) vary and there is no widely accepted definition.[1] For the purposes of this document, AI systems shall be understood as learning systems, i.e., machines that can learn and through this, become better at tasks, which are typically performed by humans.[2] AI systems are thus emulating human cognitive functions, albeit it is not entirely clear how the "intelligence" of such systems is measured.[3]

2. Machine learning is the dominant AI technique that can be described as a subfield of AI.[4] It works by identifying patterns in training data and then applying the obtained knowledge to new data and improving their performance on specific tasks without being expressly programmed.[5] Machine learning processes exist in different variations, depending on the data they build upon, and their task.[6] Machine learning contains three stages:

(i) program a model architecture;

(ii) develop a model through the training process based on a training algorithm and training data sets;

(iii) the model is applied to new data to produce a specific output.

3. One type of such a machine learning model is artificial neural networks. When an architecture is composed of a higher number of layers of neurons connected by adjustable parameters (weights), it is called a deep neural network, capable of deep learning.[7] Simply put, deep learning outputs emerge from training a computer with big data through a complex numerical optimization process and performing a task based on the statistical probability calculated from what it has learned. Document SCP/30/5[8] illustrates how deep machine learning works.

4. The success of deep learning models is generally based on their ability to take advantage of voluminous training datasets and the increase of computational power. Limitations of deep learning models become apparent particularly where no or limited training data (e.g., processing rare human languages, drug discovery for rare diseases, etc.) is available or in domains with legal restrictions.

5. Typically, one differentiates between general (or strong) AI and narrow (or weak) AI. The narrow AI is trained and focused on performing specific tasks, while the general AI would have a self-aware consciousness having the ability to solve problems.[9] Today, only narrow AI systems exist, but they are already showing successful functional applications in various fields,

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[1] Ryan Abbott, Intellectual property and artificial intelligence: an introduction, in *Research Handbook on Intellectual property and Artificial Intelligence*, p. 2, 6 (Ryan Abbott ed., 2022).
[2] WIPO Technology Trends 2019 – Artificial Intelligence, p. 19, available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf.
[3] The so-called Turing Test, which tests whether a human, who is conversing in writing (through keyboard and screen) with another human and computer system at the same time, could reliably tell the machine from the human apart, is the most well-known method but not without criticism. See, McCarthy, What is Artificial Intelligence?, available at: https://www-formal.stanford.edu/jmc/whatisai.pdf.
[4] WIPO Conversation on Intellectual Property (IP) and Artificial Intelligences (AI), WIPO/IP/AI/2/GE/20/1 REV (2020), par. 11.
[5] European Commission, Artificial Intelligence for Europe, COM(2018)237 final, p. 10.
[6] Drexl/Hilty et al., Technical Aspects of Artificial Intelligence, Max Planck Institute for Innovation and Competition Research Paper No. 19-13, p.3.
[7] *Ibid*, p.6.
[8] https://www.wipo.int/edocs/mdocs/scp/en/scp_30/scp_30_5.pdf.
[9] Butz, Towards Strong AI, KI - Künstliche Intelligenz, 2021, p.1; What is artificial intelligence (AI), available at: https://www.ibm.com/topics/artificial-intelligence.

such as banking (e.g., approval of loans), medical sciences (e.g., diagnostic of melanoma), transportation (e.g., autonomous driving) or generating texts.

6. More recently, generative AI models, which are machine learning models that are capable of "creating" new output data once trained, have attracted attention. Using large language models (LLMs), AI can be trained to learn not only individual words that form a sentence but also the correlation between these words, which allows a trained model to generate new content, such as texts and images. The generative models have also been used for designing new chemical compounds for, e.g., medicinal use (generative chemistry)[10], as LLMs are not confined to the processing of human languages but any combination of symbols, context and meaning.

7. Although deep learning models are able to learn, it still requires human interaction. For example, AI-human interaction is required in the creation of the network architecture, the determination of the best parameters (number of neurons per layer, size of input, etc.), selection of the resulting classes, and decision on how to encode the input in numerical format and in particular, the creation and making available of the training data, as well as providing the prompts to the AI model.[11] In addition, it is humans who evaluate the AI outputs, based on what the humans wish to achieve.

II. HUMAN-AI INTERACTION IN THE INVENTION PROCESS

8. Humans have been using technological tools to create new inventions and advance technological development. However, in the process of innovation, from the Eureka moment to conceiving an idea and developing a concept towards an invention that has practical utility, humans have been dictating the process. Even if humans use technological tools that have evolved substantially over time – for example, from a hammer to computer programs – humans have been indisputably accepted as inventors of inventions.

9. However, with the rapid development of AI technology, a reflection about how this interaction between humans and AI tools could evolve, and whether AI would play a role that is beyond being a "tool" in the innovation process, has been taking place.

10. For the consideration of inventorship, the interaction between humans and AI may take place in different ways, at least in theory:

(i) Human-only invention: This is the classical case regarding inventorship. In accordance with the established principles of national law, either one or several humans may claim inventorship for the invention. Inventors working "horizontally" together and contributing to the invention may potentially be co-inventors, and thus may have the right to a patent jointly.

(ii) Human-invention, assisted by AI: The human may be assisted by the AI in the innovation process. This assistance can take place in different forms, such as the identification of the technical problem to be solved or the verification of a certain solution found. As the AI is not engaged in the actual process of "conceiving" the invention, there is no argument to be made for the AI being an inventor. AI, in this case, is merely a tool in the hands of a human inventor.[12] For example, a human wants to develop a new pharmaceutical drug to improve the current available treatments of cancer. For this purpose, the human asks a deep learning mechanism to collect all available data on drugs

[10] https://www.nature.com/articles/s42256-022-00451-1.
[11] *Ibid*.
[12] See, for instance, the response from Finland to Note C. 9141, arguing "[…] we currently consider AI to be a tool of a human inventor, be that the person who operates the AI system, designs the algorithm, collects the input data for the system or performs another important steps for the software to function."

including the pharmaceutical formulae in this field, and their side effects. Based on this data, the human continues the work and comes up with a new and inventive solution.

(iii) Joint human-AI-invention: The human and the AI would work together, and both substantially contribute to the conception of the invention, for example, development of a new pharmaceutical compound with less side effects. It describes an invention that was created jointly by a human and AI system.

(iv) AI-invention, assisted by human: This case describes the inverse of the aforementioned case (ii). While there is considerable assistance by a human, e.g., with regard to identifying a problem to be solved, the actual conception of the invention is done by an AI system. The degree of assistance given by a human could vary. In essence, the AI would conceive the invention, and the human takes part in tasks that would not substantially contribute to the inventive concept (e.g., carrying out routine experiments).

(v) AI-only invention: This case is the extreme version of the aforementioned case (iv) and the inverse of case (i). Completely autonomous AI systems, which would engage in an inventive process even without the initial start signal given by a human, are still inconceivable. Therefore, this case is – for the time being – merely of theoretical interest. In this case, an AI would act without any human assistance and carry out the mental act on its own.

11. In each scenario, according to the disclosure requirement under patent law, a patent application may or may not be required to disclose the AI system involved. For example, if the invention solves the problem by using the output data X from an AI model with input data Y, the AI system could be essential for making and using the invention. However, if an AI system created (or assisted to create) a new chemical compound, making and using that compound *as such* does not require the AI system.

12. In addition to the different levels of human-AI interactions, another element that may be highlighted is that multiple persons in different roles may be involved in the creation of inventions using AI. For example, different persons may be involved in identifying a technical problem to be solved, designing an AI algorithm, generating and selecting data for training the AI model, using the trained AI model to produce an output from a set of input data, and analyzing and verifying the output data *vis-à-vis* the problem to be solved. Depending on the scope of the claimed invention and how the AI is associated with the claimed invention, more than one person may be considered joint inventors.

13. As illustrated above, how humans and AI systems contribute to the creation of AI-related inventions may vary significantly. Therefore, it seems necessary to look into the fundamental question: what is the notion behind the term “inventor” and how it is determined? Seeking answers to such a question under current patent law may bring the debate beyond the question as to whether an AI system can be named an inventor or not. Therefore, this document also addresses pertinent issues relating to inventorship under patent law, although it is not intended to be an exhaustive guide on inventorship.

14. It should be noted that, in relation to inventorship and AI, there are two distinct questions: (i) how the rules on inventorship are applied to AI inventions under the current patent law (*de lege lata*); and (ii) what rules on inventorship should be applied to AI inventions in the future under patent law (*de lege ferenda*). Whereas the former is a pure factual legal inquiry, the latter involves policy analysis and choices that may, or may not, require a legal reform in future. While both questions are equally important, this document focuses on the first question, as a baseline to be clarified before any further analysis and debate.

III. HISTORY OF INVENTORSHIP

15. Between the 14th and 16th century, monarchs in Europe were granting privileges in the form of letters patent for various activities, such as silk manufacturing, printing, making of playing cards[13], or brewing. These privileges were granted for a wide variety of common arts, but also for inventions, or introducing inventions (in the sense of importing ideas from abroad) in the territory of the ruler[14] and depended on the monarch's mercy, as strict rules for the granting of the letters patent were missing.[15] Some of these privileges granted protection against imitation, others were exemptions from the strict regulations imposed by guilds.[16]

16. At that time, the idea of rewarding the person of the inventor was not unheard of. The promotion of the local economy in the monarch's territory and the generation of income for the crown were the driving factors behind the development of this letters patent system. Frequently, privileges were also simply granted to favorites of the courts and royal supports more generally.[17] This development led to a situation that severely hampered commerce, as, for instance, the British Crown had granted patents of monopoly on salt, vinegar, or leather production. As a remedy, in 1623, the British Parliament enacted the Statute of Monopolies, which prohibited the granting of privileges by the Crown, with the exception of patents for the "first and true inventor" of a new manufacture. The particular section six of the statute reads:

> "[…] any declaration before mentioned shall not extend to any letters patents and grants of privilege for the term of fourteen years, or under, hereafter to be made, of the sole working or making of any manner of new manufactures within this realm, to the true and first inventor and inventors of such manufactures, […]"

17. The mentioning of the "first and true inventor", whose inventions are shielded from the prohibition of granting privileges and the abolishment of all monopolies, marks a historic change in focus, away from the monarch, towards the person who conceived the invention. As the Statute of Monopolies had a considerable influence on the development of other patent laws in Europe, its innovative idea to put the inventor front and center spread to multiple jurisdictions.

18. Thus, it is no wonder that this "shift in focus" towards the inventor is also found in the early French patent legislation. First, in 1789, France abolished the practice of granting privileges through letters patent. Subsequently, the *Société des inventions et des découvertes* (Society of Inventions and Discoveries) lobbied for the adoption of a patent law, similar to the English one. Particular weight in this respect was given to a report presented by Stanislas de Boufflers, arguing that inventions are inventors' products, which should be protected by virtue of natural rights.[18] In 1791, a patent law was enacted in France. It put the inventor first, declaring the rights in their intellectual creations as essentially a human right. The first part of the preamble of the French Patent Act of 1792 reads:

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[13] The privilege for importing and selling playing cards in England was annulled by the Court of King's Bench in the case *Edward Darcy Esquire v Thomas Allin of London Haberdasher* (1602) 74 ER 1131.
[14] Fritz Machlup, An Economic Review of the Patent System: Study of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary, United States Senate 85th Congress, Second Session pursuant to S. Res. 236 Study No. 15, p. 2.
[15] Mark Lemley, Why do juries decide if patents are valid? 99 Va. L. Rev. 1673, 1680 (2013).
[16] Christoph Ann, Patentrecht, Section 4 paras. 4-15 (8th ed. 2022).
[17] *Oil States Energy Servs., LLC v. Greene's Energy Grp., LLC*, No. 16-712, slip op. at 5 (U.S. Apr. 24, 2018) (Gorsuch, J., dissenting) (speaking of "letter patents" as "little more than feudal favors").
[18] S. de Boufflers, Rapport sur la propriété des auteurs de nouvelles découvertes et inventions en tout genre d'industrie, 1791, available at: https://gallica.bnf.fr/ark:/12148/bpt6k438194/f4.item.textelmage; Gabriel Galvez-Behar, The patent System during the French industrial revolution : Institutional change and economic effects, Economic History Yearbook, 2019, Patent Law and Innovation in Europe during the Industrial revolution, 60 (1), pp. 31-56, pre print available at: https://shs.hal.science/halshs-00544730/file/GGB-FRENCH-PATENT-SYSTEM-PRE-PRINT.pdf, p. 4.

> "[…] considering that any new idea, whose manifestation or development can become useful to the society, belongs originally to the one who conceived it, & that it would be an attack on human rights in their essence, not to consider an industrial discovery as the property of its author".[19]

19. Finally, the Constitution of the United States of America, in Article 1 Section 8, Clause 8, grants the Congress the power "to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries". According to this provision, inventors have exclusive rights for a certain purpose within society. While the French patent law emphasizes the natural right of the inventor (although usefulness of inventions for the society at large was acknowledged), the Constitution of the United States of America appears to focus on a utilitarian rationale, namely the "promotion of progress of science". Though these approaches differ in detail, the reference point for the patent is in both cases the same: the inventor. The pivotal importance of the inventor becomes obvious in Madison's explanation of the copyright and patent clause, stating that;

> "The copyright of authors has been solemnly adjudged, in Great Britain, to be a right of common law. The right to useful inventions seems with equal reason to belong to the inventors. The public good fully coincides in both cases with the claims of individuals."[20]

20. In summary, the perception of patents has changed over a long period of time. The Statute of Monopolies no longer saw patents as a contract between monarchs and their subjugated citizens, but rather a "social contract" between the patentee and society that acknowledged the individual and its ingenuity.[21] The idea that human ingenuity promotes progress of science and creation of useful inventions for society, for which natural law requires the granting of a reward in the form of an exclusive right to a specific person, rendered the inventor central to patent law. This approach became even more prominent in the decades to come, and was included in international debates on patent law, culminating at the Revision Conference for the Paris Convention for the Protection of Industrial Property, held in London in 1934. At that Conference, the "right to be mentioned in the patent" for the inventor was introduced and spurred substantial changes in national patent laws. For instance, German patent law switched from the applicant principle to the inventor principle, abolishing company inventions as such.

IV. INTERNATIONAL LEGAL FRAMEWORK RELATING TO INVENTORSHIP

A. PARIS CONVENTION FOR THE PROTECTION OF INDUSTRIAL PROPERTY

21. Article 4ter of the Paris Convention for the Protection of Industrial Property (Paris Convention) states that "[t]he inventor shall have the right to be mentioned as such in the patent." The provision was introduced at the Revision Conference of London in 1934 and established moral rights of the inventor, entailing the right of recognition. The provision, however, addresses neither an economic right nor economic benefits of inventors.[22] The inventor may waive the right to be mentioned, unless national legislation prescribes otherwise.[23] The issue of inventorship as such and how exactly the moral rights of the inventor may be

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[19] French Patent Act of January 7, 1791, available at: https://artflsrv03.uchicago.edu/philologic4/revlawall1119/navigate/12/59/.
[20] James Madison, The Federalist No. 43.
[21] Edward Walterscheid, The Early Evolution of the United States Patent Law: Antecedents (Part 3), 77 J. Pat. & T. Off. Soc. 771, 793 (1995).
[22] *Ibid*, para. 10:36.
[23] Georg H. C. Bodenhausen, Guide to the Application of the Paris Convention for the Protection of Industrial Property, 1968, p. 64.

exercised is a matter of national law, as the Paris Convention does not elaborate on these matters.

22. Historically, Article 4ter of the Paris Convention builds on prior work done by the Consultative Committee on Intellectual Workers of the International Labour Organization (ILO), which also discussed rules regarding the rights of employee inventors.[24] In fact, the inclusion of moral rights of the inventor "to be mentioned in the patent" was advocated for by the Consultative Committee on Intellectual Workers of the ILO on the basis of an earlier resolution, adopted at an ILO meeting in Geneva in 1929, which generally called for the protection of employee inventions, including fair remuneration of employee inventors.[25] However, the issue of remuneration was considered to be too closely connected to the contractual arrangements between employer and employee to be part of the Paris Convention.[26] Therefore, in the absence of any consensus among delegations at the Revision Conference, a provision regarding the employee inventions was not incorporated into the Paris Convention. The moral rights provision, however, was adopted without opposition.[27]

B. PATENT COOPERATION TREATY (PCT)

23. Pursuant to Article 1(2) of the Patent Cooperation Treaty (PCT), "[n]o provision of this Treaty shall be interpreted as diminishing the rights under the Paris Convention for the Protection of Industrial Property of any national or resident of any country party to that Convention". In contrast to the Paris Convention, the PCT does not speak explicitly of a right of the inventor to be mentioned. However, since only the Contracting States of the Paris Convention may become a party to the PCT,[28] in effect, all PCT Contracting Parties shall comply with the Paris Convention, including Article 4*ter* regarding the moral rights of inventors.

