

Creative Machines, Orphan Inventions: AI and the concept of inventor at the EPO

Ana Nordberg

Associate Professor, Senior Lecturer,

Faculty of Law, Lund University

Abstract:

In 2018, an AI system named Device for the Autonomous Bootstrapping of Unified Sentience – DABUS – was credited by its creator to have independently developed a number of inventions. Since then, DABUS creator, supported by a team of interested academic legal scholars and patent attorneys has launched an international campaign to test the boundaries of patent law concerning the designation of inventor.

This chapter analyses these ongoing attempts to patent the output of this AI system focusing mainly at the EPO decision of the receiving section and legal board of appeal, and discussing a selection of relevant points of law raised by this case. Additionally, decisions concerning attempts to patent the DABUS output issued at other jurisdictions will also be very briefly analyzed to provide context to the ensuing discussion on de lege ferenda proposals for eventual legislative interventions regarding what is here described and coined as Orphan Inventions.

Key words: *Concept of Inventor; Inventorship; Patentability of AI Inventions; Patent eligibility; AI inventions in Europe; EPC and AI.*

1. Introduction

In 2018, an AI system named DABUS (Device for the Autonomous Bootstrapping of Unified Sentience) was credited by its creator to have independently developed two inventions: a neural flame and a fractal container. DABUS is described as a new AI paradigm ‘an extensive trillion neuron artificial neural architecture that can autonomously learn and create’, able to develop potential inventions by aggregating simple concepts combining them into more complex ones ‘that in turn launch a series of memories that express the anticipated consequences of those ideas’.¹ DABUS is also described as a creative machine, one that is not designed to solve specific problems within a given delimited field of knowledge, but rather gathers and uses information from diverse fields of research and human endeavour. In summary, and according to its creator, DABUS being a ‘sentient artificial general intelligence can replicate all aspects of human cognition, including perception, creativity, consciousness, and sentience’ and is capable of having ‘subjective feelings about their cognitive products.’²

DABUS creator, supported by a team of interested academic legal scholars and patent attorneys³ has launched an international campaign to ‘seeking intellectual property rights for inventions generated by an AI without a traditional human inventor’, and testing the boundaries of patent law

¹ Imagination Engines, ‘DABUS Described’, Available at: <https://imagination-engines.com/index.html> (retrieved 10 January, 2022).

² Idem. For a technical description see Thaler, S. (2021) ‘Topological Learning and Sentient AGI’, 8 (1) *Journal of Artificial Intelligence and Consciousness*, 1-30.

³ The Artificial Inventor Project, ‘The Team’. Available at: <https://artificialinventor.com/about-the-team/> (retrieved 10 January, 2022).

concerning the designation of inventor.⁴ This chapter analyses the ongoing attempts to patent the output of this AI system at the EPO, the decision of the receiving section and legal board of appeal (JBA), discussing a selection of relevant points of law raised by this case. Several decisions concerning the DABUS case have also been issued at national level, and will be very briefly analysed to provide context to the ensuing discussion on *de lege ferenda* proposals for legislative interventions regarding *orphan inventions*.

2. DABUS patent applications at the EPO

Two Patent applications naming DABUS as the inventor, were filed at the EPO.⁵ Both were refused on grounds that only humans could be recognized as inventors under the EPC. In public oral proceedings held on the 21st December 2021, concerning combined cases J 8/20 and J 9/20, the EPO Legal Board of Appeal dismissed the applicant's appeal and upheld the EPO's examiner decision,⁶ confirming that an inventor designated in a patent application must be a human being. These decisions remain unpublished at the date of this paper. However, the EPO, through their website, has officially released information and statements, claiming that:

‘There is a common understanding that the inventor is a human being: the person who created the invention by their own creative activity. This has been confirmed by an academic study on AI inventorship commissioned by the EPO⁷ and in the discussions with the EPC contracting states’⁸.

Under Article 81 EPC the ‘[...] 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.’ Rule 19 EPC further clarifies that the designation ‘shall state the family name, given names and country and place of residence of the inventor’ and also that the EPO ‘shall not verify the accuracy of the designation of the inventor’.⁹ Regarding the related question of patent ownership, Article 60(1) EPC establishes that the right to a European patent belongs to the inventor or their successor in title.

In cases J 8/20 and J 9/20 the question arose as to whether the applicant, arguing that the inventions had been created autonomously by DABUS an artificial intelligence entity, could designate this AI as the inventor and himself as patent owner, by reason of being the owner of the said AI – and as such the ‘inventor's successor in title’¹⁰. While its precise nature may be disputed, under the European Patent Convention (EPC) the designation of the inventor is a requirement which a patent

⁴ The Artificial Inventor Project, ‘Patent applications. Available at: <https://artificialinventor.com/patent-applications/> (retrieved 10 January, 2022).

⁵ Patent Applications EP18275163 and EP18275174.

⁶ Decisions J 8/20 and J 9/20 of the Legal Board of Appeal, of 21 December 2021 [unpublished].

⁷ Shemtov, N., *A study on inventorship in inventions involving AI activity* (EPO, 2019).

⁸ Pihlajamaa, H., ‘Legal aspects of patenting inventions involving artificial intelligence (AI): Summary of feedback by EPC contracting states’, Committee on Patent Law, 20 February 2019. Available at: [https://documents.epo.org/projects/babylon/eponet.nsf/0/3918F57B010A3540C125841900280653/\\$File/AI_inventorship_summary_of_answers_en.pdf](https://documents.epo.org/projects/babylon/eponet.nsf/0/3918F57B010A3540C125841900280653/$File/AI_inventorship_summary_of_answers_en.pdf) (retrieved 15 February, 2022).

⁹ Rule 19, EPC Implementing Regulations.

¹⁰ Letter concerning the inventor, 2 August 2019, Patent application EP182275163.6, Available at: <http://register.epo.org/application?documentId=E3NDIJI0723DSU&number=EP182275163&ing0en&npl=false> (retrieved 10 January, 2022).

application must fulfil. Assessment of this requirement takes place prior to and independently from the substantive examination.

The European Patent Office is not mandated to verify ‘ex officio’ the accuracy of the designation of the inventor.¹¹ However, the Receiving Section of the EPO refused both DABUS patent applications objecting to the designated.¹² The decisions of the receiving section considered the designation submitted by the applicant not to be consistent with Article 81 EPC, based on two sets of reasons: Firstly, it concluded that within the meaning of Article 81 and Rule 19(1) EPC only a human person could be an inventor. Secondly, a machine could not transfer any rights to the applicant and thus the statement that the applicant was successor in title derived from ownership of the AI system (the inventor) did not satisfy the requirements of Article 81 EPC in conjunction with Article 60(1) EPC.

Following the two above mentioned appeals (J 8/20 and J 9/20), the EPO Legal Board of Appeal (JBoA) confirmed the decisions of the Receiving Section refusing applications EP 18 275 163 and EP 18 275 174 and refusing the auxiliary request concerning patent ownership derived from ownership and creation of the ‘inventor’ – the AI system DABUS.

