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Inventions without inventors

The challenge of applying patent law objectives to AI generated inventions

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Contents

Summary

Artificial intelligence is rapidly advancing and becoming more autonomous. This is highlighted by the recent patent applications filed for inventions made by the AI, DABUS. The case law regarding DABUS' inventions holds that only a natural person can be an inventor within the meaning of patent law. This is because, to hold rights associated with being identified as the inventor, the inventor needs to have legal capacity. This effectively means that AI generated inventions are not patentable even if the invention otherwise would meet the requirements for a patent. The importance of this topic is only growing as AI advances.

The purpose of this thesis is to investigate the possibilities of protecting AI generated inventions within European patent law. This thesis uses the legal dogmatic method to analyze relevant law and compare it with legal objectives of patent law. This allows discussion of *de lege ferenda* regarding possible solutions to protect AI generated inventions. To analyze future solutions, it is relevant to understand the justifications behind the patent system to ensure that any future solutions align with the objectives and justifications of patent law. The objectives and justifications of the patent system are analyzed using philosophical and economic theories. They are then applied in the context of AI generated inventions. The question of whether a different interpretation can be adopted of legal personality to allow AI to be designated the inventor within patent law is discussed after an analysis of the current case law on the topic. Other solutions are discussed considering the objectives and justifications of the patent law system.

This thesis concludes that the justification for patent law is to facilitate advancement and progress in society by promoting and sharing innovation and knowledge. Therefore, excluding AI generated inventions from patent protection would deviate from this purpose as it would risk decreasing investment and innovation in AI development. As well, it would disincentivize the sharing of AI generated inventions with society as it would fall into the public domain. Therefore, there is a need to protect AI inventions

to uphold the objectives of patent law. A solution could be to adopt a different interpretation of legal personality and extend certain legal capacity for AI to be named the inventor. However, the requirement to designate an inventor under patent law safeguards the human inventor's right to attribution. This solution is therefore not viable. What is concluded in this paper is that a new patent regime is needed for inventions that do not have natural persons as inventors. This will allow safeguarding the right of the human inventor, adapting the patent need based on the amount of investment put into the invention, and allow for an adapted definition of 'non-obvious' or inventive step in the context of AI invention.

Sammanfattning

Artificiell intelligens utvecklas snabbt och blir alltmer självständig. Detta framgår av de patentansökningar som nyligen lämnats in för uppfinningar som gjorts av DABUS som är en AI. Enligt rättspraxis angående DABUS uppfinningar kan endast en fysisk person vara uppfinnare i patentlagstiftningens mening. Detta beror på att uppfinnaren måste ha rättskapacitet för att kunna inneha de rättigheterna förknippade med att anges som uppfinnare. Detta innebär i praktiken att AI-genererade uppfinningar inte är patenterbara även om uppfinningen i sig uppfyller kraven för patent. Ämnets relevans ökar i takt med AIs utveckling.

Syftet med uppsatsen är att undersöka möjligheterna att skydda AI skapade uppfinningar inom den europeiska patenträtten. I uppsatsen används den rättsdogmatiska metoden för att analysera relevant lagstiftning och jämföra den med patenträttens mål. Detta görs för att kunna diskutera *de lege ferenda* och ge svar på möjliga lösningar för att skydda AI skapade uppfinningar. För att analysera framtida lösningar är det relevant att förstå motiveringarna bakom patentsystemet för att säkerställa att framtida lösningar överensstämmer med patenträttens mål. Motiveringarna för patentsystemet analyseras med hjälp av filosofiska och ekonomiska teorier. Detta tillämpas sedan på ämnet av AI skapade uppfinningar. Frågan om huruvida en annan tolkning av begreppet juridisk personlighet kan antas för att möjliggöra att AI utses till uppfinnare inom patenträtten diskuteras efter en analys av den nuvarande rättspraxis. Andra lösningar diskuteras mot bakgrund av patenträttens motiveringar.

Uppsatsen drar slutsatsen att patenträttens mål är att stödja utveckling i samhället genom att främja uppfinningar och delandet av dessa uppfinningar. Att undanta AI skapande uppfinningar från patentskydd skulle avvika från patenträttens syfte eftersom det skulle riskera minskad investering och innovation i AI-utveckling. Detta skulle motverka att AI-uppfinningar delas med samhället eftersom de skulle hamna i den offentliga sfären. Det finns därför ett behov av att skydda AI-uppfinningar för att upprätthålla

patenträttens mål. En lösning skulle kunna vara att anta en alternativ tolkning av begreppet juridisk personlighet och utvidga rättsliga möjligheter för AI att bli nämnd uppfinnare. Kravet på att utse en uppfinnare enligt patentlagstiftningen skyddar dock den mänskliga uppfinnarens rätt till erkännande. Denna lösning är därför inte bäst lämpad. Slutsatsen i uppsatsen är att det behövs ett nytt patentsystem för uppfinningar som inte har fysiska personer som uppfinnare. Denna lösning gör det möjligt att skydda den mänskliga uppfinnarens rätt, att anpassa patent behovet utifrån hur mycket som investerats i uppfinningen och att möjliggöra en anpassad definition av uppfinningshöjd i för AI-uppfinningar.

Preface

Before this chapter closes, I want to extend my sincerest gratitude to a deserving few. Thank you to the teachers at the law faculty whose inspiring lectures have helped foster my interest for intellectual property law. To my colleagues at AWA Sweden who have engaged in interesting and fruitful discussions about AI and patent law this past term. I want to thank my friends for their support and for all the memories we have made together during these past 5 years.

Most importantly I want to thank my family for their unconditional love and support. To my father, who will forever be loved and missed, for his endless encouragement and reminder to believe in myself. To my mother and my sister, who's strength inspires me every day. And to my partner Daniel, for his unwavering encouragement and support.

Lund, January 2023.

Emma Johansen

Abbreviations

AI	Artificial intelligence
CJEU	Court of Justice of the European Union
EPC	European Patent Convention
EPO	European Patent Office
EU	European Union
IP	Intellectual property
NIR	Nordiskt Immateriellt Rättskydd
PCT	Patent Cooperation Treaty
PRV	Patent och registreringsverket
SvJT	Svensk Juristtidning
UKIPO	United Kingdom Intellectual Property Office
UPC	Unitary patent court

1 Introduction

1.1 Background

Intellectual property is centrally important for the success of EU countries' economy, competition, and for the functioning of the internal market.[1] It is an accepted fact that artificial intelligence (AI) will challenge the law, but uncertainty still lies in how the law will change to accommodate AI.[2] This question is highlighted by recent case law regarding Dr. Thaler's AI named DABUS. Dr. Thaler claims that DABUS autonomously generated two patentable inventions; the first a food container and the second "a neural flame to alert emergencies".[3] The application was filed without designating an inventor and resulted in the European Patent Office asking Dr. Thaler to rectify this.[4] In the patent application Dr. Thaler designated the DABUS as the inventor. The European Patent Office (further EPO) denied the application. The Boards of Appeal for the European Patent Office rejected the appeal based on AI's lack of legal personality and held that an inventor in the definition of patent law needs to be a natural person. Therefore, an AI cannot be designated as the inventor on a patent application.[5]

If patent law does not allow for AI to be designated as inventor on patent applications, the question remains how AI generated inventions should be treated and protected under patent law. As the development of AI continues and the field advances, it is important to understand how to protect these inventions to protect the investments that go into developing AI.[6] The importance of this topic is growing as AI technology rapidly advances. Given

[1] Wennersten, Ulrika (2022), 'Kommissionens nya handlingsplan om immaterialrätt.' *NIR*, p.1.

[2] Gervais, Daniel (2020), 'Is Intellectual Property Law Ready for Artificial Intelligence?.' *GRUR International*, Vol. 69.2, p. 117.

[3] J 0008/20 (Designation of inventor/DABUS) of 21.12.2021, p. 21; WIPO, 'The Artificial Inventor Project', 2019, <https://www.wipo.int/wipo_magazine/en/2019/06/article_0002.html> (visited 2022-12-10).

[4] Engel, Andreas (2020/9), 'Can a patent be granted for an AI-generated invention?.' *GRUR International: Journal of European & International IP Law*, vol. 69, p. 1125.

[5] Ibid.

[6] Engel (2020/09) p. 1127.

the EPO's decision on the matter, if only natural persons can be the inventor of a patent, then AI generated inventions will either be kept private, or they will fall into the public domain. If it is unclear how inventors can protect inventions generated with their AI, this might stall investment into AI inventions, or even make inventors reluctant to share the inventions with society for fear of it falling to the public domain.[7] There are further risks and implications that could arise if the question of how to deal with AI inventorship is answered. It is therefore relevant to investigate how AI inventorship under patent law should be dealt with in the future.

[7] Engel (2020/9) p. 1127.

1.2 Purpose and research question

DABUS' inventions were denied patent protection by the Bords of Appeal of the European Patent Office because AI lacks legal personality.[8] The effect of this is that AI generated inventions will not be granted protection under patent law. Therefore, the purpose of this thesis is to investigate the future possibilities of protecting AI generated inventions under patent law. When searching for future solutions it is relevant to analyze the practical consequences of current patent law in the context of AI generated inventions, and to compare these effects with the justifications for the patent system.[9] Further, possibilities to protect AI generated inventions with patents will be explored and compared to the objectives of patent law. To fulfil this purpose, the following questions will be answered:

1. What are the justifications behind the patent system?

    a. To what extent is there a need to protect AI generated inventions under patent law according to the justifications and objectives of the patent system?

2. In what way could an alternative interpretation of legal personality than that of the EPO be adopted to allow AI inventorship under patent law?

    a. Are there other solutions that can protect AI generated inventions and if so do these solutions support the objectives of patent law?

1.3 Delimitations

Certain delimitations will be made to the scope of this thesis due to limited space and time. This thesis will focus on law regulating the European patent. When complementation to European patent law is needed, Swedish national

[8] J 0008/20 p. 21.

[9] Björkwall, Pia (2015/04), 'The Many Faces of Patents: Implications for Legal Analysis.' *NIR*, p. 397.

patent law will be used. Other national law will be disregarded, except when such is needed to bring context to relevant case law or examples. The Unitary Patent and the Unitary Patent Court[10] will not be discussed within the scope of this thesis because it is not yet in effect.[11] The conclusions made in this thesis will be based on relevant law for the European patents, such as the European Patent Convention[12]. As the UPC will use sources of law such as the EPC to regulate the granting of the Unitary Patent, the conclusions made in this thesis will still prove relevant in the context of future legislation.[13]

AI affects many aspects of intellectual property law. This thesis will however only focus on patent law. AI's effect on copyright law will briefly be discussed as an example. There are currently ongoing discussions on how AI will affect the inventive step in patent law.[14] This issue is not included within the scope of this thesis. The question of whether AI currently can invent on an autonomous level will not be answered in this paper. Rather, the point of departure for this thesis is that AI and technology is advancing, and the law needs to be prepared to deal with the effects of when AI is capable of autonomously inventing.

Patent applications for the inventions created by DABUS have been filed in multiple jurisdictions. As the focus of this thesis is European patent law the application with the EPO will be discussed. Filings in two other jurisdictions will be discussed as examples, the United Kingdom and Australia. These cases are chosen as examples because in both jurisdictions there has been either a court or a judge with opposing opinions. The cases therefore best illustrate different views on the subject. The patent application was approved in South Africa. However, since South Africa does not try the patent applications on a substantive level, it gives little insight into answering the

[10] Further UPC.
[11] Art. 24 Agreement on a Unified Patent Court 2013/C 175/01.
[12] Convention on the Grant of European Patents (European Patent Convention) signed in 1973, further EPC.
[13] Art. 24 Agreement on a Unified Patent Court 2013/C 175/01.
[14] European Commission, 'Trends and developments in artificial intelligence', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p.121.

research questions and will therefore not be discussed within the scope of this thesis.[15]

1.4 Methodology and materials

To provide answers to the research questions, the legal dogmatic method will be used. This method uses relevant sources of law such as legislation or legal text, preparatory works, case law, and doctrine to establish relevant law.[16] By establishing relevant law it is possible to use legal sources such as doctrine to critically analyze relevant law and compare it with legal objectives. This enables discussion of *de lege ferenda*, what the law should be.[17] Specifically for this paper, relevant law will be analyzed and compared with the justifications and objectives of patent law to determine whether these justifications extend to AI generated inventions. Further, discussion will be made of *de lege de ferenda* regarding future solutions to protect AI generated inventions within patent law.

In addition, a law and technology approach will be adopted.[18] As the thesis discusses artificial intelligence, a technology that is quickly advancing, it is important to view the effects associated with AI in a societal and legal context.[19] This approach will mainly be used when analyzing the objectives behind patent law and discussing *de lege ferenda*.

To establish relevant law international law will be used and will therefore need to interpret international treaties. When interpreting international law, the interpretation method codified by the Vienna Convention will be used. [20]

[15] 'DABUS Gets its First Patent in South Africa Under Formalities Examination', 2021-07-29, <https://ipwatchdog.com/2021/07/29/dabus-gets-first-patent-south-africa-formalities-examination/id=136116/> (visited 2022-12-07).

[16] Sandgren, Claes (2006/04), 'Är rättsdogmatiken rättsdogmatisk?.' *Tidsskrift for Rettsvitenskap* p. 651; Jareborg, Nils (2004), 'Rättsdogmatik som vetenskap.' *SvJT*, p.4.

[17] Sandgren, Claes (2006/04) p. 650, 655.

[18] Cutter, Anthony Mark, & Gordijn, Bert (2009), 'Ethics, law, technology and policymaking.' *Studies in Ethics, Law, and Technology*, vol. 3.2, p. 2.

[19] Ibid.

[20] Art. 31 Vienna Convention on the Law of Treaties 1969

Treaties should be interpreted in good faith and their objectives and purpose should be considered in the interpretation according to Article 31 of the Vienna Convention.[21] The preamble and annexes should be included in the interpretation of a treaty. Other sources of law can be used as supplement to interpret relevant law.[22] The Vienna Convention mentions supplementary sources of law such as preparatory works, this list is however not exhaustive.[23]

As the focus of this thesis is on the regional European patent, the legal sources regulating the European patent will be used. The EPC is a multilateral treaty which in 1977 instated the intergovernmental organization; the European Patent Organisation.[24] The European Patent Organisation has legal personality. The organization's representative is the president of the European Patent Office.[25] The EPC creates a system of law that unifies the granting of the European patent for the states who are signatories of the treaty.[26] The European Patent Organisation currently has 39 members states, of which include all 27 members of the European Union.[27] The European Patent Office (further EPO) is the executive branch of the European Patent Organisation and administers the granting of European patents according to the EPC, which is overseen by the Administrative Council.[28] The Articles of the EPC regulate the granting of European patents.[29] The EPC also contains 'Implementing Regulations' which are referred to as Rules. These rules serve to in detail explain the application of the Articles of the EPC.[30]

[21] Art. 31 Vienna Convention.