24. In the context of formality requirements relating to an international patent application, according to PCT Article 4(1)(v), the request, included in an international application, shall contain, *inter alia*,

> "the name of and other prescribed data concerning the inventor where the national law of at least one of the designated States requires that these indications be furnished at the time of filing a national application. Otherwise, the said indications may be furnished either in the request or in separate notices addressed to each designated Office whose national law requires the furnishing of the said indications but allows that they be furnished at a time later than that of the filing of a national application."

25. PCT Article 4(4) further stipulates that,

> "[f]ailure to indicate in the request the name and other prescribed data concerning the inventor shall have no consequence in any designated State whose national law requires the furnishing of the said indications but allows that they be furnished at a time later than that of the filing of a national application. Failure to furnish the said indications in a separate notice shall have no consequence in any designated State whose national law does not require the furnishing of the said indications."

26. As information regarding the inventor is typically required in the national phase, it is generally recommended that it is included in the request.[29] The formalities regarding the

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[24] Record of the Revision Conference of London, Union Internationale pour la Protection de la Propriété Industrielle, Actes de la Conférence Réunie à Londres, 1934, p. 90-91.
[25] *Ibid*, p. 160-161.
[26] *Ibid.*
[27] Sam Ricketson, The Paris Convention for the Protection of Industrial Property: A Commentary para. 10:35 (2015).
[28] PCT Article 62(1),
[29] Thomas Henninger, Filing an international application, in *PCT: Strategy and Practice*, p. 39 (Derk Visser et al. eds., 2021).

information of the inventor are further specified by the Regulations under the Patent Cooperation Treaty (PCT Regulations) and the Administrative Instructions under the Patent Cooperation Treaty (Administrative Instructions).

27. According to Rule 4.6 of the Regulations, the request shall, where Rule 4.1(a)(iv) or (c)(i) applies, indicate the name and address of the inventor, or, if there are several inventors, of each of them. With regard to the exact form of the name and address, names of natural persons shall be indicated by the person's family name and given name(s), the family name being indicated before the given name(s).[30] As to the addresses, they shall be indicated in such a way as to satisfy the customary requirements for prompt post delivery at the indicated address […]".[31]

28. Furthermore, the international application may contain certain declarations with respect to the identity of the inventor[32], the applicant's entitlement to a patent[33] and the inventorship[34]. These declarations enable the applicant to comply with some of the national requirements of the designated Offices referred to in Rule 51*bis.*1 already during the international phase. The declarations must be worded in accordance with Sections 211 and 214 of the Administrative Instructions, respectively. The declaration of inventorship, for the purposes of designation of the United States of America (and also India, Liberia and Mongolia), contains the name, residence and mailing address of the inventor(s), and must be signed by the inventors themselves, i.e., a signature of the patent agent is not sufficient.

C. PATENT LAW TREATY (PLT)

29. Article 6(1) of the PLT states that, in principle, no Contracting Party shall require compliance with any requirement relating to the form or contents of an application different from or additional to the requirements relating to form or contents which are provided for in relation to the international applications under the PCT. In addition, PLT Article 6(2) provide that a Contracting Party may require that the information that corresponds to the contents of the request part of the international application be presented on a request form prescribed by that Contracting Party. Accordingly, the requirements relating to the form or contents of a PCT international application, including indication of inventors and relevant declarations, are incorporated by reference into the PLT.

D. AGREEMENT ON TRADE-RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS (TRIPS AGREEMENT)

30. The TRIPS Agreement itself does not contain a provision with regard to inventorship. It however incorporates Article 4*ter* of the Paris Convention by means of reference in its Article 2.1, whereby the WTO members, whether they are party to the Paris Convention or not, are obliged to implement Articles 1 through 12, and 19 of the Paris Convention.[35]

V. NATIONAL/REGIONAL LEGAL FRAMEWORKS REGARDING THE CONCEPT OF INVENTORSHIP

A. INVENTOR'S RIGHT TO A PATENT

31. Inventorship marks the point of origin of each invention. It belongs to the inventor(s) of the invention, and indicates, generally speaking, "who conceived the subject matter at issue"[36].

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[30] Rule 4.4(a) of the PCT Regulations.
[31] Rule 4.4(c) of the PCT Regulations.
[32] Rule 4.17(i) of the PCT Regulations.
[33] Rule 4.17(ii) of the PCT Regulations.
[34] Rule 4.17(iv) of the PCT Regulations.
[35] See with regard to Article 6*quinquies*, Appellate Body Report *United States-Section 211 Omnibus Appropriations Act of 1998*, WT/DS176/AB/R, January 2, 2002, paras. 124, 125.
[36] Gladstone Mill III, Patent Law Fundamentals, Volume 5 § 17:3 (2d ed., 2022).

As explained in the section on the historical development of inventorship, the importance of the concept has evolved over time. It can be understood as an "inventor centric" approach in patent law, compared to the historic origins of patents as privileges granted by a monarch. In this sense, inventorship symbolizes the "personality dimension" of a patent (besides its "property component").[37] It manifests itself in the right of the inventors to be, or (at their discretion) not to be, mentioned in a patent application or a patent as the inventor of a given invention.[38] This means that a specific (group of) person(s) is continuingly associated with the origin of the invention. Therefore, inventorship is a "static" concept, i.e., once established, it does not change over time. It focuses on identifying the person behind the conception of the invention. Thus, it serves the purpose of assigning the inventor(s) a special position within the legal order, which comes with economic and moral rights.

32. Patent rights are defined as private rights, pursuant to the preamble of the TRIPS Agreement, which means that they can be claimed by private, natural or juridical, persons in the respective national law.[39] These private rights are associated with economic rights and the ownership of the patent. The concept of *ownership* of a patent differs strictly from the concept of *inventorship,* as ownership relates to the legal *possession* over the invention, whereas inventorship relates to the *originator* of the invention. Specifically, the patent owner enjoys exclusive rights, as stipulated in Article 28.1(a) and (b) of the TRIPS Agreement, such as the making, using or selling of the invention. Also, the patent owner can assign, or transfer by succession, the right to a third party or conclude licensing contracts (Article 28.2 of the TRIPS Agreement). In contrast to the "static" concept of inventorship that, once established, does not change, ownership is a "dynamic" concept and may vary over time.

33. Yet under modern patent law, the concepts of inventorship and ownership are closely related. National/regional patent laws often stipulate that, in principle, "the right to a patent shall belong to the inventor or his successor in title".[40] In other words, in principle, once an invention is created, in the first place, it is an inventor of the invention who is entitled to claim the right to obtain a patent, and if obtained, to enjoy patent protection of the invention. An inventor may assign such a right to another person (i.e., a successor in title), who may be a natural person or a legal person. With the assignment, the right to a patent is transferred to the assignee.

34. A similar approach is chosen for instance, in Section 7(2) of the Patent Act 1977 of the United Kingdom where it is explicitly stipulated that "A patent for an invention may be (a) granted *primarily* to the inventor […] (c) in any event, to the successor or successors in title […]" (*emphasis added).* Likewise, Section 15(1) of the Australian Patent Act 1990 states that "Subject to this Act, a patent for an invention may only be granted to a person who: (a) is the inventor; or (b) would, on the grant of a patent for the invention, be entitled to have the patent assigned to the person; or (c) derives title to the invention from the inventor or a person mentioned in paragraph (b); or (d) is the legal representative of a deceased person mentioned in paragraph (a), (b) or (c)."

35. Exceptions from the general rule that the inventors own their inventions appear in several fields. Many national and regional laws provide a separate set of rules regarding the right to a

[37] See the response from the Czech Republic to Note C. 9141.
[38] *Ibid*.
[39] Carlos Correa, Trade Related Aspects of Intellectual Property Rights: A Commentary on the TRIPS Agreement, p. 42 (2020) (explaining that it is unclear why the negotiating parties included this statement in the preamble).
[40] See, for instance, Brazil (Article 6° of Law No. 9279), China (Article 6(2) of the Patent Law of the People's Republic of China), Czech Republic (Section 8(1) of Act No. 527/1990), Finland (Section 1 of the Finish Patent Act), Germany (Section 6(1) of the German Patent Act), Kenya (Section 30(1) Industrial Property Act), Republic of Korea (Article 33(1) of the Korean Patent Act), Portugal (Article 57 of the Industrial Property Code), Russian Federation (see response to C. Note 9141), Slovakia (Article 10(1) of Act No. 435/2001 Coll. On Patents, Supplementary Protection Certificates and on Amendment of Other Acts as Amended), Spain (Article 10 of the Patent Act); Article 60(1) of the European Patent Convention and Article 7(1) of the EAPC. Article 9(1) of the Bangui Agreement states that the right belongs to the inventor, while Article 61(1) of the Bangui Agreement refers to the successor in title.

patent where an invention is made within the employer-employee relationship and/or a creation of an invention is commissioned (see Section V.F. (Employee Inventions), below, for further details). In addition, specific rules may apply in the field of inventions made with the assistance of governments. For example, the provisions of 35 U.S.C. §§ 200–212, commonly referred to as the Bayh-Dole Act, govern patent rights for inventions made with federal assistance.[41]

Inventor's oath or declaration

36. Some jurisdictions require that the inventor(s) submits a formal statement, declaring that he/she believes that he/she is the inventor (or the joint inventor) of the claimed invention contained in the patent application. For instance, Section 115(a) of Title 35 of the United States Code (35 U.S.C.) states that "[a]n application […] shall include […] the name of the inventor for any invention claimed in the application. Except as otherwise provided in this section, each individual who is the inventor or a joint inventor of a claimed invention in an application for patent shall execute an oath or declaration in connection with the application", which shall be signed by the inventor (or the joint inventor) himself/herself.

Applicant's entitlement to apply for and be granted a patent

37. As the inventor may assign his/her right to a patent to another person, if the inventor is not the applicant, many jurisdictions require the submission of a declaration or a document showing how the applicant has obtained the right: in other words, why the applicant is entitled to apply for and be granted a patent. The formality requirements that an applicant, who is not the inventor, must comply with vary among different jurisdictions. For example, under Article 26(k) of Decision 486 of the Andean Community states that "the application for a patent shall be filed with the competent national office and shall contain the following: […] (k) where applicable, a copy of the document attesting the assignment of the right to the patent by the inventor to the applicant or to his principal." Accordingly, in Colombia, the applicant who is not the inventor must annex either a copy of the assignment contract or of the contract by virtue of which such assignment can be legally presumed.[42]

38. Under Article 81 of the European Patent Convention (EPC), where the applicant is not the inventor nor the sole inventor, the designation of the inventor shall contain a statement indicating the origin of the right to the European patent. The designation shall be filed in a separate document and shall state the family name, given names and country and place of residence of the inventor, contain the statement referred to in EPC Article 81, and bear the signature of the applicant or his representative.[43] If the application does not fulfil the requirements pursuant to Article 81, the applicant will have the opportunity to correct the application within sixteen months from the date of filing or, if priority is claimed, the earliest priority date, and in any event no later than five weeks prior to the intended date of publication of the application.[44] Likewise, Rule 5(5)(e) of the Regulations for Implementing the Protocol on Patents and Industrial Designs within the Framework of the African Regional Intellectual Property Organization (Harare Regulations) stipulates that where the applicant is the inventor, a statement to that effect and, where he is not, the name and address of the inventor accompanied by a statement specifying the basis of the applicant's right to the patent shall be submitted.

39. Similarly, in the United States of America, an applicant, who is not the inventor needs to provide some proof of entitlement/assignment information, such as an employment contract.[45]

[41] See with further details, Christian E. Mammen,'United States of America', in Willem A. Hoyng and Frank W.E. Eijsvogels (eds), Global Patent Litigation, Kluwer Law International; 2006, Online Update, March 2023, p 5-6.
[42] See 1.2.2.2. of Chapter One, Title X of the Internal Circular of the Superintendence of Industry and Commerce.
[43] See European Patent Guide, 4.1.014, European Patent Office.
[44] See Article 90 (3)-(5) of the EPC and Rule 60.
[45] See USPTO, Patent Rules Appendix R, Manuel of Patent Examining Procedure (July 2022), §1.46, § 1.76(7), see also the requirement for recording pursuant to §3.21, §3.24.

It is also to be noted that 35 U.S.C. 261 requires transfer of ownership by an assignment to be in writing.[46] The position of inventors, and consequently their rights, are furthermore protected by certain remedies available in case of wrongful designation of the inventorship or wrongful taking of the invention (see Section V.G., below, for further details).

B. MORAL RIGHTS

40. In implementing Article 4*ter* of the Paris Convention, national laws provide rules on the moral rights of inventors, i.e., the right to be mentioned in a patent. A transfer of moral rights is not possible under many laws.[47]

41. In Spain, pursuant to Article 14 of the Spanish Patent Act, the inventor has, *vis-à-vis* the patent holder or applicant, the right to be mentioned as such in the patent.[48] Furthermore, according to Section 63(1) of the Patent Act of Germany, the inventor is granted the right to be mentioned in the first publication of the application, the patent specification and the publication of the grant of the patent. Mentioning the inventor shall be recorded in the Register, unless the inventor requests not to be mentioned. The inventor may withdraw the request not to be mentioned at any time, in which event the inventor shall be subsequently mentioned in the applicable publication.[49] The inventor, however, may not permanently waive his/her right to be mentioned (i.e., the inventor's waiver of being mentioned shall be "without legal effect").[50] The patent law in Kenya similarly stipulates, in Section 33 of the Industrial Property Act that "[t]he inventor shall be named as such in the patent application and in the patent unless within a special written declaration addressed to the Managing Director he indicates that he wishes not to be named and any promise or undertaking by the inventor made to any person to the effect that he will make such declaration shall be without legal effect."

42. Similarly, the right of the inventor to be mentioned in the Eurasian application and Eurasian patent is ensured under Article 14(viii) of the Eurasian Patent Convention (EAPC), and further specified in Rule 8 of the Patent Regulations to the EAPC, which allows the inventors to waive their rights to be mentioned before the technical preparations for publication of the Eurasian application or the Eurasian patent have been completed. This waiver may be withdrawn within the same time period.

43. According to Article 62 of the EPC, the inventor has the right to be mentioned as such before the European Patent Office (EPO). In addition, Rule 20(1) of the Implementing Regulations to the Convention on the Grant of European Patents (Regulations) states that the inventor shall "be mentioned in the published European patent application and the European patent specification, unless he informs the European Patent Office in writing that he has waived his right to be thus mentioned." Likewise, legal instruments of other regional organizations, such as the Andean Community[51], African Regional Intellectual property Organization (ARIPO)[52] and African Intellectual Property Organization (OAPI)[53], provide the right of the inventor to be mentioned as such in the publication of the patent application and patent, and also allow the inventor to withdraw such right.

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[46] See Realvirt, LLC v. Lee, 195 F.Supp.3d 847, 859 (E.D. Va. 2016).
[47] See for example, the response of Singapore to Note C. 9141 stating that according to case law, inventorship is interpreted as a personal right which is unique to the inventor and cannot be assigned the way proprietary interests can.
[48] See the response from Spain to Note C. 9141.
[49] Section 63(1) of the German Patent Act.
[50] *Ibid*.
[51] Article 24 of Decision 486 of the Andean Community.
[52] Rule 20(2)(c) of the Harare Regulations. The Administrative Instructions on the Harare Protocol, in their Instruction 15, further elaborate that "the inventor shall be named as such in the patent […] unless […] he addresses to the Director General a special written declaration signed by him, indicating that he wishes not to be so named […]".
[53] Articles 19(1)(d) and 35(1)(e) of the Bangui Agreement Instituting an African Intellectual Property Organization (Bangui Agreement).

44. Under Section 24(1) and (2) of the Singapore Patent Act, the inventor has the right to be mentioned as such in any patent granted for the invention and, the persons whom the applicant believes to be the inventor(s) must be identified in the patent application.[54]

45. In Lithuania, a patent application and a patent must contain the "forenames and surnames" of the inventor or inventors (Article 12(1)).[55]

C. "INVENTOR" = NATURAL PERSON?

46. Under patent law, protectable inventions need to meet the industrial applicability/utility requirement. Patentable inventions are often characterized as technical solutions to specific problems. Therefore, the notion of "inventions" under the patent law reflects humanity and societal needs. To that end, an inventor carries out a process that leads to an invention – recognizing a problem, searching for an answer and identifying a solution.

47. In some countries party to the Paris Convention, the term "inventor" is defined in a dedicated statutory provision of the applicable law,[56] while other jurisdictions explain the term in secondary legislation, e.g., explanatory/implementing rules for the patent law.[57] Some countries rely on case law or a contextual reading of the term "inventor" to interpret that term. Many of those jurisdictions that have certain guidance on the interpretation of the term "inventor" point out that an inventor has to be a natural person.