3. The decisions of the Receiving Sections and Legal Boards of Appeal

The EPO Legal Board of Appeal (JBoA) examined both the question of whether an AI system could be designated as the inventor and whether the creator of such AI system could derive ownership over the inventions. The JBoA considered the decision of the Receiving Section and the appellant submissions, rejecting the appeal as well as a request for an appeal to the EBA thus confirming the Receiving Section decision.¹³ Since at the present date the full text of the decision remains unpublished, this section analyses arguments and grounds for the decisions of the Receiving Section by reference to arguments submitted on behalf of DABUS and its creator.¹⁴

3.1. Identifying the inventor by name and surname

The Receiving Section concluded that indicating the name of a machine does not fulfil the formal requirements of a patent application designating the inventor, arguing that ‘names given to things may not be equated with names of natural persons’. Names, according to the Receiving Section, serve more than an identifying function, but also allow the exercise of rights and form part of a person’s personality, citing various national law provisions concerning right to a family name and civil registry rules¹⁵ and dispositions concerning legal personality i.e., the general ability to be subject of rights and obligations withing a given legal system.¹⁶

This formal argument is developed by interpretation of the EPC implementing rules, since the convention in itself only mentions that the inventor has a right to be mentioned, a right that can be exercised against the applicant (article 61 EPC), and a corresponding procedural duty of the applicant to designate the inventor (article 81 EPC). A duty that is a formal requirement, but whose

¹¹ Rule 19 (2) EPC Implementing Regulations.

¹² Decision of the Receiving Section of 27 January 2020, European Patent Application n. 18275163.6.

¹³ At this date the full JBA joint decisions remain unpublished.

¹⁴ Statement of Grounds of Appeal, to Decision of the Receiving Section of 27 January 2020, European Patent Application n. 18275163.6.

¹⁵ Para 22, Footnote n. 3 and 4, Decision of the Receiving Section of 27 January 2020, European Patent Application n. 18275163.6, Grounds for the decision (annex).

¹⁶ Para 22, Receiving Section, application 18275163.6, Grounds for the decision (annex), 27.01.2020.

accuracy is not appreciated *ex officio* by the examining division (Rule 19 (2), implementing regulations EPC). Meaning that the EPC does not require the submission of identification documents. If the applicant had not openly stated that the inventor was a machine, the patent might had been examined as to patentability substantive requirements and eventually granted.

The right to a name, protects rights and serves a social function connected with family inheritance, culture and identity, but also with general identification purposes as subject of rights and obligations. The concept of inventor and the moral right to be named or recognised as inventor is linked with the protection of personality rights. This specific reasoning could be equally applicable by analogy to all entities vested with legal personality, given that companies, foundations and other legal persons are generally required to have registered *names* and addresses, and even a legal person national identification number registered in the relevant registry (e.g., a commercial or tax registry for legal persons).

Names are indeed linked to a notion of identity and identification and can also give rise to or be object of immaterial rights, such as intellectual property (including moral rights) and other reputational rights, however these are not always specific to human persons. Furthermore, even entities not considered legal persons - e.g. animals - have some recognised rights, and are also required to be registered in the relevant registries with names and in some cases ‘family or geneological’ designations to facilitate identification of lineage or pedigree.

On the other hand, civil registration rules and name conventions vary considerably around the world. Not all countries require that citizens have a name followed by a family name, and not all countries have closed lists of accepted names.¹⁷ Iceland, an EPC member state, does not have family names, but only patronymics or matronymics. A natural person’s name consists of a first name followed by the name of one or two parents followed by the suffix -son or dóttir (son of or daughter of). A similar tradition is also found in some Asian countries. While in some jurisdictions either there is a mononymous tradition or some individuals are allowed to choose to be known and addressed by a single name, or mononym.¹⁸ Conversely, in many countries (e.g. Portugal and Spain as well as south American countries) is common for persons to have two or several family names. It is also traditional for descriptive words to be used as names and surnames, e.g., toponymic designations, trees, flowers, plants, personal characteristics, professions or activities.

The requirement that the inventor be designated by a name, surname and address has to be interpreted in an inclusive and non-discriminatory manner. Meaning that the EPC can not be interpreted as requiring that the inventor has to present both a name and family name in order to exercise their rights, as such would be discriminatory. Indirectly such is recognised by the EPO,¹⁹ meaning that either a mononymous or several descriptive words, can satisfy the application formality requirements of providing the inventor’s name.

Considering that the requirement to mention the inventor is linked to the need to professionally acknowledge the inventor contributions to the state of the art. It should also be noted that it is not

¹⁷ E.g. under Swedish law there are no lists of accepted names, and thus names can only be refused if considered offensive; may lead to discomfort for the person bearing the name, or for some other reason is deemed inappropriate as a first name, 28 §, Act on personal names of 17 November 2016 (SFS:2016:1013) .

¹⁸ Often referred examples are north American indigenous populations, Afghanistan, Bhutan, Eritrea, India (Tamil population), Indonesia (Javanese population), Myanmar, Mongolia and Somalia.

¹⁹ Para 22, Decision of the Receiving Section.

uncommon for individuals to use shortened names or pseudonyms as professional, academic or trade names, either informally or dully registered with a professional regulatory body.²⁰ In this sense, inventors wanting to ensure professional acknowledgement might have a legitim interest in using the name for which they are known in the relevant professional circles. The EPC does not mention the need to present identity documents nor that the name of the inventor has to correspond to a name registered in a specific type of official registry. While, arguably, national patent laws may be stricter, it does follows that under the EPC it is not required that the name provided to the EPO has to correspond to a person's full name as it stands in a civil registration.

3.2. Legal personality of the inventor

The argument that an AI, described either as a machine (hardware) or a computer program (software), has no legal personality and as such cannot be object of rights and obligations has some merit, but the affirmation is too generalised. A specific evaluation of the right to be named inventor is distinct from determining whether to recognise the factual situation of a machine being the inventor. This is also a separate discussion from whether legal personality is required to be subject of ownership rights concerning a patent, and the broader issue of determining whether innovation developed by machines should be object of a patent or should such innovation remain in the public domain.

The EPC does not contain general rules defining legal personality, nor any specific rules concerning what entities are considered to be able to be object of rights and obligations under the EPC, deferring such matters to the applicable national law,²¹ e.g. Article 58 EPC concerning the entitlement to file a European patent application, prescribes that a 'European patent application may be filed by any natural or legal person, or anybody equivalent to a legal person by virtue of the law governing it.'²²

The Receiving Section argues that 'AI systems or machines have no rights because they have no legal personality', and while it is correct that so far no AI system has been granted legal personality in Europe, inventors are not restricted by country of origin by virtue of the principle of national treatment²³ and thus there is at least the theoretical possibility that, if not currently, in the future some jurisdictions may determine that AI systems can be granted some form of legal personality either directly or by analogy to other legal entities. For example, in 2017 it was widely advertised that 'Sophia', a humanoid robot with Artificial Intelligence (AI), developed by the Hanson

²⁰ It is common for researchers with long names to use professionally an abbreviated version, or to retain a professional name after official changes, e.g. by virtue of marriage, divorce or other circumstances. Professional names are also common for lawyers and other regulated professions in countries with long name traditions.

²¹ Concerning jurisdictional issues and applicable law, see Article 24, Regulation (EU) No 1215/2012 of the European Parliament and of the Council of 12 December 2012 on jurisdiction and the recognition and enforcement of judgments in civil and commercial matters, OJ L 351, 20.12.2012, p. 1–32, amended by Regulation (EU) No 542/2014 of the European Parliament and of the Council of 15 May 2014 L 163; and Commission Delegated Regulation (EU) 2015/281 of 26 November 2014.