[22] Art. 32 Vienna Convention; Sbolci, Luigi (2011), 'Supplementary means of interpretation', in: Cannizzaro, Enzo (ed.), *The Law of Treaties Beyond the Vienna Convention*, Oxford Academic, p. 149.

[23] Sbolci (2011) p. 151.

[24] EPO, 'Legal foundations', 2022, <https://www.epo.org/about-us/foundation/legal-foundations.html> (visited 2022-12-15).

[25] Art. 5 EPC.

[26] Art. 1 EPC.

[27] EPO, 'The EPO at a glance', 2022-09-30, < https://www.epo.org/about-us/at-a-glance.html> (visited 2022-12-15).

[28] Art. 4 EPC.

[29] Art. 1 EPC.

[30] G 0002/07 (Broccoli/PLANT BIOSCIENCE) of 9.12.2010, p.29

The Boards of Appeal of the European Patent Office is the only judicial instance before the EPO.[31] The function of the Boards of Appeal is to independently review the decisions made by the EPO based on the EPC. The case law from the Boards of Appeal law demonstrate how the EPC should be applied.[32] National patent law of member states of the European Patent Organisation can interface with the EPC.[33]

Swedish national patent law such as 1967:837 The Patents Act and 1945:345 Act on the Right to Employee's Inventions will be used as complement when answers to questions cannot be found in European patent law. National law from the United Kingdom and Australia will be used when discussing case law on whether it is possible to patent DABUS' inventions. These specific cases are used because they have published appeals and exemplify different perspectives on the inventor and the requirement to designate an inventor in patent law.

Furthermore, doctrine from eminent researchers is used to showcase different views on the subject. This thesis discusses the objectives behind both patent law and the requirement to designate the inventor. There exists relevant research on this that is used for this paper.[34] Discussion regarding the subject of the patentability of AI generated inventions is rather new. More research on the topic has surfaced after the first patent filing of DABUS' inventions in 2019.[35] For example, Ana Ramalho wrote a comparative analysis of IP

[31] EPO, 'About the Boards of Appeal', 2022, < https://www.epo.org/law-practice/case-law-appeals/about-the-boards-of-appeal.html> (visited 2022-12-18).

[32] EPO, 'About the Boards of Appeal', 2022, < https://www.epo.org/law-practice/case-law-appeals/about-the-boards-of-appeal.html> (visited 2022-12-18).

[33] EPO, 'National Law relation to EPC – Introduction', 2022, https://www.epo.org/law-practice/legal-texts/html/natlaw/en/a/index.htm> (visited 2022-12-18).

[34] See for example Guellec, Dominique (2007), 'Patents as an Incentive to Innovate', in: Guellec, Dominique & Van Pottelsberghe de la Potterie, Bruno (eds.), The Economics of the European Patent System: IP Policy for Innovation and Competition, 1st ed., Oxford Academic, p. 46-84; EPO, 'A study on inventorship in inventions involving AI activity', 2019-02, <https://documents.epo.org/projects/babylon/eponet.nsf/0/3918F57B010A3540C125841900280653/$File/Concept_of_Inventorship_in_Inventions_involving_AI_Activity_en.pdf> (visited 2022-12-18).

[35] Abbott, Ryan, 'The Artificial Inventor Project', 2022, <https://artificialinventor.com/> (visited 2022-11-04).

protection of AI creations in different jurisdictions.[36] There currently does not exist much legal initiative to amend European patent legislation to accommodate AI inventions.[37] Other scholars and researchers adopt a forward looking approach and discuss the consequences and potential risks that can arise if patent law is not adapted to reflect the technological advancements and the needs that come with it.[38] As well, there exists some discussion about future solutions.[39] This paper takes a future looking approach with the focus that the objectives of patent law are met.

1.5 Disposition

Chapter two gives background of relevant patent law as well as context to the state of AI. Chapter three analyzes the justifications and objectives behind patent law. Since little can be inferred about patent law's objectives from legal sources, doctrine is used to provide perspective. Philosophical and economic theories are used to identify these objectives. Analysis and answers to the first research question will be provided. In chapter four European patent law and national Swedish law is used to analyze who can be named an inventor within patent law and what function of the requirement to designate the inventor is. Chapter five aims to answer the second research question of whether a different interpretation of legal personality could be adopted to allow AI to be designated as the inventor, as opposed to the interpretation that has been adopted in case law. Chapter six uses a law and technology approach to discuss *de lege ferenda* in connection with the justifications and objectives of patent law identified in chapter three. This chapter provides analysis and

[36] Ramalho, Ana (2022), *Intellectual Property Protection for AI-Generated Creations: Europe, the United States, Australia and Japan*, 1st ed., Routledge, New York.

[37] European Commission, 'Trends and developments in artificial intelligence : challenges to the intellectual property rights framework : final report', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 119.

[38] See for example Kempas, Tobias (2020), 'A note on artificial intelligence and intellectual property in Sweden and the EU.' *Stockholm Intellectual Property Law Review*, vol 3.1, p. 54-65; Engel (2020/9); Schwein, Rachel L. (2022/09), 'Patentability and Inventorship of AI-Generated inventions.' *Washburn Law Journal*, vol. 60, p. 561-604.

[39]See Nordberg, Ana (2022), 'Creative Machines, Orphan Inventions: AI and the concept of inventor at the EPO', in: Karlsson-Tuula, Marie et. al. (eds.), *Magna Mater Marianne Levin (Fetskrift)*, 1st ed., Jure Förlag, Stockholm, p.147-165; Adde, Laura & Smith, Joel (2021), 'Patent pending: the law on AI inventorship.' *Journal of Intellectual Property Law & Practice*, vol. 16.2, p. 97-98; Brax, Matti (2019/01), 'Effects of Digitalization on Patenting.' *Nordiskt Immateriellt Rättskydd*, p. 156-158.

answers to the second sub question. Analysis and answers to the questions are provided throughout the thesis and a conclusion is provided in the final chapter.

2 Background and relevant law

2.1 Intellectual property and artificial intelligence in practice

The importance and value of IP and its protection is growing in today's economy. The European Commission states that intangible assets such as patents make up the "cornerstones of today's economy".[40] In the last 20 years, investments into intellectual property have increased by 87% in the EU alone. For reference, investments for tangible assets have only seen a 30% increase.[41] For companies to compete on a global market, strong intellectual property assets and protection is key.[42] In a report delivered by the European Commission, it was highlighted that to have a successful economy, there needs to exist a strong IP framework to support businesses and their IP assets. One problem they highlight is the need of clear answers to the question of how to effectively protect AI generated inventions.[43]

AI has no universally accepted definition. For the purpose of this thesis the definition provided by the European Commission in its 2018 Communication on "Artificial Intelligence for Europe"[44] will be used:

> "Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals (…)".[45]

[40] Communication from the Commission - Making the most of the EU's innovative potential, and intellectual property action plan to support the EU's recovery and resilience, COM(2020)760 final, p. 1

[41] Ibid.

[42] COM(2020)760, p. 2-3.

[43] Ibid.

[44] Communication to the European Parliament, the European Council, the Council, the European Economic and Social Committee of the Region - Artificial Intelligence for Europe, COM(2018)237 final, p. 1

[45] Ibid.

AI such as voice assistants, search engines and face recognitions systems are software-based AI.[46] AI can also be hardware that is embedded in devices such as robots and autonomous cars. AI is a part of our daily life in forms of language translators, subtitle generators and spam detectors. Often AI needs data to improve their performance.[47]

AI has been researched since the mid 1950's.[48] However, earlier AI was limited since a human was required to predict the scenarios the AI would encounter, and the human would then program the AI for that specific situation. AI has only since recent years developed to be self-learning which was not a reality that was accounted for when the current patent system was legislated.[49] AI presupposes a certain amount of autonomy.[50] This autonomy is expected to increase over time as AI develops. The level of autonomy in AI can differ. Some AI are seen as tools and require significant human intervention while other AI require little to no human intervention.[51] The inventing process requires that a problem is identified and that a solution with technical application to that problem is created. Currently most scholars are unanimous in claiming that AI is incapable of identifying the problem autonomously.[52] Many experts and researchers claim that AI will be responsible for a fourth industrial revolution.[53] Therefore, legislation needs to be future proof to accommodate the coming technological advancement where AI in the future will be capable of inventing autonomously.[54]

AI has been particularly effective in generating inventions in the pharmaceutical industry.[55] Using deep learning, AI can effectively automate the inventing process. AI uses large datasets and develops and tests

[46] COM(2018)237 final, p. 1
[47] Ibid.
[48] Elliot, Anthony (2018), *The Culture of AI*, Routledge, London, p.2
[49] Holmdahl, Daniel (2019/4) 'Robot eller människa – vad spelar det för roll? En undersökning av kravet på mänskligt skapande inom upphovsrätten i ljuset av kreativ artificiell intelligens.' *NIR*, p. 432; Kempas (2020), p. 55, 65.
[50] Ramalho (2022) p. 79.
[51] Ibid.
[52] Ramalho (2022), p. 78.
[53] Zamel, Christian N. (2021/4), 'Artificiell intelligens och immaterialrätt – några reflektioner från det svenska patent och registreringsverket.' *NIR*, p. 492.
[54] Schwein (2022/09) p. 562.
[55] Ramalho (2022) p. 81.

hypotheses against observations and uses these results to amend the hypotheses and test them again at a rate that would be impossible for humans to recreate.[56]

2.2 The European patent

Patents are a type of intellectual property protection that protects inventions.[57] A patent prevents other actors from using an invention without the consent of the patent owner. A patent lasts 20 years from the date the patent application was filed.[58] An inventor can apply for different patents. An international patent is a patent that is valid on an international level between the ratifying parties of the 1970 Patent Cooperation Treaty.[59] A European patent is a regional patent that is valid throughout the contracting member states of the EPC. A national patent is a patent that is valid within the specific nation and is filed at the national patent office.[60]As mentioned above, the focus of this thesis is the European patent. Aside from the EPC there are relevant multilateral instruments whose provisions impact European patent law. [61]

Firstly, the Paris Convention for the Protection of Industrial Property[62] stipulates that signing members constitute a Union.[63] The members of this Union reserve the right to make so called "special agreements" that are separate agreements protecting industrial property.[64] Such agreements cannot breach the provisions set out by the Paris Convention.[65] The EPC is a special agreement within the meaning of the Paris Convention.[66] The Paris

[56] Ramalho (2022) p. 81.
[57] Art. 63 EPC.
[58] Ibid.
[59] PRV, 'Ansök i andra länder', 2022-10-19, <https://www.prv.se/sv/stora-patentguiden/ansok-i-andra-lander/> (visited 2022-11-18).
[60] Ibid.
[61]European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 97-98.
[62] Paris Convention for the Protection of Industrial Property 1883.
[63] Art. 1 Paris Convention 1883.
[64] Art. 19 Paris Convention 1883.
[65] Art. 19 Paris Convention 1883.
[66] Art. 87, 89 EPC; EPO, 'European Patent Guide', 2022-08-24, <https://www.epo.org/applying/european/Guide-for-applicants/html/e/ga_c2_3.html#:~:text=The%20EPC%20constitutes%20a%20special,the%20Protection%20of%20Industrial%20Property> (visited 2022-12-14).

Convention, prescribes the principle of national treatment. This principle states that member states of the convention are obliged to treat all patent applications the same. National applicants cannot be favored over foreign applicants. As well, the convention instates the principle of priority. This means that when a patent application is filed in a state that is a member of the Paris Convention, the patent owner can apply for a patent within any member state within 12 months of the first application with priority. Priority means that the application will be handled as if it were applied on the same date as the first application.[67]

Applicable provisions of the 1994 Agreement of Trade-Related Aspects of Intellectual Property Rights[68] are implemented within the EPC as most contracting members of the EPC are members of the World Trade Organisation.[69] This agreement regulates most-favoured nation treatment. This principle means that any advantages that a member state grants to their national applicants must be granted to nationals of all member states.[70] The TRIPS Agreement stipulates that patents will be granted to inventions that can either be processes or products in all fields of technology if they have industrial application, are new and involve an inventive step.[71] The term inventive step refers to the invention being non-obvious, and the term capable of industrial character means that the invention is useful.[72]

The 1970 Patent Cooperation Treaty is a patent system that harmonises the application system for a PCT patent also called an international patent. This patent system is administered by the World Intellectual Property Organization. The treaty and the application system allows applicants to

[67] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 97.

[68] Agreement on Trade-Related Aspects of Intellectual Property Rights 1994, further TRIPS Agreement.

[69] EPO, 'European Patent Guide', 2022-08-24, <https://www.epo.org/applying/european/Guide-for-applicants/html/e/ga_c2_3.html#:~:text=The%20EPC%20constitutes%20a%20special,the%20Protection%20of%20Industrial%20Property> (visited 2022-12-14).

[70] Art. 4 TRIPS Agreement.

[71] Art. 27.1 TRIPS Agreement.

[72] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 98.

apply for patents within the 157 ratifying countries.[73] The European patent is a regional patent within the meaning of the Patent Cooperation Treaty and means that a European patent can be applied for under the application system of the PCT.[74]

As mentioned above, the European Patent Organisation was instituted by the European Patent Convention in 1977, in which all EU Member States are ratifying members along with additional contracting states.[75] Filing for a European patent allows the applicant to file for a patent in all contracting states of the EPC.[76] It is also possible to designate specific countries from the contracting states.[77] The EPO examines the validity of the applications on the basis of the EPC.[78] After the EPO decides on the validity of the patent, the designated contracting states will validate the patent within their jurisdiction based on their national patent laws.[79] Formally it is required that the inventor is designated on an EPO patent application, however the EPO does not substantiate the designation.[80] According to the EPO, the owner of a patent is either the inventor or their successor in title. National law decides who is the owner of the patent if the inventor is an employee. The EPO does not define ownership or inventorship further. That is left to the national jurisdictions.[81] The EPO has no power to govern the substantive claims to a patent, this is left to the national courts.[82]

[73] WIPO, 'The PCT now has 157 Contracting States', 2022, <https://www.wipo.int/pct/en/pct_contracting_states.html > (visited 2022-12-05).

[74] EPO 'European Patent Guide', 2022-08-24, https://www.epo.org/applying/european/Guide-for-applicants/html/e/ga_c2_3.html#:~:text=The%20EPC%20constitutes%20a%20special,the%20Protection%20of%20Industrial%20Property> (visited 2022-12-14).

[75] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 98.

[76] PRV, 'European patent (EP)', 2022-12-01, < https://www.prv.se/en/the-advanced-patent-guide/apply-in-other-countries/european-patent-ep/> (visited 2022-12-18).

[77] Ibid.

[78] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 98.

[79] Ibid.

[80] Art. 81 EPC; Rule 19 EPC.

[81] European Commission, 'Trends and developments', <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 99; Art. 60 EPC.