48. Facing the so-called DABUS applications, some national/regional patent offices and courts confronted the question as to whether an AI system can be an inventor under their patent laws. This question closely relates to the definition and interpretation of the term "inventor". Therefore, the decisions of national patent offices and courts relating to the DABUS applications provide detailed legal analysis of this term. Therefore, an overview of these decisions from Australia, Brazil, Canada, Germany, India, New Zealand, the Republic of Korea, South Africa, the United Kingdom, the United States of America and the European Patent Office (EPO), compiled in Section VI.B., below, provides additional information on this topic.

Definition according to statutory provisions

49. In several jurisdictions, statutory provisions define inventors as "natural persons". For instance, in Cuba, Article 6(2) of Decree-Law No. 290 defines the term "inventor" as "a natural person[58] who has created an invention eligible for protection by a patent or registered utility model". Similarly, pursuant to Article 2(8) of the Patent Law of Lithuania, an "inventor is a natural person who creates an invention", or pursuant to Article 17(1) of Moldavian Law 50/2008 on the Protection of Inventions, the inventor is "the natural person whose creative work has led to the invention".

50. Article 1347 of the Russian Civil Code defines the "author of an invention" as "the citizen whose creative work created the corresponding result of intellectual activity". Similarly, in Brazil, according to Article 6° of the Industrial Property Law (Law No. 9279, May 14, 1996), the right to obtain a patent shall be assured to the author of an invention. With a view to Article 11 of the Copyright Law (Law No. 9610, February 19, 1998), which states that "[t]he author of a literary,

[54] See the response from Singapore to Note C. 9141.
[55] See the response from Lithuania to Note C. 9141.
[56] These countries include, for instance, Cuba, Kenya, Lithuania, Moldova, the Russian Federation, Singapore, Slovakia, the United Kingdom, and the United States of America.
[57] See, for instance, the responses from Slovakia and China to Note C. 9141, referring to the "Explanatory Memorandum to the Patent Act (2001)" for excluding nonhuman entities from inventorship" [Slovakia], and to Article 13 of the "Implementation Rules of the Patent Law" to define the term inventor [China], respectively.
[58] Which means, according to the Cuban Civil Code, Law No. 59 any human being with the capacity to enjoy legal rights and be subject to legal obligations, see response from Cuba to Note C. 9141.

artistic or scientific work is the natural person who created it", the inventor is considered as a natural person in Brazil.[59]

51. In Rule 13 of the Implementing Regulations of the Chinese Patent Law, an inventor is defined as any person who makes creative contributions to the substantive features of an invention-creation. Similarly, in Slovakia, an Explanatory Memorandum provides guidance as to who is capable of innovation and consequently, what defines inventorship. The Explanatory Memorandum to the Patent Act (2001) notes that only natural persons can be inventors, since only natural persons are capable of cogitation, creative cogitation, which is the basic precondition of creation of any invention.[60]

Definition by case law

52. For the United Kingdom, the inventor is defined in section 7(3) of the Patent Act as "the actual devisor of the invention". Independently of the DABUS case, according to case law, the understanding of the word "actual" denotes a contrast with a deemed or pretended deviser of the invention; it means, the natural person who "came up with the inventive concept."[61]

53. Section 2(1) of the Singapore Patent Act of 1994 stipulates that the "'inventor', in relation to an invention, means the actual deviser of the invention and 'joint inventor' is to be construed accordingly." Courts interpreted the term "actual devisor" to mean "the natural person who came up with the inventive concept."[62] The Singaporean courts further interpreted that inventorship is a personal right which is unique to the inventor and cannot be assigned the way proprietary interests can.[63]

54. Section 1 of the Finnish Patent Act of 1967 states "[w]hoever has, in any field of technology, made an invention […] or his or her successor in title, shall be entitled on application to a patent and thereby to the exclusive right to professionally exploit the invention in accordance with this Act". According to the well-established jurisprudence, the word "whoever" means a natural person and thus a human being.[64]

Definition according to contextual reading

55. Some jurisdictions rely on a contextual reading of the term "inventor" to come to the conclusion that an inventor is a natural person. Specifically, beyond the policy justification of the patent system, the legislative provisions regarding the inventor's moral rights, the right to a patent being originated by the inventor, assignment of the right to a patent from the inventor to a successor in title as well as the requirement to indicate the name of the inventor in a patent application (in the form of a given name and a surname) are often considered as important clues that lead to such an interpretation.

56. For example, in Spain, it is established that the term "inventor" refers to a natural person by reading together with the provision stating that "the right to the patent belongs to the inventor or his or her successors in title."[65] As only humans have a successor, it is implied that inventors need to be necessarily humans.[66] In addition, the same interpretation can be drawn from Rule 2 of the Implementing Regulations of the Spanish Patent Act, which requires the indication of a

[59] See the response from Brazil to Note C. 9141.
[60] See the response from Slovakia to Note C. 9141.
[61] See House of Lords, Yeda Research and Development Company Limited (Appellants) v. Rhone-Poulenc Rorer International Holdings Inc and others [2007] UKHL 43 (decision of October 24, 2007), para. 20 with further references.
[62] *Energenics Pte Ltd v Musse Singapore Pte Ltd* [2013] SGHCR 21, see response from Singapore to Note C. 9141.
[63] *Ibid*.
[64] See the response from Finland to Note C. 9141.
[65] Article 10 of the Spanish Patent Act.
[66] See the response from Spain to Note C. 9141; a similar idea was mentioned in the response from the Czech Republic to Note C. 9141.

name and surname of an inventor for the designation of the inventor.[67] Likewise, the Portuguese patent law acknowledges only a natural person as inventor, since the "name" and "residence" that shall be indicated in the patent application are interpreted to mean the name and residence of a natural person, and the entitlement to a patent by an inventor and his/her successor in title is only legally possible with regard to natural persons.[68]

57. In the same line, Articles 36(1) and 184-5(1) of the Patent Act of Japan stipulate that the "*shimei*" of the inventor, and the "*shimei*" or "*meisho*" of the applicant must be submitted in a written application to the Commissioner of the Japan Patent Office. In that context "*shimei*" is understood as a surname and a first name of a natural person, whereas "*meisho*" is interpreted as the name of a juridical person.[69] As only the term "*shimei*" is used in connection with the inventor, it may be inferred that the inventor has to be a natural person. This contextual reading is further consistent with Article 29(1) of the Japanese Patent Act ("A person that invents an invention with industrial applicability may obtain a patent for that invention […]"), the possibility of transferring the right to a patent (Article 33(1)), and the requirements regarding succession of the right (Article 34(1)).[70] It is thus not permitted to indicate other entities than natural persons as the inventor in patent applications in Japan.[71]

58. Similar to the above countries, only natural persons are accepted as inventors under the patent law of the Republic of Korea, since a patent application must contain the name and the domicile of an inventor, pursuant to Article 42 of its Patent Act.[72]

59. In India, while its patent law does not define the term "inventor", Section 2 of the Indian Patent Act, 1970 stipulates that the "true and first inventor does not include either the first importer of an invention into India, or a person to whom an invention is first communicated from outside India." Since that provision only negatively describes who is not a "true and first inventor", whether the "true and first inventor" has to be a person or not cannot be ascertained. Section 6 of the Indian Patent Act, however, states that any *person* claiming to be the true and first inventor of the invention can make an application for a patent (emphasis added). Furthermore, Section 7(3) of the Indian Patent Act makes it clear that only a person is seen as an inventor, as the provision stipulates that "Every application […] shall name the person claiming to be the true and first inventor;".

60. Norwegian patent law in Section 1 of the Patent Act, establishes that "[w]ithin any technical field, any person who has made an invention which is susceptible of industrial application, or his successor in title, shall, in accordance with this Act, have the right on application to be granted a patent for the invention […]". The wording "any person" is understood to refer to a natural person, not a juridical person.[73] This follows from interpretation of the provisions based on a natural understanding of the wording and legal sources.

D. DETERMINATION OF AN "INVENTOR"

61. Inventorship is established differently in each jurisdiction, but common themes exist. In general, an inventor makes a creative contribution to technological advancement, which results in an invention. For example, under Russian patent law, it is held that the result of intellectual activity appears due to the creative contribution of a human being.[74] Thus, the author of an invention is the citizen whose creative work created the corresponding result of intellectual

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[67] *Ibid*.
[68] See the response from Portugal to Note C. 9141.
[69] See the response from Japan to Note C. 9141.
[70] *Ibid*.
[71] *Ibid*.
[72] See the response from the Republic of Korea to Note C. 9141.
[73] See the response from Norway to note C. 9141.
[74] See the response from the Russian Federation to Note C. 9141.

activity (see Article 1347 of the Russian Civil Code).[75] Other jurisdictions follow comparable approaches by defining intellectual property as "creations of the human mind/intellect, which then prescribes human ownership and inventorship."[76]

62. In the United States of America, "conception" of an invention is understood as the true "touchstone of inventorship",[77] or the "threshold question in determining inventorship" [78]. According to established case law, a person must participate in the conception of the invention in order to qualify as an inventor.[79] The term "conception" is understood as a mental process and further defined as the "completion of the mental part of the invention".[80] According to *Burroughs Wellcome Co. v. Barr Laboratories, Inc.,* it is the formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice. Conception is complete only when the idea is so clearly defined in the inventor's mind that only ordinary skill would be necessary to reduce the invention into practice, without undue extensive research or experimentation."[81] A person must have contributed to the conception of at least one claim to be considered an inventor. [82]

63. The reduction to practice of an invention is the manifestation of the invention. This can be achieved by an actual physical creation of the product, the running of the process, or the filing of the patent application on the claimed invention (known as "constructive reduction to practice").[83] For determining an inventor, reduction into practice is *per se* irrelevant, except where conception of the invention and reduction into practice happen simultaneously.[84] Thus, "the inventor may solicit the assistance of others when perfecting the invention without "losing" any patent rights" [85]. In other words, "there is no requirement that the inventor be the one to reduce the invention to practice so long as the reduction to practice was done on his behalf"[86].

64. Another approach for establishing inventorship is found in the requirement of "creative activity" of the inventor, for instance, in the patent laws of China, the Czech Republic,[87] and Slovakia[88]. Pursuant to Rule 13 of the Implementing Regulations of the Chinese Patent Law, an inventor is defined as any person who makes creative contributions to the substantive features of an invention-creation. The term "creative contribution" is not further defined, but according to some case law, it is related to innovative intellectual work carried out in relation to the aforementioned substantive feature.[89] According to the Patent Examination Guidelines, inventors are explicitly defined as individuals – entities and organizations are not allowed to be

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[75] *Ibid*.
[76] See the response from Trinidad and Tobago to Note C. 9141.
[77] R. Carl Moy, Moy's Walker on Patent, Volume 3, § 10:11 and § 10:12 (4th edition 2020) (noting that "[…] the classic view of inventorship defines the inventor as the person who conceived of the subject matter in question, with no inquiry into who reduced it to practice.", and that "[the law's decision not to include reduction-to-practice within the definition of inventorship is part of a larger pattern of hostility to reduction-to-practice in United States patent law […]").
[78] Mueller Brass Co. v. Reading Indus , 352 F. Supp 1357(E.D. Pa 1972).
[79] In re Hardee, 223 U.S.P.Q. 1122, 1123 (Comm'r Pat. 1984).
[80] *Burroughs Wellcome Co. v. Barr Laboratories*, Inc., 40 F.3d 1223, 1227 (1994).
[81] *Sewall v. Walters*, 21 F.3d 411, 415 (Fed. Cir. 1994) with further reference to *Summers v. Vogel*, 332 F.2d 810, 816, 141 USPQ 816, 820 (CCPA 1964); *In re Tansel*, 253 F.2d 241, 243, 117 USPQ 188, 189 (CCPA 1958).
[82] See with further details and case law, Bluebook 21st ed., Sherry L. Murphy, Determining Patent Inventorship: A Practical Approach, 13 N.C. J.L.& TECH. 215 (2012) p. 227.
[83] *Hybritech Inc. v. Monoclonal Antibodies*, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986).
[84] See USPTO 2109, II. With reference to Fiers v. Revel, 984 F.2d 1164, 1168, 25 USPQ2d 1601, 1604-05 (Fed. Circ. 1993).
[85] *Trovan, Ltd. v. Sokymat SA*, 299 F.3d 1292, 1302 (Fed. Cir. 2002).
[86] *In re DeBaun*, 687 F.2d459, 463, 214 USPQ 933, 936 (CCPA 1982).
[87] See the response from the Czech Republic to Note C. 9141
[88] See the response from Slovakia to Note C. 9141, explaining that "an inventor is a person who created an invention by his own creative work" pursuant to Article 10(2) of Act No. 435/2001.
[89] Shanghai No. 1 Intermediate People's Court (2011) Hu-Yizhong-Minwu(zhi)-Chu-ZI No. 1, as cited in Noam Shemtov, A study on inventorship in inventions involving AI activity, p. 13, footnote 19 (commissioned by the European Patent Office, 2019).

named as inventors.[90] Furthermore, merely auxiliary activity regarding the invention, such as providing a laboratory or somebody responsible for organizational work only, is not considered an inventor.[91]

65. In some countries, an inventor is defined or interpreted as "an actual devisor of the invention" and his/her contribution to the "inventive concept" is an important consideration for the determination of inventorship.

66. For example, in the United Kingdom, an inventor is defined in section 7(3) of the Patents Act[92] as the "actual devisor of the invention". In *Henry Brothers (Magherafelt) Ltd v The Ministry of Defence and the Northern Ireland Office,*[93] the Court of Appeal emphasized that a two-step approach was necessary to determine inventorship. One must first identify the inventive concept and then determine who devised that concept. In this regard, it was observed that in some cases, deciding upon inventorship by assessing the evidence adduced by the parties on these two steps can be quite complex, since the inventive concept is a relationship of discontinuity between the claimed invention and the prior art (inventors themselves will often not know exactly where it lies).[94]

67. The notion of the inventive concept has been developed by the Intellectual Property Office of the United Kingdom (UKIPO) and UK courts through numerous cases. For example, the inventive concept may reside in more than an idea and may encompass the means of realization of that idea.[95] A person is not the inventor merely because he/she contributed to a claim. The contribution must be to the formulation of the inventive concept.[96]

68. Where the invention consists of a combination of individually known elements, the inventor is a person who made the combination in substance, rather than a person who merely contributed to it.[97] Relatedly, the contribution to the inventive concept would need to be distinguished from providing the "equivalent of common general knowledge in the art". In *Yeda Research and Development Co Ltd v Rhône-Poulenc Rorer International Holdings Inc. and others,*[98] the inventive concept was determined as the combination of certain monoclonal antibodies and anti-neoplastic drug, which produced synergistic effects for the treatment of cancer. While the scientist from the Respondent provided the monoclonal antibodies to the scientists of the Appellant during the research, the relevant practical work using these antibodies was devised and carried out by the latter scientists. Accordingly, the House of Lords hinted that the mere provision of the monoclonal antibodies was no more than providing the equivalent of common general knowledge, and did not contribute to the inventive concept.