²² See also (G 3/99, G 2/04).

²³ Article 58 EPC; Article 2 Paris Convention for the Protection of Industrial Property of March 20, 1883; Article 3 Agreement on Trade-Related Aspects of Intellectual Property Rights, Annex 1C of the Marrakesh Agreement Establishing the World Trade Organization, signed in Marrakesh, Morocco on 15 April 1994.

Robotics company, received citizenship from Saudi Arabia.²⁴ Although it is unclear what this electronic citizenship entails and whether or not Saudi law recognises that AI systems and Robots have legal personality, and if so, the extent of its legal capacity to exercise rights and obligations, the point remains that it is possible that an AI system may be considered subject of rights and obligations. In this light, one has to question whether the Receiving Section would maintain its objections if, like Sophia, DABUS had been granted Saudi citizenship.

Legal personality, in a broad sense, is not limited to human persons and groups of persons (commercial enterprises or ideal organizations). Around the world, legal personality has been either recognised or granted by the relevant jurisdiction to a variety of both corporeal and incorporeal entities, justified by pursuing a number of societal goals. There is precedent in maritime law to treat ships as having legal personality independent from their owner. In recent years, environmental law saw a movement to endow with rights bodies of water, forests and nature.

In 2008, Ecuador became the first country to enshrine the legal rights of nature in its constitution. In Bolivia the rights of nature (or Mother Earth) and their protection are recognised and regulated in two statutes: which aims to operationalize the rights of Mother Earth set out in the former law in the context of the so-called integral development for *Vivir Bien* (living well or good life). In 2017, the Whanganui river in New Zealand was given legal personhood.²⁵ In the same year, in India, the High Court of Uttarakhand, declared the Ganga and Yamuna Rivers and all their tributaries legal persons and appointed two legal representatives in loco parentis (although the decision was reverted by the State Supreme Court on appeal).²⁶ In 2019, Bangladesh granted all of its rivers the same legal status as humans. The landmark ruling by the High Court Division (HCD) of the Supreme Court of Bangladesh also appointed a government agency - Bangladesh's National River Conservation Commission, as the legal guardian of rivers.²⁷ Also in 2019, the city of Toledo, Ohio, USA passed what is known as the Lake Erie Bill of Rights recognizing a lake and its surrounding nature as subject of rights (later declared unconstitutional by judicial authorities).²⁸

In the EU, there has been political initiatives and concrete proposals and arguments towards an eventual legal personality for AI systems. On 16 February 2017, the European Parliament enacted a resolution urging the EU Commission to submit a proposal for a directive on civil law rules on robotics.²⁹ It included a call for 'when carrying out an impact assessment of its future legislative instrument, to explore, analyse and consider the implications of all possible legal solutions', including 'creating a specific legal status for robots [...], and possibly applying electronic

²⁴ Press release from the Center of International Communication, Riyadh, October 25, 2017, 'Saudi Arabia Is First Country In The World To Grant A Robot Citizenship', <https://cic.org.sa/2017/10/saudi-arabia-is-first-country-in-the-world-to-grant-a-robot-citizenship/> (retrieved 5 March, 2022).

²⁵ New Zealand Te Awa Tupua (Whanganui River claims settlement) Act 2017 of 20 March 2017, Available at <https://www.legislation.govt.nz/act/public/2017/0007/latest/whole.html> (retrieved 5 March, 2022); See also: Amirante, D & Bagni, S (eds) *Environmental Constitutionalism in the Anthropocene* (Routledge, 2022).

²⁶ Mohd. Salim v. State of Uttarakhand & others, 2017.

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²⁸ Lake Erie Bill of Rights, Available: <https://www.utoledo.edu/law/academics/ligl/pdf/2019/Lake-Erie-Bill-of-Rights-GLWC-2019.pdf> (retrieved 5 March, 2022) ; *Drewes Farms v. Toledo*, No. 31: 19 CV 434, 2019 WCL I 2S40 1 (D. Ohio. Mar. 18, 2019).

²⁹ European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)).

personality to cases where robots make autonomous decisions or otherwise interact with third parties independently'.³⁰ It also contained a call on the Commission to 'a horizontal and technologically neutral approach to intellectual property applicable to the various sectors in which robotics could be employed'.³¹

The EU has subsequently chosen a different direction, currently expressed in the proposed AI Act.³² The current EU Commission proposal for a Regulation laying down harmonised rules on AI as part of a wider comprehensive package of measures that address problems posed by the development and use of AI, including liability issues³³. It does not contain any mention of legal personality for AI systems, but rather regulates obligations of those providers and users of AI systems in the union. Previously, already in 2019, the EU Parliaments had adopted a resolution on a comprehensive industrial policy on AI and robotics³⁴, abandoning the idea of a special status for AI and instead proposing a sectorial approach in the areas of law impacted by AI. In the following year, the EU parliament, it adopted another resolution with specific recommendations concerning a civil liability regime for AI, in which it expressly distance itself from the idea of attribution of legal personality to AI entities, stating that eventual 'changes in the existing legal framework should start with the clarification that AI-systems have neither legal personality nor human conscience' and that 'all physical or virtual activities, devices or processes that are driven by AI-systems may technically be the direct or indirect cause of harm or damage, yet are nearly always the result of someone building, deploying or interfering with the systems; notes in this respect that it is not necessary to give legal personality to AI-systems'.³⁵

It has also been argued that there is no need for granting legal personality specifically to AI, because already withing current commercial/corporate law there are several possibilities for the creation of company structures that might provide functional and adaptive legal solutions for 'housing' autonomous systems.³⁶ Indeed, multibillion global companies have been constructed around computer programs, online video games, social networking websites and search engines.

Legal entities have become increasingly dematerialised, with many based almost exclusively in immaterial assets and decentralised digital operations, it is likely that several jurisdictions might have (or soon allow) formats or typologies of legal persons flexible enough to accommodate the notion of an AI a legal entity.

Furthermore, although legal personality is usually necessary for an entity to be subject to rights and obligations, there is precedent in EU legislation of entities being subject of rights and obligations regardless of lack of legal personality. A first example would be the notion of undertaking in EU competition law, that according to Court of Justice of the European Union

³⁰ Para 59 (f), EU Parliament Resolution (2015/2103(INL)).

³¹ Para 18, Idem.

³² Proposal for a Regulation of The European Parliament and of the Council laying down harmonised rules on Artificial Intelligence (Artificial Intelligence Act) and amending 7 certain Union legislative acts, Brussels, 21.4.2021, COM(2021) 206 final 2021/0106 (COD).

³³ Para 1.3, Explanatory Memorandum, AI Act.

³⁴ European Parliament resolution of 12 February 2019 on a comprehensive European industrial policy on artificial intelligence and robotics (2018/2088 (INI)), P8_TA(2019)0081.

³⁵ Para 6 and 7, European Parliament resolution of 20 October 2020 with recommendations to the Commission on a civil liability regime for artificial intelligence 2020/2014(IN)L, P9TA(2020)0276.

³⁶ Bayern, S.J., et al., (2016) 'Company Law and Autonomous Systems: A Blueprint for Lawyers, Entrepreneurs, and Regulators' 9 (2) *Hastings Sci & Tech Law J*: 135-162.