[82] G 0003/92 (Unlawful applicant) of 12.6.1994, p. 6

As well, the patent applicant must disclose the invention on the patent application. This is prescribed in Article 83 of the EPC and states that disclosure means a description that is "sufficiently clear and complete for it to be carried out by a person skilled in the art."[83] As a part of disclosing the invention, drawings can be included.[84]

For an invention to be patentable according to the EPC it needs to meet the novelty criteria and involve an inventive step.[85] Another requirement is that the invention must have industrial application.[86] According to case law this means that the invention must have a concrete technical character.[87] The EPC defines a novel invention as an invention that "does not form part of the state of the art"[88]. The definition of state of the art is "everything made available to the public, by means of written or oral description, by use, or in any other way before the date of filing the European patent application"[89].

2.3 Swedish patent law

In Sweden the 1967:837 Patents Act regulates Swedish patent law. However, since Sweden has ratified the EPC any Swedish law that contravenes from the provisions of the EPC is disregarded.[90] A Swedish patent has the same lifetime as a European patent, 20 years.[91] The Swedish regulation of patents grant patents for inventions with industrial application. In practice the requirement of industrial application has been defined as having technical character. The term invention is not defined by Swedish law, however, a non-exhaustive list of things that cannot be considered inventions are listed. This list is non exhaustive.[92] An invention needs to be novel and have technical

[83] Art. 83 EPC.
[84] EPO, 'European Patent Guide – disclosing your invention', 2022-08-24, <https://www.epo.org/applying/european/Guide-for-applicants/html/e/ga_c4_2_1.html>, (visited 2022-12-18).
[85] Art. 52.1 EPC.
[86] Art. 57 EPC.
[87] England, Paul (2019), *A Practitioners Guide to European Patent Law*, 1st. ed., Hart Publishing, Oxford, p. 135.
[88] Art. 54.1 EPC.
[89] Art. 54.2 EPC.
[90] NJA 2004 s 497, p. 520.
[91] 4:40 1967:837 The Patents Act.
[92] 1:1 1967:837 The Patents Act.

application according to Swedish law.[93] There is also a formal requirement for the invention to be disclosed on the patent application.[94] Swedish patent law will be discussed further in chapter 4 when discussing who can be an inventor within the meaning of patent law.

2.4 AI in the context of relevant patent law

This chapter gives background to the workings of the European patent system. According to the TRIPS Agreement, inventions in all technology fields are patentable given that they meet the requirements of novelty, inventive step and have industrial application. Therefore, in theory if an AI generated invention meets these requirements it falls under patentable subject matter. The European patent system consists of both the EPC and Member State's national patent law. This thesis will therefore use Swedish patent law to provide context where the EPC does not provide clear answers. As is shown by the above, Swedish patent law is harmonized to a degree with the EPC, as the Swedish courts have stated that any national law that goes against the EPC will be disregarded.

As illustrated above, AI has been discussed and researched since the mid 1950's. Most of the patent regulations were drafted when the level of AI was not nearly as advanced as it is today. It is only in the recent years that AI has been capable of learning. While drafting the regulations, the reality of dealing with AI generated inventions was therefore not taken into regard. The following chapter will provide context for the objectives behind patent legislation. This information will be useful in attempting to interpret and apply patent law in a context that the legislators of patent law could not foresee.

[93] Johnshammar, Patentlag (1967:837) 1:1, Karnov (JUNO).
[94] 2:8 1967:837 The Patents Act.

3 What are the justifications for patent law?

3.1 The conflicting interests in patent law

When discussing the objectives of patent law, objectives refer to the justifications for why we have patent law in our society and what the regulation aims to protect.

AI's effect on patent law was not considered when the EPC was drafted in 1973.[95] Therefore, to apply relevant patent law on AI generated works it is important to understand what patents aim to protect and what these objectives can tell us about protecting AI generated inventions. In doctrine both philosophical and economic theories are used to explain the justifications behind patent law. Therefore, these theories will be used to analyze the objectives behind patent law in this chapter.

There are two conflicting interests that lie within intellectual property law that need balancing.[96] For patent law specifically, the two conflicting interests manifest in the interest of the inventor or owner of a patent to have sole economic rights to the invention, against the interest of society having access to the invention to advance innovation and development.[97]

3.2 Justifications for patent protection

3.2.1 Philosophical perspectives

There are many theories justifying why we have patent law. The Natural rights theory can provide one such justification.[98] According to this theory individuals should be entitled to have natural property rights over the products

[95] Kempas (2020) p. 55.
[96] Zamel (2021/4) p. 489.
[97] Ibid.
[98] Ramalho (2022) p. 85 & Guellec (2007) p. 47.

and results of their mind.[99] The natural rights theory is rooted from John Locke's labor theory. Both these theories see property rights as naturally pre-existing. The theories build on the idea that when an inventor has invested their labor into something they should own the results.[100] This theory distinguishes between discoveries and inventions. They should be treated differently because inventions are created, whereas a finding preexists its discovery.[101]

Another theory justifying patent protection is the incentive or utilitarian theory. This theory claims that social welfare should be maximized and that social institutions should be designed around this goal.[102] According to the utilitarian theory, patents provide incentive for invention which in turn benefits society. Without patent protection an inventor would not be able to protect their invention from free riders. This would result in inventors and invention owners being discouraged to invent or reveal their inventions to the public. In turn society would be worse off, as the theory assumes that inventions are required for progress. The utilitarian view is that in a free market investment into innovation and invention would be suboptimal, resulting in a suboptimal rate of inventions.[103] Therefore, the utilitarian theory believes that patents will, through protecting the inventors right to exclusive commercialization of the invention for a limited time, provide incentive for inventors to invent and share their inventions with society. This will in turn drive future innovation.[104] Without sharing or disclosing their inventions, this would result in other inventors working on the same research projects, would be a waste of resources and therefore a societal loss.[105]

As well, the social contract or informational theory can also give insight to the objectives of patent law.[106] According to this theory there is value in protecting information exchange. Patents grant protection for an invention in

[99] Ramalho (2022) p. 85 & Guellec (2007) p. 47.
[100] Ramalho (2022) p. 85.
[101] Guellec (2007) p. 48.
[102] Guellec (2007) p. 49.
[103] Guellec (2007) p. 50.
[104] Ramalho (2022) p. 86.
[105] Guellec (2007) p. 50.
[106] Ramalho (2022) p. 87.

exchange for information about the invention. This supports the goal to promote innovation as it gives society information about the state of technological development which is needed for further development.[107] This theory is an adapted version of the utilitarian theory that has become the standard legal view today.[108] Without the legal protection that patents provide for inventions, the inventors or owners of the invention will be deterred from sharing or disclosing their knowledge or information about the invention. The likelihood increases that they will try to keep the invention secret, meaning that society will not be able to benefit from it.[109]

3.2.2 Economic perspectives

From an economic perspective the purpose of patent law is to prevent a free-rider problem.[110] When an invention is created the marginal cost of copying that invention is much smaller than if someone has to recreate the invention themselves or buy the rights to use the invention. Copying an invention however exploits the inventor's investment, ingenuity, and effort. The purpose of patent law from an economic perspective is therefore to circumvent this free-rider problem by creating a time limited monopoly for the invention. This allows the owner of the invention to recover their investments for 20 years while the invention and information about the invention is shared with society.[111]

One way to view and protect intellectual property is to view them as property rights. However, economists like Guellec argue that this is not viable because of the following.[112] The economic theory behind property rights was developed in 1968 with the purpose to internalize externalities to promote social welfare. Assets that are not owned as private property risk becoming over exploited. This is referred to as 'the tragedy of the commons'. Guellec

[107] Ramalho, (2022) p. 87.
[108] Guellec (2007) p. 51.
[109] Guellec (2007) p. 74.
[110] Cubert, Jeremy A. & Bone, Richard G.A. (2018), 'The law of intellectual property created by artificial intelligence', in: Barfield, Woordrow & Pagallo, Ugo (eds.) *Research Handbook on the Law of Artificial Intelligence*, 1st ed., Edward Elgar publishing, Northampton, p. 413.
[111] Cubert & Bone (2018) p. 413.
[112] Guellec (2007) p. 51.

illustrates this with an example of a fishpond. If all fishers have access to the pond, their interest will be to utilize as much of the pond before other fishers can. The sustainability of the pond will therefore be disregarded and will result in overfishing, causing harm to the overall community. However, with a privately owned pond the owner has a vested interest in the sustainability of the pond.[113] Guellec argues that the same theory does not hold for intangible assets. This is because property rights aim to internalize negative externalities, while the knowledge and information that intangible assets have positive externalities. Some economists provide the view that tangible and intangible assets should be treated the same because a positive externality can be subjective depending on the person. This is however dismissed as it ignores that the knowledge which is provided when sharing inventions strongly benefit the public and can be seen as a public good.[114]

The ideas behind economic property rights can still be applied, however dynamically, on intellectual property.[115] Consider the fishpond example, property rights aim to reduce shortages. Patents generate a type of shortage since it reduces the public's access to the invention. The static view is that intellectual property rights such as patents create a scarcity of the protected products. However, this only creates a scarcity of already existing inventions. The dynamic view sees patents as a way of reducing shortages of new inventions. This is the main difference between property rights for tangible and intangible assets. The aim of property rights is to manage the current scarcity of resources. Intellectual property rights aim to generate investment to prevent future scarcity.[116]

3.3 What can patentability requirements tell us about the objectives of patent law?

[113] Guellec (2007) p. 52.
[114] Ibid.
[115] Guellec (2007) p. 53.
[116] Ibid.

As mentioned above in chapter 3.1, patent law must balance two conflicting interests. The requirements set out for patentability can be seen as a tool to help balance these interests. The requirement for an inventive step, also referred to as non-obviousness, helps ensure that trivial and basic inventions that can be seen as building blocks for future inventions do not receive patents.[117] The importance of this is that if obvious inventions would be patented, i.e. inventions that are foundational to the field. If such inventions would be patented this would allow inventors and companies to have a monopoly on that field and block others from innovating.[118] This conveys that patent law is aims to prevent blockage for future innovation.

Another requirement for patentability that helps balance the conflicting interests is disclosure of the invention.[119] The disclosure requirement supports the value of informational exchange in line with the informational theory discussed above. This requirement is important for the balance of interests since it allows society to learn from the invention and further develop and innovate, no matter how incremental.[120]

3.4 Patents as a policy tool

Investments into innovation are riskier than other investment types.[121] Therefore, without policy promoting investment into innovation, markets will not generate invention on an efficient level. Innovation is generally important to society because knowledge can be considered a public good. Governments will therefore use policy tools to incentivize such investments. Among these tools, such as public research systems, business subsidies, soft loans, and tax incentives are intellectual property rights including patents.[122]

[117] Ramalho (2022) p. 87.
[118] Zingg, Raphael (2021), 'Foundational Patents in Artificial Intelligence', in: Jyh- An Lee, Reto M Hilty, and Kung- Chung Liu (eds.), *Artificial Intelligence and Intellectual Property*, Oxford University Press, p. 76.
[119] Ramalho (2022) p. 88.
[120] Ibid.
[121] Guellec (2007) p. 55.
[122] Ibid.

Through empirical studies it has been found that patents are more effective in securing return on investments made into inventions in certain industries.[123] These industries include chemicals, biotechnology, drugs and medical equipment.[124] A survey conducted in the US explains that the most common reason why firms choose to patent is to prevent others from copying their invention.[125] Of next importance is to block competitors, and after that to gain freedom to run their business without risking the threat of litigation based on other patents. This is found to be true within European countries as well. When reviewing surveys focusing on whether patents add value to innovation, it was found that patents had the highest added value in the following industries: pharmaceuticals, biotech, medical instruments, machinery, computers, and industrial chemicals.[126]

3.5 The justifications of the patent system in the context of AI inventions

According to Engel, applying the justifications for patents for AI generated inventions is complex.[127] For AI to be able to generate an invention, investment in forms of time and money are needed in large amounts. To incentivize further innovation (which is one of the aims of patent law) these efforts need to be rewarded. Granting patents for AI generated inventions will grant the owners of the invention certain protection in exchange for disclosure about the invention. This will contribute to societal knowledge, just like a man-made invention. Engel highlights that the lack of protection might lead patent applicants to provide false information about the inventor. Engel explains that the EPC does not necessarily regulate this, and it would have to be mitigated by criminal law. During the patent granting process, the patent office does not verify the accuracy of who the designated inventor is. Nor will

[123] Guellec (2007) p. 67.
[124] Ibid.
[125] Guellec (2007) p. 68.
[126] Guellec (2007) p. 70.
[127] Engel (2020/9) p. 1127.

the patent office revoke an already granted patent solely based on incorrectly designating the inventor of the patent. The applicant will therefore not be worse off by lying on the application than if they were truthful about an AI generating the invention. [128]

Schwein believes that inventions regardless of whether they were invented by AI or a human are beneficial to society.[129] It therefore does not make sense to deny patent protection of AI inventions if the invention meets all requirements for patent protection. According to Schwein, refusing to allow AI inventions to be patented can make entities reluctant to patent their inventions and thereby cause a chilling effect. This is because they would be required to disclose information about the invention while facing the risk that the patent will be denied solely based on that the invention was created with enough autonomy of an AI.[130] Further, Schwein expresses concern regarding the integrity of the patent system if no clear direction is given on how to deal with AI inventorship. This problem will only grow as AI advances.[131]

3.6 What can the justifications for the patent system tell us about the need to protect AI generated inventions?

Beyond the natural rights theory that one should own the products of their mind, the utilitarian theory explains the purpose of patent law in a larger societal context. From applying the utilitarian perspective on patent law, it becomes clear that the purpose of patent law is to promote the sharing of knowledge and innovation with society to facilitate progress. This is because the utilitarian theory claims that institutions and regulations within society should aim to maximize social welfare. Patents protect social welfare in the sense that they protect invention and the disclosure of those inventions for

[128] Engel, (2020/9) p. 1127.
[129] Schwein (2022/09) p. 568.
[130] Ibid.
[131] Schwein (2022/09) p. 602.

societal progress. Patents are therefore seen as a protection and reward for the inventor for sharing and disclosing their invention. This is because without patents we risk that inventors will keep their inventions to themselves. This will hinder further advancement and invention based on those inventions. As well, the risk exists that multiple inventors would attempt to solve the same problems and make duplicates of the same invention. This goes against the utilitarian theory as it would waste resources and be a societal loss. That the purpose of patent law is to promote the invention and disclosure of inventions is further supported by the informational theory. This theory views the purpose of patent law to incentivize information exchange in return for patent protection to provide society with a picture of the state of technology and allow for innovation to be built on that existing technology. Disclosure being a requirement for patentability also demonstrates the importance of sharing knowledge as a justification for the patent system.