69. In addition, it was held that more than a theoretical proposal is required to be an actual deviser of the invention. In this regard, Jacob LJ characterized *obiter dictum* the "actual devisor" as someone who has "turned what was 'airy-fairy' into that which is practical […]".[99]

70. Similarly, in Australia, an "Inventor" has been held a "person who makes or devises the process or product".[100] It is a person who materially contributes to the inventive concept that is

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[90] See the response from China to Note C. 9141.
[91] See the response from China to Note C. 9141
[92] Patents Act 1977 (as amended), an unofficial consolidation produced by the Legal Section (January 1, 2021).
[93] *Henry Brothers (Magherafelt) Ltd v The Ministry of Defence and the Northern Ireland Office* [1999] RPC 442.
[94] House of Lords, decision October 24, 2007, *Yeda Research and Development Co Ltd v Rhône-Poulenc Rorer International Holdings Inc and others*.
[95] *Minnesota Mining & Manufacturing Company v Birtles, Lovatt and Evode Ltd (BL O/237/00)*.
[96] *University of Southampton's Applications [2005] RPC 11.*
[97] *Henry Brothers (Magherafelt) Ltd v The Ministry of Defence and the Northern Ireland Office* [1997] RPC 693
[98] House of Lords, decision October 24, 2007, *Yeda Research and Development Co Ltd v Rhône-Poulenc Rorer International Holdings Inc and others*.
[99] *University of Southampton's Applications* [2005] RPC 11
[100] *JMVB Enterprises* at [71]-[72]; *Atlantis Corporation v Schindler* [1997] FCA 1105; 39 IPR 29 at 54.

discerned from the whole of the specification, including the claims.[101] The courts have clarified that the body of the specification should explain the inventive concept and the claims assist in understanding the concepts that give rise to the invention. Consequently, even if a patent application contains "one invention, it may be the subject of more than one inventive concept or inventive contribution".[102] For instance, if the invention consists of a combination of elements. It may be that different persons contributed to that combination.[103]

71. Under German law, courts and jurisprudence have developed the principles of how to determine an inventor.[104] According to the decision of the Federal Court of Justice[105] *BGH-Steuervorrichtung*, an inventor develops the knowledge how a concrete technical problem can be solved with certain technical means and announces this knowledge (while maintaining a confidentiality excluding the public from this) in such a way that it can be used as an instruction for technical action.[106] The "act of creating the invention", requires a creative contribution to finding the solution to a technical problem, whereby this needs to be examined by considering the entire invention protected by the patent, including its genesis.[107] Since this act entails an intellectual contribution, it is missing in cases where, for example, the contribution to the invention merely consists of providing funds or facilities for the invention.[108] An invention is only complete if the teaching on which it is based, is technically executable, i.e., if the average person skilled in the art can work successfully according to the inventor's specifications. The patent claim need not explain in detail how the skilled person should act according to the given teaching. If the person skilled in the art requires more detailed instructions, it is however necessary, but also sufficient, to reproduce these in the patent description.[109]

72. As to the determination of inventorship in Japan, in the absence of the legislative definition of the term "inventor", the established theory is based on the definition of the term "invention", i.e., "a highly developed creation of a technical idea utilizing natural laws"[110]. Since the technical idea of a patented invention must be determined on the basis of the claims, taking into account the description and drawings, it is generally accepted that the inventor must have actually contributed to the act of creation of the technical idea. In general, Japanese courts set two steps for the determination of an inventor: (i) identify the "distinctive part" of the invention (i.e., technical idea), which are those that overcome technical problems and produce the technical effects of the invention; and (ii) identify the activities of the alleged inventor in the process towards the "completion of the invention" and evaluate his/her substantive contribution to the distinctive part of the invention. The Supreme Court ruled that the invention is complete when the technical idea is concrete and objective to the extent that a person skilled in the art can repeatedly implement the idea, achieving the desired technical effect.[111] Consequently, persons who made their contributions after the completion of the invention are not inventors. If their contributions are towards the elements outside the "distinctive part", they are not inventors either. From these principles, it follows that persons who made non-technical contributions, such as a person providing financial support or a mere supervisor[112] are not inventors.

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[101] For example, *Polwood Pty Ltd v Foxworth Pty Ltd* (includes corrigendum dated 5 March 2008) [2008] FCAFC 9 (18 February 2008); Kafataris v Davis [2016] FCAFC 134 (5 October 2016).
[102] *Polwood Pty Ltd v Foxworth Pty Ltd* (includes corrigendum dated 5 March 2008) [2008] FCAFC 9 (18 February 2008) in [61].
[103] *Idem.*
[104] See the response from Germany to Note C. 9141.
[105] *Bundesgerichtshof*, *BGH*.
[106] *BGH,* decision of May 18, 2010, X ZR 79/07, par. [38]; Response from Germany to Note C. 9141; For a similar understanding see response from Brazil to Note C. 9141 ("inventors are understood as persons that solved a technical problem").
[107] *BGH*, decision of May 17, 2011 – X ZR 53/08, guiding principle b– *Atemgasdrucksteuerung*.
[108] Christoph Ann, Patentrecht, Section 19 paras. 17, 20 (8th ed. 2022).
[109] *Bundesgerichtshof* (Federal Court of Justice), decision of November 10, 1970 – X ZR 54/67 at mn 32 – *Wildverbissverhinderung.*
[110] Article 2(1) of the Patent Act of Japan.
[111] Supreme Court decision of October 13, 1977, 1974 (Gyo-Tsu) 107, Minshu Vol. 31, No. 6.
[112] Tokyo District Court Decision on December 26, 2001 (Wa) 17124, 2000.

Similarly, if the contribution is something that can be provided by a person skilled in the art[113] (such as carrying out routine work[114]), it is not sufficient to be recognized as an inventor.

73. With respect to the "distinctive part" of the invention to which an inventor must make substantive contribution, the Japanese IP High Court has rendered several decisions in which it was defined as "the part of the configuration of the claimed invention that has not be found in any prior art", which "serves as a basis of the means of solving a problem unique to the invention". In other words, the distinctive part consists of elements that are distinguishable from the state of the art and essential to solve the technical problem unique to the invention.[115]

74. In France, it is an established rule that the invention consists of the means capable of obtaining a result. Consequently, the inventor is the one who discovers the means. It follows from this understanding that posing a problem or indicating a goal to be achieved is not inventing, because it is not providing the solution.[116] Following this rule, for example, a person who expresses the desire for a result to be obtained, while leaving to others the task of finding the appropriate means to obtain it, is not an inventor.[117]

75. A person is recognized as an inventor where he/she played an active or essential role at the stage of formalization, technical development and finalization of the invention or in the analysis of the problem to be solved and the technical solution to be provided[118] Conversely, where the work of the presumed inventor did not concern the subject matter of the patent application[119] or where the presumed inventor provided nothing else than general information on the objective of their work but not information containing an invention[120], this was not sufficient for them to qualify as an inventor. For instance, a person carrying out simple execution tasks may not qualify as an inventor.[121] Likewise, coordination of research work or setting out the results to be achieved was usually not sufficient for establishing inventorship either[122].

E. ESTABLISHING JOINT INVENTORSHIP

76. Joint inventorship describes a special case of inventorship in which two or more persons have jointly made an invention. The establishment of joint inventorship and the ownership of the patent between joint inventors differs among jurisdictions. In general, the establishment of joint inventorship is guided by the considerations surrounding the determination of inventorship in general: who made what contribution to the invention. Nevertheless, defining joint inventorship is generally considered very difficult. One court referred to it as "one of the muddiest concepts in the muddy metaphysics of patent law".[123]

77. Some jurisdictions provide definitions for the term joint inventors. For instance, by codifying the decision *Monsanto Co. v. Kamp* from 1967[124], the law of the United States of America describes first and foremost what kind of circumstances do not *prevent* joint inventorship but falls short of setting explicit requirements for it. 35 U.S.C. § 116(a) states that:

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[113] Osaka District Court, March 26, 1992, (Wa) 5570, 1988.
[114] Tokyo District Court Decision on April 16, 1979, (Wa) 1107, 1977.
[115] For example, IP High Court decision of July 30, 2007, (Gyo-ke) 10048, 2006.
[116] *Le droit français des brevets d'invention*, Paul Mathély, *Journal des notaires et des avocats*, 1974, page 365.
[117] *Ibid*.
[118] See for example: CA Paris, October 2, 2015, TGI Paris, February 1, 2006.
[119] CA Paris, March 1st, 2006.
[120] TGI Paris, May 26, 2016.
[121] Cour de cassation, November 20, 2007.
[122] TGI Paris, December 20, 1985.
[123] *Mueller Brass Co. v. Reading Indus*., 352 F. Supp. 1357, 1372 (E.D: Pa. 1972).
[124] *Monsanto Co. v. Kamp*, 269 F.Supp. 818 (D.C.D.C. 1967).

> "When an invention is made by two or more persons jointly, they shall apply for patent jointly and each make the required oath, except as otherwise provided in this title. Inventors may apply for a patent jointly even though (1) they did not physically work together or at the same time, (2) each did not make the same type or amount of contribution, or (3) each did not make a contribution to the subject matter of every claim of the patent."

78. The wording of 35 U.S.C § 116(a) indicates that some form of "working together" and "type of contribution" among the joint inventors is necessary. In *Monsanto Co. v. Kamp* the requirements are further clarified:

> "To constitute a joint invention, it is necessary that each of the inventors work on the same subject matter and make some contribution to the inventive thought and to the final result. Each needs to perform but a part of the task if an invention emerges from all of the steps taken together. It is not necessary that the entire inventive concept should occur to each of the joint inventors, or that the two should physically work on the project together. One may take a step at one time, the other an approach at different times. One may do more of the experimental work while the other makes suggestions from time to time. The fact that each of the inventors plays a different role and that the contribution of one may not be as great as that of another does not detract from the fact that the invention is joint if each makes some original contribution, though partial, to the final solution of the problem."[125]

79. In *Kimberly-Clark v. Procter Gamble,* examples of joint behavior are outlined as a "collaboration or working under common direction, one inventor seeing a relevant report and building upon it or hearing another's suggestion at a meeting" and it is clarified that "[i]ndividuals cannot be joint inventors if they are completely ignorant of what each other has done until years after their individual independent efforts."[126] *PerSeptive Biosystems, Inc. v. Pharmacia Biotech, Inc* makes it clear that joint inventors must each contribute to the conception of the claimed subject matter,[127] and that a joint invention is the product of a collaboration between two or more persons working together to solve the problem addressed[128]. Even if inventors each did not make a contribution to the subject matter of every claim of the patent, they may apply jointly for the patent – a contribution to one claim of the patent is enough.[129]

80. In Germany, case law developed the main principles that co-inventors are those who have made a creative contribution to the invention.[130] Already in *BGH-Biedermeiermanschetten*[131] it is established that the standard for establishing co-inventorship covers the entire invention as described in the patent application, including the way in which it came about.[132] Further, the Federal Court of Justice specified that it is mistaken to examine the individual features of the patent claim as to whether they are known *per se* in the prior art, and, if so, to exclude them

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[125] *Ibid*. at [21]-[25].
[126] *Kimberly-Clark Corp.v.Procter & Gamble Distrib. Co*.,973 F.2d 911,916-17, 23 USPQ2d 1921, 1925-26 (Fed. Cir. 1992).
[127] *PerSeptive Biosystems, Inc. v. Pharmacia Biotech, Inc*., 225 F.3d 1315, 1324, 1325 (C. A. Fed. (Mass.), 2000).
[128] *Kimberly–Clark Corp. v. Procter & Gamble Distrib. Co*., 973 F.2d 911, 917, (Fed.Cir.1992).
[129] USPTO, Manual of Patent Examining Procedure (MPEP), 2109.01 Joint Inventorship [R-07.2022] with reference to *Ethicon Inc. v. United States Surgical Corp* "The contributor of any disclosed means of a means-plus-function claim element is a joint inventor as to that claim, unless one assertingsole inventorship can show that the contribution of that means was simply a reduction to practice of the sole inventor's broader concept." Ethicon Inc. v. United States Surgical Corp.,135 F.3d 1456, 1460-63, 45 USPQ2d 1545, 1548-1551 (Fed. Cir. 1998).
[130] *Bundesgerichtshof* (Federal Court of Justice), decision of September 16, 2003, X ZR 142/01 - *Verkranzungsverfahren*.
[131] *Bundesgerichtshof*, decision of February 20, 1979 - X ZR 63/77, BGHZ 73, 337 – *Biedermeiermanschetten.*
[132] Confirmed in *Bundesgerichtshof*, decision of May 17, 2011, X ZR 53/08, guiding principle b, mn. 16 – *Atemgasdrucksteuerung*.

from a creative contribution of a co-inventor.[133] This entails that the means of the contribution do not need to fulfill all patentability requirements.[134]

81. Generally, anyone who has made a sufficiently significant contribution to the invention is considered a joint inventor.[135] Thus, mere assistance in making the invention, such as providing funds, a laboratory or the technical registration of values by means of measurement, does not constitute joint inventorship. Neither is it sufficient if the contribution to the invention does not influence the overall success.[136] Therefore, those who only contribute to the creation based on instructions of the inventor or third parties are not considered joint inventors.[137] However, the contribution of the co-inventor does not need to be inventive itself.[138]

82. In France, according to case law[139], it is considered necessary to determine whether the person claiming the status of co-inventor has demonstrated, with regard to the claims of the filed patent, a creative contribution. For example, in one case, a person participated to the preparation of a bibliographic report concerning the prior art and a study aiming to determine the quantity, structure etc. of the metal used in the invention. The court held that the person did not carry out work that concerned the actual subject matter of the patent applications, and thus had not demonstrated a creativity that enabled him to claim the status of co-inventor.[140] Any person who played an active role within a team and intervened at the stage of formalization, technical development and finalization of the invention, was considered to be an inventor.[141]

83. In Japan, the key concepts for the determination of the inventorship as indicated above, such as the substantive “contribution to the distinctive part” of the invention with regard to the technical problem to be solved in view of the prior art, and the “completion of the invention” to the extent that a person skilled in the art can implement the technical idea, also apply to the determination of joint inventors. The IP High Court of Japan stated: “If one person conceives the technical means and is involved in the whole process of bringing it into completion, the person alone is the inventor. If more than one person is involved in the process, the inventor refers to a person who creatively contributed to a distinctive part of the invention during the process. If there is more than one such person, all of them are inventors, or joint inventors.”[142]

Ownership among joint inventors

84. Joint inventorship and joint ownership are distinct concepts. Depending on whether and how the right to a patent has been transferred from each of the joint inventors to their legal successor, a patent may be “owned” by the joint inventors, by their legal successors, or by a combination of inventors and legal successors. Nevertheless, the issue of joint ownership is briefly covered in this Section in order to provide a backdrop to the scenario involving joint human-AI inventors. Developing rules for the co-ownership of patents is characterized by striking a fine balance between often fundamentally opposed economic interests of different individuals that jointly own a patent. In a way, the exploitation of the patent is worthwhile for each of the co-owners – yet at the same time, ideally, the individual exploitation of the patent by one co-owner should not adversely affect the other co-owners. In practice, the question is whether and how the joint inventors can (or cannot) exploit the invention, license the patent, or transfer their ownership of the patent independently from each other. For instance, a focus on the freedom of one co-owner alone, including the power to license the patent to third-parties,

[133] *Bundesgerichtshof*, deision of May 17, 2022, X ZR 53/08 BGH, mn 21 – *Atemgasdrucksteuerung.*
[134] *Bundesgerichtshof*, decision of September 16, 2003, X ZR 142/01 - *Verkranzungsverfahren*.
[135] See response from Germany to Note C. 9141
[136] *Bundesgerichtshof* decision of September 16, 2003, X ZR 142/01 - *Verkranzungsverfahren*. Section II, 2.
[137] *Bundesgerichtshof*, decision of June 18, 2013, X ZR 103/11, mn. 13 – *Flexibles Verpackungsbehältnis*.
[138] See response from Germany to Note C. 9141.
[139] CA Paris, March 1, 2006.
[140] *Ibid*.
[141] CA Paris October 2, 2015.
[142] IP High Court decision of July 30, 2007, (Gyo-ke) 10048, 2006.

means that considerable power is given to a single individual, as a single co-owner has the ability "to immunize [other] persons from infringement liability unilaterally".[143] The task is further complicated by the fact that in many jurisdictions the rules covering patent co-ownership were originally designed to govern *physical* property – not *intellectual* property.

85. Conversely, if the joint interest of the group is given priority, this might result in an underutilization of the co-owned patent because cooperation might fail due to conflicting private interest of the co-owners (collective action problem) and hold-up situations might arise.[144] In fact, these problems became very much apparent in some jurisdictions, for example in the United States of America in the wake of the decision *Pitts v. Hall*[145] in the middle of the 19th century. In that decision, the court established the principle that joint inventors are like tenants in common, thus owning the patent collectively. Courts later dismissed that approach because unanimous consent of all co-owners for using the patent created the practical risk of blocking the commercial exploitation of patents, thus diminishing their commercial value.

86. For these reasons, jurisdictions across the world have found different approaches to fine-tune co-ownership of patents according to their legal tradition and economic realities. They all have to manage the conflicting interests of co-owners on the use of the patented invention, licensing, transfer of ownership, and enforcement of the patent. Approaches oscillate, generally speaking, between positions that favor exploitation of the patents by the single co-owner and more cautious approaches that give the group of co-owners more control over the exploitation.