(CJEU) case law generally encompasses and places obligations upon every entity engaged in an economic activity, regardless of its legal status.³⁷ A second can be seen in the notion of data controller and data processor, that extends to ‘natural or legal person, public authority, agency or other body’,³⁸ meaning that even entities that might not be considered to have legal personality are also subject to data protection obligations.³⁹ A third group of examples concerns animal welfare protection rules, by which animals although not having legal personality are subject of protection. Both the Council of Europe⁴⁰ and the EU treaties recognise animal welfare rights. In the EU, Article 13 of the Treaty on the Functioning of the European Union (TFEU) introduced the recognition that animals are sentient beings and the need to respect their welfare, and specific legislation has been enacted both at EU and national level.⁴¹ Currently, by virtue of the Biotechnology Directive and via EPC implementing regulations, animal suffering which is not outset by benefit to man can result in a refusal to grant a patent under Article 53 (a) EPC. Finally, the United Nations Educational, Scientific and Cultural Organization (UNESCO) protects and attribute rights to the cultural or natural heritage⁴²; and even the human genome⁴³ as humanity immaterial heritage, thus granting them if not exactly legal personality, a status that implies being subject to a number of rights or at least obligations towards them.

In summary, although currently, the EU does not appear to be considering the option of creating an electronic legal personality, it cannot be excluded that an AI system may be considered to have legal personality, under the inventor’s applicable national law. Inventors, by virtue of the national treatment principle can originate from one of the signatory of Paris convention (176 countries);⁴⁴ or WTO/TRIPS Agreement (164 countries),⁴⁵ applying directly to the EPO (38 members)⁴⁶ or via the PCT (168 members)⁴⁷. It also follows from the current legal framework that legal personality is not a requirement to being subject of legal protection, and it is not unimaginable that an entity without legal personality could be designated as the factual creator (if not the owner) of a given invention. In fact, DABUS has so far been able to be recognised as inventor in both Australia and South Africa, despite not having been formally recognised as a legal person in those jurisdictions.

³⁷ Para 21, Case C-41/90 Klaus Höfner and Fritz Elser v Macratron GmbH [1991] ECR I-1979.

³⁸ Article 4 (7) and (8), Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, OJ L 119, 4.5.2016, p. 1–88 (GDPR)

³⁹ See also Article 4 (18 and (19), GDPR.

⁴⁰ European Convention for the Protection of Animals kept for Farming Purposes, Strasbourg, 10.III.1976

⁴¹ See Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes OJ L 221, 8.8.1998

⁴² World Heritage Convention, adopted at the seventeenth session of the General Conference of the United Nations Educational, Scientific and Cultural Organization, Paris, 16 October 1972.

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⁴⁴ Paris Convention for the Protection of Industrial Property, ‘Contracting Parties’. Available at: <https://www.wipo.int/treaties/en/ip/paris/> (retrieved 21 March 2022).

⁴⁵ World Trade Organization, ‘Members and Observers’. Available at: https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm (retrieved 21 March 2022).

⁴⁶ EPO, ‘Member states of the European Patent Organisation’. Available at : <https://www.epo.org/about-us/foundation/member-.html> (retrieved 21 March, 2022).

⁴⁷ WIPO, ‘The PCT System’. Available at: https://www.wipo.int/pct/en/pct_contracting_states.html (retrieved 21 March 2022).

Reducing the relevance of legal personality-based arguments, and their ability to develop clarity and legal certainty to patentability norms.⁴⁸

3.3. Legal capacity to be named the inventor

The JBOA declared that: ‘Under the EPC the inventor had has to be a person with legal capacity. For this reason, at least, the main request was not allowable.’⁴⁹ This formulation is misguided and perhaps even confuses legal personality with legal capacity.

Natural persons, deceased after creating the invention but before or during the application procedure, can be said to be devoid of legal capacity but their heirs or successors in title can still apply for a patent and the deceased be named inventor. A minor or any person under legal guardianship, and thus lacking full legal capacity, can be named inventor (although the application needs to be filed on their behalf by a legal guardian).

On the other hand, a legal person, e.g a commercial company or research institutions with general legal capacity under the law governing it that may well include activities relating to technical research and development of new inventions, is still regarded by the EPO as lacking capacity to be named inventor.

The most compelling argument made by the Receiving Section is instead anchored in the preparatory works pointing to an understanding of the concept of inventor as corresponding to a natural person, including mentions to discussions on the possibility of inclusion of legal persons, which was not carried up into the final draft of the convention.⁵⁰ Insisting that legal persons cannot be named as the inventor (or lack legal capacity under the EPC) protects the scientific and technical community from potential refusal of employees to recognise the employee-inventors moral and economic rights. It also allows inventors (employees) to claim recognition when the patent applicant (employer) has failed to correctly identify and indicate the inventor. Allowing them also to eventually claim, compensation for moral and/or economic damages if applicable under the applicable national law. While failure to indicate the correct inventor carries no sanctions under the EPC, if the applicant cannot derive title of ownership from law or contract with the actual inventor, an incorrect designation will have consequences in patent ownership.⁵¹

The argument goes to the determination of legal capacity, not general legal capacity, but the specific legal capacity to be named inventor. Despite legal personality being attributed under national laws to a wide variety of entities (foundations, associations, commercial societies, etc), these have limited legal capacity. Unlike natural persons, the capacity of legal persons and equivalent entities is by nature defined and limited in the law by reference to the social function that these are intended to fulfil and that justifies their personhood status. Such means that the legal capacity to be subject of (or entitled to) intellectual property rights must be determined by national law. In this regard it should also be mentioned that the EPC grants European patents, that are nothing more than a bundle of rights that require validation at the respective national level. Even future European patents with unitary effect will still be subject to national law, in the absence or silence of specific EPC or EU law provisions.

⁴⁸ The decision in Australia is pending a final appeal.

⁴⁹ J008/20, p.3.

⁵⁰ Oral proceedings, at n. 24, citing the statement of the Chairman in the document IV/4806/61-F page 18.

⁵¹ Article 61 EPC.

Therefore, the relevant question is whether the EPC contains any specific provision delimiting legal capacity to be named inventor to a category of persons – natural persons, or alternatively whether it prohibits or denies specific legal capacity to legal persons and other entities to be named inventors.

Neither the EPC nor the implementing regulations have any provision that expressly reserves to natural persons capacity to enjoy the right to be named inventor. Secondary sources of law, such as preparatory works show no reference to creative machines nor AI. The drafters of the EPC did not anticipate the existence of creative machines and thus the use of preparatory works requires the use of interpretation by analogy. Analogy between AI and autonomous agents and registered legal persons (or other entities such as ‘irregular or unregistered societies’) would require an evaluation on whether the objection to these being named inventor, was founded in the nature of the legal entities existing at the time or in a social policy objective of reserving the recognition of the moral right of attribution to individual human inventors.