To maximize social welfare another purpose for patent law is to promote innovation. This is further shown by the inventive-step requirement. This demonstrates that protection will only be granted to the inventions that further societal progress and does not protect inventions that could hinder it. The disclosure requirement also demonstrates that promoting innovation is an objective behind patent law as it allows inventors to build and further develop already existing inventions.

Economic theory fortifies the argument that patent law grants invention owners' protection in return for information disclosure. As Guellec argues, economic theory of property rights cannot be applied to intellectual property. Property rights aim to prevent 'the tragedy of the commons' or the exploitation of resources. What is different with intellectual property is the knowledge that these goods bring have positive externalities because knowledge sharing strongly benefits the public. While it can be argued that patents restrict and create a shortage of knowledge to society, the limited shortage that a patent creates prevents an absolute scarcity in the future. Therefore, this further proves that the objective of patent law is to provide inventors and invention owners with a limited protection to recuperate their

investment in exchange for disclosure. Another economic aspect behind patent law is that investment into invention on a market without patent law is considered risky, therefore patent law acts as a tool to incentivize such investment. A justification behind patent law is therefore to promote investment into inventions as they enable investors to secure returns on their investments.

Now that the justifications of the patent system are identified, it is relevant to analyze whether the same justifications hold for AI inventions. I argue that the interests for granting man-made inventions also exist for inventions made by AI. Firstly, there is an equal interest in promoting the sharing of knowledge and invention with society to facilitate progress for both AI and man-made inventions. AI is a result of technological advancement that aids progress in society. Disclosure of such inventions will help portray an accurate picture of the state of technological developments and allow for others to further advance that technology in line with the utilitarian and informational theory. As Schwein presents, the inventions regardless of their creator have societal benefits. If AI is or is one day able to autonomously create an invention, I argue that there exists large interest for society to have that disclosed and shared. This is because as both the utilitarian and informational theory argue, invention and knowledge about the invention is required for progress in society.

Secondly, to motivate this sharing of information and invention for the purpose of societal progress there needs to be a way to protect such inventions from falling to the public domain. As Engel presents, even though no direct human investment will go into the invention made autonomously by the AI, large amounts of investment go into training the AI for it to be able to make an invention. As economic theory demonstrates, markets will not incentivize investment into inventions on a satisfactory level without investors having a way to recuperate their investments. As presented above, patents are a tool used to ensure that investments are protected. Therefore, in line with the motives of patent law, patent protection should be given to AI inventions to promote innovation and investment into such inventions. Further, data shows

us that patents give the highest added value in the following industries; pharmaceuticals, biotech, medical instruments, machinery, computers, and industrial chemicals. Data also confirms that these are the fields that AI technology is most advanced in as seen in chapter 2. As AI is constantly evolving and becoming more autonomous, it is likely that AI generated inventions will become a reality in the fields where patents are most heavily used and effective for protecting investment into innovation. Therefore, to continue encouraging development and investment into these fields it is pertinent that AI inventions are protected for investors to be sure that they can recuperate their investments.

Thirdly, AI development is a fact and there is a need to have clear legislation on how to handle AI inventions. As Schwein explains, the unclear position of how to handle such inventions could result in a chilling effect as it might cause invention owners to be reluctant to share their inventions or even apply for patents. This strongly deviates from the objectives of patent law to promote the sharing of inventions to facilitate progress as is explained by utilitarian, informational and economic theory. Another risk portrayed by Engel, is that owners of inventions will be motivated to lie on the patent application and falsely designate a natural person as the inventor. This would go against the purpose of patent law from an informational theory perspective as it would provide an inaccurate picture of the state of technology in society.

Therefore, from an analysis of the justifications for the patent system it becomes clear that there to a large extent exists need to protect AI generated inventions within patent law. I argue that the issue of AI inventions needs to be handled in a way that supports the objectives behind patent law as explained above. This would mean granting AI inventions a certain amount of protection in return for disclosure of the invention which supports society as information is necessary for future progress. This would further promote invention and investment into invention in the field of AI as it would provide investors a chance to recuperate their investment.

4 Who can be the inventor?

4.1 The evolving inventor

"The slow demise of the true and first inventor has been noted for decades".[132] Traditionally the view of an inventor has been an individual natural person putting effort and ingenuity into an invention. This has later evolved to an individual a part of a bigger team. Patents have as a result transformed from a personal property to a business asset where the rights to the patent is owned by the firms that employ the inventors and provide the necessary equipment.[133] We are moving further away from the traditional view of the inventor as is shown by the prospects of AI generated invention. Even though most patents are owned by companies, the requirement of designating an inventor remains.[134] Since the requirement has been interpreted in a way that prevents AI generated inventions from receiving patent protection[135], it is therefore relevant to analyze the purpose of the requirement to designate the inventor.[136] This chapter aims to give context to the term inventor in relevant law and in practice before discussing the case law on the subject in depth in chapter 5.

4.2 The inventor according to relevant law

The EPC does not define who an inventor is within the meaning of patent law. Rule 19 of the EPC stipulates that if the applicant of a patent is not the inventor, the inventor must be named. The inventor's information such as "family name, given name and country and place of residence"[137] must be included on the application. The derivation of rights must also be identified in the application. However, the EPO does not check if the designation of the

[132] Dutfield, Graham (2013), 'Collective Invention and Patent Law Individualism: Origins and Functions of the Inventors Right to Attribution.' *The WIPO Journal,* vol 5.1, p. 25.
[133] Dutfield (2013) p. 25-26.
[134] J 0008/20.
[135] See J 0008/20, will be discussed further in chapter 5.
[136] Dutfield (2013) p. 25.
[137] Art. 81 EPC; Rule 19 EPC.

inventor is correct. If someone disagrees with the designation they can claim that they have a better right to apply for the.[138] According to Ramalho, since the EPO does not check the accuracy of the designation this signals that the requirement to designate an inventor is merely a formality.[139] Since the EPC does not provide a definition for an inventor, the answer will be searched for in Swedish national patent law.[140]

In Swedish patent law the right to apply for a patent comes from the inventor.[141] The inventing process in terms of Swedish law is an intellectual achievement. As explained above, the Swedish patent system is regulated by 1967:837 The Patents Act. A definition of the inventor is not stipulated by law other than "Den som har gjort en uppfinning"[142] which translates to "The one who has made an invention". The concept of inventor is not further defined in the legal text. It is however accepted in doctrine that the inventor is always a natural person and never a legal person.[143] According to doctrine, the inventor in Swedish patent law is the person or persons that formulate and develop the idea of the invention.[144] When inventing, the inventor is required to identify a problem and then create a solution with technical application. Currently AI is still not able to identify the problem that needs solving and requires humans to identify these problems or questions for the AI to solve.[145] Note that the 'Artificial Inventor Project' claims that DABUS was able to identify the problem autonomously and therefore no human input was involved in the inventing process.[146] Whether this is an accurate assessment or not does not fall within the scope of this thesis. The fact that there might already exist autonomous AI only proves that this is at least where the

[138] Art. 81 EPC; Rule 19 EPC.
[139] Ramalho (2022) p. 97.
[140] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 98.
[141] Waltin, Jens, Patentlag (1967:837) 1:1, Chapter 2.1.1 Uppfinnaren, Lexino 2022-01-01 (JUNO) (visited 2022-10-11).
[142] 1:1 1967:837 The Patents Act.
[143] Waltin, Jens, Patentlag (1967:837) 1:1, Chapter 2.1.1 Uppfinnaren, Lexino 2022-01-01 (JUNO) (visited 2022-10-11).
[144] Wolk, Sanna (2013), *Arbetstagares uppfiningar*, 1st ed., Studentlitteratur, Lund. p.19-20.
[145] Ramalho (2022) p. 78.
[146] J 0008/20 p. 5.

technology is headed and further demonstrates the need for a comprehensive plan to deal with AI inventorship, which is the premise for this thesis.

4.3 Legal persons as patent owners

As mentioned above, the view of the traditional inventor has changed to where inventors most often are employed as part of a team by a company.[147] Subsequently, when the inventor is an employee the rights to the patent can automatically fall to a legal person, their employer. The rights can also be acquired by a legal person through contracts and agreements.[148] The 1934 Paris Convention instated the international principle of law that the inventor has a "moral right" to be accredited on the patent application, no matter who owns the rights to the patent.[149] This right extends to national patent law.[150]

In Swedish law the 1945:345 Act on the Right to Employee's Inventions and the collective agreement: the Innovators Agreement[151] regulate an employer's right to an employee's invention. This legislation was a response to the inconveniences in the form of disputes that resulted from the lack of regulation on the question of who owns the rights to an employee's invention.[152] For there to exist a relationship in which the employer is entitled to derive the rights from an employee, a prerequisite is that there exists an employment relationship.[153] The Act on the Right to Employee's Inventions is automatically applicable if there exists an employment relationship, unless the employer and the employee has come to an alternative agreement.[154] The collective agreement is only applicable if the employer is bound by the

[147] Cubert & Bone (2018) p. 416.

[148] Waltin, Jens, Patentlag (1967:837) 1:1, Chapter 2.1.1 Uppfinnaren, Lexino 2022-01-01 (JUNO) (visited 2022-10-11).

[149] Art. 4ter Paris Convention.

[150] Art. 62 EPC; PRV, 'Innan ansökan', 2022-10-13, <https://www.prv.se/sv/stora-patentguiden/innan-ansokan/> (visited 2022-11-18).

[151] Svenskt Näringsliv, 'Avtal angående rätten till arbetstagares uppfinningar', 2015, <https://www.ptk.se/wp-content/uploads/2021/04/Svenskt-Naringsliv-PTK-2015-Avtal-arbetstagares-uppfinningar-Avtal-om-skiljedomsregler-i-uppfinnar-och-konkurrensklausulstvister-1.pdf> (visited 2022-11-17).

[152] Proposal 1949:101 Royal. Maj:s Proposal to Parliament proposing a law on the right to employees' inventions; given at Stockholm Palace on 4 March 1949, p. 1,8.

[153] Wolk (2013) p. 18.

[154] Proposal 1949:101 p. 1.

collective agreement, if the employer is affiliated with a union, or if the employee's union has entered into agreement that the collective agreement is applicable.[155]

The employers right to employees' inventions includes inventions that are created both during working hours and during the employee's 'free time'.[156] The reason for this is that the working field of inventors consists of their thought process, which can take place during any time of the day. The employer's right to an invention requires that the invention falls within the employer's business area at the time that the invention was created.[157] The employer's business area is comprised of the employer's production and research activities, even areas that the employee is unaware of.[158] Inventions that fall within the employer's production activities refers to inventions that falls within the employer's business area, that can be used in the production of the employer's goods or services, and that helps reduce production costs or that in general promotes production. Inventions that fall within the employer's research activities refer to inventions that can be used within the areas of research for the employer.[159]

4.3.1 Derivation of rights to an employee's invention

The employer's rights to derivation depends on the invention and whether the law or the collective agreement is applicable. According to the law, the employer has immediate and automatic right to the invention if it is a research invention. When an employee creates an invention as a part of their primary job description, this is a research invention. The employer has the right to use or license inventions within the organization if they fall within their business area and are created outside an employee's primary job description but still

[155] Wolk (2013) p. 13.
[156] Wolk (2013) p. 20.
[157] 3 § 1945:345 Act on the Right to Employee's inventions.
[158] Wolk (2013), p. 22-23
[159] Ibid.

within the scope of their employment. This does not limit the employee from licensing or selling the invention to other organizations. The employer is also entitled to place a bid for more comprehensive rights to the invention without competition. Finally, if the invention is created outside the scope of the employee's job description, but the invention falls within the employer's business area, the employer has a right to make an offer for more extensive rights without competition.[160]

The collective agreement regulates derivation somewhat differently. If the collective agreement is applicable, the rights to an invention created within the employee's employment are automatically derived from the employee.[161] This is also the case if the invention is created outside the employee's employment, but the invention falls within the employer's business area. If an invention is created outside of the employee's employment and falls outside the scope of the employer's business area, the employer has no rights to the invention.[162]

4.3.2 Inventor's right to compensation

According to the Act on the Right to Employee's Inventions, the employee that has created an invention has a right to compensation outside of their regular salary or bonus.[163] This provision is binding for all employers and cannot be circumvented using contracts. The legislator's motive behind enforcing this provision as mandatory was to inspire innovation whilst also protecting the 'weaker' party. This provision helps the employee have a stronger hand when negotiating with their employer. The employee's right to compensation is automatic as soon as the employer derives the rights to the invention. The compensation should also reflect the types of rights derived.[164]

[160] 3 § 1945:345 Act on the Right to Employee's inventions.
[161] Wolk (2013) p. 28-29.
[162] Ibid.
[163] 6 § 1945:345 Act on the Right to Employee's inventions; Proposal 1949:101 p. 8.
[164] Wolk (2013) p. 37.

Compensation depends on the type of invention and whether the Act on the Right to Employee's Inventions or the collective agreement is applicable. When an invention is created as a part of an employee's primary job description, the law stipulates that compensation is only required if the value of the invention exceeds what the employee was presumed to achieve in relation to their salary and benefits.[165] While if the collective agreement is applicable, an invention that is created by an employee as a part of their job, will grant the employee a standard payment. According to the collective agreement, if the invention falls outside the scope of the employee's job description but still falls within the employer's business area, the employee as a right to additional compensation outside of the standard amount.[166]

4.4 The purpose of the requirement to designate an inventor

The requirement to designate the inventor on a patent application protects the right for the inventor to be attributed inventorship.[167] As has been highlighted, the traditional view of inventorship does not accurately portray the reality of inventorship today. The case of DABUS shows that we are moving even further away from this view.

Dutfield asks why the requirement is not removed and what function it serves in the context of inventorship today.[168] He brings up that it could simply be a situation where the requirement does not necessarily add value and neither cause any harm. Therefore, it serves no purpose to remove it. It could also serve as a function to attribute recognition which makes employees feel appreciated. This generates good morale within the work environment.[169]

[165] Wolk (2013) p. 38-39.

[166] Svenskt Näringsliv, 'Avtal angående rätten till arbetstagares uppfinningar,' 2015, <https://www.ptk.se/wp-content/uploads/2021/04/Svenskt-Naringsliv-PTK-2015-Avtal-arbetstagares-uppfinningar-Avtal-om-skiljedomsregler-i-uppfinnar-och-konkurrensklausulstvister-1.pdf> (visited 2022-11-17), 4.b.

[167] Dutfield (2013) p. 33-34.

[168] Ibid.

[169] Ibid.