More focus on the interest of the group of co-owners

87. As to the assignment of a patent, jurisdictions such as France and the Republic of Korea either prohibit a joint owner from assigning his or her share without the consent of all the other joint owners[146] (Republic of Korea) or establishes a pre-emption right for the other co-owners[147] (France). Further, in France, the exploitation of the patent in its own business of one co-owner is subject to payment of fair compensation to the other co-owners who do not exploit the invention.[148]

More focus on the individual owner

88. A jurisdiction with a focus on the freedom to exploit the patent by an individual co-owner is, for instance, the United States of America. According to 35 U.S.C. Section 261, patents have the attributes of personal property. Thus, courts have held that "in the context of joint inventorship, each co-inventor presumptively owns a *pro rata* undivided interest in the entire patent, no matter what their respective contribution."[149]

89. The rights of joint owners are stipulated in 35 U.S.C. Section 262. It provides that "[i]n absence of any agreement to the contrary, each of the joint owners of a patent may make, use, offer to sell, or sell the patented invention within the United States of America, or import the patented invention into the United States of America, without the consent of and without accounting to the other owners." Thus, each co-owner may independently exploit the patent and does not need the consent of his or her co-owner. Furthermore, the co-owner, who uses the patent profitably, does not need to share the revenue with the co-owners of the patent. The

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[143] R. Carl Moy, Moy's Walker on Patent, Volume 3, § 10:52 (4th ed. 2020).
[144] Robert Merges & Lawrence Locke, Co-ownership of Patents: A Comparative and Economic View, 72 J. Pat. & Trademark Off. Soc'y 586 (1990) (explaining that a jurisdiction that requires compensation of a co-owner in case another co-owner exploits the patent may have the wrong incentives to actually work the patent because each co-owner might simply wait for the other to start working the patent and getting compensated by him).
[145] *Pitts v. Hall*, 19 Fed. Cas. 758 (C.C.N.D.N.Y 1854).
[146] Article 37(3) Patent Act of the Republic of Korea.
[147] Article L613-29 e) *Code de la propriété intellectuelle* (Intellectual Property Code).
[148] Article L613-29 a) *Code de la propriété intellectuelle* (Intellectual Property Code))
[149] *Ethicon v. United States Surgical Corp*., 135 F.3d 1456, 1465 (Fed. Cir. 1998).

patent law of the United States of America allows the co-owner of a patent to license the right to others without obligation to share royalties with the other co-owners.[150] The co-owner may even grant an exclusive license to a third-party, which would prevent the granting co-owner from granting further licenses to others, but such an exclusive license would have no effect on the other co-owners of the patent, who may continue to exploit or grant others licenses under the patent.[151]

Middle ground

90. Some jurisdictions can be in some regards considered as a middle-ground position. For instance, in cases of patent co-ownership, German law applies Section 741 of the German Civil Code, i.e., the so-called *Gemeinschaft nach Bruchteilen* (co-ownership by defined shares)[152] as a default, i.e., without differing contractual agreement. It allows the exploitation for the gain of each co-owner through the application of Section 743(2) of the German Civil Code as interpreted within the jurisprudence of the Federal Court of Justice.[153] In contrast to French law, under German law, if the patent is exploited for the gain of one co-owner, there is no general compensation entitlement for other co-owners. However, in some special cases such a compensation might be deemed justified.[154] Similar to the approach of the United States of America, a patent co-owner under German law may freely transfer his or her share of the right and there is, again in contrast to French law, no pre-emption right for the other co-owners. This is because the co-owners under Sections 741 and 747 of the German Civil Code have no contractual relationship among themselves and thus enjoy *a priori* a higher degree of freedom to operate compared to situations in a partnership[155] with joint assets.

91. This may change in case a partnership is created among the co-owners, in accordance with Section 705 *et seqq*. German Civil Code, for instance, in case a group of persons deliberately decided to develop an invention jointly, based on a contractual agreement.[156] Further, a co-owner of a patent may not grant freely licenses to third-parties because this is regarded as a form of "administering the patent as such", something which can be done only jointly in a co-ownership by defined shares, in accordance with Section 744(1) German Civil Code.[157] In such a case, under German law[158] a majority vote of the co-owners with regard to the decision of granting a license is possible. In this regard, German law is similar to Australian patent law that stipulates in Section 16 of the 1990 Patents Act that "none of [the co-owners] can grant a license under the patent, or assign an interest in it, without the consent of the others."

92. In Lithuanian patent law, Article 44(3) stipulates that "[e]ach of joint proprietors of the patent may independently without consent of others assign his share in the patent or bring an

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[150] *Schering Corp. v. Roussel-UCLAV SA*, 104 F.3d 341 (Fed. Cir. 1997)
[151] Jorge Contreras, Intellectual Property Licensing and Transactions: Theory and Practice, p. 43 (2022).
[152] German law differentiates regarding ownership of property in its civil code between the so-called *Gemeinschaft nach Bruchteilen* (co-ownership by defined shares, Section 741 of the German Civil Code) and the so-called *Gesellschaft mit gesamthänderischer Bindung* (partnership with joint assets, Sections 701, 719 of the German Civil Code).
[153] *Bundesgerichtshof* (Federal Court of Justice), decision of March 22, 2005, X ZR 152/03 – *Gummielastische Masse II* ("each co-owner may use the patent, as long as there was no majority vote by the co-owner against it").
[154] See the discussion in Peter Mes, Patentgesetz ,Gebrauchsmustergesetz, Section 6 para. 27, (5th ed. 2020).
[155] In contrast to the default co-ownership approach known as "co-ownership by defined shares", the model of "joint property" (sometimes called "ownership in common") does not allow for independent transfer of shares of the invention because "joint property" constitutes a jointly hold asset, without any marketable shares. Each owner has thus a property right in the whole property.
[156] Christoph Ann, *Patentrech*t, Section 19 para. 55 (8th ed. 2022) (explaining that such a partnership contract does not need to be established in a certain legal form).
[157] *Oberlandesgericht Düsseldorf* (High Regional Court Düsseldorf), decision of July 26, 2018 – I-15 U 2/17– *Flammpunktprüfungsvorrichtung*; In other jurisdictions, this rule is specifically stipulated in the patent law, for instance in the Republic of Korea, See Article 99(4) of the Korean Patent Act.
[158] Section 745(1) of the German Civil Code.

action to court for infringement of the patent." There is no pre-emption right set forth in that provision. However, joint proprietors "[…] may only jointly surrender the legal protection conferred by a patent or conclude a licensing agreement with third parties (see Article 44(4) of the Patent Law of Lithuania).

93. In the United Kingdom, without any agreement to the contrary, a co-owner can exploit the patent for their own gain and without any obligation to account to other co-owners for profit generated.[159] However, the consent of all the co-owners is required to grant a license under the patent or to assign or mortgage a share.[160] In *Hughes v Paxman*[161], the Court of Appeal confirmed that a co-owner who wishes to use the rights by licensing them to a third party would not be able to do so without the approval of the other co-owner. Pursuant to section 37 of the Patents Act, the Comptroller of Patents has the power to determine "whether any right in or under the patent should be transferred or granted to any other person or persons" and to make an order "granting any license or other right in or under the patent".

94. In conclusion, due to the complicated relationships among co-owners of a patent, it comes as no surprise that in practice, regardless of the jurisdiction, co-owners are advised to conclude a contract that addresses these issues. Frequently, this happens by creating a holding company that holds the legal title to the patent and controls the use of it and the issuance of licenses.[162]

F. EMPLOYEE INVENTORS

95. The vast majority of inventions are not made by the "lone inventor" but rather in companies, frequently in distinct research and development divisions, or public institutions such as universities or government agencies. Consequently, inventions made by employees have a high economic relevance. The law must strike a balance between the legitimate interest of the employee as the original inventor claiming inventorship, and the legitimate interest of the employer who provided the infrastructure, funding and often the collective experience and direction, on which the invention was built.

96. In many jurisdictions, the concept of a "service invention" is used to delineate the rights between an employer and an employee. In general, three scenarios are addressed in their laws: (i) an invention created in the course of the employment duty; (ii) an invention created outside the employment duty; and (iii) an invention created outside the employment duty, but the inventor used the infrastructure or fund for the creation of the invention. The legal framework regulating these scenarios, including the procedural requirements, is not the same among various jurisdictions. Nevertheless, modern patent laws generally acknowledge the idea that, in the employer-employee relationship, the employer is entitled to the fruits of the labor, including the right to a patent, while the employee inventor may only have a claim to remuneration, where the law applicable provides so.

97. For instance, pursuant to Article 1370 of the Russian Civil Code, an invention created by an employee in the course of his or her employment duties or a specific assignment of the employer, shall be recognized as an employee invention.[163] The exclusive right to an employee invention and the right to obtain a patent belongs to the employer, unless the employment or civil law contract between the employee and the employer provides otherwise.[164] An invention created by an employee using the employer's financial, technical or other material resources but not in connection with his or her employment duties or a specific assignment of the employer,

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[159] Section 35(2)(a) of the Patents Act.
[160] Section 35(3)(b) of the Patents Act.
[161] [2006] EWCA Civ 818.
[162] R. Carl Moy, Moy's Walker on Patent, Volume 3, § 10:52 (4th ed. 2020).
[163] See the response from the Russian Federation to Note C. 9141.
[164] *Ibid*.

shall not be recognized as an employee invention.[165] The right to obtain the patent and the exclusive right to such an invention belongs to the employee, and the employer may, in such a case, demand a non-exclusive license.[166] Article 11 of the Bangui Agreement provides a similar provision.

98. In China, a similar but different model is used.[167] An invention that is accomplished: (i) in the course of performing the duties of an employee; or (ii) mainly by using the material and technical conditions of an employer; is a service invention. The right to apply for a patent in the service invention belongs to the employer.[168] However, in case (ii) above, if the employer has concluded a contract with the inventor providing the right to apply for the patent or the ownership of the patent right, such provision shall prevail. For a non-service invention-creation, the right to apply for a patent belongs to the inventor. Furthermore, Article 8 of the Patent Law provides for, *inter alia*, inventions made under commission. It states that where an invention is accomplished by a party in execution of a commission given to it from others, the right to apply for a patent belongs, unless otherwise agreed upon, to the party that has accomplished the invention.

99. Under Law no. 1540 of 2011 of Colombia, all employment relationships duly entered into as of June 16, 2022, provide for the assignment of industrial property rights by the employee to the employer, including in service contract.[169] In Cuba, if an invention was created for an entity under an employment or service contract, the entity is the patent owner and right holder, in accordance with Article §11(1) of Decree-Law No. 290.[170] In Egypt, Article 7 of the Law of the Protection of Intellectual Property Rights states that the employer shall have all rights derived from workers' or employees' inventions during the period of work or employment relationship, insofar as the invention falls within the scope of the commission contract or employment relationship.[171] The Lithuanian law provides a similar provision for a service invention created under the employer-employee relation. However, if the invention is made by a person who carries out scientific research, designing, construction works and other works of creative character under contract with a client who finances an appropriate work, the right to the patent for the invention shall be established by such contract.[172]

100. In Germany, applying the "inventor principle" stipulated in Section 6 of the Employee Inventions Act, each invention initially belongs to the employee, who made the invention.[173] Under the Act, two types of inventions exist:

(i) if the invention is classified as a service invention (*Diensterfindung*), the employer may claim the invention; whereas,

(ii) if the invention is deemed a free invention (*freie Erfindung*) different rules apply.[174]

101. Service inventions that are made during the course of the employment are: (a) either created in the context of the work done by the employee; or (b) are based on the experience or

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[165] *Ibid.*
[166] *Ibid.*
[167] See the response from China to Note C. 9141.
[168] Article 6 of the Patent Act of China.
[169] See the response from Colombia to Note C. 9141.
[170] See the response from Cuba to Note C. 9141.
[171] Article 7 par. 1 of the Law of the Protection of Intellectual Property Rights.
[172] See the response from Lithuania to Note C. 9141.
[173] See the response from Germany to Note C. 9141. The Employee Inventions Act (*Gesetz über Arbeitnehmererfindungen*) is applicable to employees, civil servants, and soldiers (Section 1). In Sections 40 to 44, it however provides specific rules to civil servants, soldiers and inventions at universities. The Employee Inventions Act may partly apply to persons that are in a similar positions as employees due to their economic dependency (Ann, *Patentrecht*, ed. 6 (2009) §21 II). A Managing Director of a limited liability company may have the obligation to transfer an invention (Higher Regional Court Frankfurt, Decision of April 13, 2017 - 6 U 69/16).
[174] See the response from Germany to Note C. 9141.

activity of the employer.[175] The employee who made a service invention is under the duty to notify the employer immediately about the invention in text form.[176] The employer may then declare that it claims the service invention.[177] Even if the employer remains silent, such a claim is deemed declared unless the employer expressly "releases" the invention within four months after receipt of the employee's report, by making a statement in text form addressed to the employee.[178] With the claim of the service invention, all economic rights regarding the invention are transferred to the employer[179], under the duty to apply for a domestic industrial property right for a service invention reported to it[180] and the entitlement (but not an obligation) to apply for industrial property protection abroad[181].

102. The employee has a claim against the employer regarding adequate remuneration.[182] Additionally, if the employer does not apply for a patent in foreign jurisdictions, the employer must, upon the employee's request, enable the employee to acquire the industrial property rights in these jurisdictions.[183]

103. Inventions made by the employee that do not qualify as service inventions are considered free inventions, for which all economic rights remain with the employee as the inventor, subject to certain conditions.[184] First, the employee has to inform the employer about the invention, unless it is obvious that the invention could not be utilized within the business of the employer. The employee has to provide sufficient information in order to enable the employer to assess whether the invention is indeed a "free invention". Second, the employee has to offer the employer a non-exclusive right for using the invention on reasonable terms and conditions, if the invention fits the business of the employer. If the employer does not accept the offer within three months, its prerogative to the non-exclusive license expires. As a special form of employee protection, pursuant to Section 22 of the Employee Inventions Act, a derogation from the provisions of the Act by contracts is not permissible to the disadvantage of the employee prior to the notification of a service invention from the employee to the employer.

104. Similar to the law of Germany, Article 58 of the industrial Property Code of Portugal stipulates the mechanism where an employer may exercise its pre-empted right to inventions created by its employees.[185] Furthermore, under the patent law of the Republic of Korea, the invention made by employees in the course of their employment are initially vested in the employee. However, a small or medium-sized enterprise (SME) shall have a non-exclusive license, if an employee acquires a patent.[186] Employers may conclude employment contracts with their employees to reserve the right to obtain a patent. An employee who completes an employee's invention shall notify the employer of his or her completion in writing without delay.[187] Where an employee's invention is completed jointly by two or more employees, such notice shall be given jointly by the employees.[188] An employee shall be entitled to a fair compensation where the employer succeeds, under a contract or employment regulation, the right to acquire the patent for an employee's invention, or is granted an exclusive license.[189]

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[175] Section 4, paragraph 2 of the Employee Invention Act.
[176] Section 5 of the Employee Inventions Act.
[177] Section 6, paragraph 1 of the Employee Invention Act.
[178] Section 6, paragraph 2 of the Employee Invention Act.
[179] Section 7 of the Employee Invention Act.
[180] Section 13 of the Employee Invention Act.
[181] Section 14 of the Employee Invention Act.
[182] Section 9, paragraph 1 of the Employee Inventions Act.
[183] Section 14 of the Employee Inventions Act.
[184] Sections 4, paragraph 3, 18 and 19 of the Employee Inventions Act.
[185] See the response from Portugal to Note C. 9141.
[186] Article 10(1) of the Korea Invention Promotion Act (KIPA). See the response from the Republic of Korea to Note C. 9141.
[187] Article 12 of the KIPA
[188] *Ibid*.
[189] Article 15 of the KIPA.

105. In the United States of America, any patent rights to an invention are vested initially in the inventor, regardless whether that person is an independent inventor, self-employed or an employee. If patent rights are owned by third parties, they must have been transferred by way of conveyance. Thus, the contractual arrangements between employer and employees with regard to inventions are crucial for both parties to allocate the rights appropriately. Unlike in copyright law of the United States of America, there is no work-made-for-hire doctrine in patent law. However, in case a person is specifically employed to invent, he or she might have to assign the invention that was created under the contract to their employer.[190] In *United States v. Dubilier Condenser Corp*., the Supreme Court of the United States created the so-called "hired to invent" doctrine and decided that "[o]ne employed to make an invention, who succeeds, during his term of service, in accomplishing that task, is bound to assign to his employer any patent obtained."[191] However, such a duty only exists if the employee has only produced that which he or she was employed to invent and if the invention is the precise subject of his or her employment contract.[192] On the contrary, if an employee makes the invention in the course of generally working in his or her field of labor and the invention was conceived in performance of the work within this field, the employment contract will not be construed to require an assignment of the patent to the employer.[193]

106. In the absence of a contract between employer and employee covering the subject of employee-made inventions (or the employee being specifically employed to make an invention), any inventions made by the employee are his/her exclusive property with the qualification that the employer is entitled to a non-exclusive license to make and use the inventions of its employee. This applies in cases where the employer has made some contribution, such as the inventions were made during the hours of employment and/or using the employer's equipment and materials.[194] Such a non-exclusive license is known as an employer's "shop right". The Federal Circuit has acknowledged that "[a] 'shop right' is generally accepted as being a right that is created in common law, when the circumstances demand it, under principles of equity and fairness, entitling an employer to use without charge an invention patented by one or more of its employees without liability for infringement."[195] It is a judicially created defense to patent infringement, and applied on a case by case basis[196].

107. Apart from the Bangui Agreement, some other regional patent laws also include provisions for employee inventions, although they rely on national laws of the members of the respective regional organization in many aspects. For instance, the EAPC and EPC provides that, if the inventor is an employee, the right to a patent shall be determined in accordance with the law of the State in which the employee is mainly employed. If such a State cannot be determined, the applicable law is that of the State in which the employer has the place of business. Decision 486 of the Andean Community provides in Article 23 that "[w]ithout prejudice to the provisions of the national legislation of each member country, in the case of inventions occurring in the course of employment relations, the employer, whatever its form and nature, may transfer part of the economic benefits deriving from the inventions to the employee inventors with the view to promoting research activity".

