RIGA GRADUATE SCHOOL OF LAW

MASTER THESIS

Patent Rights in AI-Generated Data

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DECLARATION OF HONOUR:
I declare that this thesis is my own work, and that all references to, or quotations from, the work of others are fully and correctly cited.

(Signed) …….

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Abstract

As artificial intelligence technologies continue to develop rapidly, it becomes increasingly important to understand technical and legal nature of it and of data generated by it in order to be able to resolve the multifaceted legal dilemmas surrounding artificial intelligence's role in generating novel ideas and approaches to solving existing problems, collaboration with humans as well as creation of intellectual property.

This thesis explores the legal treatment of artificial intelligence as a new legal institution and a potential subject to patent rights, as well as the nature of data generated by it with a special focus on its convergence with main patent law doctrines.

The author explores the existing international legal framework regulating patents and examines how it applies to artificial intelligence agents and their generated data in the current realities. The author analyses whether the existing law and its interpretation has become obsolete as a result of its inability to foresee the rise of artificial intelligence and whether it should be adjusted. Or rather it is a universal design, underlying the well thought through philosophy that intellectual property rights can only exist are justified and deserve protection where humans take an active role in their creation.

Keywords: intellectual property, patents, invention, inventor, inventorship, artificial intelligence, legal capacity, personhood.

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Summary

The goal of this thesis is to explore the current legal structure that governs patents and scrutinise how artificial intelligence agents may be positioned under the current legal framework and how and whether data produced by artificial intelligence agents may have any relevance in today's context.

This thesis further attempts to discern if the present human-centric interpretation of the inventorship is a shortcoming due to the unforeseen advent of artificial intelligence, or if it's a deliberate construct based on the belief that intellectual property can only be recognised and warrant protection when there is human involvement in its inception. This thesis discusses the issues arising in relation to the development, implementation and use of artificial intelligence technologies in so far as they relate to the protection of relevant intellectual property rights. This includes exploring the legal nature of artificial intelligence and data generated by it, consideration of the intellectual property rights that might arise in relation to the outputs given by the artificial intelligence systems.

In order to achieve the goal of this thesis, the author explores established international regulatory approaches and modern academic views in defining patentability, and, respectively, inventorship and status of outputs generated by artificial intelligence.

The author has elected to explore the legal frameworks of the European Union, the United Kingdom and the United States. These jurisdictions have been selected purportedly, because they are considered key players in the global patent landscape due to their substantial consumer markets, reputable dispute resolution mechanisms, solid legal structures with long history, and the extent of their innovative activities. These jurisdictions host a multitude of multinational corporations and research institutions that significantly contribute to worldwide innovation. The reach and impact of their patent systems is regarded as extensive, making them essential to observe and study. Another reason is that the patent protection legal structures in these jurisdictions are well-developed and thorough. They often act as reference points for other countries formulating their patent laws. As regards the United Kingdom, its departure from the European Union makes it crucial to keep track of developments in their national regulations. Generally, examining and monitoring the practices and doctrines of these jurisdictions can offer valuable insights into global patent trends, aid in understanding the subtleties of patent protection, and guide strategies for patent filing and litigation. Their practices and doctrines may also offer valuable insights into the future of patent protection and enforcement. Hence, these jurisdictions are the primary focus of this thesis.

The author also discusses the implications and recommendations for the future change management policy, as well as the directions and challenges for further research.

The research presented in this thesis may be beneficial for the general understanding of the existing legal framework and potential future policy trends in respect of the options for securing patent rights over the outputs generated by artificial intelligence.

In the first chapter the author undertakes a comprehensive analysis of the most recent research that encapsulates the diverse perspectives of contemporary academic authors

regarding the technical and legal characterisation of existing artificial intelligence technologies, their capabilities and limitations to autonomously generate ideas, and the concept of its personhood / personality.

The second chapter is dedicated to the analysis of existing patent regulation in the aforesaid selected jurisdictions, and the case study involving issues of inventorship pertaining to data generated by artificial intelligence agents, as well as the contentious issues of patentability of inventions assisted / aided by artificial intelligence.

The third chapter is dedicated to exploration of the philosophical theories that underpin and justify patent rights. This involves a study of the principles and ideologies that form the basis for granting patent rights, thereby providing a theoretical framework for understanding the essence and purpose of patents. Afterwards, the author conducts the reconciliation of these philosophical theories with the existing legal frameworks. This entails a comparative analysis of the theoretical underpinnings and the practical application of patent laws. The aim is to assess the extent to which current laws align with the underlying philosophical theories and identify any discrepancies or areas for improvement. Conclusively, the author evaluates the risks associated with change management, specifically those risks that may arise in relation to demanded changes to the patent system. This involves highlighting potential risks, assessing their impact and suggesting strategies to mitigate them. The goal is to ensure that any changes to the patent system are implemented smoothly and effectively, minimising any negative consequences.

Within the context of this thesis, doctrinal methodology is selected by the author as the most appropriate, because the author's objective is to provide a comprehensive report on the current legal framework and pinpoint main findings and conclusions of the competent intellectual property authorities and courts in resolving issues of inventorship for artificial intelligence agents and patentability of the outputs generated by them. To a certain extent, the author also resorts to using comparative methods. As mentioned above one of the author's objectives is to provide a holistic understanding of the patent system, from its philosophical foundations to its practical policy management application, and the management of change within this system. Accordingly, the author also employs interdisciplinary study and assesses the implications and evaluates conformity of the existing and potential legal frameworks to other aspects of economy and public interest.

Introduction

Until recent times artificial intelligence ('AI') tools found its use in research laboratories and were restricted to special closed projects. Today they saturate our everyday existence.

But their emergence has triggered a cascade of legal complexities, especially regarding intellectual property rights.

At this point of a special interest is AI with independent data generation capabilities and with all its distinctive capabilities of learning, searching, analysing, generating and presenting information, and which represents synergy with traditional artificial intelligence, though complementing it with even more powerful capabilities.

Generative AI is a branch of AI that can create novel content, such as texts, images, music, programming codes, and even technological solutions, based on a given input or prompt. It encompasses a spectrum of technologies, including large language models like GPT-4 (*note*: 'Generative Pretrained Transformer', developed by AI research and deployment company 'OpenAI, LLC'[1]), or generators of multimedia content like Stable Diffusion (*note*: AI technology developed by an open source generative AI company 'Stability AI LTD'[2]), and has many more potential applications and benefits, such as enhancing creativity, improving productivity and generating new knowledge.

However, increase in utilisation of generative AI across various domains gives rise to many complex legal issues. While AI-generated data can be innovative and valuable, it also challenges traditional legal doctrines, and, in particular, the notion of inventorship.

Generative AI churns out output data at an unprecedented pace, blurring the lines between human and machine creation.

A few years ago, the question of who would be named as inventor for AI-aided / assisted inventions came up to date - the developer who trained the AI, the user who initiated the process, or potentially the AI itself and whether such inventions should be protected by patents. Despite numerous court litigations and a variety of extensive decisions rendered across different jurisdictions among legal scholars, policymakers and practitioners, the question of inventorship in the context of AI-generated inventions still remains a debatable issue. There is no commonly accepted understanding on who should be considered the inventor when an AI machine independently creates devices. While some countries have definitively rejected claims for AI inventorship, appeals are still pending in others. The discourse on AI inventorship is far from over, and further deliberations are necessary to arrive at a universally accepted solution.

At the heart of this debate lies the fundamental assumption embedded in traditional patent regimes that inventors are human beings.

These legal frameworks, established centuries ago, were designed without foresight into the transformative capabilities of AI systems.

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[1] OpenAI, available on: https://openai.com/gpt-4 . Accessed May 10, 2024.
[2] Stability AI LTD, available on: https://stability.ai/ . Accessed May 10, 2024.

Existing legal doctrines presume human intellect and conceptions formed in human mind as necessary components for inventions, despite the fact that AI systems, powered by machine learning algorithms and neural networks, now are capable of producing an array of new, unique and distinct outputs.

The general principles for patent rights are set forth in the following four main international instruments - (i) the 1883 Paris Convention for the Protection of Industrial Property ('the Paris Convention')[3], (ii) the European Patent Convention of 1973 ('EPC')[4], (iii) the Patent Cooperation Treaty of 1970 ('the PCT')[5] and (iv) Agreement on Trade-Related Aspects of Intellectual Property Rights of 1994 ('TRIPS Agreement')[6].

Inevitably the Paris Convention of 1883 could not anticipate AI-generated inventions. The EPC explicitly mandates that inventors must be natural persons (*note*: the definition and notion will be discussed later under Chapter 2). The PCT in respect of identification of an inventor makes references to the national laws of the designated states[7].

TRIPS Agreement, finalised in 1994, which establishes minimum standards for the regulation by national governments of different forms of intellectual property as applied to nationals of other World Trade Organisation's member nations, also does not contemplate AI-made inventions.

Nevertheless, AI systems, devoid of legal capacity, consciousness or intentionality, at least at present, but they are capable of independently generating new and unique creativities. Today, AI innovations span diverse domains, including drug discovery, materials science, aerospace engineering, art, music, poetry. Reportedly, their outputs may exhibit originality, novelty and practical utility.

Competent authorities, including patent offices and courts worldwide, now grapple with the question of AI inventors as they start receiving applications for patenting inventions, where AI agents take significant roles and sometimes applicants insist on identifying their AI agents as sole inventors.

At the same time, the legal nature of AI agents is not well-defined or consistent across different jurisdictions. There are no clear visions and mutual consensus on the question of who should be recognised as the owner of the intellectual property rights of the content created by AI agents and whether such content is eligible for protection as intellectual property at all. Some experts urge these uncertainties and inconsistencies as legal risks and barriers for the development and use of AI technologies, as well as potential conflicts and

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[3] World Intellectual Property Organization. Paris Convention for the Protection of Industrial Property. Available on: https://www.wipo.int/treaties/en/ip/paris/#:~:text=The%20Paris%20Convention%2C%20adopted%20in,the%20repression%20of%20unfair%20competition . Accessed May 10, 2024.

[4] European Patent Office. Convention of the grant of European patents. Available on: https://www.epo.org/en/legal/epc . Accessed May 10, 2024.

[5] World Intellectual Property Organization. Patent Cooperation Treaty. Available on: https://www.wipo.int/export/sites/www/pct/en/docs/texts/pct.pdf . Accessed May 10, 2024.

[6] World Trade Organization. Annex 1C of the 1994 Marrakesh Agreement Establishing the World Trade Organization. Available on: https://www.wto.org/english/docs_e/legal_e/31bis_trips_01_e.htm . Accessed May 10, 2024.

[7] PCT, *supra* note 5, Art. 4, 22 and 27.

disputes among the various stakeholders involved, such as the creators, users and providers of AI tools and content.

Beyond legal considerations, there are philosophically ethical and economic implications to consider as well. Generative AI can perpetuate inaccuracies present in training data, leading to harmful outcomes. Ethical frameworks must address issues of transparency, accountability and the responsible development and use of AI technology to ensure that AI agents are not exploited to deflect accountability and obscure the role of those responsible in any potential harm, making it difficult to hold them accountable. Moreover, with the advent of AI technologies, the generation of new ideas and solutions has become a matter of moments. These technologies, capable of searching and analysing information at a pace far surpassing that of a human inventor, have begun to challenge traditional notions of human contribution in terms of time, effort and labour. If machines can efficiently and effectively produce the required solutions at minimum costs, it raises the question of why not utilise these capabilities to mass-produce, for example, necessary devices or medicines? Such an approach could potentially revolutionise markets by reducing costs of production and opening access to demanded products. However, this also brings up the concern of market competition. Should the standard become production driven by AI, it might result in the displacement of other 'human' scientists and market participants, potentially leading to monopolistic conditions and a decrease in market diversity. The potential effectiveness of AI is undeniable, but it's crucial to ponder over the larger consequences of its extensive application. The intricate challenge of weighing the advantages of AI against the necessity for equitable competition and variety in the market calls for meticulous consideration of the demanded changes and regulatory measures.

The legal nature of AI agents and their produced outputs is a complex and evolving area. As of now, AI technologies are generally considered as tools created by humans in support of humans' operations, and not as a person (even not an artificial person or entity), which raises questions of liability and inventorship.

Some experts argue that AI agents are capable of producing outputs absolutely autonomously and in these cases the output of such AI agents, for instance inventions, should be protected under existing intellectual property laws, but the AI agents be granted the status of inventors. However, this raises questions about accountability and responsibility, and about the originality of the output and whether it truly reflects human creativity and ideas conceived by the human mind. There is a strong regulatory imperative that AI technologies should be subject to product liability laws, similar to other manufactured products. If the AI produces harmful or defective outputs, the developers and deployers of the AI system should be held liable for any damages caused.

These perspectives emphasise that for the sake of public safety there is a need for the presence of a human-agent and accountability and safety measures in AI development and deployment. Depending on the context, AI-generated outputs could be treated as a form of intellectual property, subject to appropriate certifications traditionally required under the patent laws and product liability regulations, in case application of an AI agent produces harmful outputs.

Some experts, who advocate for AI, argue that the existing legal framework must be revisited to adequately address the complexities of generative AI and allow inventorship to AI agents. But, again, from the legal perspective, granting, for example, patent rights to AI inventors could revolutionise the intellectual property landscape and bring further legal and ethical uncertainties.

On the other hand, attributing AI-generated works solely to human inventors, from the perspective of incentivising the information technology industry, may overlook the significant role played by AI algorithms.

Apparently, a unified understanding of technical and legal nature of AI agents and a harmonised and balanced legal framework is essential. Otherwise, we risk a fragmented landscape where creators and users of AI technologies navigate divergent rules.

This research aims to provide a comprehensive understanding of the intersection between AI and patent law. The research has the following objectives.

Firstly, it is important to explore and define the technical and legal characterisation of existing AI technologies. For this purpose it is important to study the capabilities and limitations of AI in autonomous generating ideas and understand the current regulatory stance in respect of the concept of AI's personhood or personality.

Secondly, it is important to analyse existing international regulatory frameworks and case studies involving patentability of AI-assisted and / or AI-aided inventions in order to address contentious issues of inventorship pertaining to data generated by AI agents. Also it may help to understand the practical challenges and legal implications of AI in the patent system.

Thirdly, it is important to explore the philosophical theories that underpin and justify patent rights. For this purpose the principles and ideologies that form the basis for granting patent rights shall be explained, thereby establishing a theoretical framework for understanding the essence and purpose of patents. Further, the reconciliation of these philosophical theories with the existing legal framework, through a comparative analysis of the theoretical underpinnings and the practical application of patent laws, may help to assess the extent to which current laws align with the underlying philosophical theories, and to identify any discrepancies or areas for improvement.

In summary, this research seeks to bridge the gap between AI technology and patent law, examining the complexities of AI's role in patent systems and exploring the philosophical foundations of patent rights. The objective is to evaluate how well the new demand for AI inventorship corresponds with fundamental philosophical theories, and to pinpoint any inconsistencies or potential implications. In conclusion, the author scrutinises the hazards that could emerge due to unfounded requests for modifications in the patent system. This includes identifying possible risks, gauging their effects and proposing methods to lessen them. The ultimate aim is to guarantee that any alterations to the patent system are executed seamlessly and efficiently, reducing any adverse outcomes to the minimum.

Chapter 1: Decoding Artificial Intelligence

1.1. Historic overview

It is believed, that the first with the term 'artificial intelligence'[8] came up John McCarthy (at that time being an Assistant Professor of Mathematics at Dartmouth College), Marvin Minsky (Harvard Junior Fellow in Mathematics and Neurology), Nathaniel Rochester (Manager of Information Research at IBM Corporation) and Claude Shannon (Mathematician at Bell Telephone Laboratories) in August 1955, when they made their 'Proposal for the Dartmouth Summer Research Project on Artificial Intelligence'[9] for the Dartmouth Summer Research Project of 1956 (Dartmouth College in Hanover, New Hampshire, USA).

The Dartmouth Summer Research Project on Artificial Intelligence established the groundwork for modern AI research, attributed to the study of computers performing tasks that typically require human intelligence. The proposal was to engage an expert group of scientists to investigate the idea of building intelligent machines that could 'mimic' human intelligence and carry out cognitive tasks that are typically performed by humans.

The initial idea was mostly centred on AI systems that could be set up using computer code, based on the expertise of human professionals, and through the creation of complex decision-making paths could be used by those without expert knowledge to achieve a specific outcome.