Others claim that the purpose of the requirement is to show the public the inventor's central value to the invention.[170] It can therefore be seen as the attribution right serves to strengthen the inventor's reputation. Another view is that it serves a financial function. The reputational gain associated with the attribution can be helpful to the inventor gaining future career opportunities that can lead to higher monetary compensation.[171]

4.5 How does the requirement to designate an inventor impact the patentability of AI generated inventions?

Who can be an inventor is not defined within European patent legislation nor Swedish patent law. The case of DABUS shows that the EPO views that an AI cannot be named an inventor because of the requirement to designate the inventor. In the EPO's view, an inventor within the meaning of the EPC is a person with legal capacity, which currently AI lacks. The outcome is that an otherwise patentable invention does not receive patent protection. We have since decades back moved away from the traditional view of the inventor. The reality is that individual inventorship is overshadowed by inventorship within businesses taking the form of inventorship teams. The patent is no longer protecting the individual ingenuity of a sole inventor, but rather it can be seen as a business asset. The traditional view is further being challenged by AI generated inventions. Nowadays it can be questioned as to why the requirement to designate the inventor remains, especially if it will result in otherwise patentable inventions being denied patent protection, which has been concluded above in chapter 3 would deviate from the objectives and justifications for the patent system. It is therefore important to analyze the requirements' purpose to answer whether an inventor needs to be designated

[170] EPO, 'A study on inventorship in inventions involving AI activity', 2019-02, <https://documents.epo.org/projects/babylon/eponet.nsf/0/3918F57B010A3540C12584190280653/$File/Concept_of_Inventorship_in_Inventions_involving_AI_Activity_en.pdf> (visited 2022-12-18), p.23.

[171] Ibid.

in the case of an AI generated invention or whether certain legal capacity[172] can be attributed AI to be named as the inventor.

Employers have quite extensive rights, at least in Swedish law, to an employee's invention. The employee does not necessarily have to create the invention on duty or within their job description for the employer to have rights to the invention. Often it is enough that the invention falls within the company's field of business. This demonstrates that the law prioritizes the company's right to the patent over the inventor's right to the patent. Since the EPO does not check the accuracy of the designation it can be viewed that the designation of the inventor is only a formality and that therefore this formality should not hinder the patentability of AI generated inventions. Its formal function is to prove that the applicant has the right to apply for the patent.

However, what can be concluded from the above is that the requirement to designate an inventor protects the inventors right to be accredited. As is shown by doctrine on the field, the function of attribution is to recognize inventors for their role in creating the invention. It ensures that they feel recognized by their employer. The purpose behind the requirement can further be connected to compensation. As an inventor, at least in Swedish law, one has a legal right to fair compensation outside of their regular salary which was instated to protect the employee from being exploited. The recognition also allows the inventor to gain reputation that can benefit them in their career in terms of job opportunities, promotions, and compensation. Therefore, it seems that the function or the requirement to designate the inventor is to protect the inventor's right to attribution. The purpose could be to incentivize innovation even if the inventor is not granted sole rights to the invention.

As is exemplified in chapter 3, there are many reasons that AI generated inventions should be provided patent protection in line with the rationales behind patent law. It can therefore be considered whether the requirement of designating an inventor on the patent application is to provide the natural person rights in order to help their bargaining position against their employer

[172] AI and legal capacity will be further discussed in chapter 5.

and the right to be recognized as the inventor. Or whether it means that inventions made by non-natural persons cannot be patentable at all. As will be demonstrated below in chapter 6, not recognizing the capability of AI to generate patent worthy inventions, only because they are not natural persons, can result in outcomes that would strongly deviate from the objectives of patent law. However, even if we are moving further away from the traditional view of the inventor with AI inventors, the designation requirement can be argued to serve a substantive purpose to protect human inventors' reputation and their ability to use that reputation to gain fair compensation and recognition. This should be considered when discussing future solutions for protecting AI generated inventions.

5 AI as an inventor

5.1 The 'Artificial Inventor Project'

As patent law handles inventions and technologies that by definition are new, patent law therefore has to adapt to match the current technological field to ensure effective protection.[173] Patent law is very much subject to this right now in regard to the technological advancements in AI and the challenges these advancements bring to dealing with AI generated inventions.[174]

DABUS is an AI that has been claimed to be able to create inventions without any human intervention.[175] DABUS is a part of the 'Artificial Inventor Project'. This project aims to test the boundaries of patent law and stimulate challenging discussion and debate on how to deal with the legal impact of frontier technologies such as AI inventorship. Stephen Thaler is the owner of DABUS. Together with patent attorneys such as Ryan Abbott, they make up the 'Artificial Inventor Project' team.[176] To contribute to this debate they have applied for patents in multiple jurisdictions for the inventions made by DABUS.[177] This chapter will discuss the judgements by the Boards of Appeal of the European Patent Office, the UK and Australia to provide different views on the subject of AI inventorship in patent law. The interpretation from case law is that the EPC presupposes that the inventor has legal capacity to hold rights. This raises the question whether legal capacity could be extended to AI. This question will also be discussed in this chapter.

[173] Abbott, Ryan, 'Should AI Be Listed As An Inventor?', 2019-08-24, <ttps://artificialinventor.com/should-an-ai-system-be-credited-as-an-inventor-robert-jehan/> (visited 2022-11-04).

[174] Ibid.

[175] Abbott, Ryan, 'The Artificial Inventor Project', 2022, <https://artificialinventor.com/> (visited 2022-11-04).

[176] Abbott, Ryan. 'The Team', 2022, < https://artificialinventor.com/about-the-team/> (visited 2022-11-04).

[177] Ibid.

5.1.1 European Patent Office's view on DABUS as an inventor

The 'Artificial Inventor Project' submitted a patent application for DABUS' inventions to the European Patent Office.[178] This application was rejected on the basis that the inventor was not a natural person. The applicant, Dr. Thaler appealed this decision to the Boards of Appeal of the European Patent Office.

The question raised by the application that is relevant for this paper is:

> "Whether an applicant can designate an entity other than a natural person as the inventor under the EPC?"[179]

In their ruling, the Boards of Appeal rejected the appeal and held that the inventor of a patent can only be a natural person. The Boards of Appeal reviews its role in such a question and states that they are only able to conduct a formal examination.[180] Under rule 19.2 of the EPC, it is not for the EPO to determine whether the designation of the inventor is accurate or not. From a formal examination the Boards of Appeal was able to reject the application based on its interpretation of Art. 81 EPC and defined the inventor as a natural person with legal capacity.[181] The Boards of Appeal states that since Art. 60.1 stipulates that the rights of a patent vests in the inventor, which according to the EPO, this presupposes that the inventor has legal capacity to hold rights.[182]

The applicant argued that allowing an AI to be designated as the inventor serves the purpose of transparency for the public to know that the invention was created by an AI.[183] The court found this argument to be unconvincing as there is no normative right for the public to know how an invention was made.[184]

[178] J 0008/20 (Designation of inventor/DABUS) of 21.12.2021.
[179] J 0008/20 p. 15.
[180] J 0008/20 p. 19-20.
[181] J 0008/20 p. 21.
[182] Ibid.
[183] J 0008/20 p. 22-23.
[184] Ibid.

5.1.2 The UK's views on DABUS as an inventor

5.1.2.1 UK Intellectual Property Office

The UK is one of the jurisdictions where the 'Artificial Inventor Project' applied for a patent. The UKIPO answered whether it is possible to view a non-human inventor as the inventor under the existing patent legislation, mainly the Patents Act 1977.[185] The UKIPO recognizes that there exists no relevant case law to provide guidance on this question. They therefore rely on legislation, specifically section 7 and 13 of the Patents Act 1977.

The applicant argued in front of the UKIPO that the term 'person' when referring to the inventor in section 7 of the Patents Act 1977, does not necessarily imply a natural person. They argue that the definition could be more broadly interpreted such as when considering 'a person skilled in the art' which is a legal fiction. As well, the applicant provides the argument that the function the requirement to name the inventor is to provide information about the actual devisor of the invention whether it be a human, AI, or joint human and AI invention. The failure to correctly identify the devisor would mislead the public. They point out that withholding an invention from the public because of the nature of the inventor would be societally disadvantageous.[186]

The UKIPO mentions that the current patent legislation was legislated without the issue of AI inventorship in mind.[187] The UKIPO claims that it is therefore apparent that the legislators meant 'person' as a natural person within the meaning of the Patents Act 1977. The UKIPO points out that a changed interpretation of the inventor needs to be intentional and indicated from legislators or higher courts, which currently does not exist.[188] Therefore

[185] BL O/741/19 p. 14.
[186] Ibid.
[187] BL O/741/19 p. 18.
[188] BL O/741/19 p. 14, 19.

the UKIPO found that only a natural person could qualify as an inventor under existing patent law.[189]

Another question that the UKIPO had to regard was whether the owner of an AI could be entitled to the AI's invention. The UKIPO responds to this question by saying that it is not possible to acquire property rights from the AI by virtue of ownership. The Patents Act 1977 stipulate that a patent may be granted to the inventor or the person who has derived the rights from the inventor.[190] In the case of an AI, it is held by the UKIPO that the AI cannot hold property rights and therefore cannot transfer the property rights to its owner.[191]

5.1.2.2 UK High Court

The decision was appealed and tried by the High Court. The court upheld the decision made by the UKIPO and the appeal was rejected.[192] However one of the three judges has a dissenting opinion. Lord Justice Birss along with Lady Justice Laing and Lord Justice Arnold unanimously agreed that only a natural person could be considered an inventor in the meaning of the Patents Act 1977. Lord Justice Birss explains that an inventor under the Patents Act 1977 is the 'person' that devised the invention. As AI are not 'persons', Lord Justice Birss concludes that DABUS cannot be considered an inventor under the current legislation. Even if DABUS is the actual deviser of the invention, DABUS has no right to be called an inventor under the current law. An inventor under the Patents Act 1977 has the right to be mentioned on a patent application and as an employee they have rights to fair compensation. A machine cannot possess any of these rights.[193] Lady Justice Laing and Lord Justice Arnold agree with this.[194]

[189] BL O/741/19 p. 14, 19.
[190] Section 7.2 Patents Act 1977.
[191] BL O/741/19 p. 14.
[192] A3/2020/1851 Thaler v. Comptroller p. 18-26.
[193] A3/2020/1851 p. 54-56.
[194] A3/2020/1851 p. 102.

Lord Justice Birss is of the opinion that the critical issue lies within section 13 of the Patents Act 1977.[195] Section 13 requires the applicant to designate "the person or persons whom he believes to be the inventor or inventors."[196] Its purpose is to streamline the patent application process. Lord Justice Birss explains that he finds it surprising that an invention was denied a patent when the applicant in good faith was unable to identify an inventor with a valid explanation. According to the Lord Justice Birss, section 13.2 requires the applicant to disclose who they genuinely believe the inventor to be. If this can be done in a satisfying way, such as explaining that there is no inventor under the meaning of current patent law since the inventions was generated by an AI, no higher obligation should be enforced.[197]

Further he states that simply because all inventors are people, this does not mean that all inventions are invented by people.[198] In his judgement, Dr. Thaler had fulfilled the requirements to designate who he genuinely believed was the inventor. Dr. Thaler left out the inventor as it was his genuine belief that DABUS, the AI, devised the invention. According to section 13(2)(b), the applicant needs to identify the derivation of rights to apply for a patent for the relevant invention.[199] In the case of DABUS, Dr. Thaler is the owner of DABUS and believes that the rule of law should apply, meaning that as the owner of DABUS he owns its products. Lord Justice Birss notes that this issue would not arise, had Dr. Thaler named himself as the inventor. He does not believe that the rule of law is needed in this case as if Dr. Thaler claims derivation of his right, and if someone else has a stronger claim or right to apply for a patent for said invention, they would be able to argue that they have a better claim to the rights.[200]

Lady Justice Laing and Lord Justice Arnold believe the requirements in section 7 and 13 to be cumulative. Therefore, if the inventor or devisor of the

[195] A3/2020/1851 p. 58.
[196] Section 13(2)(a) Patents Act 1977.
[197] A3/2020/1851 p. 59-60.
[198] A3/2020/1851 p. 79.
[199] A3/2020/1851 p. 82-85.
[200] A3/2020/1851 p. 81-85.

invention is not a natural person, then the application falls, no matter if the applicant can be said to have in good faith informed about the inventor. They both rejected the appeal.[201]

5.1.3 Australia's view on DABUS as an inventor

5.1.3.1 The Federal Court of Australia

On appeal the Federal Court of Australia ruled in favour of granting the AI generated inventions patents.[202] Though this ruling was overturned by the Full Court of the Federal Court of Australia, it is relevant to evaluate the arguments brought up in favour of granting AI generated inventions patents. Justice Beach is of the opinion that the term inventor in the Australian Patents Act 1990 is applicable to AI generated inventions. He explains that an inventor is an agent noun because it has suffixes such as 'or' or 'er'. Agent nouns describe what verb the agent is doing. He exemplifies that agent nouns can refer to both natural persons and non-natural entities such as 'computer'.[203] Thereby he concludes that the term inventor can refer to an AI system if it is the AI that has invented the invention. As well, he claims that this interpretation accurately reflects reality as there exists patentable inventions that are created by AI.[204]

The patent application was rejected at the Australian Patent Office because they found that only a natural person could be the inventor of a patent.[205] Justice Beach claims that this is wrong and confuses the concepts of inventorship and ownership. He holds that while it is true that only a natural or legal person can be the owner of a patent, it would be false to claim that only a natural person could be an inventor. The AI could also not be the patentee or controller of the invention.[206]

[201] A3/2020/1851 p. 101, 148.
[202] Thaler v Commissioner of Patents (2021) FCA 879.
[203] Thaler v Commissioner of Patents (2021) FCA 879. P.10, 120.
[204] Ibid.
[205] Thaler v Commissioner of Patents (2021) FCA 879. P 12-13.
[206] Ibid.

Justice Beach further explains that by following the reasoning of the Commissioner, otherwise patent worthy inventions would be denied patent protection.[207] The judgement emphasises that this reasoning would interfere with the purpose of the Patents Act 1990.[208] Justice Beach argues that it is not effective to interpret the inventor in the light of when the legislation was drafted, as the nature of inventions and inventors is constantly evolving.[209]

The judgement presents many examples of how AI is involved in the inventing process such as AI's involvement in pharmaceutical research.[210] According to Justice Beach, this illustrates that we can no longer adopt a narrow view or definition of inventor, as doing so would have inhibiting consequences for innovation.[211] In the Australian patent legislation, like in most jurisdictions, the term inventor is not defined. Even if the inventor refers to a person in the legislation, Justice Beach explains that 'person' can be used to refer to a political or corporate body as well as a natural person.[212]

Justice Beach held that in comparison to copyright law, patent law does not protect moral rights of the human creator/inventor in such a way that would preclude non-human made inventios from patent protection.[213]

5.1.3.2 Full Court of the Federal Court of Australia

The ruling made by Justice Beach was appealed and overturned by the Full Court. The panel of judges held that the purpose of identifying an inventor on the patent application is to ensure that the applicant has the right to apply for the patent.[214] They conclude that since applications where the applicant

[207] Ibid.
[208] Thaler v Commissioner of Patents (2021) FCA 879. P.14.
[209] Thaler v Commissioner of Patents (2021) FCA 879. P.15, 122.
[210] Thaler v Commissioner of Patents (2021) FCA 879. P.44.
[211] Thaler v Commissioner of Patents (2021) FCA 879, p.56.
[212] Thaler v Commissioner of Patents (2021) FCA 879, p. 60; 2C(1) of the Acts Interpretations Act 1901 (Cth).
[213] Thaler v Commissioner of Patents (2021) FCA 879, p. 119.
[214] Commissioner of Patents v Thaler (2022) FCAFC 62, p.

is not the inventor, the provisions of patent law require that the rights to the invention is derived from the inventor. According to the Full Court this makes it clear that an inventor within the meaning of patent law needs to have legal personality.[215] AI is unable to give up rights to a patent because they lack legal personality.[216]

5.2 Legal personality vs. legal capacity

The case law discussed above shows that in all jurisdictions the appeals were rejected based on legal personality or rather because AI lacks legal personality. It is therefore relevant to analyze legal personality to see if another interpretation could be adopted for AI to be named the inventor.