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[190] Jorge Contreras, Intellectual Property Licensing and Transactions: Theory and Practice, p. 27 (2022).
[191] *United States v. Dubilier Condenser Corp*., 289 U.S. 178, 187–88 (1933).
[192] *Ibid*.
[193] *Ibid*.
[194] Gladstone Mill III, Patent Law Fundamentals, Volume 5 § 17:21 (2nd ed., 2022).
[195] *Beriont v. GTE Labs., Inc*., 535 F. App'x 919, 923 (Fed. Cir. 2013).
[195] *Ibid*.
[196] See *McElmurry v. Arkansas Power Light Co*., 995 F.2d 1576, 27 U.S.P.Q.2d 1129, 1528 (Fed. Cir. 1993) for the factors that may be applied by courts.

G. LEGAL CONSEQUENCES OF INACCURATE DESIGNATION OF INVENTORS

108. If the applicant fails to provide the names of the inventors or indicates the wrong inventors (either in good faith or intentionally), there can be different consequences to the application and different kinds of remedies may be available, depending on the applicable law.

No indication of inventors

109. In implementing Article 4*ter* of the Paris Convention (the inventor's right to be named in a patent), national/regional patent laws typically requires an applicant to indicate the name(s) of the inventor(s) in a patent application, as part of the formality requirements. Usually, a patent office invites the applicant to comply with the requirements within a prescribed time limit. For example, where a Japanese patent application does not indicate an inventor (within the meaning of its patent law), this is considered as an incomplete description. The applicant is ordered to engage with the amendment procedures within a specified time frame, because it does not comply with these necessary formalities.[197] If the applicant fails to do so, the office rejects the application.

Wrongful designation of an inventor and usurpation

110. Many patent laws allow for the correction of a wrongfully designated inventor. For example, it is possible to amend the designation of the inventor(s) (either by replacing a person indicated as an inventor with another person or adding a new person as another inventor) in a Japanese patent application as long as it is pending before the Japan Patent Office. In so doing, the applicant shall provide a reason for the change and submit a declaration from each and every inventor indicated in the application before and after the change, in which a person(s) who is a true inventor(s) and a person who is not an inventor shall be identified. In many countries, an error in the indication of the inventor(s) is not a grounds for invalidation of the patent.

111. In the United States of America, an improper declaration of inventorship in a patent application can lead to invalidation, because "[a] patent is invalid if more or fewer than the true inventors are named"[198] or the unenforceability of the patent, in case there was intent to deceive the United States Patent and Trademark Office (USPTO)[199]. There is however, also the possibility to correct errors in the inventorship. For patent applications, 35 U.S.C. §116(c) applies, giving the Director of the USPTO the corrective authority, whereas for issued patents, a federal court or the USPTO can, pursuant to 35 U.S.C. §256, rectify the designation of the inventor. As courts have to allow a patentee to rectify a wrongly stated inventorship before declaring the patent invalid,[200] the severity of improper inventorship is mitigated.

112. A wrongful designation of an inventor in a patent application may raise the question as to the applicant's entitlement to the patent from the outset. If the right to a patent has not been properly assigned from the true inventor, the applicant is not entitled to the right as a legitimate successor in title. For example, Article 133 of the Patent Act of the Republic of Korea provides that an interested party, or an examiner, may file a petition for trial to seek invalidation of a patent, if the patentee has no right to obtain the patent in accordance with Article 33(1) of the Patent Act.[201]

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[197] See the response from Japan to Note C. 9141.
[198] *Frank's Casing Crew & Rental Tools v. PMR Techs*., 292 F.3d 1363, 1381 (Fed. Cir. 2002)
[199] *Gemstar-TV Guide Int'l v. ITC*, 383 F.3d 1352, n.1, (Fed. Cir. 2004).
[200] *Checkpoint Systems, Inc. v. All-Tag Security S.A*., 412 F.3d 1331, 1340 (Fed. Cir. 2005).
[201] See the response from the Republic of Korea to Note C. 9141.

113. Similarly, the patent laws of many countries[202] allow for revocation procedure and/or transfer of the right to a true inventor, at the pre- or post-grant stage, in case of usurpation. For example, in Germany, the true inventor or a party aggrieved by the usurpation can require the patent applicant to assign to him/her the right to the grant of the patent, or in case a patent has already been granted, the transfer of the patent.[203] In principle, this claim would be possible within a time limit of two years after publication of the grant of the patent.[204] Furthermore, if the aggrieved party has filed opposition on the grounds of usurpation, he/she can still bring an action within one year after the final conclusion of the opposition proceedings. These deadlines, however, do not apply, if the proprietor of the patent acted in bad faith when obtaining the patent.[205] In addition, taking the essential content of the patent from the descriptions, drawings, models, implements or equipment of another person or from a process used by another person without his/her consent, is a ground for invalidation of a granted patent.[206]

VI. THE "DABUS CASE"

A. OVERVIEW OF THE DABUS APPLICATIONS

114. Against the backdrop of the speed of technological development in the field of AI, it is no surprise that AI systems support humans in the process of making inventions and are, by some, considered to be sole inventors as such.[207] The most prominent example of the latter view is the so-called DABUS case, named after the AI system "Device for the Autonomous Bootstrapping of Unified Science" (DABUS).

115. In its simplest form, the operation of that AI system can be explained as a system of two neural networks.[208] The first network is trained on data, which alters the connection weights between the nodes and stores the data. The first network then "generates noise" by further altering its own connection weights, essentially corrupting the data it has been trained on, which generates novel output. The novel output is a variation of the objects the system has been initially trained on. The second network knows what data the first network was trained on, and thus can identify whether what is coming out of the first network is new and how different it is. The second network can control the level of noise in the first network and can also be trained to model the first network outputs. In short, it is alleged that the first network produces new outputs at superhuman speed and the second network evaluates how "well" these outputs will perform. With today's technology, such an AI system can be composed of thousands of neural networks, each representing certain concepts, such as "warmth" or "enjoyment" and how they relate to each other, e.g., warm food can result in enjoyment. Later, in unsupervised operation, it is claimed that the machine combines basic ideas into complex ideas and stops when a complex idea terminates in a particularly salient concept.

116. Allegedly, DABUS made two separate inventions, namely: (i) a flashing light beacon for attracting enhanced attention in emergency situations; and (ii) a fractal food container. Purportedly, as to the former, DABUS was not told to invent "a flashing emergency light" but rather to be on the lookout for things that could prevent death.[209] Therefore, it allegedly

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[202] For example, Japan (see case law at: https://www.ip.courts.go.jp/eng/hanrei/Important_IP_Judgment_by_Category/Patent/Usurpation/index.html).
[203] Section 8 of the German Patent Act.
[204] *Idem*.
[205] *Idem*.
[206] Moreover, the inventor may also claim damages based on Section 823(1) of the German Civil Code, which is the central provision of German tort law, because the moral rights of the inventor are considered part of the broader "general right of personality", protected by Section 823(1) of the German Civil Code.
[207] Ryan Abbott, Intellectual property and artificial intelligence: an introduction, in *Research Handbook on Intellectual property and Artificial Intelligence*, p. 2, 11-13 (Ryan Abbott ed., 2022).
[208] The explanation in this paragraph regarding how DABUS works is taken from *Ibid*, p. 17.
[209] *Ibid.*

combined the ideas for a new flashing light mechanism with the need to attract attention in an emergency, and essentially generated a patent claim.[210]

117. Patent applications for these two inventions were initially filed by Stephen Thaler in the United Kingdom and with the EPO, as there was no need to initially disclose the inventor in both jurisdictions.[211] After having been invited by the EPO to provide an inventor, Thaler designated DABUS as the inventor and stated himself as the employer of the AI system. Later, Thaler argued that he had obtained the right to the patent as a successor in title. It is reported that Thaler had subsequently filed the applications in 15 additional jurisdictions.[212]

118. The International Bureau of WIPO received an international application pursuant to Article 3(1) of the PCT with the application number PCT/IB2019/057809 and the filing date of September 17, 2019. On the PCT request Form, the inventor was named as "DABUS, The Invention was autonomously generated by an artificial intelligence". Furthermore, a declaration regarding the identity of the inventor pursuant to PCT Rules 4.17(i) and 51*bis*.1(a)(i) was submitted, which contained the following:

> "DABUS, The Invention was autonomously generated by an artificial intelligence of 1767 Waterfall Dr St. Charles, Missouri 63303 United States of America
>
> is the inventor of the subject matter for which protection is sought by way of this international application".

119. The international application was processed normally, since in accordance with PCT Article 4(4), even the failure to indicate the name and other prescribed data concerning the inventor on the request Form shall have no consequence in any designated State whose national law requires the furnishing of the said indications but allows that they be furnished at a time later than that of the filing of a national application. Furthermore, the failure to furnish the said indications in a separate notice shall have no consequence in any designated State whose national law does not require the furnishing of the said indications.[213]

B. IP OFFICE DECISIONS AND JUDGEMENTS OF COURTS

120. Various IP Offices received DABUS patent applications either via the PCT application entering in the national phases or by direct filing. In the following, some of the proceedings in the IP Offices and courts (if available) will be outlined.

Australia

121. The PCT application entered into the national phase in Australia on September 9, 2020. IP Australia found that treating the AI machine as an inventor is not consistent with Section 15(1) of the Patents Act[214]. Specifically, it does not meet Section 15(1)(a) that requires an inventor being a person. An assignment from an AI machine to the applicant according to Section 15(1)(b) of the Patents Act would not be possible, since the law does not presently recognize the capacity of an AI to assign property.[215] Further, Section 15(1)(c) of the Patents

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[210] *Ibid.*
[211] *Ibid,* p.16.
[212] *Ibid*.
[213] PCT Article 4(4).
[214] Section 15(1) of the Australian Patents Act states:
"(1) Subject to this Act, a patent for an invention may only be granted to a person who:
(a) is the inventor; or
(b) would, on grant of a patent for the invention, be entitled to have the patent assigned to the person; or
(c) derives title to the invention from the inventor or a person mentioned in paragraph (b); or
(d) is the legal representative of a deceased person mentioned in paragraph (a), (b) or (c).
[215] Stephen L. Thaler [2021] APO 5 (9 February 2021), para. 26.

Act provides that a patent may be granted to a person who derives the title to the invention from the inventor. However, that provision was also found to be non applicable. IP Australia observed that although "it is open to argument that an artificial intelligence machine could be regarded as communicating information about an invention to the owner of the machine for any and all purposes", the AI machine cannot have a "beneficial interest in any property" as set out in the established case law.[216] As AI cannot be an inventor, IP Australia determined that it is not possible to identify a person who can be granted a patent. Thus, the application did not comply with regulation 3.2C of the Patent Regulations, which requires, among others, the applicant to provide the name of the inventor. Consequently, IP Australia concluded that the application lapsed pursuant to regulation 3.2C(5).

Court decisions

122. The decision of IP Australia was appealed. The Federal Court of Australia ruled that an AI system can be an inventor for the purposes of the Australian Patents Act 1990.[217] The ruling was, *inter alia*, based on the argument that the term "inventor" is an agent noun and as such can be a person or a thing that invents.[218] Furthermore, it was held that nothing in the Australian Patents Act expressly refutes the proposition that an AI can be an inventor[219] and that the ruling merely reflects reality of inventions and an evolving nature of the term "inventor" just as with the term "inventions" developed over time.[220] Also, the decision draws attention to the distinction between ownership and inventorship by highlighting the fact that acknowledging DABUS as the inventor does not mean, at the same time, that the AI owns the invention.[221]

123. The decision of the Federal Court of Australia was reversed by the Full Federal Court of Australia in April 2022, which ruled that an AI system cannot be an inventor under the Australian Patents Act, and rather, the inventor must be a natural person.[222] Although the term "inventor" is not defined in the Patents Act, that term in Section 15(1)(a) is considered to be "the person who is responsible for the inventive concept".[223] With a view to the well-established jurisprudence regarding the identification of an inventor, the court stated that "the law relating to the entitlement of a person to the grant of a patent is premised upon an invention for the purposes of the Patents Act arising from the mind of a natural person or persons".[224] It thus found that it was a human endeavor that was rewarded by the grant of a patent.[225]

124. As the High Court of Australia has denied further appeal, the decision of the Full Federal Court of Australia is final.[226]

Brazil

125. Following the national phase entry of the PCT application, an application BR 11 2021 008931-4 A2[227] contained "DABUS" as an inventor with the explanation that the invention was autonomously generated by AI. Currently, the Brazilian National Institute of Industrial Property (INPI) holds the view that an inventor is a natural person, and has no specific definition of who the inventor should be in the context of an invention created by AI.[228] Consequently, the

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[216] *Ibid*. para. 27 with further references to *H's Application* in footnote 19, and para. 28.
[217] *Thaler v Commissioner of Patents* [2021] FCA 879, para. 10, https://artificialinventor.com/wp-content/uploads/2021/08/Thaler-v-Commissioner-of-Patents-2021-FCA-879.pdf.
[218] *Ibid*, para. 120.
[219] *Ibid*, para. 118.
[220] *Ibid*, para. 121.
[221] *Ibid*, paras. 12, 165 to 200.
[222] *Commissioner of Patents v Thaler* [2022] FCAFC 62, paras. 108, 113.
[223] *Ibid,* para. 101.
[224] *Ibid*, para. 105.
[225] *Ibid*, para. 116
[226] Transcript of the Special Leave Hearing, [2022] HCA Trans 199, para. 625; see the response from Australia to Note C. 9141.
[227] See https://patentimages.storage.googleapis.com/5c/8f/6c/3934ebf654b034/BR112021008931A2.pdf.
[228] See the response from Brazil to Note C. 9141.

Federal Attorney Office of INPI issued a legal opinion, in August 2022, indicating that it is not possible to designate AI as an inventor.[229]

Canada

126. Following the national phase entry of the PCT application in Canada, the Canadian Intellectual Property Office (CIPO) started processing the DABUS patent application (CA 3137161). It issued a compliance notice on November 8, 2021.[230] The notice referred to the fact that the patent application listed a machine as an inventor. Consequently, the application is not in compliance with Section 27(2) of the Canadian Patent Act (a patent application must be filed by the inventor or the inventor's legal representative) and Section 54 of the Patent Rules (*inter alia*, an indication of the name and postal address of each inventor and a statement of applicant's entitlement to file), since under Canadian law, it does not appear possible for a machine to have rights or to transfer rights to a human.

127. In its response dated July 22, 2022 to the compliance notice,[231] the applicant argued that it derived entitlement to file a patent application through its ownership of DABUS, based on the doctrine of property arising from accession, according to which the owner of a thing is also the owner of the fruits of that thing.

Germany

128. In March 2020, the German Patent and Trade Mark Office (*Deutsches Patent- und Markenamt*, DPMA) rejected two patent applications containing DABUS as an inventor, arguing that only a natural person can be named as an inventor in a patent application according to section 37 of the German Patent Act[232]. The DPMA based its reasoning, amongst others, on the wording of section 63(2) of the Patent Act relating to a wrongful designation of an inventor, which referred to the inventor's person ("*die Person des Erfinders*"). In its opinion, that wording indicated a need for a natural person to be an inventor. The DPMA also referred to the purpose of naming natural persons: names serve not only identification purposes but enable natural persons to exercise their rights. According to the German Civil Code (BGB), which reflects the decision of the German legislator, only natural persons (section 1 ff. BGB) and legal persons (sections 21 ff. BGB) can be the bearers of rights and obligations. As an AI system is a neither legal nor natural person, it cannot bear the inventor's personality right ("*Erfinderpersönlichkeitsrecht*"), which also includes the substantive right to the patent (section 6 PatG) or the right to be named (section 63 PatG).[233] Further, the DPMA referred to case law[234] showing that a legal entity cannot be an inventor. In addition, as the AI cannot bear rights and obligations as non-natural and non-legal person, it cannot transfer the right to the patent according to section 6 PatG.[235]

129. Subsequently, the PCT application entering the national phase before the DPMA was equally rejected in January 2023 for the same reasoning.

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[229] Legal Opinion No. 00024/2022/CGPI/PFE-INPI/PGF/AGU.

[230] Compliance Notice by CIPO, dated November 8, 2021, searchable at: https://www.ic.gc.ca/opic-cipo/cpd/eng/searchMenu.html.

[231] Searchable at: https://www.ic.gc.ca/opic-cipo/cpd/eng/searchMenu.html.

[232] Section 37(1) of the German Patent Act states:
"(1) Within 15 months after the date of filing or, if an earlier date is claimed to govern the application, within 15 months after that date, the applicant is to designate the inventor or inventors and affirm that, to his or her knowledge, no other persons participated in the invention. Where the applicant is not the inventor or not the sole inventor, the applicant is also to indicate how he or she acquired the right to the patent. The accuracy of the statements made is not verified by the German Patent and Trade Mark Office."