A prime example of this is considered the 'Deep Blue'[10] AI system. It was designed to sift through a collection of potential chess moves, which were prepared by human chess grandmasters, and use the current position on the board to assess and decide its next move.

The main goal of the Dartmouth research project was to provide the foundation for a generation of machines in the future that would employ abstraction to 'mimic' human thought processes - comprehend written language, resolve logical puzzles, depict visual scenarios, and essentially 'mimic' every function of the human brain.

Over time, the phrase 'artificial intelligence' and researches around it have gained and lost popularity, with many interpretations of the notion[11].

But these days, due to recent achievements of highly specialised software-based AI systems[12] like virtual assistants, automatic news aggregation, image and speech recognition, translation software, automated financial trading, legal eDiscovery, self-driving cars and automated weapon systems, which have outperformed humans at tasks requiring

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[8] Dartmouth College, available on: https://home.dartmouth.edu/about/artificial-intelligence-ai-coined-dartmouth. Accessed May 10, 2024.

[9] John McCarthy, Marvin L. Minsky, Nathaniel Rochester and Claude E. Shannon, 'A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence, August 31, 1955', *AI Magazine* 27 (4):12, accessed May 10, 2024. https://doi.org/10.1609/aimag.v27i4.1904 .

[10] IBM Heritage, available on: https://www.ibm.com/history/deep-blue . Accessed May 10, 2024.

[11] Stanislas Chaillou, *Artificial Intelligence and Architecture: From Research to Practice* (Basel: Birkhauser, 2022), pp.20-22.

[12] Martin Ebers and Sussana Navas (eds.), *Algorithms and Law* (Cambridge: Cambridge University Press, 2020), p.41.

extraordinary human intelligence, the world has again begun to acknowledge AI as a real technology with practical applications[13].

1.2. General concept

AI refers to the broad field of computer science dedicated to creating systems that can perform tasks that typically require human intelligence.

Alan Turing's 'imitation game'[14], now more widely referred to as 'the Turing's test', established a benchmark for AI by comparing it with human intelligence. In order to establish whether a machine may be considered 'intelligent', the most straightforward method is to confront a human and a computer, and verify if a computer can convincingly mimic human responses under certain circumstances. Specifically, a human observer should be unable to repeatedly and accurately discern whether a response to a question was provided by a computer or another human. If the observer is unable to make this distinction, the computer is said to have 'passed' the Turing test and may be regarded as 'artificially intelligent'.

One may presume that AI is synonymous with robots, but this perception is far from accurate. In reality, robotics and AI are distinct fields, although they can intersect.

AI is a branch of computer science that focuses on training software[15],[16] to learn from its own experiences, recognise patterns, adapt to new information and accomplish tasks akin to human intelligence.

Robotics, on the other hand, pertains to the design and construction of programmable physical or industrial machines capable of performing various actions.

1.3. Types of technologies

AI technologies are commonly systematised into different categories and sub-categories[17].

Models that emulate human intelligence and replicate human behaviour fall under the category of 'cognitive models'. These models pertain to behavioural technologies.

Machine learning technologies pertain to systems that 'think' and 'act' rationally. Commonly, the following main concepts[18] are attributed to AI:

(1) machine learning, being an algorithm that enables a computer to learn from examples without explicit programming;

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[13] Chaillou, *supra* note 11, pp. 24-31.
[14] Alan Mathison Turing, 'Computing Machinery and Intelligence', *Mind: A quarterly Review of Psychology and Philosophy*' VOL.LIX, No. 236 (October, 1950): pp.433-460, available on: https://turingarchive.kings.cam.ac.uk/publications-lectures-and-talks-amtb/amt-b-19 . Accessed May 10, 2024.
[15] Marcos Wachowicz and Lukas Ruthes Goncalves, *Artificial Intelligence and creativity: New concepts in Intellectual Property* (Curitiba: Gedai, 2019), pp. 51-55.
[16] Tencent Research Institute (eds.), *Artificial Intelligence: A National Strategic Initiative* (Singapore*:* Palgrave Macmillan/Springer Nature Singapore Pte Ltd., 2021), pp.4-8,12-13.
[17] Rainer Berkemer and Markus Grottke, 'Learning Algorithms: What is Artificial Intelligence Really Capable of?', in *AI - Limits and Prospects of Artificial Intelligence,* ed. by Peter Klimczak and Christer Petersen (Bielefeld: transcript Verlag, 2023*)*, pp.10-17.
[18] Wachowicz and Goncalves, *supra* note 15.

(2) deep learning, being a subset of machine learning that utilises artificial neural networks for data processing;

(3) neural networks, being interconnected networks modelled after the human neuronal system.

Schematically, AI may be delineated in the following four layers[19]:

(1) the basic infrastructure layer, which forms the foundation and encompasses hardware and computational power, as well as large-scale data;

(2) the algorithm layer, which comprises a variety of machine learning and deep learning algorithms;

(3) the technical layer, which encompasses various technical facets, such as computer vision or language technologies equipped with an analytical functions, and also natural language processing technology, which offers understanding and assessment capabilities along with technologies that provide decision-making and interactive capacities for planning systems and for large-scale data or statistical analysis;

(4) and finally, the application layer, which consists of industry solutions, within different fields like finance, security, transportation, medicine, science and many more.

With regard to machine learning, as it is commonly discussed and known, it is important to understand that it employs algorithms[20] to enable AI agents to extract information from data in a manner akin to human cognition.

'Deep learning' is a subset of 'machine learning', based on artificial neural networks, which comprises several layers of neuron functions[21]. This kind of architecture was loosely inspired by the biological neural networks in animals' brains. The fundamental component of artificial neural networks is a function called a neuron, which mathematically models a biological neuron. This concept paves the way for different methods of arranging these neuron functions into interconnected networks capable of performing intricate tasks. A single neuron can receive numerous inputs, but it always produces just one output[22]. Neurons are organised into sophisticated, usually arranged in layers, with information typically flowing from the input layer to the output layer. At present, multiple layers are commonly used in neural networks because neurons within the same layer don't connect with each other, but they can interact with neurons in different layers. The layers in between, known as hidden layers, are a characteristic of modern neural networks, which are often employed in pattern

[19] Tencent Research Institute, *supra* note 16, pp.16-23.
[20] Josef Drexl, Reto Hilty, Francisco Beneke, Luc Desaunettes-Barbero, Michèle Finck, Jure Globocnik, Otero Begoña Gonzalez, Jörg Hoffmann, Leonard Hollander, Daria Kim, Heiko Richter, Stefan Scheuerer, Peter R. Slowinski, and Jannick Thonemann, 'Technical Aspects of Artificial Intelligence: An Understanding from an Intellectual Property Law Perspective', *Max Planck Institute for Innovation & Competition Research Paper No. 19-13* (2019): pp. 4-5, available on SSRN: https://ssrn.com/abstract=3465577. Accessed May 10, 2024.
[21] Leonid Berlyand and Pierre-Emmanuel Jabin, *Mathematics of Deep Learning: An Introduction* (Berlin / Boston: De Gruyter, 2023), pp.6-16.
[22] Berkemer and Grottke, *supra* note 17, p.11.

recognition and typically contain a large number of these hidden layers. These are also referred to as deep neural networks when they have a sufficiently high number of layers.

Generally, the objective of a neural network is to train artificial neurons to accurately differentiate an unknown dataset that adheres to the same underlying rules as the classification patterns used to train the neural network from a dataset that does not follow such classification patterns. For this purpose, a neural network composed of artificial neurons is trained using an initial dataset with labelled data that already has correctly assigned outputs. The outcome of this training can then be used to classify patterns that are still unknown.

Compared to other learning methodologies, deep learning utilises broader parameters and more complex models, thereby facilitating a more profound and intelligent comprehension of data. The entire procedure is dependent on the examination of data through various algorithms - a set of instructions that are followed step by step.

Deep learning commences with the original features and learns independently how to amalgamate them with higher-level features. The entire process is self-contained from end-to-end and directly ensures that the final result will be optimised. However, the intermediate layer is a 'black box'[23], so it is not possible to determine what features the computer has extracted or to explain precisely why it generated a concrete output based on a given input. Research is still being conducted in this area[24]. In addition to the black-box phenomenon, factual scarcity is also created by the implementation of technical safeguards like application programming interfaces.

A significant challenge in training is that the corresponding neural network can either be over-trained (known as over-fitting) or under-trained (known as under-fitting). An overtrained network becomes too specialised in individual cases, losing its ability to generalise. As a result, its ability to correctly classify an unknown pattern becomes questionable. On the other hand, an under-trained neural network tends to produce false positives. Ideally, a well-classified network not only separates data adequately, but also transcends mere rote learning[25].

The training of machine learning algorithms is commonly subdivided into supervised, unsupervised and semi-supervised learning[26].

In supervised learning environments algorithms deal with problems, where the classes of the object in the training set are known *a priori*. When a machine learning algorithm is being trained, it is possible to compare the algorithm's outputs with the known correct labels. If the output of the algorithm does not align with the correct label, the algorithm self-adjusts or 'learns' in hopes of generating more precise outputs in subsequent iterations. After the training phase concludes, the algorithm's parameters become set, enabling the algorithm to be applied to a broader scope.

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[23] Lou Blouin, 'AI's mysterious 'black box' problem, explained', *University of Michigan-Dearborn Faculty Experts Portal* (March 6, 2023). Available on: https://umdearborn.edu/news/ais-mysterious-black-box-problem-explained . Accessed May 10, 2024.
[24] Drexl et. al., *supra* note 20.
[25] Berkemer and Grottke, *supra* note 17, pp.12.
[26] Berlyand and Jabin, *supra* note 21, pp.19-24.

Contrary to supervised learning, in unsupervised learning environments algorithms learn from unlabelled training sets - the classes of the objects in the training set are not known *a priori*. Here it is not possible to compare the output of the algorithm with the known label.

In semi-supervised environments the exact classifiers are known only on some strict subset of data.

The primary human involvement in machine learning lies in[27] (i) selecting or creating a training algorithm, which can necessitate inventive thinking to formulate a new algorithm, (ii) adjusting the parameters, often being a process of trial and error and studies on application of parameters, (iii) labelling data and designing the model architecture. Even though models may seem 'intelligent', they produce results based solely on probability computations. Thus, the contemporary AI technologies are relatively self-sufficient and are capable of 'thinking' relatively independently, but require fine-tuning by experts in machine learning.

Furthermore, within the realm of AI science, the concept of an 'evolutionary algorithm'[28] is recognised.

An 'evolutionary algorithm' is a method of optimisation that seeks to find the optimal solution to a problem from a set of independently generated alternatives. These algorithms are based on the principles of Darwinian evolution, which has demonstrated to be a potent process of optimisation. Unlike artificial neural networks that require training data to find a solution, an evolutionary algorithm begins by randomly generating an initial population of potential solutions with varying attributes. The algorithm then assesses the quality or fitness of each solution in the population and chooses the most suitable ones. These selected solutions are then altered through processes such as reproduction, mutation and recombination, creating a new population that is evaluated again. This cycle continues until an optimal solution is discovered. While evolutionary algorithms can be utilised in machine learning to identify the best model, their applications extend beyond model creation, as they can be employed for other tasks.

1.4. Capabilities and limitations

Despite the differences described above, the contemporary AI technologies are limited to the following four common characteristics: (i) rules, (ii) learning, (iii) search, (iv) representation[29].

So far, even the most advanced AI applications, according to the analyses, still lag behind educated humans, even though they might appear to be on a par[30].

AI's remarkable performance is only possible because it operates within the specific context of datasets, adhering to the rules, which are human-defined. AI lacks volition - as

[27] Drexl et.al., *supra* note 20, pp.4-11.
[28] *Ibid.,* pp.11.
[29] European Commission. *A definition of Artificial Intelligence: main capabilities and scientific disciplines* (18 December 2018). Available on: https://digital-strategy.ec.europa.eu/en/library/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines . Accessed May 10, 2024.
[30] Berkemer and Grottke, *supra* note 17, pp.33-39.

long as the objective function is externally defined, the system will solely focus on excelling at specified tasks and will not independently establish connections to other tasks or strategically similar situations.

The end result of a machine learning model, in other words - output, is determined by its training objective. The precision of the result is contingent upon the model's quality, which in turn is influenced by the model's structure, the algorithm used for training, and the data utilised for training[31].

AI lacks understanding, a characteristic that defines AI learning algorithms despite the impressive results they produce:

> *'The existence of adversarial examples suggests that being able to explain the training data or even being able to correctly label the test data does not imply that our models truly understand the tasks we have asked them to perform. Instead, their linear responses are overly confident at points that do not occur in the data distribution, and these confident predictions are often highly incorrect. This work has shown we can partially correct for this problem by explicitly identifying problematic points and correcting the model at each of these points. However, one may also conclude that the model families we use are intrinsically flawed. Ease of optimization has come at the cost of models that are easily misled. This motivates the development of optimization procedures that are able to train models whose behavior is more locally stable'*[32].

This lack of understanding means that AI is not equipped to anticipate which of its own weaknesses might be exploited, making it susceptible to misuse or deception leading to incorrect decisions and questionable solutions.

It is also recognised that an AI's behaviour heavily depends on the dataset used for training the network. In the case of reinforcement learning, every interaction leaves its unpredictable impact on the AI, which in turn is governed by the AI's rules.

The learning algorithm will optimise what it's trained to optimise, but will overlook any varying circumstances that might accompany the elements it focuses on in its solution. Furthermore, it will disregard the potential consequences of that. It does not alter its optimization rules that guide the direction of learning within the human-defined game rules, it does not contradict or suggest that there might be a different perspective involved, and it does not emphasise the challenge of reconciling diverse perspectives. All these aspects remain the domain of humans and are unsurprisingly a crucial part of true 'intelligence' - personality and education.

Based on numerous assessments by field experts, the prevailing consensus is that the current landscape of AI predominantly comprises what is commonly referred to as 'narrow

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[31] Drexl et.al., *supra* note 20, pp.4-11.

[32] Ian J. Goodfellow, Jonathon Shlens and Christian Szegedy, 'Explaining and Harnessing Adversarial Examples' *CoRR abs/1412.6572* (2014): p.9 Available on: https://www.semanticscholar.org/reader/bee044c8e8903fb67523c1f8c105ab4718600cdb. Accessed May 10, 2024.

AI'[33], [34], [35], [36], [37]. That means that these systems are designed to perform specific tasks or a set of closely related tasks. They operate under predefined rules and cannot exhibit the same level of understanding or adaptability as a human.

Despite this, it would be unreasonable not to acknowledge that their capabilities within their domain are impressive. They can analyse large datasets more quickly and accurately than humans, identify patterns and trends, and make data-driven predictions or decisions. Inevitably, AI's capabilities should not be undervalued.

Nonetheless, it is important to be aware of the limitations and potential risks of AI, including that based on evolutionary algorithms, and to ensure that AI technologies are duly overseen and used responsibly and ethically, but their outputs double-checked.

1.5. Legal definitions and status

Pinning down a precise definition of AI can prove challenging. As demonstrated in the foregoing sections, this complexity arises because seemingly unrelated technologies often receive the AI label. Therefore, the exact interpretations of AI differ depending on the specific use case. The legal term for AI is not universally agreed either.

Furthermore, notwithstanding the ongoing heated debates about the need to assign personhood to AI, the EU, the UK and the USA unanimously resist adopting this concept for the time being.

(a) European Union

On March 13, 2024, the European Parliament adopted Regulation (EU) of the European Parliament and of the Council laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (the 'EU AI Act')[38].

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[33] Oliver Gassmann, Martin A. Bader and Mark James Thompson, *Patent Management: Protecting Intellectual Property and Innovation* (Cham: Springer Nature Switzerland AG, 2021), p.227.

[34] Cherie M. Poland, 'Generative AI and US Intellectual Property Law', *Cornell University Open Access Archive* (2023): p.5, available on: https://arxiv.org/pdf/2311.16023.pdf#:~:text=Work%20generated%20by%20AI%20systems,generated%20by%20an%20AI%20system , OCID profile: https://orcid.org/orcid-search/search?searchQuery=0000-0002-6345-649X. Accessed May 10, 2024.

[35] The Alan Turing Institute, *Common Regulatory Capacity for AI* (18 July 2022), pp. 15-18. Available o: https://doi.org/10.5281/zenodo.6838946 . Accessed May 10, 2024.

[36] Tencent Research Institute, *supra* note 16, pp.4-8.