Given the historical context, it does seem credible that the drafters of the convention intended to provide protection to individual scientists (understood as humans) from abuse of power in labour or business relationships. The protection of the right to being named inventor, as an international principle of law, was introduced in 1934 by virtue of the insertion into the Paris Convention of article 4ter, which simply states that ‘[t]he inventor shall have the right to be mentioned as such in the patent’.⁵² Currently, both the EU charter⁵³ and several countries provide direct or indirect constitutional protection to intellectual property,⁵⁴ with some expressly attributing the nature of fundamental human rights to the rights of authors⁵⁵ and some also extending such protection to inventors.⁵⁶ The inception of attribution rights as a human right, in the form of a specific right derivative from general personality rights and a specific example of reputation rights, points to an understanding of the right of attribution in intellectual property as exclusive to human persons.

However, it should be noted that legal persons may also enjoy, even if in a more limited manner, rights to a reputation. This is for example visible in trademark law where protection is conferred to the link between a sign, a type of goods and services, and the reputation on the market of a commercial entity, but also in geographical indications. Arguably, legal persons employing or sponsoring scientists, would have an interest in being named inventors, where no specific human inventor can be found, to establish a reputation of fostering innovation.⁵⁷ Similar reasoning can be applied to AI systems, where developers and sponsors have an institutional interest in protecting and promoting recognition of the specific AI system for delivering successful outputs. Although,

⁵² Graham, D. (2013) ‘Collective invention and patent law individualism: origins and functions of the inventor’s right of attribution’ 5 WIPO Journal 25. See also Fromer, J.C. (2012) ‘Expressive Incentives In Intellectual Property’, 98(8) Virginia Law Review: 1745-1824; Lissoni, F., Montobbio, F. and Zirulia, L. (2013) ‘Inventorship and authorship as attribution rights: An enquiry into the economics of scientific credit’, 95 Journal of Economic Behavior & Organization: 49-69; Shemtov, N., *A study on inventorship in inventions involving AI activity* (EPO, 2019).

⁵³ Article 17 (2) Charter of Fundamental Rights of the European Union, OJ C 202, 7.6.2016, p. 397–397.

⁵⁴ E.g. Greek Constitution, Article 17.

⁵⁵ E.g. Sweden Regeringsformen 16 §.

⁵⁶ E.g. Constitution of Spain, Article 20(1); Constitution of Portugal, Article 42.

⁵⁷ On the rights of employees in different jurisdictions see: Wolk, S. and Szkalej, K. (eds) *Employees’ Intellectual Property Rights*, (2nd Edition, Kluwer Law International, 2017). Concerning different theoretical frameworks, see for example O’Connor, S.M. (2012) ‘Hired to Invent vs. Work Made for Hire: Resolving the Inconsistency among Rights of Corporate Personhood: Authorship, and Inventorship’ 35 Seattle U. L. Rev. 1227.

AI will not respond to reputational incentives, the same is true for animals, legal persons and institutions that routinely receive prizes, awards, grants and other types of incentives that target not the recipient non-human entities directly, but rather are an indirect incentive to the humans that own, create, invest and finance them.

There is also an argument to be made in favour of a right of the community to know how an invention has come to exist. Patent applications, as any other official document, should describe technical facts and not legal fictions. However, it should be emphasised that any solutions developed for adapting formal requirements to the existence of AI cannot not diminish the rights of human intellectual creators and put to question the entire structure of Patent law as a system for incentivising technical innovation.

The contribute of AI systems should perhaps instead be recognised by mandatory disclosure in the patent application without indicating them as the inventor. Because, admitting that AI could be named inventor would allow legal persons engaged in research to prioritise naming the AI under their control or ownership as inventor instead of their scientific staff. This would in practice entail a danger that inventors would be substituted, completely or partially, by the tools they use. Researchers intending to patent their innovation might even be selective regarding using AI tools by fear of losing their moral rights in favour of the AI owner.

Furthermore, companies, research institutions and individual researchers use AI systems in a multitude of fields of science and technology that are often developed by third parties. Companies and research institutions would face the danger of losing or having to share their IP with the AI software developers. Considering the likelihood that a handful of multinationals will largely dominate the market for AI systems/software, attributing the status of inventor or co-inventor to AI systems would create a danger that ownership of a large percentage of innovation would be ultimately concentrated in the hands of these AI developers.

3.5. The nature of the requisite to designate the Inventor

The EPC sets a requirement upon the patent applicants to designate the inventor. The nature of such requirement has also been under scrutiny as a consequence of the DABUS cases. The EPC reserves for national law the appreciation of legal personality and legal capacity, as it does not have any provisions establishing a need to provide documentation regarding the legal status neither of the designated inventor, nor the patent owner. Although the EPO examines whether the designation of the inventor formally complies with the requirements lay down on the EPC and implementing rules,⁵⁸ the EPO does not carry an ex officio determination on the accuracy of the designation of the inventor. Such is clearly stated under Rule 19 (2) of EPC the EPC implementing regulations,⁵⁹ and deferred to national law according to the Patent Law Treaty.⁶⁰ Nor such designation can be freely object of opposition by any member of the public. A request for rectification, requires the consent of the wrongly designated inventor, or if such request is filed by a third party, it is also necessary the consent of the patent applicant and the patent owner (if not the inventor).⁶¹ Unless the wrongly designated person is in agreement, the person who asserts having better title to be designated has to argue her case before national courts.

⁵⁸ Article 90 (3), EPC.

⁵⁹ Rule 19 (2), EPC Implementing regulations.

⁶⁰ Rules 16(2)(c) and 16(9), Patent Law Treaty Regulations.

⁶¹ Rule 21(1), EPC Implementing Regulations.

Several provisions detail the procedural venues for asserting the right to a patent as an object of ownership. Granting procedures, may be stayed, while the right is argued in national courts, in accordance to rule 14 EPC implementing Regulations.⁶² Once a final decision has been adjudicated declaring that a person other than the applicant is entitled to the grant of the European patent, the correct patent owners may (a) prosecute the European patent application as his own application in place of the applicant; (b) file a new European patent application in respect of the same invention; or (c) request that the European patent application be refused.⁶³ If a patent has already been granted to a non-entitled proprietor, such is also ground for revocation.⁶⁴

These provisions do not, however, mention directly cases where only the inventor has been mistakenly identified. The right of the inventor to be mentioned is a right ‘vis-à-vis the applicant for or proprietor of a European patent’, meaning that such is a private law dispute. Arguably, in case of adjudication determining that the inventor was incorrectly stated in the application, the rules above mentioned will apply even if the proprietor will remain unchanged.

With this legal landscape in mind, in theoretical terms it sometimes emerges different conceptions regarding the nature of the designation of the inventor. Designating the inventor, can be constructed it seems as either: (i) a substantive requirement of inventorship; (ii) a matter of objective factual determination; (iii) a formal requirement to determine the subject of moral and economic rights. It is this last option that is the most accurate, the duty to indicate the inventor and the patent owner in the application are formal requirements that once the patent is granted form the basis of a presumption of titularity regarding both the moral right of attribution and the economic rights of patent ownership.

In their respective submissions, both the receiving section and DABUS creator appear to agree that the designation of the inventor is a formal requirement and not a substantive patent requirement. However, while the applicant sees this requirement is a ‘mere formality’, the EPO understands it as an important procedural admissibility prerequisite, without which an application cannot be examined, and thus a patent will not be granted.⁶⁵ In order for the patent application to be received and examined, an inventor has to be designated, and it has to be a human person (arguably regardless of how the invention come to existence).