[233] DPMA, decision of 24.03.2020 (102019128120.2) at II.1.a).

[234] BGH GRUR 71,210, 212 – *Wildverbißverhinderung*

[235] DPMA, decision of 24.03.2020 (102019128120.2) at II.1.a) 2

Court decisions

130. The above decisions of DPMA rejecting the two German patent applications were appealed to the German Federal Patent Court (BPatG). As to the case regarding the patent application DE1020191281202, the BPatG referred to the concept of the inventor's moral rights, which finds its expression in Section 37(1) of the Patent Act,[236] to reject the idea that an AI as such could be an inventor. Consequently, an AI system cannot be designated as an inventor in a patent application. The BPatG also found that there is no room for developing the law further through adjudication, as it denied the existence of a lacuna with regard to the rule on the designation of the inventor.

131. However, the BPatG also found that the designation of the inventor in a specific way, namely, "[name of natural person], who caused the artificial intelligence DABUS to generate the invention" is admissible on the patent application form and sufficient for the designation of the inventor.[237] The court based its conclusion on the fact that Section 7(2) of the Patent Regulation does not contain an exhaustive list of declarations, which can be made by the applicant.[238] Thus, the additional declaration ("[…] who caused the artificial intelligence DABUS to generate the invention") was permissible. Concerns about practical problems due to the length of the entry under the "designation of the inventor" were dismissed by the BPatG, as the DPMA has discretion with regard to the publication of the information contained in the field "inventor" on the patent application form.

132. Finally, the BPatG admitted an appeal on the legal question whether an AI system could be designated as an inventor within the meaning of Section 37(1) of the Patent Act, because it is a matter of fundamental significance, and a decision by the Federal Court of Justice *(Bundesgerichtshof,* BGH) is necessary to ensure coherent future adjudication in different courts. The appeal to the BGH is pending.[239]

India

133. Subsequent to the national phase entry of the PCT application, the Patent Office in India issued an Examination Report, dated October 26, 2021, for patent application number 202017019068, which named DABUS as an inventor. The Report stipulates that the application cannot be proceed to the formal and technical examination, because the true and first inventor of the invention indicated is artificial intelligence.[240] It reasoned that DABUS is not a person as per Section 2 (Definitions and interpretation)[241] and Section 6 (Persons entitled to apply for patents)[242] of the Patent Act 1970, and a valid proof of right had not been submitted by the applicant. In addition, the Report points out other issues that are not in compliance with the substantive patentability requirements.

134. In responding to the Report, the applicant submitted amendments to the application, and reiterated that while DABUS is not a person, it is a sole true deviser of the invention that is required to be indicated by the applicant in its patent application in accordance with the Indian

[236] See footnote 233. See also the response from Germany to Note C. 9141.
[237] *Bundespatentgericht* (Federal Patent Court), decision of November 11, 2021 – 11 W (pat) 5/21; see translation of the decision in 71 GRUR International: Journal of European and International IP Law, 1189 (2022).
[238] Section 7(2) of the Patent Regulations provides a list of information that must be contained in the indication of the inventor on the prescribed form. The list includes the first name, surname and addresses of the inventors.
[239] See the response from Germany to Note C. 9141.
[240] Examination Report re application no. 202017019068, section (7)(I)1.1.
[241] Section 2(1)((y) reads: "true and first inventor" does not include either the first importer of an invention into India, or a person to whom an invention is first communicated from outside India.
[242] Section 6(1) reads: Subject to the provisions contained in section 134, an application for a patent for an invention may be made by any of the following persons, that is to say,— (a) by any person claiming to be the true and first inventor of the invention; (b) by any person being the assignee of the person claiming to be the true and first inventor in respect of the right to make such an application; (c) by the legal representative of any deceased person who immediately before his death was entitled to make such an application.

Patent Act. A pre-grant opposition against the application was submitted on October 27, 2022, based on the various grounds, including non-compliance with Section 6. In particular, the opponent argues that the "true and first inventor" must be a human inventor and a machine does not hold any legal rights that can be transferred to the applicant. It further notes that under circumstances where non-natural persons are covered, the Patent Act explicitly stipulates it as an exception, e.g., Section 2(1)(s) explicitly states that "person" includes the Government. Furthermore, the opponent submitted that the applicant merely discovered the subject matter by reviewing the result given by the AI machine, and decided to file a patent application.

New Zealand

135. The PCT application entered into the national phase in New Zealand on May 12, 2021. In January 2022, the Intellectual Property Office of New Zealand (IPONZ) rendered a decision that the application for grant of a patent by Dr Thaler was void, since the application did not identify a natural person (i.e., human) inventor. As no inventor had been identified, no entitlement to a patent can be derived.

136. Specifically, the Assistant Commissioner considered the application did not comply with Section 22(1) of the Patents Act, which provides that a patent for an invention may only be granted to a person who: (a) is the inventor; or (b) derives title to the invention from the inventor; or (c) is the personal representative of a deceased person mentioned in paragraph (a) or (b). In particular, IPONZ stated that "[t]he term "inventor" as used in and as in the scheme of the Patents Act 2013 (the Act) refers only to a natural person, an individual. That inventors [sic] fall within the class of natural human persons is intrinsic to the proper construction of the Act. If the legislators had intended to allow granting of patents in New Zealand for inventions devised solely by non-humans such as artificial intelligences, or life forms other than human beings they would have drafted the Act to accommodate these possibilities specifically and explicitly. They did not do so. It is not appropriate for the Commissioner to ignore this fact and decide a case as though they should have done so."[243]

137. With respect to Section 5(1) of the Patents Act, which states that, in general, the term "inventor" means, in relation to an invention, the *actual deviser* of the invention (emphasis added), IPONZ stated that that definition was no more than a statement that for an individual to be an inventor, they must have contributed to actually devising the invention, as opposed to importing or communicating the invention into New Zealand.

Court decisions

138. The High Court of New Zealand, Wellington Registry dismissed the appeal in March, 2023, and confirmed the decision of the IPONZ that "the term "inventor", as used in and as in the scheme of the Patents Act 2013 refers only to a natural person, an individual." Thus, the artificial intelligence called DABUS could not be the actual deviser of the invention.[244] The court ruling was mainly buttressed by the legislative history, including the New Zealand patent legislation from 1860 up to the Patent Act of 2013.[245]

139. While acknowledging that Section 22(1) does not explicitly state that the inventor needs to be a person, the Court stated that the natural reading of that provision would suggest so.[246] In addition, the Court was of the opinion that Sections 9 and 177 to 193 would sit most easily with inventors who are persons.[247] The Court also considered the question as to whether the 2013 amendments to the Patents Act, which removed the direct references to "persons" in the relevant provisions, had been intended by Parliament to open up the possibility of an AI being

[243] Stephen L. Thaler [2022] NZIPOPAT 2 (31 January 2022) para. 2.
[244] *Thaler v Commissioner of Patents* [2023] NZHC 554.
[245] *Ibid*, para. 31.
[246] *Ibid*, para. 27 with further details.
[247] *Ibid*., para. 28-29 with further details.

an inventor. On this point, it found that the Explanatory Note to the Bill on introduction indicated the purpose behind the amendment had been to prevent mere importers, who are not actual devisers of the invention, from qualifying as inventors.[248] Consequently, the Court was of the opinion that effectively expanding the definition of inventor through statutory interpretation by courts was not appropriate.[249]

Republic of Korea

140. Subsequent to the national phase entry of the PCT application, the Korean Intellectual Property Office (KIPO) denied the patent application 1020207007394 on September 28, 2022, on the ground that an inventor must be a natural person.[250] Artificial intelligence systems are not fulfilling the requirements under the Patent Act of the Republic of Korea, since only a natural person is accepted as a valid inventor.[251]

Court decisions

141. In June 2023, the Seoul Administrative Court confirmed that KIPO was within its rights to request an amendment to the inventor section in the application based on Article 203(3) of the Patent Act of the Republic of Korea. Firstly, the plaintiff argued that KIPO's rejection of the application was not justified, because the application complied with the formality requirements under the PCT in the corresponding PCT application. The Court rejected the argument, stating that KIPO had the authority to conduct formality examination according to the Patent Act. Secondly, the Court confirmed that, according to the Patent Act, only natural persons can be listed as an inventor. Thirdly, the Court highlighted that in the current state of technology, there was no substantiated data supporting the existence of strong AI, which could independently make decisions and act without relying on algorithms or data developed or provided by humans. Fourthly, the Court held that the status of an inventor required legal capacity, which was granted, in principle, only to natural persons (Article 3, Civil Act), while a legal person has a limited legal capacity (Article 34). As AI did not fall under the category of a natural person nor a legal person under existing laws, it was not possible to attribute legal capacity to AI within the current legal framework.[252]

South Africa

142. In July 2021, South Africa, without any substantive examination of the patent application, issued a patent in the DABUS case, listing "DABUS, The invention was autonomously generated by an artificial intelligence" as the inventor.[253]

United Kingdom

143. In December 2019, the UKIPO refused to proceed with DABUS patent applications GB1816909.4 and GB1818161.0 due to a lack of the statutory requirements concerning inventorship and entitlement.[254] Specifically, UKIPO stated that there was a clear expectation that the "inventor" under Section 7 of the Patents Act and the person whom the applicant believed to be the inventor under Section 13 are a natural person. On the entitlement to a patent, the applicant argued that it acquired the right by virtue of ownership of the inventor (i.e., DABUS). The UKIPO however decided that even if DABUS were an inventor, no law allows for

[248] *Ibid*. para. 32, further details regarding the legislative history also in para. 11.
[249] *Ibid*, para. 33.
[250] Press statement issued by KIPO, dated October 3, 2022, available at: https://www.kipo.go.kr/en/BoardApp/UEngBodApp?c=1003&board_id=kiponews&catmenu=ek06_01_01&seq=1734.
[251] See the response from the Republic of Korea to Note C. 9141.
[252] See the summary of the judgement in English, available on https://artificialinventor.com/patent-applications/.
[253] Patent Journal of South Africa, July 2021, Vol. 54 No. 7, /3242, p. 255.
[254] UKIPO Decision: BL O/741/19.

the transfer of ownership of the invention from the inventor to the owner, and that derivation of right through ownership of the inventor did not meet the requirements of Section 7(2).

Court decisions

144. The High Court of Justice Business and Property Courts of England and Wales Patents Court confirmed the UKIPO's decision that an AI cannot be considered inventor under the Patents Act of 1977,[255] which was also confirmed in the appeal by the Court of Appeals (Civil Division)[256]. According to the Courts, the term "inventor" is construed as the "person" who is the actual deviser of the invention.[257] The High Court also stated that the "court can only construe legislation and cannot itself legislate, no matter how great the policy need".

145. Furthermore, the High Court also put forward the argument that the concept of "inventive step" found in patent law restricts the term inventor to natural persons, because only they are capable of mental activity and coming up with something that is "not obvious to a person skilled in the art.[258] This line of argument however was not followed by the Court of Appeals, pointing out that the "inventive step is a question answered by considering how a *notional* person skilled in the art would behave".[259] The permission to appeal the decision rendered by the Court of Appeals was ordered on August 12, 2022.

146. An oral hearing in the Supreme Court of the United Kingdom was conducted on March 2, 2023, and the judgment is to be handed down at a later date.[260]

United States of America

147. In its decision in April 2020,[261] the USPTO was of the opinion that the definition of an inventor in 35 U.S.C. § 100 (f) ("the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention") demanded a natural person to be an inventor. According to the USPTO, the wording of 35 U.S.C §101 "Whoever invents or discovers any new and useful (…)" indicated that an inventor must be a natural person.[262] Further, the USPTO referred to case law,[263] such as *Univ. of Utah v. Max-Planck-Gesellschaft zur Förderung der Wissenschaften* e.V., according to which the Federal Circuit had established that a state could not be an inventor, because in order to perform the mental act of conception, inventors must be natural persons and cannot be corporations or sovereigns.[264]

Court decisions

148. The United States District Court for the Eastern District of Virginia[265] in 2021, and the United States Court of Appeals for the Federal Circuit (CAFC)[266] in 2022 confirmed the decision of the USPTO.

149. Both courts denied the possibility for an AI to be an inventor and held that the Patent Act requires an inventor to be a natural person. The decisions are in line with the consistent earlier

[255] [2020] EWHC 2412 (Pat).
[256] [2021] EWCA Civ 1374.
[257] [2021] EWCA Civ 1374, paras. 50 to 54, 97; [2020] EWHC 2412 (Pat), para. 45(1).
[258] [2020] EWHC 2412 (Pat), para. 45(3)(c).
[259] [2021] EWCA Civ 1374, para. 56 (emphasis added by the author).
[260] https://www.supremecourt.uk/cases/uksc-2021-0201.html.
[261] Decision on Petition: In Re Application No. 16/524,350.
[262] *Ibid*., page 4.
[263] *Ibid*., page 5.
[264] See, 734 F.3d 1315 (Fed. Cir. 2013) *Univ. of Utah v. Max-Planck-Gesellschafl zur Förderung der Wissenschaften e.V.* at page 13.
[265] *Thaler v. Hirshfeld, et al*, 558 F.Supp.3d 238 (E.D. Va. 2021).
[266] *Thaler v. Vidal*, 43 F.4th 1207 (Fed. Cir. 2022).

holdings of the CAFC, albeit decided without any connection to AI, that only natural persons can be inventors.[267]

150. In its 2022 ruling, the CAFC based its decision on the provisions in 35 U.S.C., which expressly provide that inventors are individuals (35 U.S.C. § 100(f)[268] and (g), and § 115). Even though the US Patent Act itself does not further define the term "individual", the court argued that it must be read as a "human being, a person", following the United States Supreme Court decision in *Mohamad v. Palestinian Auth,*[269] because "nothing in the Patent Act indicates that Congress intended to deviate from the default meaning".[270] The court further pointed out that the use of personal pronouns ("herself", "himself") in the Patent Act as well as the required statements in the form of an inventor's oath or declaration in § 115(b) of the Patent Act. Thus, the CAFC rejected the notion that the Patent Act is open to other reasonable readings with regard to the term "inventor". Accordingly, it did no pursue any other forms of statutory construction. Policy arguments regarding the encouragement of innovation and public disclosure through the possibility to designate an AI as inventor on the patent application form, as submitted by the patent applicant, were dismissed by the court as speculative and unfounded. The court further explained that it was not confronted with "the question of whether inventions made by human beings with the assistance of AI are eligible for patent protection."[271]

151. The Supreme Court of the United States of America denied a petition for a *writ of certiorari* on April 24, 2023.[272]

European Patent Office (EPO)

152. In November 2019, the EPO Receiving Section refused the two patent applications, EP 18275163 and EP 18275174, designating DABUS as an inventor. The main reasons for its decisions are:

- Only a human inventor can be an inventor in the meaning of the EPC and meet the formal requirements under the EPC Article 81[273] and Rule 19(1)[274] regarding the designation of the inventor.

The legislative history of the EPC consistently refer to the inventor as being a natural person. Furthermore, names given to natural persons serve not only the function of identifying them, but also enable them to exercise their rights and form part of their personality.

[267] *Univ. of Utah v. Max-Planck-Gesellschaft zur Förderung der Wissenschaften E.V.*, 734 F.3d 1315, 1323 (Fed. Cir. 2013); *Beech Aircraft Corp. v. EDO Corp*., 990 F.2d 1237, 1248 (Fed. Cir. 1993).
[268] Pursuant to § 100(f) of the United States Patent Act, an inventor is defined as "[…] the individual or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention."
[269] See *Mohamad v. Palestinian Authority*, 566 U.S. 449, 454.
[270] *Thaler v. Vidal*, 43 F.4th 1207, 1211 (Fed. Cir. 2022).
[271] *Ibid*. at 1213, see also the response from the United States of America to Note C. 9141.
[272] https://www.supremecourt.gov/search.aspx?filename=/docket/docketfiles/html/public/22-919.html.
[273] Article 81 reads: The European patent application shall designate the inventor. If the applicant is not the inventor or is not the sole inventor, the designation shall contain a statement indicating the origin of the right to the European patent.
[274] Rule 19(1) states: The request for grant of a European patent shall contain the designation of the inventor. However, if the applicant is not the inventor or is not the sole inventor, the designation shall be filed in a separate document. The designation shall state the family name, given names and country and place of residence of the inventor, contain the statement referred to in Article 81 and bear the signature of the applicant or his representative.

- Since an AI has no legal personality, the requirements of EPC Articles 60(1)[275] and 81 are not met, since an AI can be neither employed nor can they transfer any rights to a successor in title.

AI systems or machines have at present no rights because they have no legal personality comparable to natural or legal persons. Legal personality of non-natural persons is based on legal fictions, either created by legislation or developed through consistent jurisprudence.