[37] Steve J. Bickley and Benno Torgler, 'Cognitive architectures for artificial intelligence ethics', *AI & Soc* 38 (2023): pp.501-519. Accessed May 10, 2024. https://doi.org/10.1007/s00146-022-01452-9 .

[38] European Parliament legislative resolution of 13 March 2024 on the proposal for a regulation of the European Parliament and of the Council on laying down harmonised rules on Artificial Intelligence (Artificial Intelligence Act) and amending certain Union Legislative Acts, *COM(2021)0206 – C9-0146/2021 – 2021/0106(COD)*, 13 March 2024. Available on: https://www.europarl.europa.eu/RegData/seance_pleniere/textes_adoptes/definitif/2024/03-13/0138/P9_TA(2024)0138_EN.pdf . Accessed May 10, 2024.

The EU AI Act aims to establish harmonised rules for the use of AI within the European Economic Area. The objectives are:

(1) to ensure that AI systems placed on the EU market are safe and comply with existing laws related to fundamental rights and EU values;

(2) to secure legal certainty in order to encourage investment and innovation in AI technologies;

(3) to secure effective governance and enforcement of existing laws concerning fundamental rights and safety requirements for AI systems;

(4) to secure a unified single legal framework for AI applications for lawful, safe, and trustworthy development, distribution and operation of AI, thus preventing fragmentation.

The EU AI Act is named the ever first specialised law intended to govern AI[39],[40].

The EU AI Act delivers on the political commitment by President von der Leyen, who announced in her political guidelines[41] for 2019-2024 that the Commission would put forward legislation for a coordinated European approach, and what is important to note, on the human and ethical implications of AI.

The AI Act, has chosen to use the definition 'artificial intelligence system' (AI system)', as provided by the Organisation for Economic Co-operation and Development ('OECD')[42],[43] and has given it a meaning of:

> *'a machine-based system designed to operate with varying levels of autonomy, that may exhibit adaptiveness after deployment and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments'*[44].

Accordingly, under *acquis communautaire* AI systems are primarily characterised as software-based or, in other words built upon software, tools, which through machine learning approaches (supervised, unsupervised, reinforcement learning), logic-based and

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[39] Tyler Markoff, 'The First of its Kind: the EU AI Act and What it Means for the Future of AI', *Fordham Journal of Corporate & Financial Law* (23 April 2024), available on: https://news.law.fordham.edu/jcfl/2024/04/23/the-first-of-its-kind-the-eu-ai-act-and-what-it-means-for-the-future-of-ai/ . Accessed May 10, 2024.

[40] Gretchen Scott, Omer Tene and Rachel Thurbon, 'The World's First AI Regulation Is Here', *Goodwin Procter LLP Law Firm* (USA), (14 March 2024), available on: https://www.goodwinlaw.com/en/insights/publications/2024/03/alerts-practices-aiml-series-1-the-worlds-first-ai-regulation-is-here . Accessed May 10, 2024.

[41] European Parliament. *Political Guidelines for the next European Commission 2019-2024* (19 July 2019). Available on: https://www.europarl.europa.eu/resources/library/media/20190716RES57231/20190716RES57231.pdf. Accessed May 10, 2024.

[42] Organisation for Economic Co-operation and Development. *Recommendation of the Council on Artificial Intelligence* (8 November 2023). Available on: https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449 . Accessed May 10, 2024.

[43] Stuart Russell, Karine Perset and Marko Grobelnik, 'Updates to the OECD's definition of an AI system explained', *Organisation for Economic Co-operation and Development AI policy Observatory* (29 November 2023), available on: https://oecd.ai/en/wonk/ai-system-definition-update . Accessed May 10, 2024.

[44] EU AI Act, *supra* note 38, Art. 3(1).

knowledge-based approaches (knowledge representation, symbolic reasoning, *etc*.) and statistical approaches, Bayesian estimation, search and optimization methods, are explicitly designed to generate outputs (text, images, video, audio, predictions, recommendations, or decisions, *etc*.).

The OECD term was originally developed in 2019[45]. But later in November 2023 it was amended to specifically encompass recent technological advancements, including generative AI[46].

The EU AI Act does not assign a distinct legal nature to AI. According to the concept of the EU AI Act, AI systems are primarily viewed as sophisticated tools or products. This means they generally should fall under existing product liability and safety frameworks[47],[48] - the liability for actions or harm caused by AI systems should rests primarily with human deployer[49], importers[50], distributors[51]. Mostly, the national laws of the EU member states do not cover legal personhood issues in relation to AI[52] either.

(b) United Kingdom

There is no single regulation on AI in the UK yet. However, the UK actively elaborates on guidelines and principles to promote responsible AI development and deployment.

Thus, on February 2, 2024 the House of Lords' Communications and Digital Committee has issued its report concerning large language models and generative AI[53]. Simultaneously, on February 6, 2024 the UK government published its response to the March 2023 White Paper, which outlines a pro-innovation strategy for regulating AI[54].

Overall, the UK policies do not provide any highly specific definition of AI. Instead, they adopt a broad understanding of AI as systems that demonstrate intelligent behaviours[55].

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[45] Organisation for Economic Co-operation and Development, 'Scoping the OECD AI principles: Deliberations of the expert group on Artificial Intelligence at the OECD (AIGO)*', OECD Digital Economy Papers* No. 291 (November 2019): p.20, accessed May 10, 2024. https://doi.org/10.1787/d62f618a-en .

[46] *Supra* note 43.

[47] European Commission. *Explanatory Memorandum to the proposal for the AI Act* COM(2021)206-2021/0106(COD), paras.1.3,2.1,3.4. Available on: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206 . Accessed May 10, 2024.

[48] European Commission. *Proposal for a Regulation of the European Parliament and of the Council laying down harmonised rules on Artificial Intelligence,* recitals 28,52,82. Available on: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206 . Accessed May 10, 2024.

[49] EU AI Act, *supra* note 38, Art.25,26,27,50.

[50] *Ibid*., Art.25,23.

[51] *Ibid*., Art.20,24,25.

[52] Rowena Rodrigues, Konrad Siemaszko and Zuzanna Warso, 'D4.3: Analysis of the legal and human rights requirements for AI and robotics in and outside the EU, version v2.0', *The SIENNA Project* Ref. Ares(2019)2271631-29/03/20 (29 March 2019): pp.5,19,77-80, accessed May 10, 2024. https://doi.org/10.5281/zenodo.4066812.

[53] UK Parliament. *Large language models and generative AI* (2 February 2024). Available on: https://publications.parliament.uk/pa/ld5804/ldselect/ldcomm/54/54.pdf . Accessed May 10, 2024.

[54] UK Government Services portal. *A pro-innovation approach to AI regulation: government response* (February 2024). Available on: https://www.gov.uk/government/consultations/ai-regulation-a-pro-innovation-approach-policy-proposals/outcome/a-pro-innovation-approach-to-ai-regulation-government-response . Accessed May 10, 2024.

[55] *Ibid*., para.3.

This likely encompasses machine learning, natural language processing, computer vision, and related fields.

At the same time, the UK acknowledges that the AI industry is developing very rapidly and it is challenging to define the term as such. Therefore, for a proportionate effective regulatory approach they currently distinguish between[56]:

(1) highly capable general-purpose AI, representing *'foundation models that can perform a wide variety of tasks and match or exceed the capabilities present in today's most advanced models. Generally, such models will span from novice through to expert capabilities with some even showing superhuman performance across a range of tasks'*;
(2) highly capable narrow AI, representing *'foundation models that can perform a narrow set of tasks, normally within a specific field such as biology, with capabilities that match or exceed those present in today's most advanced models, and being able to demonstrate superhuman abilities on these narrow tasks or domains*', and
(3) agentic AI or AI agents, representing *'an emerging subset of AI technologies that can competently complete tasks over long timeframes and with multiple steps'*.

And more importantly, that the UK introduce a term for a future prospects of 'Artificial General Intelligence (AGI)'[57], representing:

> *'a theoretical form of advanced AI that would have capabilities that compare to or exceed humans across most economically valuable work';*

and a term for another future level of super intelligence[58] as *'Superhuman performance: when an AI model demonstrates capabilities that exceed human ability benchmarking for a specific task or activity*.'

Nonetheless, the UK policy documents do not explicitly define AI as a distinct legal entity. Neither the documents assign a personality to AI systems[59]. It's likely that, for the time being, the UK authorities do not support the idea of equality of AI with humans or entities or an artificial person with independent rights or legal standing. AI systems would merely be considered tools, products, or even services depending on their application.

Similarly as the EU AI Act, the UK policy documents determined the AI liability contextually. The documents suggest splitting the responsibilities among:

(1) developers and programmers, those who design and create AI systems. They might bear liability if errors in the code or training data lead to harm;

(2) deployers and operators, those who use the AI system. They might hold responsibility for ensuring it's used appropriately and that risks are managed.

To this effect, existing product liability laws could apply in cases where AI systems cause harm due to defects.

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[56] *Ibid*.
[57] *Ibid.*
[58] *Ibid*.
[59] *Supra* note 52, p. 79.

Interestingly, but the UK also define the criteria for AI autonomy[60] as '*capable of operating, taking actions, or making decisions without the express intent or oversight of a human*.'

(c) United States of America

Like the UK, the US doesn't have a single unified AI law yet[61], but rather a combination of federal and state initiatives[62],[63].

At the federal level the first regulatory guidance on AI was issued back in 2019[64], encouraging agencies to adopt a risk-based approach when dealing with AI-related issues. Additionally, the National Initiative on Artificial Intelligence[65] was passed in 2021 with the aim to establish a framework for coordinating AI use across federal agencies without imposing specific obligations on AI usage more broadly.

Overall, the US legal framework governing AI is currently focused on interplay of the use of AI and product liability, data privacy, intellectual property, discrimination and workplace rights, and aims at preventing any harm to the US citizens and bias, and ensuring fairness, transparency and explainability, as well as truthful, fair and equitable use of AI[66].

The definitions stipulated by the US National Initiative on Artificial Intelligence highlight the multifaceted nature of AI and defines that AI means:

> *'a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments'.*

Additionally, of interest are two more definitions stated in the US National Initiative on Artificial Intelligence, that is:

(1) 'AI model', which means:

> *'a component of an information system that implements AI technology and uses computational, statistical, or machine-learning techniques to produce outputs from a given set of inputs';* and

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[60] *Supra* note 54.

[61] Louis Lehot, 'United States: Artificial Intelligence Comparative Guide', *Mondaq - Foley&Lardner LLP* (11 December 2023). Available on: https://www.mondaq.com/unitedstates/technology/1059776/artificial-intelligence-comparative-guide . Accessed May 10, 2024.

[62] US National Institute of Standards and Technology. *AI Risk Management Framework*. Available on: https://www.nist.gov/itl/ai-risk-management-framework . Accessed May 10, 2024.

[63] White House. *Blueprint for an AI Bill of Rights making automated systems work for the American People* (October 2022). Available on: https://www.whitehouse.gov/wp-content/uploads/2022/10/Blueprint-for-an-AI-Bill-of-Rights.pdf. Accessed May 10, 2024.

[64] United States of America. E.O. 13859 of Feb 11, 2019, 84 FR 3967, pp.3967-3972. Available on: https://www.federalregister.gov/documents/2019/02/14/2019-02544/maintaining-american-leadership-in-artificial-intelligence .Accessed May 10, 2024.

[65] United States of America. 15 U.S.C. § 9401-9462. Available on: https://www.law.cornell.edu/uscode/text/15/chapter-119. Accessed May 10, 2024.

[66] White House. *Fact Sheet: President Biden Issues Executive Order on Safe, Secure, and Trustworthy Artificial Intelligence* (30 October 2023). Available on: https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/30/fact-sheet-president-biden-issues-executive-order-on-safe-secure-and-trustworthy-artificial-intelligence/ . Accessed May 10, 2024.

(2) 'AI system', which means *'any data system, software, hardware, application, tool, or utility that operates in whole or in part using AI'.*

Currently, U.S. federal laws do not assign personhood to AI systems[67]. They do not recognise AI as an 'artificial person'[68], nor do they grant AI legal capacity or any personal or moral rights. AI is treated as a tool or technology rather than a legal entity with inherent rights or responsibilities. The legal framework primarily focuses on regulating AI's use, ensuring transparency and protecting consumers and privacy.

1.6. Recapitulation

By analysing the technical features of AI, and underpinning them by the adopted legal definitions, it becomes evident that AI lacks the attributes of personhood and legal capacity. It is conceptualised as a system rather than an autonomous entity (even not an artificial entity) or person. It is understood as a system - a complex set of interrelated elements working together to achieve specific objectives and differentiated by levels of its sophistication.

At its core, AI comprises a collection of algorithms, data, and computational processes. These technical features enable AI systems to analyse vast amounts of data, identify patterns and make predictions or decisions based on predefined rules. However, crucially, AI lacks consciousness, emotions and subjective experiences - hallmarks of personhood[69]. Unlike humans, AI does not possess the capacity for independent thought or moral / common sense reasoning[70]. AI does not possess consciousness, emotions or subjective experiences, which are fundamental aspects of personhood[71]. It operates based on predefined algorithms and does not have the ability to fully autonomously act or make decisions and, as such, bear legal responsibilities. It operates within the confines of its programming and executing tasks based on predetermined instructions.

Legal frameworks typically define entities with rights and responsibilities, such as individuals, corporations or government bodies. However, these definitions do not easily apply to AI due to its inherent nature as a non-human system[72]. While some jurisdictions have explored the possibility of granting legal personhood to AI entities, such approaches remain contentious and largely theoretical[73]. Instead, the prevailing understanding is that AI should be treated as a tool or instrument created and controlled by humans[74].

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[67] *Supra* note 52, p.80.
[68] US Cornell Law School, available on: https://www.law.cornell.edu/wex/artificial_person. Accessed May 10, 2024.
[69] Elisabeth Hildt, 'Artificial Intelligence: Does Consciousness Matter?', *Front. Psychol., Sec. Theoretical and Philosophical Psychology*, Volume 10 (02 July 2019), accessed May 10, 2024. https://doi.org/10.3389/fpsyg.2019.01535.
[70] European Commission. *A definition of Artificial Intelligence: main capabilities and scientific disciplines* (18 December 2018). Available on: https://digital-strategy.ec.europa.eu/en/library/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines . Accessed May 10, 2024.
[71] Hildt, *supra* note 69.
[72] S. M. Solaiman, 'Legal personality of robots, corporations, idols and chimpanzees: a quest for legitimacy', *Artificial Intelligence and Law (2017) 25 (2), 155-179,* available on: https://ro.uow.edu.au/cgi/viewcontent.cgi?article=4088&context=lhapapers . Accessed May 10, 2024.
[73] *Supra* note 52, pp.17-24,77-80,88.
[74] *Note*: In 2017 the European Parliament published a proposal to grant to the self learning robots an 'electronic personality' (*see* paragraph 59(f) of the Civil Law Rules on Robotics -

AI is fundamentally a machine-based system designed to achieve a set of objectives defined by a human, who implements AI technology and may use computational, statistical or machine-learning techniques to finally receive outputs from a given set of inputs.

Viewing AI as a system, rather than an entity or person, is a *sine qua non* for further change management policy. Existing AI technologies still may not be considered as able to act rationally with full awareness and autonomy. First and foremost, it underscores the primacy of human responsibility in the development, deployment and use of AI technology. Human actors, including 'AI couches', deployer and end-users should bear the ultimate responsibility for the actions and consequences of AI systems[75]. This necessitates robust governance frameworks that prioritise human supervision, transparency, accountability and ethical considerations.

https://www.europarl.europa.eu/doceo/document/A-8-2017-0005_EN.html?redirect . This status could enable each robot to have its own insurance and be held accountable for any harm or property damage they cause if they malfunction and start causing harm. The proposal was mainly demanded by the manufacturers of robots, who claimed that this would put the robots on *a par* with the legal entities / corporations. As they claimed it would help to impute independent responsibility and liability and make the robots *sub judice*. This initiatives was heavily criticised by the experts and legal researchers (*see* Open letter to the European Commission signed by political leaders and industry experts from the EU countries https://www.politico.eu/wp-content/uploads/2018/04/RoboticsOpenLetter.pdf) and later abandoned by the European Parliament. Both links accessed May 10, 2024.

[75] European Commission. *Ethics Guidelines for a Trustworth AI* (8 April 2019). Available on: https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai. Accessed May 10, 2024.