5.2.1 Definitions of legal personality

> "We must consider what *person* stands for; which I think, is a thinking intelligent being, that has reason and reflection, and can consider itself as itself, the same thinking thing, in different times and places."[217]

This is John Lockes definition of a person, which closely links the term person with human beings.[218] This is considered a traditional definition of a person. In a legal context this type of person, a human, is called a natural person. A natural person can assume human rights.[219]

[215] Commissioner of Patents v Thaler (2022) FCAFC 62, p. 98.
[216] Commissioner of Patents v Thaler (2022) FCAFC 62, p. 108.
[217] Locke, John (1844), *Locke's Essays: An essay concerning human understanding and a treatise on the conduct of the understanding (complete in 1 volume with the Author's last additions and corrections)*, James Kay, Jr. & Bro., Philadelphia, p. 210.
[218] Ibid.
[219] Van Genderen, Robert H. (2018), 'Legal Personhood in the age of artificially intelligent robots', in: Barfield, Woodrow & Pagallo, Ugo (eds.), *Research handbook on the Law of artificial intelligence*, Edward Elgar Publishing, Northampton, p. 215.

There is also the more legal view of a person. The term legal person is a type of legal fiction.[220] It is a fundamental term that forms the basis of many legal assumptions. It is used to describe entities that can have rights and duties.[221]

A legal person is a legal actor that has legal capacity.[222] A definition of a natural person and legal person can therefore be "a subject of legal rights and duties".[223] Legal capacity refers to the ability to have rights and obligations. Legal persons is an umbrella term that covers non-human entities that hold certain legal capacity. Examples include corporations, associations, and government associations.[224] The assumption today is that legal relations occur between natural and legal persons. Despite not being human entities, corporations or other legal persons can have certain legal capacity. The idea behind this is that a company is made up of natural persons that act on the company's behalf. [225]

It has long been held that only humans have been able to conduct logic reasoning which is a requirement to have rights and duties. [226] Although, legal personality has been extended to other non-human entities. In many countries' laws, no definition of a person is given other than an entity being capable of having rights and obligations.[227]

The definition of person is and has been subject to change to reflect society as culture and traditions develop.[228] Take for example slaves during the Roman Empire. Slaves did not have legal personality. As well, women in the Netherlands until 1975 had limited legal capacity in comparison to men as they were unable to make any legally binding decisions without the consent

[220] Naffine, Ngaire (2017), 'Legal Persons as Abstractions: The Extrapolation of Persons from the Male Case', in: Kurki, V.A.J & Pietrzykowski (eds.), *Legal Personhood:Animals, Artificial Intelligence and the Unborn,* 1st ed., Springer International Publishing, Cham, p. 15.

[221] Burylo, Yurii (2022), 'Legal Personhood of Artificial Intelligence Systems: To Be Or Not To Be?.' *Entrepreneurship, Economy and Law*, vol. 2, p. 19-20.

[222] Van den Hoven van Gerden (2018) p. 215.

[223] Van den Hoven van Gerden (2018) p. 218.

[224] Van den Hoven van Gerden (2018) p. 216.

[225] Burylo (2022) p. 19-20.

[226] Ibid.

[227] Van den Hoven van Gerden (2018) p. 218.

[228] Note that slaves were able to have and hold certain amounts of property, see Van den Hoven van Gerden (2018) p. 218.

of their husbands.[229] These examples illustrate that the definition and concept on legal personality can and has evolved. With technological advancement some argue that AI will be able to conduct logic reasoning in the future.[230] Technology and AI often have legal effects on society which raises the question whether AI should have some sort of legal personhood with limited legal capacity.[231]

5.2.2 Non-natural entities that have legal personality

The most obvious example of a non-natural entity that has legal personality is a corporation or business. These entities have legal personality and capacity to conduct economic acts with legal consequences and liability.[232] Van Genderen states that the scope of who is given legal personality depends largely on cultural, economic, and political circumstances.[233]

There are instances where inanimate objects have been granted legal status. Legal personality was granted to the Whanganui River in New Zealand. [234] Prior to this, the river was viewed as property. Granting the river legal personhood aimed to make it a legal entity with rights and duties and for these rights and duties to be forced onto other legal persons.[235] On part, the motive for granting the river legal personality was to ensure its health and to preserve its resources.[236] Another example is that in Bolivia, Mother Earth was granted legal personality and equal rights as humans.[237]

[229] Van den Hoven van Gerden (2018) p. 218.
[230] Burylo (2022) p. 19-20.
[231] Van den Hoven van Gerden (2018) p. 216.
[232] Van den Hoven van Gerden (2018) p. 219.
[233] Ibid.
[234] Hutchinson, Abigail (2014), 'The Whanganui River as a Legal Person.' *Alternative Law Journal,* vol 39.3, p. 179.
[235] Ibid.
[236] Ibid.
[237] Vidal, Johan, 'Bolivia enshrines natural world's rights with equal status for Mother Earth', 2011-04-10, <theguardian.com/environment/2011/apr/10/bolivia-enshrines-natural-worlds-rights> (visited 2022-11-04).

In Saudi Arabia, an AI robot entity, Sophia was granted citizenship.[238] This is viewed by many as highly controversial. What rights and duties Sophia has because of this citizenship is unclear.[239] However, it does show that the limits to which the legal fiction legal personality is stretched. Further, even ships have certain legal personality according to maritime law.[240]

Rights and obligations, usually stem from legal personality. However, there are occurring instances where non legal persons have rights and obligations.[241] For example, the CJEU held in the case C-41/90 Klaus and Fritz Elser v. Macratron GMBH, that in EU competition law obligations are placed on all entities involved in an economic undertaking regardless of the entity's legal status.[242] Also take the European Convention for the protection of animals kept for farming purposes, this convention sets out minimum rights for animals used for the purpose of livestock. The convention's purpose is to shield these animals from unnecessary suffering or harm caused by the care they are given.[243] Adde and Smith submit that a possible solution to protect AI generated inventions under patent law would be to extend AI the right to be named as the inventor on a patent application without granting AI any legal personality.[244]

5.2.3 Electronic legal personality

It is accepted that AI will play a significant role in future society.[245] The need for electronic legal personality and how it will be formed depends on the legal actions that an autonomous AI can take.[246] Not all AI function or will function

[238] Paraviainen, Jaana & Coeckelbergh, Mark (2021), 'The political choreography of the Sophia robot: beyond robot rights and citizenship to political performances for the social robotics market.' *AI & Society*, vol. 36, p. 715.
[239] Ibid.
[240] Nordberg, Ana (2022) p.150.
[241] Nordberg (2022) p.152.
[242] C-41/90 Klaus and Fritz Elser v. Macratron GMBH (1991) ECLI:EU:C:1991:161, p. 21.
[243] European Convention for the protection of animals kept for farming purposes L 323/14; Nordberg (2022) p. 152.
[244] Adde & Smith (2021) p. 98.
[245] Van den Hoven van Gerden (2018) p. 248.
[246] Van den Hoven van Gerden (2018) p. 229.

on the same level of autonomy. This will impact the need for and different levels of legal capacity.[247]

In 2017 the European Parliament presented recommendations to the European Commission regarding possible regulation of robots.[248] The aim of this document was to address the legal consequences of the increasingly advanced AI and the new 'industrial revolution'. The document points out that the regulation needs to beware not to hinder innovation.[249] One of the suggestions was to create a separate legal status for robots or AI with enough autonomy. Enough autonomy refers to AI that can make decisions autonomously or interact on their own with third parties. The purpose of this electronic personality would be to hold the AI responsible for any damages caused.[250]

This is supported by some practitioners as they believe that when AI reaches a level of autonomy to take autonomous decisions it would be outdated to hold the manufacturer or the owner liable.[251] However, the opposition claims that electronic personality would decrease the manufacturer's responsibility and could lead to AI being blamed and letting manufacturer or owners walk away blame free without consequences.[252]

Some people are of the opinion that the definition of the term person is a human being and that a person needs no other defining characteristic other than being human.[253] Therefore it is argued that AI should not be granted legal personality simply because AI is not human. Under this definition of person, companies are only extended legal personality because the actions of a company can be traced back to the humans working for the company. Professor van Genderen however argues that this definition of person is not

[247] Van den Hoven van Gerden (2018) p. 248.
[248] European Parliament Resolution of 16 February 2017 with recommendations to the Commission of Civil Law Rules on Robotics, 2015/2103/INL, points B-C.
[249] Ibid.
[250] European Parliament Resolution of 16 February 2017 with recommendations to the Commission of Civil Law Rules on Robotics, 2015/2103/INL, p. 59(f).
[251] Burylo (2022) p. 20.
[252] Ibid.
[253] Van den Hoven van Gerden (2018) p. 234.

viable as it does not explain why we grant humans different levels of legal capacity based on mental fitness, age, and other physical characteristics.[254]

The EPO held in the case discussed above, that the inventor under the EPC needs to be someone with legal personality. Nordberg states this statement "is misguided and perhaps confuses legal personality with legal capacity".[255] She points out that within patent law it is possible for the heirs to a deceased person to patent the invention of the deceased and name them as the inventor, despite the deceased lacking legal personality. This is also found with minors. They lack legal capacity but if the application is filed by a legal guardian a minor can be designated the inventor. However, companies which are legal persons with general legal personality are unable to be designated the inventor. Therefore, Nordberg finds the argument of the EPO to refer to the specific legal capacity to be designated the inventor of a patent when stating that only a legal person can be named the inventor of a patent.[256]

According to van Genderen "one could analogize to AI the characteristics of current players that have legal personality and then select which legal rights will be given to an AI entity".[257] It is however raised that before an analogy is adopted for the purpose of extending AI legal status in order to have the specific legal capacity to be named the inventor of a patent, it first needs to be ensured that the decision to exclude legal entities from being named the inventor at the time when the EPC was drafted was not a conscious decision made to reserve the right of recognition to natural persons.[258]

5.3 In what way could another interpretation of legal personality be adopted to allow AI inventorship under patent law?

[254] Ibid.
[255] Nordberg (2022) p. 153.
[256] Nordberg (2022) p.153-154.
[257] Van den Hoven van Gerden (2018) p. 216.
[258] Nordberg (2022) p.153-154.

The EPO Boards of Appeal's judgement was based on the formal requirement to designate an inventor. Because an AI cannot hold the rights associated with being named the inventor, they therefore held that only a legal person could be designated the inventor. It is therefore relevant to question if another interpretation of legal personality could be adopted to enable AI to be designated as the inventor.

Even though, as the Boards of Appeal state, the public has no normative right to transparency that the invention was created by an AI, I argue that transparency falls under the informational purpose of patent law, as discussed in chapter 3. As Engel identifies, if AI inventions are not able to receive protection under patent law this will motivate entities to falsely identify a natural person as the inventor, thus providing a skewed image of the technological state which deviates from the objectives of patent law.

From the dissenting opinion of Lord Justice Birss it can be concluded that the designation requirement serves to protect the natural inventor's right to be named as the inventor, which further supports the conclusions made in chapter 4 that the requirement does not only serve a formal function. Therefore, in his opinion it would be wrong to grant AI those same rights since AI have no right to compensation or recognition. Dr. Thaler was able to provide a valid and coherent reason as to why no inventor was designated, which according to the judge should suffice and the patent should have been granted. Further, he points out that the designation requirement has a formal function to aid the process of validating the derivation of rights. The judge sees the terms inventor and invention as separate from another. He held that just because an inventor is a natural person within patent law, this does not mean that all inventions are created by natural persons. An argument against this view would be that patent applicants such as corporations could file applications without naming an inventor to circumvent inventors' rights to recognition and fair compensation. This would however be rectified through claims of better right, as Lord Justice Birss explains. In comparison to the two other judges, Lord Justice Birss looks beyond the formal requirements of

patent law and applies a more substantive approach that better reflects the reality of inventorship today.

Justice Beach too adopts a more substantive perspective when ruling on Dr. Thaler's application in Australia. Like I mention in chapter 3, he adopts a perspective that falls in line with the purpose of patent law, to promote the sharing of inventions with society to facilitate progress. He points out that adopting the perspective of the EPO, the High Court in the UK, and the Federal Court of Australia, will result in with patent worthy inventions that cannot receive patent protection. I argue that this presents risks, as identified by experts such as Engel, that inventions will be withheld from the public, or protected by trade secrets which will be further discussed below.

The appeals discussed above were all rejected on the basis concerning legal personality or the lack of legal personality for AI. However, as the discussion above presents, legal personality is a concept that is adaptable. The courts in the abovementioned cases hold a very narrow view of legal personality and capacity.

In line with what both Lord Justice Birss and Justice Beach argues, the nature of inventions and inventors are changing, this is also supported by the conclusions made in chapter 4. It is no longer guaranteed that a natural person is the creator of a patentable invention. As presented above, legal personality has been subject to change as society evolves. This raises the question of whether AI will cause a change to the perspective on personhood. Locke's definition of personhood implies that a person is an entity that can conduct logic reasoning. As AI develops the goal is for AI to autonomously conduct logic reasoning, falling into Locke's definition of a person. This supports what both Lord Justice Birss and Justice Beach showcase in their rulings, that the legal personality of the inventor should not be interpreted so rigidly.

There are many examples of non-natural entities that have been granted a certain type of legal personhood, such as rivers and other entities in nature. In line with what van Genderen claims, the scope of legal personality largely depends on cultural, economic and political circumstances, it can therefore be

inferred that granting bodies in nature legal personhood is a result of cultural and political circumstances, particularly referring to climate change and the climate crisis. Further, examples of ships and robots gaining legal personality also supports the possibility of viewing AI and legal personality in a more flexible way that reflects the current need and state of society. In the example of the robot Sophia, what her citizenship status entails is unclear but together with the other examples they stretch the definition and scope of legal personality. These examples weaken the argument that an AI invention, simply because AI lacks legal personality, cannot be protected by patent law.