In the DABUS case the applicant considers that the formality requires only a factual determination and that the applicant has a duty to provide truthful information regarding such identity. Being that the inventions were totally independently created by the AI system, there is no other option available than to indicate the AI as the inventor. Under such approach, if the designation of inventor is not a substantive requirement, then there should be no objections to alter such formal requirements to encompass a new reality that creative non-human entities are now developing innovation and patent rules should thus adapt.

However, the objections to accepting an AI system as the inventor are more than merely based on formalities and procedure. Although inventorship is not a substantive requirement, but rather a

⁶² Rule 14 (1) EPC Implementing Regulations states that ‘If a third party provides evidence that he has instituted proceedings against the applicant seeking a decision within the meaning of Article 61, paragraph 1, the proceedings for grant shall be stayed unless the third party communicates to the European Patent Office in writing his consent to the continuation of such proceedings.’

⁶³ Article 61 (1), EPC:

⁶⁴ Article 138 (1), EPC.

⁶⁵ Paras 34-37, Receiving Section decision.

formal requisite necessary to allow the determination of the subject of the right to attribution and patent ownership, there are strong policy reasons supporting the exclusion of legal persons or other non-human entities from being named the inventor.

The requirement to indicate the inventor should not be interpreted as a pure matter of objective factual determination, because the right to be acknowledged as inventor is a subjective right. Its determination obeys to procedural norms and should be interpreted narrowly and by reference to the object of the right – the invention. Academic traditions may dictate a broad understanding concerning who should be given credit for scientific research and corresponding academic authorship. However, patents are granted for inventions, not for scientific theories or ideas. The right to be named inventor is a narrower concept and extending only to those persons that have a closer connection with the identification of the technical problem and the core inventive concept that forms the basis for the invention. Theoretical contributions to the field form part of the prior art, but do not necessarily provide basis for recognition as the inventor. The requirement to name the inventor should be interpreted as an obligation to identify the human person(s) with such a close and strong link with the inventive process, to justify attribution of ‘inventorship’

Conversely, and assuming that DABUS and other similar systems are in fact capable of independent innovation, then such reality needs to be framed and taken into account by patent law. It cannot be ignored simply because these creative machines do not find it easy to fit the existing procedural forms. AI systems are being widely used in research activities, notable in drug discovery by the pharmaceutical industry. An important question that remains open is whether the contribute of AI should be object of acknowledgment and how. Calls for stronger regulation, furthering accountability and transparency concerning decisions, actions and other outputs of AI and automated systems are a general society concern and not a policy issue limited to patent law. Public interest might provide enough justification, or under future circumstances even impose, the disclosure of the intervention of AI in the inventive process, because such might have broader consequences and implication in the assessment of substantive patent requisites.

3.6. Ownership of patents over AI generated inventions

In the DABUS applications, the owner of the AI system, stated to have acquired the right to the European patent from the inventor by being its successor in title, arguing that the owner of the automated system, was inherently assigned any intellectual property rights created by the AI. Given that the EPO asserts that only natural persons can be inventors, and only inventors or their successors in title can own a patent, the question of whether AI can transfer rights became irrelevant. If the AI is not recognised as the inventor, then it cannot assign or transfer, either by virtue of law or contract, the economic rights to the invention.

Regardless, the Receiving section chose to elaborate on the matter,⁶⁶ linking patent ownership to the issues of legal personality. The solution presents an apparent simple solution to a complex problem – machines lack legal personality, thus cannot own nor transfer property. As previously mentioned, because personality and capacity are determined by national law, the EPO can only discard the possibility for ownership after determining and examining the applicable law. Neither the EPC, nor the various national jurisdictions, provide for clear and definitive answers as to

⁶⁶ Paras 30-33, Id.

whether IP generated by an AI or automated system should be left in the public domain or be subject of appropriation and if so by whom.

It is well established in legal tradition that income or material goods generated by a given property, e.g., fruits, crops, animal off-spring, rents, royalties, etc, generally will be transferred to the owner of the said property. IP economic rights created by employers, in the course of their duties, also generally belong to the employer (in the absence of specific disposition to the contrary in law or contract).

Because immaterial property diverges in their nature considerably from material goods the first example cannot be applied by analogy without further consideration. Furthermore, if as DABUS creator claims this AI is capable of independent thinking and creation, as well as subjective ‘feelings’ towards its creation, one has to consider whether such an entity (eventually deserving autonomous personhood) can or not be object of property rights.

Likewise, concerning employees, a reasoning by legal analogy encounters several hurdles. The specific social dynamics of employment relationships are very different from the connection between an AI and its developers. Incidentally the same can be said concerning an analogy argument comparing the links between an AI and its creators, with other situations of transfer of ownership e.g., inheritance, contract, mergers and acquisitions, etc.

Should other entities other than human persons be accepted as inventors, given the complexity of involved in the creation, training, development and employment of AI and automated systems R&D, the quality and legitimacy of title of the patent proprietor, by virtue of law or contract will have to be determined and defined to encompass a variety of possible situations.

4. DABUS applications in National Patent offices and courts

A number of similar DABUS patent applications for the same inventions were filled in national patent offices, exploring a vast array of arguments, specific to national patent law and other provisions of the respective legal systems. This has led to a number of patent office and court decisions, that are currently at different stages, some being final, while in other cases appeals are either pending or still possible.⁶⁷ In similarity to the EPO, mostly these discussions revolve around whether it is possible for an AI system to fulfil formal requirements, regardless of the non-existence of a human person that can be indicated as the inventor.

4.1. UK

Applications filed directly in the United Kingdom Intellectual Property Office (UKIPO)⁶⁸ were rejected under the argument that DABUS and its creator, did not respectively fulfil the statutory requirements concerning inventorship and entitlement. The decision was appealed to the High Court, which has upheld the UKIPO decision,⁶⁹ concluding that “the provisions of the Patents Act

⁶⁷ DABUS creator legal team website lists court decisions in the UK, USA, Germany, EPO and Australia, a Patent published in South Africa, and pending patent applications in Brazil (BR 112021008931-4); Canada (CA 3,137,161), China (CN 2019800061580), India (IN 202017019068), Israel (268604 & 268605), Japan (JP 110001519), New Zealand (NZ 776029), Republic of Korea (KR 10-2020-7007394), Saudi Arabia(521422019), Switzerland (00408/21) and Taiwan(TW 108137438 & TW 108140133). See: <https://artificialinventor.com/patent-applications/> (retrieved 10 March, 2022).

⁶⁸ U.K. Patent Applications GB 18168909.4 and GB1818161.0.

⁶⁹ *Thaler v. Comptroller-General of Patents* [2020] EWHC 2412 (Pat). Available at: <https://www.bailii.org/ew/cases/EWHC/Patents/2020/2412.html> (retrieved 10 March, 2022).

1977 are extremely clear” that an inventor must be a person. The appeal was dismissed, but not without the mention that “[The] court can only construe legislation and cannot itself legislate, no matter how great the policy need.”⁷⁰ The case was appealed to the Court of Appeal and dismissed on September 21, 2021.⁷¹ Regarding the central question, the three judges on the panel agreed that an inventor must be a person. However, opinions diverged on whether the applicant satisfied the requirements of section 13 of the UK Patent Act and the legal consequence of non-compliance, namely on whether the patent could still be granted to the creator of the AI system.