Chapter 2: Deciphering Patent Law Doctrines

While AI intersects with various aspects of intellectual property law, including:

(1) industrial property rights (which among others deal with patents, trademarks, industrial designs, trade secrets), and
(2) copyrights, which are also a very hot topic of discussions today in light of AI technological developments,

AI poses particular challenges to patent rights.

This claim may be justified by the unique challenges and opportunities that AI presents in the context of patent law.

Firstly, AI technologies are increasingly being used to invent new products and processes, raising questions about inventorship and patentability. Existing patent laws require a human inventor and inventive concept, traditionally attributed to the human mind. But AI systems are now capable of creating inventions independently. This raises fundamental questions about the notation of an 'inventor' and the allocation of patent rights.

Secondly, the strategic use of patents in the AI sector can influence the direction of AI development. Companies with large patent portfolios can shape the AI landscape, potentially stifering competition and innovation.

2.1. Legal concept of inventorship

A patent gives the right to prohibit the imitation or use of an invention by others for a limited period of time, and this in turn allows monopolistic prices when commercialising the innovation[76],[77].

In contrast to permissive rights, patent rights are exclusionary rights that, as aforesaid, prohibit the imitation of the protected invention by third parties[78] - a patent grants the right to prevent others from commercially producing, using, offering, storing, importing or selling an invention for a specific registered jurisdiction and for a limited period of time, as a rule for 20 years[79].

However, when registering a patent, the information pertaining to the innovation, including an inventor, claims and specifications in respect of an invention, must be disclosed. Typically, any technical invention that is[80]:

(1) novel / original - an invention may not be pre-existing in the public domain or be the subject of prior patents, and

(2) involving an inventive step - an invention may not be obvious or easily deductible using existing skills or technologies and may not be a solution that any skilled

[76] Lionel Bently, Brad Sherman, Dev Gangjee and Phillip Johnson, *Intellectual Property Law*, Sixth edition, (Oxford: Oxford University Press, 2022), pp.409-410.
[77] Gassmann and Bader, *supra* note 33, pp.4-8.
[78] *Ibid*., pp.14-16.
[79] TRIPS, *supra* note 6, Art.27,28,33.
[80] *Ibid*., Art.27.

practitioner in the field would immediately realise upon being tasked with a specific practical problem, and

(3) practical and with a defined function and commercial viability, and capable of immediate production to serve its intended purpose,

may be eligible for patent grants.

The standards for determining novelty and inventiveness are 'absolute' and have global applicability[81]. Accordingly, if an invention meets these three stipulated conditions, pursuant to the TRIPS Agreement[82], it can be granted patent protection in any of 164 World Trade Organization member countries[83].

Patents represent a formal agreement between inventors and the government. The government commits to creating legal structures that enable inventors to receive compensation when their ideas are utilised by others, for the duration of the patent's validity. In return, inventors permit the government to document their ideas in public records, making them accessible to those who are interested. Occasionally, patents are classified as industrial property, designed to protect technological innovations that can be applied in manufacturing or other business activities.

Generally, there are two distinct steps involved in becoming an inventor - (i) the conception, which involves detailing the idea, and (ii) the reduction to practice, a legal term for making the idea functional. By commonly adopted definitions, an inventor is someone who devised an invention.

Legal precedents have established that a person needs to have made a contribution to the idea of the invention; and also the inventor can utilise the expertise of others to refine and improve the invention[84]. Conversely, if an individual has carried out a substantial portion of the task, like building the entire prototype, but has not contributed to the original idea of the invention, he / she shall not be considered as attained the status of an inventor.

It's important to note that the person who owns a patent and the person who invented a device can be two different individuals. A patent possesses all the characteristics of personal or physical property, but as the proprietor of a property, one is not necessarily required to be its original creator. This very principle is also applicable to patents - the proprietor is not required to be the inventor to hold a patent[85], and, for example, may obtain the right to apply for a patent by way of assignment of this right to him / her by the inventor.

The accurate determination of patent inventorship carries significant legal weight[86]. The fundamental legal premise is that patent grants operate under the assumption that the listed inventors are indeed the sole creators. The criteria for someone to qualify as an inventor

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[81] Gassmann and Bader, *supra* note 33, p.15.
[82] *Supra* note 6.
[83] World Trade Organization. *Members and Observers*. Available on: https://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm . Accessed May 10, 2024.
[84] Matthew Y Ma, *Fundamentals of Patenting and Licensing for Scientists and Engineers*, Second edition (Singapore: World Scientific Publishing Co. Pte. Ltd., 2015), pp.35-37.
[85] *Ibid*., pp.42-46.
[86] *Ibid*.

extend beyond mere involvement; instead, it hinges on whether that individual has made a substantive contribution to at least one patent claim. At the same time the laws allow joint inventorship, and there are no legal restrictions on the maximum number of inventors, the order of their names, or the specific percentage of contribution required for someone to be considered an inventor[87]. Instead, the crucial factor is whether an individual has contributed to the conception of at least one claim, including any dependent claims, rather than the extent of their overall work. Identifying correct inventorship is rather important. An incorrect inventorship may adversely affect patentee capabilities in patent prosecution or any future patent applications[88].

(a) European Union

The European Patent Convention ('EPC'), having 39 contracting states as of 1 May 2024[89], does not provide the definition for the inventor. However, the Rules to the EPC and the applicable European Patent Office's ('EPO') guidelines explicitly ask for the identification of family name, given names and full address of the inventor[90],[91],[92],[93],[94],[95], which indicates that under the EPC the inventor is understood to be a natural person only.

In most EU Member States[96] an inventor is considered to be an individual whose creative act forms the basis of the invention - the one who has identified how a specific technical problem can be resolved using certain technical means. Accordingly, to be acknowledged as an inventor, a person must have made an independent, intellectual contribution. Thus, the person who comes up with the idea for a new device is considered the inventor, even though the idea may be far from a finished product and may require significant development to create the final product. Yet, some Member States consider an applicant to be the inventor, unless contested; provided that a group of individuals can also be 'the inventor'

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[87] *Ibid*.
[88] *Ibid*.
[89] European Patent Office. *Contracting States to the EPC*. Available on: https://www.epo.org/en/legal/guidelines-epc/2023/foreword_6.html . Accessed May 10, 2024.
[90] European Patent Office. *European Patent Convention,* rule 19(1) (Valid: June 2016 - November 2020). Available on: https://link.epo.org/web/EPC_16th_edition_2016_fr-4.pdf . Accessed May 10, 2024.
[91] *Ibid.*
[92] European Patent Office. *Guidelines for Examination in the European Patent Office,* A-III, 5.3 (Valid: November 2017-November 2018). Available on: https://link.epo.org/web/guidelines_for_examination_2017_en.pdf . Accessed May 10, 2024.
[93] European Patent Office. *Guidelines for Examination in the European Patent Office,* A-III, 5.3 (Valid: November 2018-November 2019). Available on: https://link.epo.org/web/guidelines_for_examination_2018_hyperlinked_en.pdf . Accessed May 10, 2024.
[94] European Patent Office. *Guidelines for Examination in the European Patent Office,* A-III, 5.3 (Valid: March 2022-March 2023). Available on: https://link.epo.org/web/epo_guidelines_for_examination_2022_hyperlinked_en.pdf . Accessed May 10, 2024.
[95] European Patent Office. *Guidelines for Examination in the European Patent Office,* A-III, 5.3 (Valid from: March 2024). Available on: https://link.epo.org/web/legal/guidelines-epc/en-epc-guidelines-2024-hyperlinked.pdf . Accessed May 10, 2024.
[96] Paul England, et al., *A practitioner's guide to European Patent Law: For National Practice and the Unified Patent Court,* Second edition (Oxford/New York: Hart Publishing/Bloomsbury Publishing Plc., 2022), pp.440-447.

when an invention is the result of several people working together based on an agreement, in such a case they are collectively entitled to the patent grant[97].

(b) United Kingdom

According to the UK Patents Act of 1977 ('the UK Patents Act'), the term 'inventor'[98] means the actual deviser(s) of the invention, and 'joint inventor' shall be construed accordingly. This definition of 'inventor' applies to all references in the UK Patents Act.

Despite the fact that the definition provided by the UK Patents Act does not specify whether a natural or any other subject may be regarded as the inventor, the UK Patent Rules explicitly refer to an 'inventor' as a natural person[99],[100].

Further, a two-step approach is implemented to determine inventorship - (i) first the inventive concept should be specified, and (ii) then the person, who devised that concept, should be identified[101].

This concept was established in *Henry Brothers (Magherafelt) Ltd. v The Ministry of Defence and the Northern Ireland Office [1997] RPC 693*, which held that[102]:

> *'where an invention consisted of a combination of elements, it was not right to divide up the claim and then seek to identify who had contributed which element. One must seek to identify who in substance had been responsible for the inventive concept, namely the combination: whose idea it had been which turned a useless collection of elements into something that would work'.*

In the case of joint inventorship, the question is therefore whether all parties are jointly responsible for devising the inventive concept.

The concept of an invention may extend beyond just an idea and may include the method of bringing that idea to life[103]. When the invention is a combination of elements that

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[97] *Ibid*.

[98] United Kingdom. Patents Act 1977, s.7(3). Available on: https://www.legislation.gov.uk/ukpga/1977/37/data.pdf . Accessed May 10, 2024.

[99] United Kingdom. Patents Rules 2007 and The Patents (Fees) Rules 2007, rule 11(1)-(2) and 44(1)(b). Available on: https://assets.publishing.service.gov.uk/media/5ff56de7d3bf7f65d3791bd5/consolidated-patents-rules-and-fees-rules-2007.pdf . Accessed May 10, 2024.

[100] United Kingdom Intellectual Property Office. *Formalities Manual on examination practice under the Patents Act 1977*, s.2.61 (Published: 31 March 2017). Available on: https://www.gov.uk/guidance/formalities-manual-online-version/chapter-2-request-for-grant-of-a-patent-form-1 . Accessed May 10, 2024.

[101] UK Intellectual Property Office. *Manual of Patent Practice under the Patents Act 1977*, s.7(3) (Published: 19 February 2016). Available on: https://www.gov.uk/guidance/manual-of-patent-practice-mopp/section-7-right-to-apply-for-and-obtain-a-patent . Accessed May 10, 2024.

[102] *Ibid*., para.7.12.2.

[103] United Kingdom Intellectual Property Office, Decision of Divisional Director acting for the Comptroller G.M.Bridges, *Birtles, Lovatt and Evode Ltd* v *Minnesota Mining and Manufacturing Company,* BL O/237/00 (2000): paras.56,60-64. Available on: https://www.ipo.gov.uk/p-challenge-decision-results/p-challenge-decision-results-bl?BL_Number=O/237/00 . Accessed May 10, 2024.

are individually known, the inventor is the person who essentially created the combination, not just someone who contributed to it[104].

In determining who came up with the inventive concept, it's crucial that a person is not considered an inventor simply because he / she contributed to a claim. The contribution must involve the formulation of the inventive concept.

(c) United States of America

According to section 100(f) of the US Patent Act[105], the term 'inventor' means the individual or, if a joint invention, the individuals collectively, who invented or discovered the subject matter of the invention. Moreover, the application for a patent may be made only by the inventor, or it must be authorised to be made by the inventor[106]. Hence, subject to compliance with all other applicable requirements, the patent itself may be granted to the applicant[107], which based on rules governing the procedure for submission of a patent application, may be only the inventor or its assignee.

According to the established legal doctrine[108], in the US, it is mandatory requirement that all the actual inventors be identified and listed on the patent application (*note*: honest failures permitted)[109],[110].

Under the provisions of the US Patent Act, any individual who 'invents' a subject matter that is eligible for a patent has the right to obtain one[111]. Consequently, US patent applications are required to name the 'true and only' inventors.

In the United States, the process of invention involves two steps[112] - (i) the conception of the idea or the subject matter that forms the basis of the patent claims, which could include multiple claims; and (ii) the actualization of the idea, or creating a functional model of the invention as claimed.

Accordingly, the process of determining the correct inventorship primarily focuses on the first step, the conception. This requires identifying each individual, who contributed to the conception of the idea or ideas that form the patent claims.

The term 'conception' is typically understood as the process where an inventor forms a clear and lasting mental image of a fully functional invention, ready to be implemented[113]. The terms 'clear and lasting' imply that the invention can be brought to life, or made into a

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[104] *Supra* note 101, para.7.12.2.
[105] United States of America. 35 U.S.C. §§ 1-390. Available on: https://www.law.cornell.edu/uscode/text/35 . Accessed May 10, 2024.
[106] *Ibid*., paras.111(a)(1)-(b)(1) of Part II of Title 35.
[107] *Ibid*., paras. 151(a), 152 of Part II of Title 35.
[108] United States Patent and Trademark Office. *Manual of Patent Examining Procedure*, s.602.08(b) (Valid from: July 2022). Available on: https://www.uspto.gov/web/offices/pac/mpep/index.html . Accessed May 10, 2024.
[109] Jerry Cohen, et.al., *Intellectual Property Practice*, Third edition (Boston: Massachusetts Continuing Legal Education Inc., 2016), §3.4.4.
[110] *Supra* note 105, para.118 of Part II of Title 35.
[111] *Supra* note 105, para.101 of Part II of Title 35.
[112] United States Patent and Trademark Office. *Manual of Patent Examining Procedure*, §2109 [R-07.2022]. Available on: https://www.uspto.gov/web/offices/pac/mpep/s2109.html . Accessed May 10, 2024.
[113] *Ibid*.

working model, using only common skills in the field, without the need for extensive research or experimentation. Thus, an idea is considered fully conceived when it is clear and lasting enough to allow someone with ordinary skills in the field to bring it to life without excessive experimentation. A complete conception must encompass all aspects of the subject matter claimed in the patent. Thus, when determining who the inventor is, the focus is on the invention claimed - (i) the subject matter of the claims, and then (ii) the individuals, who conceived each of the claims that represent the invention. From here it can be deduced, that the determining the inventorship must be as follows:

(1) an inventor is a person who comes up with the subject matter of at least one claim of the patent; and

(2) if two or more people work together to create the invention through combined efforts, they are all considered inventors.

2.2. Recent litigations

One of the landmark inventions applied for patenting, where AI played a significant role, and that has sparked significant debate about the identification of the AI agent as an inventor, are the inventions devised by DABUS[114] - the first one concerning a 'Food Container' and the second one relating to 'Devices and Methods for Attracting Enhanced Attention'.

DABUS stands for 'device for the autonomous bootstrapping of unified sentience' - an AI system developed by Dr. Stephen Thaler[115]. DABUS simulates human brainstorming processes and is capable of conceiving new ideas independently.

Allegedly, DABUS contained several neural networks that had been trained with information in various fields, but received training only in general and proceeded to independently conceiving the inventions and to identifying them as novel and salient[116]. Then the first neural network generated novel ideas and the second neural network not only identified sufficiently novel ideas, but also generated an effective response to selectively form and ripen ideas having the most novelty and utility. It was urged that not a human operator, but exactly DABUS identified the novelty and salience of the inventions, and therefore DABUS was claimed to be considered as an inventor.

The patent applications for DABUS's inventions were initially filed in the UK and the EU. And later, an international patent application under the PCT[117] was filed with the World Intellectual Property Organization ('the WIPO') in September 2019, and afterwards, several applications around the world for national and regional patents were also filed.

As a matter of fact, under an international application in accordance with the Patent Cooperation Treaty it is possible to seek patent protection for an invention simultaneously in all PCT contracting states, which were 157 as of 1 May 2024, by filing a single 'international' patent application instead of filing several separate national or regional patent

[114] Artificial Inventor Project, available on: https://artificialinventor.com/patent/ . Accessed May 10, 2024.
[115] Imagination Engines, Inc., available on: https://www.imagination-engines.com/founder.html . Accessed May 10, 2024.
[116] Artificial Inventor Project, available on: https://artificialinventor.com/467-2/ . Accessed May 10, 2024.
[117] PCT, *supra* note 5.

applications[118],[119],[120],[121]. For example, the international PCT application may be filed with the European Patent Office ('the EPO') or the WIPO as the receiving authorities. Based on the PCT international patent application a search of prior art, known as an international search, as a rule is made, but once completed, a report and written opinion on the patentability of the invention should be published by the receiving authority.

However, the PCT international patent application does not result in an international patent automatically. As a result of processing the PCT international patent application the receiving authority should formulate a preliminary, non-binding opinion on the patentability of the claimed inventions. Afterwards this needs to be confirmed separately in each country where the applicant is willing the intellectual property rights to be protected[122]. Therefore, once the PCT procedure is finalised, the applicant should initiate procedures with the regional patent office, for example with the EPO for the EU, and / or national patent offices for securing the protection of the invention in each state of interest[123].