153. The applicant filed appeals against these decisions, which were reviewed by the Legal Board of Appeal of the European Patent Office in cases J 8/20 and J 9/20 (see below, under "Legal Board of Appeal").

154. On December 20, 2021, the applicant filed a divisional application (EP 21216024), dividing EP 18275163, which was covered by case J 8/20.[276] The Examination Division, in its report dated March 14, 2023, rendered the preliminary opinion on, *inter alia*, the issues raised in the main and auxiliary requests, concluding that the application does not meet the requirements concerning the designation of an inventor. In its main request dated August 22, 2022, the applicant made a statement, instead of designating the inventor, that the applicant was not able to identify an inventor and that the applicant who owned DABUS had the right to a patent. On this point, the Examination Division maintained that the applicant had not submitted a statement of origin of the right and therefore does not comply with EPC Article 81. As a new auxiliary request dated August 22, 2022, in a Designation of inventor form, the applicant designated as inventor "Stephen L. Thaler by virtue of being the owner of the AI system (DABUS) that created the invention disclosed in the application". Additionally, the applicant introduced the following statement in the description: "The applicant has identified Dr. Stephen L Thaler as the deemed inventor by virtue of Dr Thaler being the owner of the artificial intelligence machine DABUS […]. The invention disclosed herein was created autonomously by DABUS and is an AI-generated invention […]". The Examination Division stated that the auxiliary request did not meet the requirements of Article 81, as it did not clearly and unambiguously designate an inventor. It also noted that the above statement introduced in the description was irrelevant to the understanding of the invention, and should therefore be deleted. As of September 2023, the divisional application is still pending.[277]

Legal Board of Appeal

155. The Legal Board of Appeal of the EPO (Board of Appeal) dealt with the designation of an AI inventor in its decisions J 8/20 (appeal against the refusal of application No.18275163) and J 9/20 (appeal against refusal of application No. 18275174), dated December 21, 2021. It rejected the notion that an AI could be designated as an inventor in the context of the EPC.[278] Instead, the Board of Appeal argued that, under Article 81 EPC, the designated inventor has to be a person with legal capacity. This can be inferred, without the necessity to refer to the *travaux préparatoires* of the EPC, from the plain meaning of the word "inventor".[279] Further support was found in the purpose of the provision, which aims at protecting the rights of the inventor. Namely, the Board of Appeal specifies that the purpose of Article 81 EPC and the

[275] Article 60(1) states: The right to a European patent shall belong to the inventor or his successor in title. If the inventor is an employee, the right to a European patent shall be determined in accordance with the law of the State in which the employee is mainly employed; if the State in which the employee is mainly employed cannot be determined, the law to be applied shall be that of the State in which the employer has the place of business to which the employee is attached.
[276] EPO Board of Appeal, Case J 8/20, decision of December 21, 2021, ECLI:EP:BA:2021:J000820.20211221 – Designation of inventor/DABUS.
[277] See the European Patent Register at https://register.epo.org/application?number=EP21216024.
[278] See the response from the EPO to Note C. 9141.
[279] EPO Board of Appeal, Case J 8/20, decision of December 21, 2021, ECLI:EP:BA:2021:J000820.20211221 – Designation of inventor/DABUS, section 4.3.2 and 4.3.3.

related provisions in the Regulations is "primarily to confer and to protect rights of the inventor […], to facilitate the enforcement of potential compensation claims provided under domestic law, and to identify a legal basis for entitlement to the application."[280] As an AI does not enjoy rights, it can thus not be designated as an inventor under the EPC.[281]

156. The Board of Appeal further clarified that a transfer of the patent right from an AI to a natural person is not possible because an AI as such does not own any rights and has no legal personality. In this context, a mere designation of ownership over the AI does not bring the owner in the scope of Article 60(1) EPC, i.e. the owner cannot automatically be considered as a "successor in title" because no transaction regarding the patent right occurred in the first place.[282]

157. Regarding the broader question as to whether inventions made by AI are generally patentable, the Board of Appeal agreed that the scope of EPC Article 52(1) regarding patentable inventions was not limited to inventions conceived by humans.[283] Therefore, the Board of Appeal clarified that *how* an invention had been made played no role under the EPC.[284] However, the Board of Appeal believed that the broad wording of Article 52(1) cannot override the formal requirement of the EPC with regard to the designation of a person with legal capacity as an inventor.[285]

VII. CONCEPT OF INVENTORSHIP IN RELATION TO AI INVENTIONS

A. OVERVIEW OF THEORIES RELATING TO PATENT PROTECTION OF AI INVENTIONS

158. Although it is generally believed that AI technology has not reached to the point where AI systems can autonomously create inventions, some scholars have advanced their thoughts on whether inventions created by AI should be protected under patent law, and if so, how it should be framed. This subchapter provides a non-exhaustive overview of theories relating to patent protection of inventions created by AI.

159. Some argue that the law should recognize AI inventorship or, at least, co-inventorship for the purposes of patent law, as it would encourage innovation through increased research and investment in AI systems.[286] This line of argumentation follows the classic patent incentive theory, albeit not in connection with the AI systems themselves (which do not need incentives to be productive[287]) but rather with the people developing and maintaining those machines. Further questions could be asked with regard to indirect incentives for the companies that are investing in AI systems and are profiting from the output of their AIs.

160. A justification of AI inventorship based on the natural rights theory, for instance in the line of thought of Hegel,[288] is rarely advocated for, as it is harder to reconcile with the very nature of

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[280] *Ibid*., section 4.3.3.
[281] *Ibid*, section 4.3.3.
[282] *Ibid*, section 4.4.2.
[283] *Ibid*, section 4.6.2.
[284] See the response from the EPO to Note C. 9141.
[285] EPO Board of Appeal, Case J 8/20, decision of December 21, 2021, ECLI:EP:BA:2021:J000820.20211221 – Designation of inventor/DABUS, section 4.6.5.
[286] Ryan Abbott, The reasonable robot, p. 82-87 (2020); Donrich Thaldar & Meshandren Naidoo, AI Inventorship: The right decision?, 117 S. Afr. J. Sci. 1, 3 (2021) (arguing that the decision by the South African Patent Office to allow the designation of DABUS as an inventor was "progressive and pro-science").
[287] Shlomit Yanisky Ravid & Xiaoqiong Liu, When Artificial Intelligence Systems Produce Inventions: An Alternative Model for Patent Law at the 3A Era, 39 Cardozo L. Rev. 2215, 2239 (2018).
[288] Hegel argues that property rights are used for realizing the personality of humans, see Georg W.F. Hegel, *Grundlinien der Philosophie des Rechts* (Elements of the Philosophy of Right), 1821. Thus, "[…] an idea belongs to its creator because the idea is a manifestation of the creator's personality", see Justin Hughes, The Philosophy of Intellectual Property, 77 Geo. L.J. 287, 330 (1988).

AI systems, unless one would recognize them as legal persons.[289] Ultimately, the debate over legal personhood of AI systems is the crux of the whole matter – not only regarding AI and IP but AI and the law in general, as some judges suggested in their DABUS decisions. As AI systems are supporting, and in fact substituting, more and more activities traditionally carried out by humans, such as driving, the question of rights (as well as responsibilities, e.g. for wrongdoing) become more pressing. These issues are broadly discussed[290] but legal personhood for AI systems are generally seen with skepticism.[291]

161. Some argue that AI inventions pose challenges to the justification theory of patents that relies on the promotion of disclosure of (new) information through the patent system. Some argue that this justification does not apply to inventions created by AI because "[…] the inner workings and the use of AI in the inventive process are not properly understood or are largely unknown."[292] "While patent law's enablement doctrine focuses on the particular result of the invention process, some argue that AI presents a lack of transparency and difficulty in replication that profoundly and fundamentally challenges the disclosure theory in patent law."[293] However, it may be not adequate to discuss this issue in a generalized manner, since the sufficiency of disclosure under patent law involves various factors, such as the scope of the claims and the person skilled in the art. The sufficiency of disclosure requirement has also been applied to those inventions that the reproduction of their exact copies is not practicable (e.g., biological variability of reproduced material).

162. Some scholars hold the view that acknowledging AI inventorship would prevent the wrongful or dishonest claim to AI-created inventions by humans, and at the same time, it provides better recognition of human inventors who created the invention on their own.[294]

163. Other scholars are agreeing with the notion that AI inventorship does exist, as these AI systems are perceived as the true and only inventors of AI-generated inventions. At the same time, these scholars are not persuaded that the inventorship should lead to ownership – i.e., a protection of the invention through exclusive rights – but rather they see the invention as part of the public domain.[295] Some, however, argued that it may lead to the so-called tragedy of the anticommons and its detrimental effects on innovation.[296] Furthermore, the lack of flexibility regarding the allocation of rewards is seen as inefficient for AI systems, as there are multiple parties involved with different degrees of contributions to the invention.[297] Also, patent protection might, especially in the case of an exponential growth of AI-generated inventions,

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[289] Brown, Property ownership and the legal personhood of artificial intelligence, 30 Information & Communications Technology Law 208-234 (2021) (arguing that weak AI, but not strong AI, may be granted legal personhood); Mark Fenwick & Stefan Wrbka, AI and Legal Personhood, in *The Cambridge Handbook of Artificial Intelligence: Global Perspectives on Law and Ethics* p. 288-303 (Larry DiMatteo, Cristina Poncibò et al., eds, 2022) (supporting the exploration of personhood for AI in cases of harm caused by them); Visa Kurki, A Theory of Legal Personhood, p. 175-190 (2019) (arguing that strong AI may have legal personhood regardless of whether those AIs are worthy of moral consideration); Eliza Mik, AI as a Legal Person?, in *Artificial Intelligence and Intellectual Property* p. 419-439 (Jyh- An Lee & Reto M. Hilty eds., 2021) (arguing that there is no purpose or benefit of granting personhood to an AI in the context of IP law).

[290] For an overview see, James Dempsey, Artificial Intelligence: An Introduction to the Legal, Policy and Ethical Issues, Berkeley Center for Law & Technology, August 10, 2020.

[291] See, for instance, the response from Finland to Note C. 9141.

[292] Tabrez Ebrahim, Artificial Intelligence Inventions & Patent Disclosure, 125 Penn St. L. Rev. 147 (2020).

[293] *Ibid*.

[294] Ryan Abbott, The reasonable robot, p. 83 (2020).

[295] Shlomit Yanisky Ravid & Xiaoqiong Liu, When Artificial Intelligence Systems Produce Inventions: An Alternative Model for Patent Law at the 3A Era, 39 Cardozo L. Rev. 2215, 2258 (2018) (arguing that first-mover advantages, electronic open source tools and social recognition are preferable over patent protection).

[296] James Buchanan & Yong Yoon, Symmetric Tragedies: Commons and Anticommons, 43 Journal of Law and Economics 1-13 (200); Michael Heller, The tragedy of the anticommons: property in the transition from Marx to markets, 111 Harv. L. Rev. 621-688 (1998).

[297] Shlomit Yanisky Ravid & Xiaoqiong Liu, When Artificial Intelligence Systems Produce Inventions: An Alternative Model for Patent Law at the 3A Era, 39 Cardozo L. Rev. 2215, 2252 (2018).

impede follow-on invention through a steep increase of transaction costs for developing cumulative innovation.[298]

164. If one accepts the premise that AI systems can be considered inventors according to patent law standards, and thus can be more than mere tools in the invention process, the legal doctrines of joint inventorship or employee inventors in patent law are seen by some as possibly applicable.[299] Whether joint inventorship or the rules regarding employee inventions apply would be mainly a question of how the human-AI relationship will be perceived. In a relationship among equal innovators, joint inventorship might prevail. Conversely, if the relationship would be in the nature of a sponsor-inventor relationship with *quasi* mutual dependency, the employee invention rules might be used as a model. Either way, the lack of personhood, or of legal capacity of AI systems, does not seem to fit to the existing legal frameworks.[300]

B. POTENTIAL INTERSECTIONS BETWEEN INVENTORSHIP AND AI

165. The DABUS applications are so far the only concrete case of an AI system being claimed as an inventor. In that case, national/regional patent offices predominantly looked at the question as to whether indicating the AI system as an inventor on a patent application meets the formality requirement under the applicable law. Extended analysis carried out by some patent offices and courts, however, show that the question can touch upon many fundamental issues that have been the cornerstones of the modern patent law. These include:

(i) the inventor's right to a patent (in principle), which may be assigned to a successor in title (issues relating to the lack of legal capacity of AI systems, establishment of a chain of title and ownership, compliance with the formality requirements, including declarations or statements on inventorship and the applicant's entitlement to a patent);

(ii) moral rights of inventors (the rationale behind the moral rights of inventors and naming the inventor, and indication of the name of the inventors in a patent application);

(iii) definition and interpretation of the terms "inventor" and "joint inventor" (the notion of "inventions" under patent law and an inventor being an originator of the invention, whether an inventor shall be a natural person, and qualification and determination of an "inventor" and a "joint inventor");

(iv) inaccurate designation of an inventor, including usurpation (mechanisms to correct inaccurate designation of an inventor, legal consequences of non-submission or inaccurate designation of an inventor, including the cases where inventorship is falsely claimed by a third party, and possible remedies in case of usurpation).

While information about employee invention models under various national laws are also collected in this document, as described above, the lack of legal personality of AI systems would be a significant hurdle for applying these models.

166. The legal frameworks addressing these issues are naturally led by the rationale and policy objectives of the patent system, which are commonly described as promoting inventive activities and transfer of technology by setting a mechanism for providing incentives to innovate, protecting inventions and facilitating dissemination of new technological information and technologies. The policy and legal analysis of these intertwined issues in the context of the AI

[298] *Ibid*.; Suzanne Scotchmer, Innovation and Incentives p. 127-161 (2004) (discussing cumulative innovation).
[299] See the response from the Russian Federation to Note C. 9141; Xiang Yu & Runzhe Zhang et al., Challenges of artificial intelligence to patent law and copyright law and countermeasures, in *The Future of Intellectual Property*, p. 150, 156 (Daniel Gervais, ed., 2021).
[300] See the response from Colombia to Note C. 9141.

is beyond the scope of this paper. However, the compilation of the national/regional law and decisions of patent offices and courts point more to certain issues than others, as indicated in the previous paragraph.

167. As stated in Chapter II, interaction between a human and an AI system during the invention process may take different forms. In other words, contribution to the invention process may vary greatly, whether it is made by a human or by an AI system. This comes with very different results from a patent law assessment perspective, depending on what role the AI system plays in it and how that system was created, trained and used. That could be a reason why discussions on AI inventorship have already been started, even if humans continue to participate in the invention process.

168. For example, multiple persons may be involved in the creation of inventions using AI. One person may have identified a technical problem to be solved and have an idea of using AI to find a solution. Another person may have developed or trained the AI model, such as designing an AI algorithm, generating and selecting data for training the AI model. In addition, there may have been another person who is a user of the trained AI model to find a solution to the identified problem. Yet, another person may have been involved for analyzing and verifying the AI output. Even if that does not involve a question as to whether an AI machine can be an inventor by itself, the question of who an inventor is, or who can be deemed joint inventors, needs to be determined, based on the circumstances of each case.

169. In addition, considering the impressive advancement of machine learning technologies, an AI system, even if it is not autonomous, might demonstrate substantive contribution at a much higher level to the invention creation process in future. As a potential scenario, although sufficient contribution to the conception of the invention is made by a human inventor, an AI system might also contribute to the invention at the level where, if it were a human, it could qualify as a joint inventor.

170. Some countries have started stakeholder consultations that address the issues around intellectual property and AI, including questions relating to inventorship. For example, the government of the United Kingdom sought evidence and views on a range of options relating to, *inter alia*, patent protection for AI-devised inventions.[301] The government issued a consultation outcome paper entitled “Artificial Intelligence and Intellectual Property: Copyright and Patents: Government response to consultation”.[302]

171. The USPTO launched a request for public comments regarding artificial intelligence and inventorship,[303] which contains a number of questions relating to the current state of AI technologies, contribution to the conception of an invention by non-humans and joint inventorship, ownership issues, and future directions on the matters relating to inventorship. It also organized Listening Sessions on these issues, during which the USPTO presented hypothetical cases.[304]

[End of Annex and of document]

[301] https://www.gov.uk/government/consultations/artificial-intelligence-and-ip-copyright-and-patents.
[302] https://www.gov.uk/government/consultations/artificial-intelligence-and-ip-copyright-and-patents/outcome/artificial-intelligence-and-intellectual-property-copyright-and-patents-government-response-to-consultation.
[303] https://www.federalregister.gov/documents/2023/02/14/2023-03066/request-for-comments-regarding-artificial-intelligence-and-inventorship.
[304] https://www.uspto.gov/initiatives/artificial-intelligence/ai-and-emerging-technology-partnership-engagement-and-events.