4.2. Germany

Faced with similar patent applications, the German Patent and Trademark Office (GPTO) rejected two parallel applications (DE 10 2019 128 120 and DE 10 2019 129 136) in which DABUS was designated as inventor. The matter was appealed to the Federal Patent Court, which ruled that the listed inventor must be a natural person, even if the AI has identified both the problem and the solution. According to media reports by DABUS creator legal representatives, the Federal Patent Court⁷² took a pragmatic approach, which also did not permit the sole naming of the AI system but allowed a co-naming of the AI system additionally in the designation of the inventor as being involved in the invention. The Court has not elaborated regarding the legal capacity of an AI system.

4.3. USA

In 2019, DABUS creator applied for two patents at the United States Patent and Trademark Office (USPTO) listing the AI system as the inventor.⁷³ The USPTO refused the patent applications citing as main reason a failure to identify a human inventor, stating that legislation and Federal Circuit case law on inventorship require that an inventor must be a natural person.⁷⁴ Under U.S. patent law, an inventor must have contributed to the invention’s conception, defined as ‘the formation in the mind of the inventor of a definite and permanent idea of the complete and operative invention as it is thereafter to be applied in practice’.⁷⁵ In its decision the USPTO states that the statutory language of Title 35 of the U.S. Code and existing Federal Circuit case law in *Beech Aircraft Corp. v EDO Corp.*⁷⁶ and *University of Utah v Max-Planck-Gesellschaft*⁷⁷ suggest that “conception – the touchstone of inventorship – must be performed by a natural person.” The decision was subsequently appealed to the U.S. District Court, that confirmed the USPTO’s decision,⁷⁸ noting

⁷⁰ Id.

⁷¹ *Thaler v. Comptroller-General of Patents* [2021] EWCA Civ 1374, Case No: A3/2020/1851. Available at: <https://www.bailii.org/ew/cases/EWCA/Civ/2021/1374.html> (retrieved 10 March, 2022).

⁷² *11 W (pat) 5/21 (unpublished)*. See interview with Legal representative(s) Markus Rieck and Malte Köllner. Available at: <https://www.ipstars.com/NewsAndAnalysis/the-latest-news-on-the-dabus-patent-case/Index/7366> (retrieved 10 March, 2022).

⁷³ U.S. Patent Applications 16/524,350 and 16/524,532.

⁷⁴ USPTO Decision in Patent Application 16/524,350. Available at: https://www.uspto.gov/sites/default/files/documents/16524350_22apr2020.pdf?utm_campaign=subscriptioncenter&utm_content=&utm_medium=email&utm_name=&utm_source=govdelivery&utm_term= (retrieved 10 March, 2022).

⁷⁵ *Townsend v. Smith*, 35 F.2d 292, 295 (C.C.P.A. 1929).

⁷⁶ 990 F.2d 1237, 1248 (Fed. Cir. 1993).

⁷⁷ 734 F.3d 1315 (Fed. Cir. 2013).

⁷⁸ *Thaler v. Hirshfeld et al.*, No. 1:20-cv-00903-LMB (E.D.Va. September 2, 2021).

that allowing AI to be accepted as the inventor would require legislative intervention. A further appeal to the Federal Circuit is currently pending.

4.4. South Africa

The South African IP Office (the Companies and Intellectual Property Commission) granted DABUS patent application.⁷⁹ Although South Africa operates a depository or recognition system, the patent office conducts examination for basic formal requirements, including the need to identify the inventor and patent owner. The South Africa Patent Act of 1978⁸⁰ provides several grounds for patent revocation and thus it remains possible that DABUS patents will be challenged.

4.5. Australia

The Australian Federal Court in an historic decision on 30 July 2021 ruled that an AI system can be an inventor under the Patents Act of Australia.⁸¹ However an appeal was lodged and is currently pending. The patent application⁸² was initially rejected by the patent office (IP Australia) citing as reasons that ‘Section 15(1) of the Patents Act is inconsistent with an artificial intelligence machine being treated as an inventor’ and ‘[T]he applicant has not complied with the direction under regulation 3.2C(4).’⁸³ Upon appeal the Australian Federal Court concluded in summary that ‘an inventor as recognised under the Act can be an artificial intelligence system or device. But such a non-human inventor can neither be an applicant for a patent nor a grantee of a patent. So to hold is consistent with the reality of the current technology. It is consistent with the Act. And it is consistent with promoting innovation.’⁸⁴

Main reasons for the decision include the argument that by using strict interpretation of a procedural requirement in a subordinate instrument – need to provide a name and address –, it would substantively preclude the possibility of a patent grant for that invention. Nothing in the Patent Act justifies such a result.⁸⁵ Furthermore, it is also mentioned that according to cited previously established case law in *PMT Partners Pty Ltd (in liq) v Australian National Parks & Wildlife Service*⁸⁶ ‘[i]t is also of fundamental importance that limitations and qualifications are not read into a statutory definition unless clearly required by its terms or its context, as for example if it is necessary to give effect to the evident purpose of the Act’.⁸⁷

5. Plans for the future: regulating ‘orphan inventions’

As demonstrated in previous sections, there is no concrete regulatory framework for situations where the inventor is either unknown or where inventorship cannot be attributed to one or several specific human persons. This section presents and discusses *de lege ferenda* options, on how

⁷⁹The Companies and Intellectual Property Commission Patent Journal, Vol. 54, No. 7, July 2021, part II. Available at: https://iponline.cipc.co.za/Publications/PublishedJournals/E_Journal_July%202021%20Part%202.pdf (retrieved 10 March, 2022).

⁸⁰ Patents Act (Act n. 57 of 1978), assented to on 26 April 1978 and subsequently amended. Available at: <https://wipo.int/en/text/181330> (retrieved 10 March, 2022).

⁸¹ Thaler v. Commissioner of Patents [2021] FCA 879.

⁸² Australia Patent Application n: 2019363177. Available at: <https://www.austlii.edu.au/cgi-bin/viewdoc/au/cases/cth/APO/2021/5.html> (retrieved 10 March, 2022).

⁸³ Stephen L. Thaler [2021] APO 5 (9 February 2021).

⁸⁴ Para 226, Stephen L. Thaler [2021] APO 5 (9 February 2021).

⁸⁵ Para 13, Stephen L. Thaler [2021] APO 5 (9 February 2021).

⁸⁶ Para 310, *PMT Partners Pty Ltd (in liq) v Australian National Parks & Wildlife Service* (1995) 184 CLR 301.

⁸⁷ Para 14, Stephen L. Thaler [2021] APO 5 (9 February 2021).

should the patent system regulate these *orphan inventions*, meaning inventions that are not linked to a known human inventor.

Currently the EPC can only grant of patents where a human inventor is known. Other than rejecting to examine patent applications or accepting a fictitious designation of a human that is not the actual inventor, there are no other procedural venues to deal with AI inventions. Likewise, national decisions provide an array of arguments and contributes to the understanding of the legal situation, but they do not issue a comprehensive solution for regulating the phenomena of creative AI and automated systems and so the matter remains unsettled.