(a) European Union

Back in autumn 2018 Dr. Thaler ('the applicant') applied for European patents under the EPC with the EPO for the DABUS' inventions[124],[125].

While under the EPC a patent application may be filed by any natural or legal person (or any body equivalent to a legal person by virtue of the law governing it)[126], a patent may be granted only to an 'inventor or inventor's successor in title'[127]. That means that the proprietor of the patent may only be the inventor or inventor's legitimate successor.

Moreover, according to Article 81 and Rule 19(1) of the EPC[128], the patent application shall designate the inventor and state the family name, given names and full address of the inventor. In case the applicant is not the inventor or is not the sole inventor, the designation shall contain a statement indicating the origin of the right to the patent.

In both cases, in spite of the aforementioned requirements of the EPC, the initial applications lodged with the EPO did not identify an inventor. Further, in response to the

[118] World Intellectual Property Organization. *PCT Q&As,* q.1. Available on: https://www.wipo.int/pct/en/faqs/faqs.html . Accessed May 10, 2024.
[119] European Patent Office. *Euro-PCT guide*, s.2.1.002. Available on: https://link.epo.org/web/legal/guide-europct/en-euro-pct-guide-2023.pdf . Accessed May 10, 2024.
[120] PCT, *supra* note 5, Art.3,10.
[121] World Intellectual Property Organization. *PCT Applicant's Guide*, ch.2.002. Available on: https://pctlegal.wipo.int/eGuide/view-doc.xhtml?doc-code=pctip&doc-lang=en&doc-type=guide. Accessed May 10, 2024.
[122] *Supra* note 121, ch.4.
[123] *Supra* note 118, qq.25-26.
[124] European Patent Office. *Application EP3564144 'Food Container'* (17 October 2018). Available on: https://register.epo.org/application?number=EP18275163 . Accessed May 10, 2024.
[125] European Patent Office. *Application EP3563896 'Devices and Methods for Attracting Enhanced Attention'* (7 November 2018). Available on: https://register.epo.org/application?number=EP18275174 . Accessed May 10, 2024.
[126] EPC, *supra* note 4, Art.58.
[127] EPC, *supra* note 4, Art.60(1) and Rule 74.
[128] *Note*: according to the 16th version of the EPC and its implementing Rules, which were in effect at the time of Dr. Thaler's applications (from June 2016 through November 2020), and according to the 17th version, which is in effect from November 2020. Available on https://www.epo.org/en/legal/epc/archive . Accessed May 10, 2024.

EPO's demand to designate the inventor, the applicant reported that the inventions were autonomously created by DABUS, and claimed he has the patent rights as the employer, but later, however, as the successor in title. The applicant argued that machine should not own patents, instead, he, as the machine's owner, should automatically own any intellectual property the machine produces as the assignee of any resulting patents; thus insisting that DABUS be designated as the inventor[129].

The EPO[130] rejected in both cases for two main reasons - (i) incompliance with inventorship requirements[131], and (ii) defective legal capacity[132].

It is worth noting that the EPO did not challenge novelty, inventive step, patentable subject matter, industrial application or sufficiency of disclosures. Hence, the primary obstacle to patent approval was not that the inventions were conceived by AI. Rather, it was the absence of a natural person associated with the invention - a requirement under current laws and principles of accountability.

The applicant appealed the EPO's negative decisions[133] and insisted that DABUS, the actual deviser of the inventions, be named as inventor in accordance with the provisions of Articles 62[134], as well as Article 81 and respective Rule 20[135] of the EPC.

Among other things, the applicant challenged the statements made by the EPO that the EPC required human inventorship as a condition for granting a patent and that the EPC in general did not permit the patenting of inventions by any inventor other than a human inventor. The applicant called for an evolutive interpretation of the requirements about designation of the inventor, and claimed that the EPC should be interpreted as requiring specification of the true deviser, irrespective of its legal status, but denial of the patent protection for inventions devised by other than the human on the basis of designation rules, or for lack of entitlement, was contrary to the intentions of the lawmakers and spirit of the EPC[136].

Additionally, the applicant claimed that refusing an application for a patentable invention because it did not designate a natural person as inventor was in conflict with the principles set out in Article 52 of the EPC, which stipulates that European patents shall be granted for any inventions, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial application. He emphasised that recognising

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[129] Decision of the Legal Board of Appeal of the European Patent Office of 21 December 2021, *Thaler Stephen L* v *European Patent Office*, ECLI:EP:BA:2021:J000920.20211221, para. II. Available on: https://www.epo.org/boards-of-appeal/decisions/pdf/j200009eu1.pdf . Accessed May 10, 2024.

[130] *Note*: Decisions on the original applications were made by the EPO's Receiving Section (Decision for EP 18 275 163 and Decision for EP 18 275 174). Later, these decisions were fully confirmed by the Legal Board of Appeal of the EPO (case law identifier *ECLI:EP:BA:2021:J000820.20211221* and *ECLI:EP:BA:2021:J000920.20211221*) .

[131] *Note*: by reference to Art.81 and Rule 19(1) to the EPC, because an inventor within the meaning of the EPC had to be a natural person.

[132] *Note*: by reference to Art.60(1) and 81 of the EPC, because a machine had no legal personality.

[133] *Note*: the appeals were dismissed.

[134] EPC, *supra* note 4.

[135] *Note*: first part of Art.81 and Rule 20 to the EPC requires that the inventor is designated in the European patent application.

[136] *Supra* note 129, para.XIV.

AI as an inventor aligns with public interest and fairness, because the public has the right to be informed and understand who is the inventor, which in turn could also promote AI development, because acknowledging machines as inventors would also credit the creators of these machines[137].

Despite all arguments, based on the ordinary interpretation of the EPC's requirements (applicability of which were disputed by Dr. Thaler appealing to technological advances and criticising archaical interpretation of the EPC) according to Article 31(1) of the Vienna Convention on the Law of Treaties[138], and also by reference to legal definitions stipulated by the law, the EPO determined that only a human can legally be considered an inventor under the EPC, but naming a machine as the inventor would violate the above referenced rules. This clarification underscores that the EPC is not outdated; rather, it emphasises the fundamental principle that only human beings are eligible for inventorship and reinforcing the fundamental principle that inventions arise from human creativity and ingenuity[139]. The provisions regarding the inventor's designation primarily aim to protect the inventor's rights, enable enforcement of potential compensation claims, and establish a legal basis for application entitlement. Designating a machine without legal capacity cannot fulfil these objectives[140].

As regards the defective legal capacity, the EPO concluded that the statement indicating that the applicant acquired the right to the European patent from DABUS as employer, and / or even more as a result of succession in title, did not meet the requirements of Articles 60(1) and 81 of the EPC, because a machine has no legal personality and lacks legal capacity to effect any assignment of rights. Therefore, DABUS could neither be an employee, nor transfer any right.

Additionally, the EPO refuted the argument of the applicant that the public has the right to know the actual deviser, because according to Article 83 of the EPC '*whether the latter is published depends only on a unilateral decision of the inventor*'[141].

As a matter of fact, it's worth noting that the decisions made by the Boards of Appeal at the EPO, while only holding persuasive authority and not being legally binding on the courts in the EPC contracting states, are often adhered to whenever feasible. The rulings of the Boards of Appeal, particularly those of the Enlarged Board of Appeal, at the EPO are typically held in high regard by the contracting states, and it is common for these decisions to be followed in their domestic courts[142]. This is because the decisions of the Boards of Appeal contribute to the harmonisation of patent laws in the EPC contracting states and provide guidance on the interpretation of the EPC[143]. Specifically, the courts in the UK are required to

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[137] *Supra* note 129, para.XIV.
[138] United Nations. Vienna Convention on the Law of Treaties of 1969. Available on: https://legal.un.org/ilc/texts/instruments/english/conventions/1_1_1969.pdf . Accessed May 10, 2024.
[139] *Supra* note 129; para.XV.
[140] *Supra* note 129; para. 4.3.
[141] *Ibid*.
[142] England et.al., *supra* note 96, pp.2-5.
[143] World Intellectual Property Organization. *An International Guide to Patent Case Management for Judges*. Available on: https://www.wipo.int/patent-judicial-guide/en/full-guide/epo-appeal-boards . Accessed May 10, 2024.

take judicial notice of decisions of the Boards of Appeal at the EPO under section 91(1)(c) of the UK Patents Act.

(b) United Kingdom

The UK authorities (note: the UK Intellectual Property Office, that was subsequently fully supported by the Patents Court, the Court of Appeals and the Supreme Court) were also unanimous that applications for patents with DABUS named as the sole inventor may not be accepted.

Applications with the UK Intellectual Property Office ('UKIPO') were filed almost at the same time as with the EPO, in autumn 2018[144],[145]. In the applications, it was stated that the applicant was not the inventor, requiring him to file a statement of inventorship and right of grant to the patent. In that form, the applicant stated that the inventor was an AI machine 'DABUS', and that the applicant had acquired the right to grant the patents because he owned DABUS.

According to the conclusions made by the UKIPO[146] as per the UK Patents Act a natural person must be identified as the inventor. Since DABUS is not a natural person, it cannot qualify as an inventor. Furthermore, the applicant is still not entitled to apply for a patent simply by virtue of ownership of DABUS, because a satisfactory derivation of right has not been provided.

Indeed, similarly as under the EPC, under the UK Patents Act a patent may be granted only to an inventor, or, at the preference of the inventor, to its successor in title[147]. According to Section 13(2) of the UK Patents Act, if an applicant for a patent is not an inventor himself, he / she must identify the person or persons whom he / she believes to be the inventor or inventors.

On appeal, the UK Patents Court[148] supported the UKIPO's decision by additionally emphasising the requirement to prove a transfer of a right that originally vested in the inventor as the UK Patents Act differentiates between the first creation of rights in property (invention) and their subsequent transfer[149] (succession). An applicant can only derive his / her rights (whether directly or indirectly, where there may be multiple transfers) from an inventor, who must be capable of holding and, most importantly, transferring the rights, that is

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[144] United Kingdom Intellectual Property Office. *Application No. GB2574909 'Food container'* (17 October 2018). Available on: https://www.ipo.gov.uk/p-ipsum/Case/ApplicationNumber/GB1816909.4. Accessed May 10, 2024.

[145] United Kingdom Intellectual Property Office. A*pplication No. GB2575131 'Devices and methods for attracting enhanced attention'* (7 November 2018). Available on: https://www.ipo.gov.uk/p-ipsum/Case/ApplicationNumber/GB1818161.0 . Accessed May 10, 2024.

[146] United Kingdom Intellectual Property Office, Decision of Mr Huw Jones, Deputy Director acting for the Comptroller, BL O/741/19 (2019): para.30. Available on https://www.ipo.gov.uk/p-challenge-decision-results/o74119.pdf . Accessed May 10, 2024.

[147] United Kingdom. Patents Act 1977, s.7(2). Available on: https://www.legislation.gov.uk/ukpga/1977/37/data.pdf . Accessed May 10, 2024.

[148] *Thaler* v *The Comptroller-General of Patents, Designs And Trade Marks* [2020] EWHC 2412 (Pat) (21 September 2020). [2020] WLR(D) 526, [2020] RPC 20, [2020] EWHC 2412 (Pat), [2020] Bus LR 2146; para. 49.

[149] *Ibid*., paras. 38 and 47.

to say the invention and the right to apply for a patent. This is a strong indicator that an inventor must be a person with legal capacity.

Crucially, the UK Patent Courts did not allege that DABUS was not itself capable of an inventive concept. The UK Patent Courts proceeded on the basis that DABUS had 'invented' the subject of the patent applications; nevertheless, concluding that DABUS was not, and could not be, an inventor within the meaning of the UK Patents Act, simply because DABUS was not a natural person and lacked legal capacity to transfer the rights to the applicant.

When assessing the rights of Dr. Thaler to apply for a patent on the basis of the rule of law, him being the owner of DABUS and as such presumably being the owner of all outputs of DABUS as a matter of the common law doctrine of accession, the UK Royal Courts of Justice made an interesting observation by stating that[150] '*an invention is a piece of information'* and there may be *'no property in information even if it is confidential'*.

This principle should only be applied to physical property, and not to new inventions, which are considered intangible intellectual property. Therefore, it is not possible to claim the right to apply for a patent on the basis of doctrine of accession.

To be mentioned as an inventor is a right of the inventor in the first place, to which only a person with legal capacity may be entitled, but not a thing.

(c) United States of America

The applications for DABUS inventions were filed with the US Patent and Trademark Office ('USPTO') in July 2019, again listing DABUS as the sole inventor.

The USPTO maintained that only a natural person can be an inventor. This position was based on the language of the US Patent Act, which consistently uses terms such as 'whoever', 'himself or herself' and 'individual', when describing inventors.

Later, this position was fully supported by the US District Court for the Eastern District of Virginia[151], that ruled that an AI machine cannot be regarded as an 'inventor' under the US Patent Act, and also affirmed by the US Court of Appeals for the Federal Circuit[152] that ruled that the US Patent Act is unambiguous and the statutory scheme is coherent and consistent, therefore no broader interpretations may be made. The decision referred to legal and dictionary definitions of 'individual', and emphasised that both require the individual to be a 'natural person'.

Additionally, in respect of inventorship, the USPTO explained that inventorship has long been a condition for patentability, but the threshold for inventorship is 'conception', which is:

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[150] *Stephen Thaler* v *Comptroller General of Patents Trade Marks and Designs*, Case No. A3/2020/1851, September 21, 2021. [2021] EWCA Civ 1374; paras. 124-134.
[151] *Thaler* v. *Hirshfeld,* 558 F. Supp. 3d 238 (E.D. Va. 2021), para.247.
[152] *Thaler v. Vidal*, case No. 2021-2347 (5 August 2022), para.IV.

'complete performance of the mental part of the inventive act and it is the formation in the mind of the inventor of a definite and permanent idea of the complete and operative invention as it is thereafter to be applied in practice'[153].

The USPTO noted that the terms 'mental' and 'mind' indicate that the conception must be performed by a natural person.

Later, Dr. Thaler filed a petition asking the US Supreme Court to clarify whether the US Patent Act restricts the definition of an inventor to only be a human being. But the US Supreme Court refused the petition[154].

(d) Other countries

Patent applications for the two aforesaid DABUS' inventions have been filed worldwide[155] also in Germany, Canada, New Zealand, Taiwan, Israel, South Korea, Japan, and also in Brazil, China, India, Saudi Arabia, Singapore and Switzerland, with DABUS named as the sole inventor.

So far, Germany[156], Canada[157], Brazil[158], India[159], New Zealand[160], Taiwan[161], Israel[162], [163] , China and South Korea[164] have rejected the patent applications, primarily on the grounds that a natural person must be listed as an inventor on a patent application. Decisions from Saudi Arabia, Singapore and Switzerland are still pending.

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[153] United States Patent and Trademark Office, Decision on petition of Deputy Commissioner for Patent Examination Policy Robert W. Bahr, application No. 16/524,350 (2020): pp.6-7. Available on: https://www.uspto.gov/sites/default/files/documents/16524350_22apr2020.pdf . Accessed May 10, 2024.

[154] *Stephen Thaler, Petitioner* v. *Katherine K. Vidal, Under Secretary of Commerce for Intellectual Property and Director, United States Patent and Trademark Office, et al.*. No. 22-919, in case 2021-2347 (21 March 2023).

[155] The Artificial Inventor Project, available on: https://artificialinventor.com/patent/ . Accessed May 10, 2024.

[156] Federal Patent Court, Case 11 W (pat) 5/21, decision of 11 November 2021, ECLI: DE: BPatG:2021:111121B11Wpat5.21.0.

[157] Canadian Intellectual Property Office. *Patent application No. CA 3137161* (16 December 2020). Available on: https://www.ic.gc.ca/opic-cipo/cpd/eng/patent/3137161/summary.html?query=applicant%253A(Thaler)&type=boolean_search&wbdisable=true. Accessed May 10, 2024.

[158] Carolina Alves, 'Brazilian PTO issues an opinion declaring that Artificial Intelligence cannot be indicated as an inventor in patent application', *Clarke+Modet* (13 October 2022). Available on: https://www.lexology.com/library/detail.aspx?g=9a1fece3-3b02-4f22-b75f-2daf0fb6ea06 . Accessed May 10, 2024.