Seeing how flexible definitions of legal personality and legal capacity have been to reflect needs in society in the past, the possibility of attributing AI legal personhood or rights in the future seems viable to a certain extent. Arguments against granting AI legal personality include that AI is not human and strong AI will make decisions autonomously without human input. Whereas entities such as corporations have been granted legal personality because it is possible to break down the actions of such entities to human representatives. This argument does not necessarily hold, as for example there is no human aspect behind entities in nature granted legal personality. As well, it is possible to limit legal personality, for example based on age and mental fitness. Some might argue that granting electronic or AI personality will result in manufacturers not taking due precautions and responsibility if they can blame AI. A solution would be to provide legal personality with limited legal capacity that would prevent manufacturers from passing on accountability.

It seems that the view of the EPO is that only natural persons have the legal capacity to be named the inventor. This is showcased as natural persons with limited legal capacity such as minors have legal capacity to be designated the inventor. All the while a company that has general legal capacity cannot be named the inventor. It would therefore seem possible to grant AI certain legal capacity to be designated as the inventor on a patent application through analogy. Given that there are multiple examples where non-natural entities are granted certain rights and obligations for example, livestock animals have

the ability to hold animal rights without having legal personality, it could theoretically be possible to grant AI the right to be named an inventor.

Therefore, there is a possibility to adopt a different interpretation of legal personality and capacity for AI to be designated the inventor. However, any analogy to extend rights to AI needs to ensure that it does not contravene the objectives and purpose of the EPC instating the requirement to designate an inventor. As demonstrated in chapter 4, the human inventor can be seen to have a substantive right to be attributed as the inventor and has right to fair compensation. This right is enforced by the requirement to designate the inventor. Therefore, granting an AI the same level of recognition could dilute the human inventor's right to attribution. This conclusion is also supported by what Lord Justice Birss sates, that it would be wrong to name an AI an inventor as this requirement and title protects the human inventors right to attribution and compensation. However, as Justice Beach states, the requirement should not be interpreted in a way that completely precludes inventions with no human inventors from patent protection. It is therefore necessary to find a solution that encompasses AI generated inventions but that also protects the human inventor's right. Such solutions will be discussed in chapter 6.

6 Changes on the horizon?

6.1 Brief comment on the need for change

Law does not exist in a vacuum.[259] Patent law particularly is an area of law that is constantly evolving together with technological evolution. In order to identify and solve problems, a deeper understanding is required of the practical consequences of current patent legislation.[260] This thesis focuses on the issue of AI generated inventions that is currently challenging patent law. This section of the thesis will discuss possible solutions to the issue.

Björkwall explains that when discussing possible solutions, it is important to recognize that patent law can have different practical effects depending on the specific context.[261] Equally important is to compare the effects of a solution with the purpose of patent law.[262] It is therefore important to understand the practical implications of the interpretation that the EPO Boards of Appeal has made and to compare the effects of the decision with the justifications and objectives for patent law. This shows the need for a solution that accurately reflects society's needs.

From what has been discussed above it is clear that even if the current patent system only recognizes humans as inventors, that does not mean that all inventions are made by humans. What can be said about the different jurisdictions that have tried Dr. Thalers case is that the rulings have been focused on what the law currently permits. There has been very little discussion from the courts about how the law can be interpreted in the light of technological advancements or how the law could be adapted.[263] The possibility of an adaptation of patent law has neither been ruled out. After the DABUS ruling the UKIPO made a call for experts and practitioners views on

[259] Björkwall (2015/04), p. 397.
[260] Ibid.
[261] Ibid.
[262] Westman, Daniel (2019/1), 'Den fjärde industriella revolutionen – en immaterialrättslig introduktion.' *NIR*, p. 150.
[263] Adde & Smith (2021) p. 97-98.

AI inventorship, likely spurred by the DBAUS case.[264] Westman stresses that the solution adopted needs to focus on not hindering the creation and distribution of powerful technology.[265]

6.2 Aspects to consider of when finding future solutions

European patent attorney Brax illustrates that not all inventions are equal, however all patented inventions receive the same protection.[266] Brax exemplifies this by comparing a pharmaceutical invention to an app invention. The former invention in the example is a lifesaving invention that resulted from years of work by scientists and researchers. The latter invention is an idea that took an afternoon to develop into an invention. This invention can be made into an app and will spend some weeks trending until it is overtaken by the next trend. Brax claims that this example illustrates that the needs of patent protection is not one size fits all. This is becoming ever more apparent with regards to digitalization and the advancement of AI.[267] Brax claims that a new type of patent protection needs to be established to meet needs that digitalization has brough on. Brax explains that this is because the current patent system was developed without considering the innovation and types of inventions we are witnessing today.[268]

Cubert and Bone highlight that 'strong AI' or fully autonomous AI will be much faster and better at inventing than humans.[269] We might reach the point where AI will invent on demand, meaning that the marginal cost of inventing will nearly reach zero. In that case there is no investment to protect, and it could be argued that protection should not be extended to these inventions.[270] Engel points out that if an AI generated invention produced at a low cost and with little effort is granted the same protection as a human invention, this

[264] Adde & Smith (2021) p. 97-98.
[265] Westman (2019) p. 150.
[266] Brax (2019/01) p. 157.
[267] Brax (2019/01) p. 158.
[268] Brax (2019/01) p. 157-158.
[269] Cubert & Bone (2018) p. 426-247.
[270] Ibid.

could disincentivize human invention.[271] It is for that reason that many experts argue that there should be stricter requirements for AI inventions to be able to be granted a patent than man-made inventions.[272]

According to Engel, large companies owning powerful AI systems and technologies would gain a more dominant market position if they were able to patent AI inventions.[273] Another aspect that future lawmakers need to beware of is the potential risk of monopolization. For example, *dropout*, is an AI technique for neural networks to generate new data. Google holds a patent on this AI technology which practitioners claim is a quite standard technology fundamental for future AI development. Many researchers in the field express their fears of a patent thicket arising. A patent thicket refers to large companies holding patents on AI technology that is needed for future innovation. As a result, this will hamper future innovation as only the patent holders can freely use these technologies, preventing other players from inventing using standard or essential AI tech.[274]

6.3 Possible solutions

A fundamental change in patent law needs to take place in order to accommodate the new surge of technological advancements. The discussed jurisdictions that have tried the case of DABUS as an inventor have all decided (with some significant dissenting comments) that an AI cannot be named as an inventor on a patent application because AI is not a natural person. However, as Engel states, it is possible for the AI to be the de facto inventor without being granted the rights of inventor within the meaning of patent law.[275] The following section will present and discuss solutions to the problem presented in doctrine.

Researchers like Daria Kim argue that it is still possible to look for the human inventor in an AI generated invention and that current patent legislation is

[271] Engel (2020/9) p. 1127.
[272] Zamel (2021/4) p. 491.
[273] Engel (2020/9) p. 1128.
[274] Zingg (2021) p. 76.
[275] Engel (2020/9) p. 1128.

sufficient to handle AI inventions.[276] While Ahlgren et al., argue that it will not be very long till we are dealing with inventions where it is no longer possible to look for the human inventor.[277] Kempas highlights that looking for the human inventor is not a long-term solution.[278] He claims that AI is evolving and the purpose of patent law is to encourage invention and the distribution of the invention.[279] Schwein agrees and states that the integrity of the patent system is at risk if the issue of AI inventorship is not dealt with as the main purpose of patent law is to promote disclosure and commercialization of inventions.[280] This further strengthens the conclusions made in chapter 3.

Some claim that a possible solution is that the AI owner should own the inventorship rights of the AI generated invention. However, Adde claims that this is only a short-lived solution to a long-term problem. In the future when AI further advances, there will be a need to correctly identify the AI as the creator of an invention.[281] The legal team of the 'Artificial Inventor Project' argued to the courts that the AI's rights as the inventor of the invention should be automatically transferred to Dr. Thaler as he is the owner of the AI.[282] This refers to a legal tradition in property law where for example the owner of a fruit tree is transferred the right to the fruits of that tree.[283] Such an analogy cannot be used on intellectual property without further deliberation due to the fundamental differences between the nature of material property and immaterial property.[284]

[276] Kim, Daria (2020), 'AI-Generated Inventions: Time to Get the Record Straight?.' *GRUR* International, vol 69.6, p.455; European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10) p. 118.

[277] Ahlgren, Magnus et al., 'Artificiell intelligens & immaterialrätt - ett tankepapper från patent- och registreringsverket', 2021-05-27, <https://www.prv.se/globalassets/in-swedish/om-oss/aktuellt/promemoria-kring-ai--immaterialratt-210527.pdf> (visited 2022-10-10), p. 13-14.

[278] Kempas (2020) p. 65.

[279] Ibid.

[280] Schwein (2022/09) p. 602.

[281] Adde & Smith (2021) p. 98.

[282] Nordberg (2022) p.159.

[283] Ibid.

[284] Guellec (2007) p. 52; Nordberg (2022) p. 159.

Adde points out that the solution of dealing with AI generated inventions needs to account for who receives the rights to patent an AI invention.[285] However, the issue of ownership is not new or unique to AI inventorship. In terms of an AI invention there are three possible views of who should be granted the right to the patent; the AI system owner; the person who developed or trained the AI, or the user of the AI. Prior to AI generated inventions the question of ownership would be answered using law and contractual agreements. The European Commission views that the same will apply for AI generated inventions.[286] Many national jurisdictions will have thorough laws on employers' rights to employees' inventions and in most cases of ownership will most likely be sufficiently solved by such existing legislation.[287]

Another solution suggested by researchers such as Brax and Nordberg, is to create a separate patent regime specifically for inventions where no human inventor can be named.[288] This solution will allow for legislators to create a type of intellectual property protection that specifically meets the needs and requirements for these inventions such as a limited time period for the owners economic right.[289]

[285] Adde & Smith (2021) p. 98.
[286] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 104-105.
[287] Ibid.
[288] Nordberg (2022) p.165; Brax (2019/01) p. 157-158.
[289] Ibid.

6.4 Trade secrets as protection for AI generated inventions

Trade secret law aims to regulate unfair competitive conduct.[290] Trade secrets prohibit the "unlawful acquisition, use and disclosure of trade secrets".[291] According to Article 2 of the EU directive on trade secrets, something is a trade secret if:

"(a) it is secret in the sense that it is not, as a body or in the precise configuration and assembly of its components, generally known among or readily accessible to persons within the circles that normally deal with the kind of information in question;

(b) it has commercial value because it is secret;

(c) it has been subject to reasonable steps under the circumstances, by the person lawfully in control of the information, to keep it secret."[292]

The information that can be classified as trade secrets is broad. Trade secrets are considered effective in protecting technological information[293]. The reason why is because it is not possible to independently discover or reverse engineer the information. It is also difficult to share the information without significant effort. AI technology is therefore suitable for trade secret protection. The algorithm and code of the AI, which is considered sensitive information, can be stored in the cloud while the AI's service or product can

[290] Lee, Nari (2021), 'Hedging into Property? – Invisible Trade Secrets and International Trade in Goods', in: Griffiths, Jonathan & Mylly, Tuomas, *Global Intellectual Property Protection and New Constitutionalism: Hedging Exclusive Rights,* Oxford Academic, p. 108.

[291] Art. 1 Directive 2016/943 of the European Parliament and of the Council of 8 June 2016 on the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition, use and disclosure.

[292] Art. 2 Directive 2016/943.

[293] Zekos, Georgios I. (2021), *Economics and Law of Artificial Intelligence*, 1st ed., Springer International Publishing, Cham, p. 477.

still be provided to customers. Often trade secrets and patents are used together. A patent can protect the core invention. The more detailed information can still be protected by trade secrets.[294]

Westman highlights that there is a potential risk that owners of AI will become reluctant to distribute their AI's innovation and rather protect them using trade secrets.[295] Some benefits of protecting AI generated inventions using trade secrets is that they are automatically protected without time restrictions. However, the owner is not able to use or exploit the invention exclusively. If the information becomes generally known or accessible it will no longer be protected by trade secrets. Another challenge is that it might be difficult to keep the information secret as it might not always be clear or straightforward which information falls under trade secrets.[296]

6.5 Lessons to be learned from copyright

There is a parallel that can be drawn from copyright law when discussing future solutions for patent law. In EU copyright law there exists limited exclusive rights for works with significant investment. This type of protection is referred to as related rights.[297] As mentioned in the delimitations, this will be reflected on briefly due to space and time, it is however something I think is worth researching further.

AI advancement, like in patent law, is also challenging the limits of copyright law. This is because work protected by copyright presupposes human authorship.[298] It is important to note that copyright law and patent law protect different intellectual property and are not to be seen as the same. Therefore, there are limitations to the comparison that can be conducted. However, the

[294] Kempas (2020) p. 58.
[295] Westman (2019) p. 150.
[296] Kempas (2020) p. 58.
[297] Zamel (2021/4) p. 491 & European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 89.
[298] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 84.

two separate fields of IP share similar premises.[299] For example, both legislations aim to incentivize creation and innovation through limited economic reward. In some jurisdictions doctrines have been borrowed from one another as analogies, and the different protections have been described as non-identical twins.[300]

The InfoSoc directive[301] is a directive on copyright that harmonizes copyright within all EU Member States.[302] According to the InfoSoc directive the aim of copyright is to "foster substantial investment in creativity and innovation".[303]

According to case law, a work within the meaning of copyright is defined as works "that are original in the sense that they are the authors own intellectual creation."[304] Copyright therefore presupposes that an author is a natural person.[305] If there is no author, works might still be protected under the copyright regime through related rights. Either natural or legal entities can be granted these rights. Related rights do not require the work to have an author or be original to be granted protection. There are six harmonized related rights in the EU; performing artists, phonogram producers, broadcasting organizations, press publishers and film producers.[306] Member States enjoy certain discretion and can prescribe further related rights. For example, the UK and Ireland provide protection for computer programs that do not have natural persons as authors. In this case the national law provides certain protection for the work. The rights are given to the individual who made the necessary arrangements for the work to be created. Many have flagged that

[299] Matulionyte, Rita & Lee, Jyh-An (2022), 'Copyright in AI generated works: Lessons from recent developments in patent law.' *Scripted*, vol. 19.1, p. 23.

[300] Matulionyte & Lee (2022) p. 23.

[301] Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society, further InfoSoc directive.

[302] Recital 3, 4 InfoSoc directive.

[303] Recital 4 InfoSoc-directive.

[304] Case C-05/08 Infopaq International v Danske Dagblades Forening (2009) ECLI:EU:C:2009:465 (Infopaq).

[305] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. p. 68-69.