The discussion on formal elements left open the most important questions: can an AI actually invent or is an AI just a tool, at best an entity skilled in the art? Is the AI just a tool that surveys and does big data analysis, programmed to find patterns and produce technical solutions or is it truly independently generating technical innovation? The statement that the AI was the creator of these two inventions was not investigated. In the current DABUS litigation so far analysed, factual assertions submitted by the applicant regarding DABUS, its autonomous capabilities and its role in the development of the inventions specified in the applications were not object of a detailed examination, but rather were assumed to be an accurate representation of reality.⁸⁸

Every discussion on creative machines has in the background a technical debate on what is creativity and thresholds for IP protection. Creativity in Patent law is measured by the inventive step or non-obviousness criteria. A substantive patentability requirement independent of the identity of the inventor, but not immune to the type of tools and resources employed to reach the said invention. It does follow that, in the future, it cannot be discarded that the use of AI systems to develop an inventive concept may well become considered a routine step and an approach obvious to try for a person skilled in the art. Be as it may, eventual threshold changes in the approach to the assessment of a substantive requirement – inventive step – although indirectly connected, are a separate discussion from the entitlement to moral rights to be named inventor and entitlement to patents as object of property and for this reasons the patent offices and courts have not yet ruled on such matters.

So far, most jurisdictions have been refusing applications indicating an AI system as the inventor. In the aftermath of these decisions specialised patent law firms are advising clients to either file patent applications in the name of a the human responsible for the development of the AI, or to ensure a sufficient degree of human intervention during the innovative process, for example have a person constantly monitoring experiments, review results and providing feedbacks to the system for improvement, in order to enable that person to claim inventorship of eventual results.⁸⁹ The necessity to consider adapting patent legislation to the realities of AI has been advocated by some scholars,⁹⁰ object of attention and commissioned reports by patent institutions, such as the WIPO⁹¹

⁸⁸ Para 12 EPO Receiving Section decision; See also para 6, *Thaler v. Comptroller-General of Patents* [2020] EWHC 2412.

⁸⁹ E.g., Pintas IP group, ‘Advice for AI Owners or Users’ Available at: <https://pintas-ip.com/dabus-a-case-study-on-patent-law/> (retrieved 10 March, 2022).

⁹⁰ Abbott, R., *The reasonable robot: Artificial Intelligence and the Law* (Cambridge Univ. Press, 2022).

⁹¹ WIPO Secretariat, ‘Revised issues paper on intellectual property policy and artificial intelligence’ WIPO/IP/AI/2/GE/20/1 REV, May 21, 2020.

and the EPO⁹² or the EU commission⁹³, acknowledged by courts, and recognised as a policy issue by governments.⁹⁴

The lack of alternatives to patent AI generated innovation, opens the possibility for challenging the designation of inventor and consequentially the ownership of patents developed with intervention of AI and automated systems. It weakens the moral rights of attribution of individual scientists and engineers working in research labs with AI support. Diminishes legal certainty and potentially creates further venues for predatory litigation. Two complementing options emerge as potential solutions: (1) mandatory disclosure of AI intervention; (2) a new legal regime for *orphan inventions*.

The first and more urgent course of action is one that mostly maintains the status quo. It assumes that most inventions will remain patentable although they received main contributes during the innovations processes that can be attributed to AI and automated systems. In order to adapt to the growing employment of AI, it is necessary to develop further statutory EPC rules, or at least formal guidelines on inventorship attribution, that include specific norms and guidance to properly accommodate a reality comprising various possible types of uses and interventions of AI and automated systems in inventive processes. These rules should acknowledge the different contributes of those that developed, trained and instructed these AI systems. AI system interventions should be object of mandatory disclosure in the patent application, not only to solve issues of attribution and ownership, but rather to allow such to be taken into consideration during the evaluation of substantive requirements, such as inventive step and sufficiency of disclosure. The ownership of such patents should also be formally clarified, since different entities will contribute to the development of the AI system at different stages and such AI systems will be used in a variety of settings, with or without additional human intervention, by third parties during the innovation process.

A second possibility for the future is to create regulation to allow patents for ‘orphan inventions’, in this sense understood as patents without a known human inventor. This should be a cumulative model, that would create alternatives to situations where it is important to preserve and expand moral rights of attribution, without the corresponding economic rights. Fees, term, and eventually examination structure should also be adapted to the objective of creating an *inventive commons*.

The model could be applied to AI generated inventions where there is not a human inventor, but also to any collective inventions where there is a group and not a individually identifiable human person(s) providing the major and determinant contributions to develop the inventive concept and

⁹² Shemtov, N. *A study on inventorship in inventions involving AI activity* (EPO, 2019).

⁹³ European Commission, Directorate-General for Communications Networks, Content and Technology, Hartmann, C., Allan, J., Hugenholtz, P., et al., Trends and developments in artificial intelligence: challenges to the intellectual property rights framework : final report, Publications Office, 2020, <https://data.europa.eu/doi/10.2759/683128>

⁹⁴ UKIPO, ‘Government response to call for views on artificial intelligence and intellectual property’, published 23 March 2021. Where the UK government states plans to ‘build on the suggestions made by respondents and consult later this year on a range of possible policy options, including legislative change, for protecting AI generated inventions which would otherwise not meet inventorship criteria’. Available at: <https://www.gov.uk/government/consultations/artificial-intelligence-and-intellectual-property-call-for-views/government-response-to-call-for-views-on-artificial-intelligence-and-intellectual-property> (retrieved 10 March, 2022). See also UKIPO (2021) ‘Consultation on Artificial Intelligence and Intellectual Property: copyright and patents’, published 29 October 2021. Available: <https://www.gov.uk/government/consultations/artificial-intelligence-and-ip-copyright-and-patents> (retrieved 10 March, 2022).

the technical problem and technical solution the invention seeks to solve. Such model would have the advantage of allowing moral rights of attribution to be vested in non-human entities, such as AI systems, groups and networks of scientists, or generally legal persons without necessarily generating the corresponding economy rights.

As a complement, an eventual orphan inventions legal regime, could include the option for allowing limited economic rights in certain cases of orphan inventions. This would be a legislative opportunity to develop simplified and standardised economic exploitation models for non-exclusive licensing, with previously established contractual terms. This possibility could also function as a model and eventually provide solutions catering to situations, where although a human inventor exists and wishes to have recognition as such, they do not have an interest in asserting economic rights or face barriers to exploitation. Such a system would allow AI individual researchers, SME's and research institutions to obtain recognition and generate a stream of income that is at least fair and reasonable in light of the circumstances, without the premium rewards, burdens and complexities of commercially managing and exploiting patent portfolios.

6. Conclusion

Decisions concerning the patentability of AI generated inventions, have so far been evaluated through formal requirements. The need for a deeper discussion and evaluation of possibilities is necessary. Some jurisdictions have granted patents listing AI entities as the inventor, or at least allow the inclusion of AI as a co-inventor or intervenient (or may soon do so) and it cannot be disqualified that AI entities may be granted some form of legal personality and legal capacity as inventors in some jurisdictions.

Any changes of legislation would also have to include a general debate both on the possibility for legal persons to be named inventors and the broader social-economic impact and implications of allowing nonhumans to be inventors.

There are solid theoretical arguments to continue to reserve to human inventors the attribution rights in patents or inventorship, but this does not undermine the reality that AI are growly employed in innovation processes. There remains an urgent need for further broader social debates on how to develop specific rules and guidelines to regulate the intervention of AI or other creative machines in the innovation process and if or how to allocate ownership over such outputs.