[159] Nayantara Sanyal, 'Inventions by Artificial Intelligence: Patentable or Not?', *BtgAdvaya* (22 August 2022). Available on: https://www.btgadvaya.com/post/inventions-by-artificial-intelligence-patentable-or-not . Accessed May 10, 2024.

[160] *Thaler* v *Commissioner of Patents,* [2023] NZHC 554 [17 March 2023].

[161] *THALER, Stephen L.* v *TWIPO, Ministry of Economic Affairs,* court case No. 110 appeal No. 813, [August 17, 2022].

[162] Israel Patent Office. *Patent application No. 268605 'Food Container'* (8 August 2019). Available on: https://israelpatents.justice.gov.il/search/en/patent-file/details/268605 . Accessed May 10, 2024.

[163] Israel Patent Office. *Patent application No. 268604 'Devices and Methods for Attracting Enhanced Attention'* (8 August 2019). Available on: https://israelpatents.justice.gov.il/search/en/patent-file/details/268604 . Accessed May 10, 2024.

[164] 'Summary of Administrative Court's Decision of June 30, 2023 by Seul Administrative Court', *Lee International IP&Law*. Available on: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fartificialinventor.com%2Fwp-content%2Fuploads%2F2023%2F07%2FWOKR_Summary-of-Administrative-Courts-Decision.docx&wdOrigin=BROWSELINK . Accessed May 10, 2024.

From a patent policy perspective, the most intriguing decisions were made by Australia and South Africa, because they bypassed the usual scrutiny of legal prerequisites and relied on an evolutionary interpretation of established norms.

The Australian Patent Office ('APO')[165] held that naming an AI machine as an inventor is inconsistent with section 15(1) of the Australian Patents Act of 1990[166], since it stipulates that a patent for an invention may only be granted to a person, who (i) is the inventor, or (ii) would, on the grant of a patent for the invention, be entitled to have the patent assigned to the person, or (iii) derives title to the invention from the inventor or a person aforementioned, or (iv) is the legal representative of a deceased person as aforementioned. Also naming an AI machine as an inventor may not fulfil the regulation 3.2C(2)(aa) of the Australian Patents Regulations 1991[167], which requires identification of the name of the inventor.

Unexpectedly, upon judicial review, the judge of the Federal Court of Australia ('FCA') issued an opinion that section 15(1) of the Australian Patents Act does not prohibit an AI system or device from being treated as an inventor[168]. Interestingly, the judge acknowledged that AI machines may be autonomous and made a clear distinction between automation and autonomy of AI. While automation refers to the execution of predefined tasks without human intervention, autonomy implies a higher level of self-governance and decision-making capability. Notably, he then described DABUS as semi-autonomous. It was suggested that an inventor may be an AI system, but in such a circumstance could not be the owner, controller or patentee of the patentable invention[169]. Unlike the EPO, the UKIPO and the USPTO, in respect of the ownership the FCA stated that Dr. Thaler, being the owner, programmer and operator of DABUS, on established principles of property law, should be regarded the owner of the invention:

> *'In that respect, the ownership of the work of the artificial intelligence system is analogous to ownership of the progeny of animals or the treatment of fruit or crops produced by the labour and expense of the occupier of the land (fructus industrialis), which are treated as chattels with separate existence to the land'*[170].

Remarkably, the FCA stated that language of section 15(1)(c) of the Australian Patents Act should be interpreted as recognising that the rights of a person who derives title to the invention from an inventor extend beyond assignments to encompass other means by which an interest may be conferred. Moreover, according to the FCA the word 'derives' should include the meaning to 'receive' or 'obtain from a source or origin', to 'get', 'gain' or 'obtain', and 'emanating or arising from'. Accordingly, the FCA acknowledged that Dr. Thaler apparently obtained possession of the invention through and from DABUS. And as a

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[165] Australia IP. *Patent application No 2019363177 'Food container and devices and methods for attracting enhanced attention'* (17 September 2019). Available on: https://ipsearch.ipaustralia.gov.au/patents/2019363177. Accessed May 10, 2024.
[166] Australia. Patents Act 1990 (Superseded version C2021C00062 (C48), 18 December 2020 - 25 August 2021). Available on: https://www.legislation.gov.au/C2004A04014/2020-12-18/text . Accessed May 10, 2024.
[167] Australia. Patents Regulations 1991 (Superseded version F2020C00984 (C71); 01 October 2020 - 25 August 2021). Available on: https://www.legislation.gov.au/F1996B02697/2020-10-01/text. Accessed May 10, 2024.
[168] *Thaler* v *Commissioner of Patents* [2021] FCA 879, para.64.
[169] *Ibid*., para.226.
[170] *Ibid.,* para.167.

consequence of his possession of the invention, combined with his ownership and control of DABUS, the FCA agreed that he *prima facie* obtained title to the invention. Thus, according to the FCA, there is no need for the inventor ever to have owned the invention, and there is no need for title to be derived by an assignment.

However, the APO[171] elected to dispute the FCA's decision in the Full Court of the FCA, and achieved overturning the prior decision of the FCA that AI can be a named inventor on a patent application. The Full Court of the FCA conclusively ruled that the law relating to the entitlement of a person to the grant of a patent is premised upon an invention for the purposes of the Patents Act arising from the mind of a natural person. Only those who contribute to, or supply, the inventive concept (or somebody claiming through them) are entitled to the grant of a patent, but the purpose of the grant of a patent for an invention is to reward inventor's ingenuity. Thus, only a person with a legal personality could be the 'actual inventor' under the current laws. The Full Court of the FCA also stated that the inventor for the purposes of section 15(1)(a) of the Australian Patents Act is the person who must be regarded as 'responsible' for the inventive concept. For the patent applicant to be entitled to the invention, the inventor's role in conceiving of the invention must be able to be demonstrated. When disputes arise regarding patent rights, including challenges to the validity of a patent or entitlement to its grant, the identification of the inventor becomes central. Courts and patent authorities must carefully evaluate competing contentions about who contributed to the invention. This involves objectively assessing individual contributions. If a person's involvement was essential for the final concept of the invention, they have an entitlement to it. In summary, the Full Court of the FCA stated that identifying the true inventor is crucial for patent validity and ownership disputes. It ensures that those who significantly contributed to the invention receive appropriate recognition and rights.

Later, the High Court of Australia[172] in fact reiterated the main finding of the Full Court of the FCA and held that AI is incapable of being named as an inventor of a patent application under Australian law as it currently stands.

The first and, so far, the only patent office to award a patent for DABUS' inventions and listing an AI system, rather than a natural person, as an inventor, is the South African Companies and Intellectual Property Commission ('SACIPO')[173] .

The SACIPO's granted patent listing DABUS as the inventor with a note that '*the invention was autonomously generated by an artificial intelligence*'. The developer of DABUS, Dr. Stephen Thaler, was named as the patentee. This decision is very interesting from the perspective of legal doctrine.

The South African Patents Act No. 57 of 1978[174] ('SA Patents Act') in its Section 27(1) states that a patent application can be made (i) by the inventor, (ii) by someone who has

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[171] *Commissioner of Patents* v *Thaler,* [2022] FCAFC 62, [13 April 2022].
[172] *Thaler* v *Commissioner of Patents,* [2022] HCATrans 199 [11 November 2022].
[173] South African Companies and Intellectual Property Commission. *Patent No.2021/03242* (2021). Available on: https://iponline.cipc.co.za/Publications/PublishedJournals/E_Journal_July%202021%20Part%202.pdf. Accessed May 10, 2024.
[174] South Africa. Patents Act 57 of 1978. Available on: https://www.saflii.org/za/legis/consol_act/pa1978109/. Accessed May 10, 2024.

obtained the right to apply from the inventor, or (iii) by both. It also stipulates that anyone other than the inventor, who is applying for a patent must provide proof of their right or authority to apply in a manner prescribed by the SA Patents Act.

The SA Patents Act does not define the term 'inventor', but it defines the term 'applicant' meaning '*the legal representative of a deceased applicant or of an applicant who is a person under legal disability*'[175]. It also defines the term 'patentee' meaning '*the person whose name is for the time being entered in the register as the name of the grantee or proprietor of a patent*'[176]. Further during the text pronouns like 'him' and 'person' when referring to the inventor appear. This implies that according to the SA Patents Act, an inventor must be a person, and therefore, an AI system, being a thing, cannot be considered an inventor.

If the inventor is not the applicant, and the applicant has obtained the right to apply from the inventor, the rights to the invention must be transferred from the inventor to the applicant according to Regulation 22(1)(d) of the South African Patent Regulations[177]. Typically, this transfer of rights should occur through an assignment of rights, with the informed consent of the inventor(s) to the applicant(s). An assignment or other proof that satisfies the registrar of the applicant's right to apply must be submitted to the SACIPO.

Additionally, under Regulation 22(1)(c) of the South African Patent Regulations, the applicant is required to submit a declaration and power of attorney using a dedicated form. This form necessitates a statement detailing how the applicant acquired the right to apply for a patent from the inventor.

Nonetheless, the SACIPO granted the patent, and it looks like the SACIPO skipped these checks. Reportedly, till recent times the SACIPO did not have a substantive patent examination system[178]; however, checks for compliance with formal requirements were always mandatory.

Later, the experts[179] suggested that this was not an overlooking or error, as may seem at first glance, but a bold decision based on the Intellectual Property Policy of the Republic of South Africa[180].

But even so, this case may have significant implications for the future of AI and patent law, as it challenges traditional notions of invention and ownership.

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[175] *Ibid*., s.2.
[176] *Ibid*., s.2.
[177] South Africa. Patent Regulations 1978. Available on: https://www.saflii.org/za/legis/consol_reg/pr1978200/ . Accessed May 10, 2024.
[178] Tyron Grant, 'Registrar of patents takes steps to prevent abuse of South Africa's patent system', *Spoor & Fisher* (29 May 2023). Available on: https://www.lexology.com/library/detail.aspx?g=fa395132-a643-4b9a-a0df-d66bcad516e0 . Accessed May 10, 2024.
[179] Donrich Thaldar and Meshandren Naidoo, 'AI Inventorship: The Right Decision?', *South African Journal of Science* Vol. 117 No. 11/12 (2021), accessed May 10, 2024. https://doi.org/10.17159/sajs.2021/12509.
[180] Department of the Trade and Industry of the Republic of South Africa. *Intellectual Property Policy of the Republic of South Africa, Phase 1. 2018*. Available on: https://www.gov.za/sites/default/files/gcis_document/201808/ippolicy2018-phasei.pdf . Accessed May 10, 2024.

Chapter 3: Policy Adjustment Considerations

As evidenced by a series of recent litigations taken by Dr. Thaler worldwide, which were reviewed above, it is mandatory in most national patent systems to specify a human inventor on any patent application. Furthermore, it is required to prove assignment of the inventor's rights to the applicant, where required.

Currently, the stance of the respective patenting authorities in the EU, the UK and the USA is that patents cannot be granted for new solutions found by AI systems, where there is no human inventor identified.

However, the aforesaid assessment was focused on the matter whether applications met the formal requirements of the law. Therefore, the referenced competent authorities did not address the fundamental request for evolutionary interpretation of the contemporary laws and requirements, but literally limited their review to consistent application of the laws. Indeed, if patents are to be granted in respect of inventions devised by machines, this is for the policy makers to evaluate and not for the courts. Yet the potential for an extended interpretation was evaluated to a certain degree. This evaluation was not solely based on the textual content of the statutes, but also considered their purpose and context.

Patentability of inventions created independently by AI agents presents a complex intersection of legal, philosophical and economical considerations. As we further analyse these aspects, it becomes apparent that policy makers contemplating changes to intellectual property policies must consider a multitude of factors.

These factors range from the technical nuances of AI and machine learning, to the broader regulatory policy of incentivising innovations and maximising social welfare. Furthermore, the international nature of intellectual property law adds another layer of complexity, as any changes would need to be harmonised across different jurisdictions.

From the perspective of the public interest, fragmented regulation may result in legal challenges and financial costs for businesses, if they inadvertently infringe upon intellectual property rights in a jurisdiction with a different regime.

To ascertain the need for amendments to intellectual property policies, and to discern the nature of such potential modifications, it is imperative to undertake a comprehensive examination of all these aspects. This examination should encompass all facets, including the classical philosophical theories that form the bedrock of policing property and, in particular, intellectual property regulation, the potential disruptive risks associated with these changes, and the societal impact. Only through such a holistic analysis can we truly understand the implications and chart a course for the future of intellectual property law in the age of AI.

3.1. Considerations from the perspective of classic philosophical theories

Traditionally, there are several classic theories that justify the existence of intellectual property rights[181],[182], which are used to underpin regulatory reforms, including:

(1) moral right theory - this theory suggests that individuals have the right for the product of their labour. In the context of patents, this means that inventors should have the right to control their inventions[183]. It acknowledges that inventors invest time, effort and their mental energy into developing new inventions, and they deserve recognition and protection for their mental labour. This principle emphasises the personal connection between the inventor and their inventions, underscoring the importance of respecting their intellectual property rights;

(2) incentive / reward theory - this theory suggests that individuals have the right to profit from their labour. In the context of patents, this means that intellectual property rights provide an incentive to further create and innovate. This also serves as an encouraging message for other inventors to act. In the context of patents, the idea is that by obtaining a temporary monopoly, the inventor will be rewarded for material and time investments in research and development. This reward also serves as a form of recognition for the inventor's contribution to overall development of technology and science and benefits for the society. Thus it supports personality doctrine - granting patents also serves as a means to acknowledge the dignity and value of individual inventors[184];

(3) public interest - this theory suggests that the lawmakers, when deciding on regulatory policy, should always strive to maximise the common social good, benefit and welfare. In the context of patents, by offering a temporary exclusive right, inventors are encouraged to innovate and reveal their inventions, and in such a way foster innovation, improve quality of life or advance knowledge in the interests and for the benefit of society. The fundamental concept is striking a fair balance between the monopoly or 'supremacy' of others and the wider societal advantages that come from, for example, technological advancement. This revelation then allows for expanding on the invention, fostering further innovation and technological progress. Generally, the patent system is deemed justifiable if it results in an overall gain for society, considering both the advantages of new inventions and the costs of monopoly, such as elevated prices which must be borne by the society.

These theories are not mutually exclusive and often overlap in practical application. For example, rewarding inventors can be seen as both a recognition of their moral right to the fruits of their labour and a way to incentivise further innovation. Similarly, the public interest

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[181] Lionel Bently, Brad Sherman, Dev Gangjee and Phillip Johnson, *Intellectual Property Law*, Sixth edition, (Oxford: Oxford University Press, 2022), pp.413-415.

[182] Robert P. Merges, *Justifying Intellectual Property* (Cambridge / London: Harvard University Press, 2011), pp.31-191.

[183] Roger Brownsword, *Law, Technology and Society: Re-imagining the Regulatory Environment* (Oxon / New York: Routledge Taylor & Francis Group, 2019), pp.143-144.

[184] Roger E. Schechter and John R. Thomas, *Intellectual Property: the Law of Copyrights, Patents and Trademarks* (St. Paul: Thomson West, 2003), pp.288-290.

can be served both by incentivising innovation (leading to technological progress) and by recognising the moral rights of inventors. Importantly, the labour-centred and incentive-centred theories have provided the basis for the TRIPS agreement and have been utilised in cases presented to the World Trade Organisation's dispute resolution mechanism[185]. They have a significant and crucial influence on how the global system for protecting intellectual property rights is managed and evolves through legal precedents. On the other hand, the theory of public interest is named the most popular nowadays[186].

However, these theories are challenged by the advent of AI. AI has the potential to reduce the human effort needed to search for and produce new innovations, which influences theories centred around labour and resources contribution.

Furthermore, AI may change specific market circumstances, which in turn my impact theories related to incentive and public interest.

(a) Labour and reward

One of the leading applicant's arguments in support of identifying the AI machine as an inventor was that patents granted for inventions devised by AI would incentivise the development of AI systems, and that acknowledging machines as inventors would acknowledge the work of machines' creators[187].

Evaluating this argument from the perspective of the above fundamental principles, the author is compelled to reiterate that a patent is an exclusive right granted by a sovereign authority to an inventor for a new and useful process, design or invention. It serves as a legal protection mechanism, allowing inventors to exclude others from making, using or selling their invention for a limited period, but in exchange for this exclusive right, inventors must disclose technical information about their invention to the public through a patent application[188].