[306] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 88.

this does not follow the rules set out by EU copyright law, however, this argument is negated as it is considered a related right.[307]

Related rights do not grant the same level of protection as copyright. The purpose of related rights is to reward entrepreneurship, and economic investment, whereas copyright rewards originality.[308] Copyright grants the author economic and moral rights. Economic rights mean the sole right to use the work for financial gain and the moral right refers to the right to be recognized as the author and not have the work used in a way that can be seen as offensive to the author.[309] A work that falls under copyright is granted protection from its initial creation until 70 years after the authors death.[310]

Related rights are granted to works that despite lacking originality and authorship contribute to society with creativity, technical or organizational skill.[311] There is no other threshold requisite for something to fall under the protection of related rights. This could therefore allow AI to create videos or films, and these would be granted protection under related rights for rights of film producers.[312] Related rights grant works protection for 70 years from their publication or communication to the public.[313]

There is another type of right referred to as *sui generis*.[314] The beneficiary of this right is the person or company that initiates and takes the risk of investment in creating a database. Unlike related rights, *sui generis* has a

[307] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 88.
[308] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 89.
[309] WIPO, 'Understanding Copyright and Related Rights', 2016, <https://www.wipo.int/edocs/pubdocs/en/wipo_pub_909_2016.pdf> (visited 2022-11-28), p. 9.
[310] Publications Office of the European Union, 'Copyright and related rights: term of protection', 2019, <https://eur-lex.europa.eu/EN/legal-content/summary/copyright-and-related-rights-term-of-protection.html> (visited 2022-11-28).
[311] Ibid.
[312] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 91-93.
[313] Publications Office of the European Union, 'Copyright and related rights: term of protection', 2019, <https://eur-lex.europa.eu/EN/legal-content/summary/copyright-and-related-rights-term-of-protection.html> (visited 2022-11-28).
[314] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 92-93.

threshold requirement. This right requires 'substantial investment'. Substantial investment refers to both qualitative, such as enlisting expertise, and quantitative investment, such as time, effort, energy, and financial resources. Quantitative investment could very well refer to investment into the AI that will be used to build a database. According to case law, the significant investment refers to obtaining contents such as materials to compile a database. This right grant protection for 15 years after the creation of the database.[315]

It can be inferred that related rights and *sui generis* act as a weaker type of copyright protection where investment still deserves rewarding in exchange for sharing it with the public. This resonates with the justifications for patent law.

It is believed to be preferable that AI created works are shared with society to promote creation and the spreading of knowledge than for such works to be privatized because they receive no protection.[316] In Ramalho's opinion, AI works should be protected through an adapted 'disseminator right'. This right is extended to publishers of previously unpublished books who's copyright has expired. The publishers receive protection for the economic rights of the author for a limited period of 25 years. This solution for AI creations would be suitable according to Ramalho as there is a distinction between creation and dissemination. As AI has no incentive to create, this would not reward AI creations with a protection reserved for creative efforts.[317] Senftleben and Buijtelaar argue that even if the AI cannot be incentivized to generate creative work, the person who invests time, effort and energy into training the AI can be motivated to share these works with society in return for protection.[318] Copyright offers a strong protection that does not necessarily fit AI generated

[315] European Commission, 'Trends and developments', 2020, <https://data.europa.eu/doi/10.2759/683128> (visited 2022-09-10), p. 92-93.

[316] Ramalho, Anna (2017) 'Will Robots Rule the (Artistic) World?: A Proposed Model for the Legal Status of Creations by Artificial Intelligence Systems.' *Journal of Internet Law*, 21(1), p. 21.

[317] Ramalho (2017) p. 22.

[318] Senftleben, Martin & Buijtelaar, Laurens (2020) 'Robot Creativity: An Incentive-Based Neighbouring Rights Approach', *European Intellectual Property Review*, 42(12), p. 811.

works, therefore they are in favor of creating a new related right for such works. With a new related right law makers can tailor these rights. The protection would be limited to give owners enough time to recoup their investment.[319]

6.6 What are other solutions that would protect AI generated inventions?

Currently AI generated inventions are not patentable, as is shown by the multiple rulings on the DABUS case. One view is that it is not necessary to adopt any changes in legislation since it is still possible to look for the human inventor in an AI generated invention. However, as Björkwall explains patent law does not exist in a vacuum. It protects a field of law that is rapidly evolving. This is showcased by that fact that many experts argue that AI will be responsible for a fourth industrial revolution. It is therefore important to understand the effects of patent law in the specific context of AI inventions, and to analyze whether the effect falls in line with the objectives of patent law. The reality is that the courts adopting this narrow view of the inventor and invention, which has been discussed in chapter 5, will cause AI generated inventions to fall into the public domain if they are disclosed or shared. This means that they will be freely exploited, leaving the entities who have made investments into the AI and AI generated inventions without protection and a chance to recuperate their investments. In turn this will discourage investment into AI for the purpose of creating autonomous AI, deviating from the justifications and objectives of the patent system.

As was mentioned in chapter 2.1, AI is currently very effective in solving problems and questions in the pharmaceutical sector. What is important to note is that, as mentioned in chapter 3.4, patents are used as an efficient tool to protect investments especially in the pharmaceutical industry. As the purpose of patent law is to promote the sharing of knowledge and invention with society to facilitate progress, promoting investment into inventions, and

[319] Senftleben & Buijtelaar (2020) p. 811.

promoting innovation, the risk of decreased investments into a field that heavily relies on patents for protecting investments signals a need for change in patent law. This demonstrates that the practical effect of the current view of AI generated inventions in patent law does not fall in line with the objectives of patent law. It also demonstrates that the current state of patent law runs the risk of hindering the creation and distribution of powerful technology, which like Westman conveys, deviates from the purpose of patent law. Therefore, in my opinion, an unclear legal situation will cause legal uncertainty within investors, which can hamper innovation and development which deviates from the justifications of the patent system.

It can be argued that a change in patent legislation to accommodate AI inventions is not needed as they can be protected by trade secrets. I however consider trade secret protection to be an ineffective solution to protect AI generated inventions within the context of the objectives of patent law. As is presented above, AI and by extension AI generated inventions are well suited to fall under trade secrets. For an AI invention to be protected by trade secrets, the invention cannot be disclosed to the public, which defeats main purpose of patent law; to promote the sharing of knowledge and invention with society to facilitate progress. As this currently is the only way to protect AI inventions from falling to the public domain, like Westman argues, there is a risk that such inventions will be withheld from society. As the premise of patent law is that innovation fuels further innovation, this would be a result that would be considered a societal loss from a utilitarian, informational and economic theory. It is also worth mentioning, since trade secrets does not allow for the owner of the invention to market the invention exclusively, the returns on the investment may be significantly lower than if they were to market the invention under a patent. This could further create a situation that deviates from the purpose of patent law, to promote investment into invention.

One solution mentioned in doctrine is to grant the owner of the AI rights to the patent of an AI invention. This view implies the derivation of rights from the AI to the AI owner. As has been discussed in chapter 3.2.2 there are fundamental differences between these rights. The main one being that

property rights exist to decrease negative externalities and prevent shortages. With intellectual property, the knowledge that comes with an IP asset has positive externalities, therefore the analogy of an owner of an apple tree owning the apples from that tree cannot simply and without consideration be applied to the example of AI generated inventions.

As has been concluded from chapter 5, the scope of legal personality and legal capacity can be stretched to accurately depict the state of society. Therefore, granting AI legal status to have legal capacity to be recognized as an inventor on the patent application could be a solution. This prevents AI generated inventions from falling to the public domain and would fulfill the objectives of patent law. It would also support the purpose of accurately portraying the state of technology within patent law as it would make clear which inventions have been created by AI and which have been created by natural persons. It would on the one hand protect the value of human inventorship to a certain extent as it would enable a distinction between human invention and AI invention. On the other hand, it cannot be ignored that the requirement to designate the inventor serves to protect human inventors' rights to attribution and fair compensation. If an AI can be acknowledged on the same level as a human inventor this could dilute the inventors right to attribution and disincentivize human invention.

Adde brings up the issue of who owns the rights to apply for the patent in this case. I believe that this is an issue that national law and regular contract law will sufficiently be able to handle, which is supported by the statement presented by the European Commission.[320] Another pitfall is that all inventions are not equal. Effectively, by granting AI legal capacity to be named an inventor on a patent application this invention will be granted the same level of protection as an invention made by a human. The risk that arises is well exemplified by Cubert and Bone who argue that strong AI will in the

[320] However, as mentioned in chapter 6.2 there exists fear of a patent thicket for AI arising. This could mean that future inventive AI will be licensed to other companies. This could complicate the question of ownership of the AI generated inventions when the invention is created under the supervision of a company that licensed the AI. This falls outside of the scope of this thesis, but it is a relevant point for investigation for future legislation.

future likely be able to invent on demand. The investments into these inventions will not equate to the investment that goes into a man-made invention. The result would be a watering down of the value of patent protection in relation to human invention. This supports the argument that patent law is not one size fits all, as is presented by Brax. Connecting this with what Westman argues, that it is important to compare the practical effects of patent law with the objectives of patent law, it becomes clear that solutions such as enabling AI to be named the inventor or granting the AI owner the rights of inventorship does not protect all the interests that patent law aims to protect. If significant investment is rewarded on the same level as little to no investment, this can disincentivize the creation of projects and inventions that require large investments.

A solution of creating a new patent regime specifically tailored to the inventions who have no human inventors, as is presented by both Brax and Nordberg, would be able to meet risks that arise with granting AI legal capacity to be named an inventor. For example, since not all inventions are valued equally this can be handled by limiting the time that the patent owner has exclusive economic rights. This solution would allow legislators certain flexibility to meet issues such as the risk presented by Engel, that companies being able to patent AI inventions who already hold patents on fundamental AI will be able to strengthen their dominance in the market. This raises the question of whether the non-obviousness requirement might need changing in relation to AI generated inventions. Though this falls outside of the scope of this essay, I would like to point out that a new patent regime could include a new definition of non-obviousness for AI inventions and I would suggest further research on this. A new patent regime would face the challenge on how to evaluate when enough investment has been poured into an AI generated invention to prevent that inventions made with little to no effort are granted protection.

When creating this new patent regime there are some lessons that can be learned from AI works in the context of copyright. Both regimes aim to protect the investment in creativity and innovation and sharing the results

with society. The copyright regime already recognized the value in protecting works that do not have human authors through related rights and the *sui generis* right. Therefore, a natural solution as is argued by Ramalho and Senftleben and Buijtelaar is to create either a disseminator right or a specific related right for AI generated works. This will protect the investments made into these works and encourage sharing them with the public, while allowing for a distinction to be made within the type and significance of investment. I consider a new patent regime specific for inventions with no human inventor to be the optimal solution, like a related right for AI works in copyright. Both solutions offer flexibility to achieve the purpose of each regime, while at the same time protecting interests such as human creativity and invention.

7 Conclusion

AI is advancing at an unprecedented rate and is becoming more effective in solving problems. All inventions that meet the requirements of novelty, inventive step, and industrial application should be eligible for patents no matter the field of technology they fall into, according to the TRIPS Agreement. However, recent judgements demonstrate that AI generated inventions are currently excluded from gaining patent protection due to an issue of legal personality.

Patent law does not exist in a vacuum. Rather it regulates a field that is ever evolving by definition, as patents only protect new inventions. Patent law is currently facing a challenge that was not evaluated when the current European patent regime was drafted. It is relevant to understand why we have patent law in the first place. This enables us to ensure that the effects of handling AI inventions in the context of patent law aligns with patent law justifications and objectives. The justification for patent law is that it serves a societal purpose to facilitate the progress of society through the promotion and sharing of innovation and knowledge.

Economic theory also explains that patents are needed to promote investment into innovation as it allows a period of economic exclusivity for the investors to secure return on their investments. In the context of AI generated inventions these rationales highlight the importance of extending certain patent protection to such inventions. AI generated inventions are a result of technological advancement. Devoid of protection for invention owners and investors, the result will be that the AI generated inventions will be kept private which goes against the justifications of patent law. Further the incentives to invest into such inventions will decrease and hamper innovation. Seeing as these are all effects that patent law aims to remedy, the objectives and justifications of patent law show that AI generated inventions should be extended some type of patent protection.

When discussing relevant solutions for allowing patent protection to AI generated inventions it is relevant to analyze the purpose of the requirement

to designate the inventor. This requirement is a formal requirement but has been interpreted and applied in a way that prevents AI generated inventions from receiving patent protection. This requirement needs to be interpreted in the context of the type of inventorship we have today. It is no longer accurate to view an inventor as a sole individual. Today inventors usually form a part of a team under a company, and it is the company that owns the rights to the patent. We are further moving away from this view with AI inventorship. In my opinion the requirement to designate the inventor should not be interpreted in a way that only allows patent protection for inventions made by natural persons. The requirement to designate the inventor serves to protect the human inventors right to attribution for their part in creating the invention. It also protects their right to fair compensation. This right should be safeguarded in any attempt to extend patent protection for AI generated inventions.

The existing case law on the subject holds that AI cannot be designated the inventor on a patent application because it lacks legal personality to hold the rights associated with being designated the inventor. The case law shows a narrow interpretation of legal personality. History shows us that the scope of legal personality can be extended and amended depending on circumstances such as culture, economy, and politics. The interpretation of inventor under patent law does not accurately portray the state of inventorship today as it is no longer guaranteed that a natural person is the creator of a patentable invention. Examples such as non-natural entities being granted legal personhood or legal capacity demonstrates that it is possible for legal status and legal capacity to be extended for AI to be named the inventor on a patent application. This would allow patent protection for AI generated inventions. However, this could not be conducted without risking the integrity of the right of human inventors to be acknowledged as the inventor. Granting an AI the ability to hold the same status as a human inventor could dilute the human inventor's right to attribution. Therefore, there are more suitable solutions.

Currently AI generated inventions are not able to receive protection under patent law. Even if some scholars claim that it is still possible to look for the

human inventor behind an AI generated invention, this is not a viable solution in the long term. This also causes risks that do not align with the objectives and justifications for the patent system. This includes patent applicants falsely naming a human inventor on a patent application which would provide a skewed picture of the state of technology. The effect could also be decreased investment into AI innovation which also deviates from the objectives of patent law. Another risk is that such inventions are privatized and protected through trade secrets. This would deviate from the purpose of patent law to promote the sharing of innovation with society. Trade secrets can therefore not be considered a viable solution for protecting AI generated inventions.

The most viable solution would be to establish a new patent regime tailored for AI generated inventions. Since not all inventions are made with equal investment, a new patent regime could accommodate for AI generating inventions with less investment than human made inventions. This could be considered with a shorter limited protection period. This solution would also protect the human inventor's right to be named an inventor as a distinction would be able to be made between the patents granted for human inventorship and AI inventorship. Drawing parallels from copyright law, even though the comparison is limited because they are two separate regimes, it can be established that there is value in protecting works that contain significant investment but have no human author. A new patent regime would have to define what significant investment means in terms of AI generated works that should be granted certain patent protection. Similar to the discussion in copyright law, the new patent regime should still protect human invention which is why I argue that a separate patent regime for AI generated inventions is the most viable solution.

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