According to incentive theory[189], behind the ideology and purposes of granting patents stands the aim of encouraging innovation. The objective is incentivising inventors to create and share novel solutions by rewarding their efforts and often enormous costs in terms of time, research and development and establishing exclusivity, enabling innovators to prevent individuals who contribute nothing from benefiting from their work. By granting exclusive rights, patents encourage the development of new technologies and advancements across various fields. This is an exclusive right of the inventors to decide if they wish to commercialise their inventions by means of licensing, or just assign these rights to a third party in exchange for a decent remuneration. Additionally, inventors should enjoy a property entitlement on the products of their labours and be entitled to 'enjoy the fruits' of their labours, in terms of exclusive rights in their works. And while patent laws are frequently

[185] Christopher May and Susan K. Sell, *Intellectual Property Rights: A Critical History* (London: Lynne Rienner Publishers, Inc., 2006), p.20.
[186] Bently et.al., *supra* note 181, pp.413-415.
[187] *Supra* note 129, para.XIV(c).
[188] Ma, *supra* note 84, pp.3-8.
[189] May and Sell, *supra* note 185, pp.17-25.

analysed in economic terms, granting patents also serves as a means to acknowledge the dignity and value of individual inventors[190, 191].

The question arises, whether the AI machine has any hopes in respect of this. Since AI lacks consciousness and intentionality, it is hard to imagine that pursuing the concept of the AI inventorship would accelerate AI agents' learning process and production of more effective and optimal patentable inventions in a more effective way. AI machines are unlikely to have any perception of motives to innovate by the prospect of obtaining patent protection or reward. Hardly likely, AI agents will start developing their learning skills in anticipation of greater respect for dignity. Instead, the creators / owners of the machines might be motivated to innovate and develop AI machines.

Also it is hard to agree that pursuing the contemporary human-centric concept of the inventorship would depress AI developers; or, for example, allowing naming the AI machines as inventors would incentivise them.

Applying incentive theory to AI-generated invention, the conclusion is that the more rational approach would be where the inventors are individuals or legal entities, deploying AI, and involved in certain scientific activities, rather than to non-human agents like AI systems. The rationale behind this position stays on the fundamental principles of patent law, which emphasise human intentionality and ingenuity, and as the basis for patent rights.

Moreover, admitting AI machines as autonomous inventors could potentially raise complex legal and liability and ethical questions regarding ownership, accountability and the actual nature of AI innovations.

Furthermore, the incentive to create AI tools stems from the potential applications and uses of these technologies, regardless of patent protection. Developers and organisations are motivated to innovate and develop AI due to factors such as market demand, the broader opportunities and applications of AI technology, competitive pressures and the prospect of commercial success. These motivations extend beyond the prospect of patent protection for AI outputs alone, suggesting that innovation can thrive without solely relying on patent incentives. This assertion does not even require specialised legal examinations; it is substantiated by the developments and achievements made in recent years, during which no specific promises in respect of patents were given[192],[193].

And of course primarily, the patent rights are proprietary rights and as such are contextualised under Article 27 of the Universal Declaration of Human Rights[194], Article 15

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[190] May and Sell, *supra* note 185, pp.17-25.
[191] Schechter and Thomas, *supra* note 184.
[192] World Intellectual Property Organization. *The Story of AI in Patents,* available on https://www.wipo.int/tech_trends/en/artificial_intelligence/story.html . Accessed May 10, 2024.
[193] World Intellectual Property Organization. *Study by the CNIPA: Brief on statistical analysis of Artificial Intelligence (AI) patents worldwide*. Available on: https://www.wipo.int/edocs/mdocs/mdocs/en/wipo_ip_conv_ge_2_22/wipo_ip_conv_ge_2_22_p1_5.pdf. Accessed May 10, 2024.
[194] United Nations. *Universal Declaration of Human Rights*. Available on: https://www.un.org/en/about-us/universal-declaration-of-human-rights . Accessed May 10, 2024.

of the International Covenant on Economic, Social and Cultural Rights[195], as human rights, which in turn are commonly associated with behaviour, character and self-awareness, being the traits of personality. In the context of patent rights this is a manifestation of being worthy of honour and respect, and worthy of safeguarding their moral and material interests. These rights are secured by the inventor's right to be acknowledged as such, regardless of whether they have assigned or transferred the rights to apply for a patent and commercialise the invention. But only humans can have legal rights, and in particular moral rights, and it follows that the whole protection system is aimed at protecting humans, their labour, property and thereby safeguarding the honour, dignity and respect of their work.

(b) Public interest

In his applications and defending his stance, the applicant appealed to the argument that the public has the right to know who is the inventor. This seems to be a fair statement. But there is a fallacy about the intended purpose of the cited provision of the law. As the EPO fairly pointed out, by virtue of Article 83 of the EPC *'whether the latter is published depends only on a unilateral decision of the inventor'*[196]. Respectively, there should be a certain demonstration of will from the inventor. So, this is primarily the right granted by the policy makers to human inventors. And again, only sentient beings are capable of understanding rights, and thus entitled to rights. Inanimate objects, on the other hand, lacking sentience and agency, do not possess the capacity to hold or exercise rights. This brings us back to the theory of personality, which AI lacks.

The applicant was also stating that allowing AI to be designated as inventor also responds to the interest of the public and to fairness[197]. Thus his intention is just to be honest about the invention process before the public, who actually is addressee of any patent. The applicant emphasised that DABUS' inventions are not the first AI-devised inventions that are applied for patenting. The fact is that Dr. Thaler is the first who claimed the AI machine be disclosed and named as inventor. The spirit of the law bestows patent monopolies for discoveries that benefit humanity. However, as AI systems are not adequately covered by regulations, especially in situations where humans do not contribute to a discovery and AI agents allegedly act autonomously, it results in people falsely assigning knowledge to undeserving entities or using confidential business information to restrict its spread. This compels applicants to understate and claim the outcomes of an AI agent's work as their own.

Indeed, reportedly, there was an invention devised by his other 'Creativity Machine'[198]. The invention was filed with the USPTO and was granted a patent application

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[195] United Nations. *International Covenant on Economic, Social and Cultural Rights*. Available on: https://www.ohchr.org/en/instruments-mechanisms/instruments/international-covenant-economic-social-and-cultural-rights . Accessed May 10, 2024.
[196] *Supra* note 129, para.4.3.6.
[197] *Ibid*., para.XIV(c).
[198] United States Patent and Trademark Office. *Patent No. US-5659666-A 'Device for the autonomous generation of useful information'* (19 August 1997). Available on: https://ppubs.uspto.gov/dirsearch-public/print/downloadPdf/5659666 . Accessed May 10, 2024.

entitled ‘Neural network based prototyping system and method'[199]. The Creativity Machine was also responsible for, but not the owner of, other inventions, including the bristle design of the Oral-B Cross Action toothbrush[200].

Another example, when AI-devised inventions are being patented, is NASA's antenna. NASA has used artificial intelligence revolutionary algorithms to produce an extremely innovative antenna design that also meets the standards required by space missions. The greatness of the invention lies in the fact that these modern space communication systems use software which, through the machine learning model, are able to control the systems seamlessly and make decisions in real time without having to wait to be instructed. However, NASA did report that the inventions was generated by AI, and human guidance subsisted in the desired performance of the antenna being specified and subsequently respecified by human scientists[201]. Therefore, in this case it aligns with the concept of AI operating independently, but not autonomously. In this scenario, the human operator, who formulates the idea and participates in the substantive examination, fulfils the qualifications of an inventor as the main contributor to the conceived concept and supervisor of the research.

Similarly, an AI system equipped with a deep learning mechanism helped the Japanese company Hitachi to design a cone-shaped structure for Japanese high-speed trains *‘Shinkansen’*) to increase aerodynamics and reduce cabin noise[202].

Inevitably, identification of an AI machine as an inventor could indeed be justified. This is because it serves the public interest to know the true originator of an invention. Transparency, in this context, is a benefit as it allows for a clear understanding of the source of innovation and can foster adoption of informed decisions.

However, achieving this transparency does not necessitate a complete overhaul of the existing system. A less disruptive approach could be to simply disclose the involvement of AI in the invention process. This could be done in the patent application itself, either in descriptions[203] or any additional specialised manner, thereby preserving the integrity of the system while still acknowledging the role of AI.

But in this case, if we are concerned with the public interest, to whom patents are ultimately addressed, the more important aspect is to inform the public about what verification and experimental tests have been carried out by the applicant / patent holder to verify and confirm the functionality, safety and applicability of the invention.

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[199] United States Patent and Trademark Office. *Patent number US-5852815-A ‘Neural network based prototyping system and method’* (22 December 1998). Available on: https://ppubs.uspto.gov/dirsearch-public/print/downloadPdf/5852815 . Accessed May 10, 2024.

[200] Abbott Ryan Benjamin, ‘I Think, Therefore I Invent: Creative Computers and the Future of Patent Law’, *Boston College Law Review,* Vol. 57, No. 4, (2016): p.1085. Available at SSRN: https://ssrn.com/abstract=2727884 or http://dx.doi.org/10.2139/ssrn.2727884

[201] NASA Astrogram, available on: https://www.nasa.gov/wp-content/uploads/2023/09/145531main_06_03astrogram.pdf. Accessed May 10, 2024.

[202] W. Michael Schuster, ‘Artificial Intelligence and Patent Ownership’, *Washington & Lee Law Review* Volume 75, Issue 4 (2019): p.1958, accessed May 10, 2024. Available at: https://scholarlycommons.law.wlu.edu/wlulr/vol75/iss4/5 .

[203] *Supra* note 129, para.4.3.7.

Further application of the principles of societal benefit has greater importance in evaluating allowability of AI inventions as such. From this perspective, given the ability of AI to learn, adhere strictly to set rules, process vast amounts of information and represent it, it is undeniable that AI can be a powerful tool in the discovery of new innovations.

As a matter of supporting the applicant's arguments, it must be acknowledged that restricting the recognition of AI's role in this process could indeed potentially hinder progress and limit the benefits that these innovations can bring to society. Therefore, from a perspective of public interest, AI-aided and / or AI-generated inventions should not be excluded from the realm of intellectual rights. However, as will be explained further, ensuring appropriate measures for transparency and oversight is crucial in order to ensure harnessing of the potential of AI, while maintaining the integrity of the patent system and safeguarding the public interest.

Another critical benchmark is to ensure that genuinely social interests are promoted and protected and not those of industries. The call and rationale for any substantive changes must be based on the true interest of the general public and not merely information technology industries, which seek guarantees for maximising profits through the protection of their investments[204]. Thus a benchmark should be applied to ensure that the society obtains fair and true, not illusory, benefits.

3.2. Considerations from the perspective of risk aspects

(a) Liability and responsibility

One more of the applicant's key arguments in favour of recognising AI agent as an inventor is its ability to operate 'autonomously'. Ryan B. Abbott suggests[205] that we should differentiate AI's involvement in creative processes - (i) one scenario is when AI is simply a tool utilised by humans, but (ii) another scenario is when AI operates independently, and, allegedly, autonomously conceives an idea of an invention and identifies non-obviousness, which allegedly is the DABUS' case. Where an AI system 'invents' autonomously the applicant claims that it should be regarded as fulfilling the qualifications of an inventor.

While these arguments advocate to adapt our conventional understanding of intellectual property rights to accommodate technological advancements, the prospect of acknowledging AI systems as inventors brings with it certain concerns due to adverse perception of real AI capabilities to act autonomously and, therefore, to the inherent and residual risks.

[204] Claudio Novelli, Federico Casolari, Philipp Hacker, Giorgio Spedicato, Luciano Floridi, 'Generative AI in EU Law: Liability, Privacy, Intellectual Property, and Cybersecurity' (14 January 2024), accessed May 10, 2024 http://dx.doi.org/10.2139/ssrn.4694565.
[205] Abbot, *supra* note 200, p.1094.

As a matter of fact, following DABUS' cases, the competent patenting authorities launched public discussions[206],[207] and evaluation processes in respect of necessity to revise the current notion of inventor. So far, no revolutionary decisions were adopted. But, these discussions reveal that patent law is not merely a technical or legal domain, but is significantly linked with public policy and considerations of economics. As AI progresses and becomes increasingly influential it is vital to persistently scrutinise these matters from a cross-disciplinary viewpoint, integrating knowledge not only from fields such as law and technology, but also social and development economics and public interest.

For AI-devised inventions the majority of respondents in the UK stated that AI is not yet advanced enough to invent without human intervention.

Following the discussion in the USA, the USPTO has provided guidelines[208] on the patent eligibility of AI-aided inventions, highlighting that a human inventor must have made a 'substantial contribution' to the invention being claimed. This represents an effort to balance the encouragement of human creativity and avoiding undue limitations on future advancements. The USPTO acknowledged that an AI system, although it cannot be listed as an inventor or co-inventor on a patent or patent application, can carry out tasks that would be considered as contributing to the invention if they were done by a human, according to the US laws. They acknowledged that the statutory language clearly limits inventorship on U.S. patents and patent applications to natural persons. At the same time with reference to policy considerations the USPTO stated that the use of an AI system in the inventive process does not preclude a natural person(s) from qualifying as an inventor if the natural person(s) significantly contributed to the claimed invention.

Essentially, according to the new USPTO's guidelines[209], both the initial application and any subsequent application that claims priority from it must list the same inventors and all of them must be individuals. As a result, a priority claim for a foreign application that identifies an AI system as the sole inventor will be rejected. This rule applies to both U.S. patent applications and applications that claim priority from foreign applications that permit non-human entities to be named as co-inventors. If a U.S. application claims priority from a foreign application that lists both an individual and a non-individual as co-inventors, only the individuals who made a significant contribution to the invention should be listed as the inventors in the U.S. application. Similarly, for an application entering the U.S. national stage, where the international application lists a non-individual as a co-inventor, applicants can meet the U.S. inventorship requirement by listing only the person(s) who made a significant contribution to the invention.

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[206] United Kingdom Intellectual Property Office. *Artificial Intelligence and IP: copyright and patents* (28 June 2022). Available on: https://www.gov.uk/government/consultations/artificial-intelligence-and-ip-copyright-and-patents . Accessed May 10, 2024.

[207] United States of America. 88 FR 9492 (14 February 2023). Available on: https://www.federalregister.gov/documents/2023/02/14/2023-03066/request-for-comments-regarding-artificial-intelligence-and-inventorship . Accessed May 10, 2024.

[208] United States of America. 89 FR 10043, pp.10045-10046. Available on: https://www.govinfo.gov/content/pkg/FR-2024-02-13/pdf/2024-02623.pdf . Accessed May 10, 2024.

[209] *Ibid*.

In turn, the European Parliament has emphasised that the existing EU intellectual property framework continues to be completely relevant, when AI is merely employed as a tool to aid an author in the creative process[210].

As reported earlier in Chapter 1 of this research, the current state of AI is often referred to as 'narrow AI', meaning that these systems are designed to perform specific tasks or a set of closely related tasks. These systems operate based on human defined algorithms and have specific, well-defined rules. Narrow AI focuses on specific tasks and lacks broader understanding or adaptability. Generative models of AI agents also, while capable of creating content independently, remain confined to their programmed scope and lack versatility of human cognition. Thus, existing AI, including generative AI, operates within algorithmic boundaries.

At its core, an AI algorithm is a set of instructions that guides a computer system to learn and operate independently. These algorithms serve as the backbone of AI[211]. AI algorithms learn from training data, which can be either labelled (with clear categories) or unlabelled (without predefined categories), processes this data, extracting patterns and relationships to build further logical chains, and adjusts internal parameters based on the input data. AI operates based on a complex set of rules, which determine their behaviour and adaptability. Without these rules (i.e., the algorithms), AI would simply not exist. Thus, current AI technologies are not conscious, self-ware or rational agent, and could not be truly considered as acting autonomously[212].

Bearing this in mind, the approach of the European Parliament seems reasonable - tool-based system[213] cannot generate awareness and as such should always be accompanied by 'a human agent'.

While AI has demonstrated unprecedented 'skills' in quality and effective information learning, search, representation and strict following to set rules, it has also introduced challenges like data discrepancies and opaque decision-making.

Undoubtedly, it is crucial not to underestimate the capabilities of current AI technologies. Despite their limitations, these machines possess abilities that can surpass those of an average human in certain respects. But it is worth reiterating again that as of now, even the most sophisticated AI systems rely heavily on machine learning to function. In order for an AI to be able to make predictions or decisions without needing to be explicitly taught to do so, it must first be trained on huge datasets. As discussed in Chapter I, the abilities of AI are derived from the context defined and set by human intelligence. The outcomes produced by the algorithm may appear to be at the pinnacle of the knowledge pyramid, but in reality, the AI is merely executing tasks without comprehending the context that the human mind has incorporated into its training. Undoubtedly, AI is able to consistently operate within the pre-established context and adhere to the rules defined for it, and produce new combinations

[210] European Parliament resolution of 20 October 2020 on intellectual property rights for the development of artificial intelligence technologies (2020/2015(INI)), para. 14. *OJ C 404*, 6.10.2021, p. 129–135. Available on: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020IP0277 . Accessed May 10, 2024.
[211] *Supra* note 16, pp.6, 16-23.
[212] *Supra* note 16, p.13.
[213] EU AI Act, *supra* note 38, recital 27.

of well-known procedures or spotting patterns that humans might overlook. But it is not capable of exercising the autonomy to decide if it wants to operate under such conditions, or perhaps it needs other dataset and operating rules in order to arrive at a desired result. For instance, the performance of 'evolutionary algorithms' in tackling hard problems is also under debate. The experts[214] suggest that they are capable of obtaining '*good enough solutions, rather than optimal solutions*' and better perform as '*post-optimiser*s'. The AI does not 'understand' the data in the same sense that humans do, as it lacks consciousness. Instead, its choices are based on patterns the AI has discovered from its training set. By processing data and spotting patterns, AI systems are now quite good at helping with ideas; yet, they are unable to make the creative leap necessary to independently conceive of an invention. When people participate in reasoned assessments and evaluations debate they are engaging in argumentation, not merely demonstration. Thus argumentation[215], rather than logical demonstration, should be seen as the core technique for justifying claims.

For instance, the UK House of Lords Select Committee on Artificial Intelligence recommended that where, as with deep neural networks:

> '*it is not yet possible to generate thorough explanations for the decisions that are made, this may mean delaying their deployment for particular uses until alternative solutions are found*'[216].

This lack of understanding and human ability to interpret data in a broader context, which is a crucial marker for the conception of innovative ideas, restricts the possibility of identifying an AI agent as an autonomous inventor of new ideas. Hence, while AI can assist in the ideation process by providing data-driven insights and predictions, the conception of an idea is fundamentally an endeavour of the human, who deployed it. Because it is the human who gives the AI a direction in which to think and thus conceives the idea of an invention. Accordingly, AI agents should be identified as a tool, the role of which is to assist and augment human capabilities, not to replace them. The ultimate responsibility and credit for the creation of new ideas and inventions should lie with the human, not the AI.

Besides, intellectual property norms require that the intellectual creation be embodied in something tangible[217]. In a standard patenting process, the journey begins with the inception of an idea, which then undergoes a reduction-to-practice phase, which entails constructing, experimenting and validating that the invention functions as intended, and further refinement of the idea[218]. The culmination of this reduction-to-practice phase typically occurs when a patent application is filed with the competent patenting authority along with all claims, descriptions and specificiations. This principle ensures that abstract concepts remain exempt from intellectual property rights. Instead, intellectual property rights are granted for the expression of those ideas in specific practical inventions. This is important to demonstrate that the invention is functional in a way that aligns with the intended purpose and to guarantee

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[214] Zhi-Hua Zhou, Yang Yu and Qian Chao, *Evolutionary Learning: Advances in Theories and Algorithms* (Singapore: Springer Nature Singapore Pte Ltd., 2019); p.69.
[215] Lance Eliot, 'AI and Legal Argumentation: Aligning the Autonomous Levels of AI Legal Reasoning', *Cornell University* (2009), accessed May 10, 2024. https://doi.org/10.48550/arXiv.2009.11180 .
[216] United Kingdom Parliament. *Report on AI in the UK; ready, willing and able?* (16 April 2018). Available on: https://publications.parliament.uk/pa/ld201719/ldselect/ldai/100/100.pdf . Accessed May 10, 2024.
[217] Schechter and Thomas, *supra* note 184, p.4
[218] Ma, *supra* note 84, pp.7-8.

that the invention is not merely theoretical, but can be practically used, apparently in a safe and beneficial mode for people.

AI systems present unique challenges in this context. While AI can generate novel ideas, it may not always have the capability to fully implement and validate those ideas. AI lacks the conscious intent that human inventors possess[219]. Human oversight plays a crucial role in ensuring compliance with the requirement, because only they are able and capable to validate AI-generated concepts, conduct experiments, and ensure practical functionality. While AI contributes significantly to invention processes, human oversight remains essential to meet the legal requirement of reduced-to-practice inventions.

Other pressing issues revolve around certifications and disclosure requirements. These elements suggest that human intervention is necessary for certification and explanation.

According to the current laws, when deciding on granting the patent, the competent patenting authorities, among other things, proceed on the assumption that the language of the patentee in the specification reflects the representations made by the inventor. For instance, in the United States, each inventor under the risk of perjury is legally obligated to make a sworn statement or affirmation for an application[220]. This statement asserts that they have examined and comprehended the specification, believe themselves to be the initial and primary creators of the invention being claimed, and commit to revealing any significant prior art they are aware of. By signing this form, inventors assume both honour and responsibility. If the inventor asserts an inventive merit of his invention and promises a particularly beneficial or useful result, this may persuade members of the public into believing that the claims are valid and act on the faith of that by, for example, becoming a licensee or by not using the alleged invention if they do not trust the expertise of the inventor. This requirement emphasises the importance of safety and operability in the patenting process, and may be seen as fully aligned with the principle of respecting public interests as discussed in Section 3.1 of this Chapter 3 above. The United States thus demonstrates a commitment to ensuring that patented inventions are not only innovative, but also safe and reliable for public use.

With AI inventions this in certain circumstances may be impossible, as AI systems often function as 'black boxes'[221],[222] rendering it challenging to fully comprehend their internal mechanisms and provide necessary information for patent applications. This lack of transparency raises concerns about if all required facts can be adequately disclosed about the AI-aided or AI-assisted invention. The 'black box' issue becomes particularly pronounced in the context of dynamic AI systems, where machine learning algorithms continuously evolve based on new data. If it is generally accepted that AI algorithms are essentially black boxes, it must be acknowledged that they may not be capable of making the necessary estimations to meet disclosure requirements. The opacity of AI systems may conflict with patent disclosure principles, potentially hindering downstream research and development. This is because, for certain results, a person skilled in the field would not be able to infer how the result was

[219] Hildt, *supra* note 69.
[220] Cohen, *supra* note 109*,* para.3.5.3.
[221] Ebers and Navas, *supra* note 12, pp.48-50.
[222] Blouin, *supra* note 23.

produced, unless supported by actual experimental data or general technical knowledge. Unless AI outputs are verified by human scientists, they cannot be deemed reliable, and thus, the disclosure requirements cannot be considered as met.

Patent applicants may also face a dilemma of balancing sufficient disclosure to meet statutory requirements, while safeguarding secrecy of AI algorithms.

It is important to reiterate that the technologies currently available are not infallible. From the perspective of liability and trustworthiness, which is a very important criteria for assessing the public benefit, their operations should be overseen by competent professionals, and the prerogative of final approval of the AI-generated devices, before their issuance to the public, must vest in those, who made a choice of application of the AI technology for their experiments and scientific explorations. In other words, the outputs provided by the deployed AI technology must always be validated against inputs provided to them by human agents to ensure accuracy and reliability. The ultimate adjudicating authority for this must be the deployer of the AI system rather than patenting authorities or the public. This prudent supervision is necessary to mitigate the risks associated with the acknowledged limitations of AI technologies, especially opacity and lack of human-like awareness, and to ensure that their potential is harnessed effectively and responsibly. The policy makers should be sufficiently uncompromising in their assessment of priorities, when deciding whether to support patenting of fully 'autonomous' AI-inventions and ensuring operability and safety of such inventions.

Perhaps, in the future, when the more elusive concept of artificial general intelligence or superintelligence will come true, the tone of the debates on inventorship may soften. But most experts and researchers view fully self-aware, autonomous, fully conscious and responsible AI agents, capable of reasoning and explaining their actions with as much detail and logic as an experienced and competent scientist can, as a theoretical possibility that lies somewhere in the distant future, a tantalising prospect rather than a present reality[223],[224].

But even if this sometimes happens, the most appropriate question then would be not about the 'redesigning' of the concept of 'inventorship', but abolishing the patent system as such, because it will stop serving its intended purpose.

Based on these consideration, it is not possible not to support the positions of the European Parliament in respect of the status of existing AI that emphasised a human-centred approach, that is in compliance with ethical principles and human rights, that the AI technology is to remain a tool that serves people and the common good[225],[226].

Additionally, there are other situations where inventors' consent is legally necessary. For instance in the United States, when applying for a reissue patent to expand the scope of claims, inventors must also sign the oath and declaration form.

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[223] *Supra* note 16, p.11-13.
[224] Bickley and Torgler, *supra* note 37.
[225] European Parliament resolution of 20 October 2020 on intellectual property rights for the development of artificial intelligence technologies (2020/2015(INI)), premise 'E'. *OJ C 404*, 6.10.2021, p. 129-135. Available on: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020IP0277 . Accessed May 10, 2024.
[226] EU AI Act, *supra* note 38, recital 6.

Last, but not least, regarding the liability issues, it is important to note that to proceed with a patent infringement lawsuit, the inventor, who plays a crucial role in such a suit, must be capable of initiating and defending a lawsuit. In this scenario, the AI, which is supposedly the inventor, must have a vested interest in the subject matter of the patent litigation. For a human inventor, this 'vested interest' could be characterised by a rise in reputation or monetary incentives. But there is no possibility to characterise this 'vested interest' for an AI agent.

(b) Abuses of patent system

As mentioned above, AI has the ability to reduce the amount of time and other resources required to produce new inventions.

Although patents encourage innovation, if AI-generated inventions become more widespread, the whole markets may be disrupted if it becomes possible to generate and seek too expansive or exclusive patents at a mass scale.

For patent protection to be beneficial, the patented innovations should represent an advancement in human knowledge; and, ideally, they should also influence other sectors of the economy[227].

Contrary to the common perception of promoting innovation, 'mass production' of inventions may have a negative impact on competition and, as a result, restrict access to important innovations. Determining the patent protection for AI-generated ideas becomes critical when weighing these worries against the benefits such 'innovations' bring to society. Everyone who works in any specific area will have to obtain a licence to use a specific technology that might be otherwise available.

Research on the societal impact of innovations in the United States and Europe indicates that a considerable number of patents in these areas possess relatively minimal value[228],[229].

The OECD has also noted a steady decrease in the average quality of patents across various countries over time[230]. The OECD highlighted that the quality of patents was declining due to the excessive lawsuits initiated by entities named as non-practicing entities, who exploited patent laws for their benefit. This situation arose exactly from an influx of trivial or incremental patent applications that contributed minimally to scientific advancement. The issue seemed to stem from the emergence of non-practicing entities, groups that exist solely to apply for patents with the intention of suing others, who inadvertently use

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[227] David Price, Colin Bodkin and Fady Aoun, *Intellectual Property: Commentary and Materials,* Sixth Edition (Sydney: Thomson Reuters (Professional) Australia Limited, 2017), pp.351-354.

[228] Michael Park, Erin Leahey and Russell J. Funk, 'Papers and patents are becoming less disruptive over time', *Nature* 613 (2023): pp.138-144, accessed May 10, 2024. https://doi.org/10.1038/s41586-022-05543-x.

[229] Kluwer Patent Blog, available on: https://patentblog.kluweriplaw.com/2023/07/05/deteriorating-patent-quality-epo-under-fire-management-is-not-impressed/ . Accessed May 10, 2024.

[230] Organisation for Economic Co-operation and Development. *Science, Technology and Industry Scoreboard 2011: Innovation and growth in knowledge economies*; pp.190-191,199 (20 September 2011). Available on: https://www.oecd-ilibrary.org/docserver/sti_scoreboard-2011-en.pdf?expires=1714419460&id=id&accname=guest&checksum=F18BE7DEED38DD1FAA730C1583F17E74 . Accessed May 10, 2024.

the same ideas, rather than using the patents to develop actual products. The ultimate consequence is an overtaxed patent office system, leading to extended approval times for legitimate inventions and the postponement of truly innovative and beneficial products. Hence, the existence of numerous low-value patents can impose significant costs on society. Such patents can obstruct innovation by creating challenges for subsequent innovators and researchers, who may be compelled to invest in costly alternatives. At times, these patents are strategically utilised to delay or block market entry. Consumers may eventually end up shouldering these costs, either due to the non-development of new products and services, or because the escalated costs of innovation are transferred to them.

Low-value patents carry additional costs, irrespective of the ability to innovate around them. First, they can hinder innovation by introducing 'clutter' into the system. As the number of patents grows, it becomes increasingly challenging for an innovator to avoid patent infringement and to recognise and build on authentic progress in human knowledge. This 'clutter' can also undermine the trustworthiness of patents, raising the rate of return demanded by investors and complicating the process for companies to leverage their patents to secure capital at the most affordable price. This problem can limit the financial accessibility for innovators holding valuable patents, which can be especially critical for start-ups and small and medium size enterprises. Second, a misdirected patent system imposes costs at the system level. The surge in patents results in more accidental infringements, infringement research, validity checks.

The deployment of AI agents could potentially lead to a surge in patent applications, because, as discussed, AI systems can generate ideas and inventions at a much faster rate than humans, which could flood the patent office with applications. This may in turn result in a further increased decline in patent quality (i.e., the degree to which a patent meets the patentability criteria). If an AI system generates an invention, it might not fully understand the implications or practical applications of the invention, leading to patents that are broad, vague, or not novel.

With more patents being filed, the likelihood of overlapping patents (i.e., a patent thicket) increases[231]. This could make it more difficult for companies to navigate the patent landscape and could potentially stifle innovation. Patent thickets could inflict substantial expenses on public welfare and hinder some beneficial innovation. This could result in a decrease in innovation from those who are capable of generating the most novel ideas, those who are thinking ingeniously. The potential hazards of patent thickets warrant meticulous evaluation.

Given the rapid advancements in AI, questions arise about whether an AI invention represents an inventive leap beyond what a skilled person in the relevant field would have deemed obvious. Therefore, the preconditions for validity of a patent should always remain a novelty, inventiveness and innovativeness. This evaluation should be centred around the novelty and nonobviousness test. The concept of the non-obviousness should be aligned with

[231] Bronwyn H. Hall, Christian Helmers and Georg von Graevenitz, 'Technology entry in the presence of patent thickets', *United States National Bureau of Economic Research* (August 2015). Available on: http://www.nber.org/papers/w21455 . Accessed May 10, 2024.

the prevailing perception of inventors as creative geniuses, and address widespread apprehensions about the excessive issuance of patents for insignificant or trivial innovations. Specifically, if a subsequent invention can distinguish itself from the existing body of knowledge, and this differentiation is not readily apparent to an individual with ordinary skill in the relevant field at the time of the invention, then it becomes eligible for patent protection[232]. For instance, the USPTO, while acknowledging AI advanced capabilities, stated that it will not extend conception of 'an act performed in the human mind' to non-natural persons[233]. The purpose of patents is to motivate people to invent, thus advancing science and useful arts. Therefore, the USPTO has reaffirmed that the US patent system continues to be structured solely to stimulate human creativity. Inevitably, applying these criteria to AI inventions presents challenges. AI systems can process vast quantities of data, uncovering insights or solutions that were previously unknown. Yet, determining whether an AI invention genuinely qualifies as novel necessitates an exhaustive examination of existing prior art and a nuanced understanding of how AI technology diverges from established solutions.

Furthermore, there is a risk that the ability of AI to quite quickly and almost effortlessly generate patentable inventions could also be exploited for building fictitious patent portfolios for the sole purpose of tax evasion, which in turn may have a direct negative effect on the public interest as the governments may lose tax revenues. Intellectual property taxation regimes, also referred to as ‘patent box’, permit earnings from the utilisation of intellectual property to be taxed at a rate lower than the standard statutory tax rate. Such systems can be exclusively beneficial to income derived from intellectual property. These systems also offer benefits to income from other geographically mobile activities or provide benefits to a broad spectrum of activities and do not necessarily exclude income from intellectual property. ‘Patent box’ systems are employed to encourage research and development by taxing patent revenues differently from other business revenues[234],[235]. However, they may also be utilised as tools for base erosion and profit shifting, to evade corporate taxes.

As a matter of fact, the UK introduced the Patent Box program in 2013[236]. It offers tax advantages to patent owners. The main goal of this initiative is to reduce the corporate tax on profits earned from patented inventions in an effort to encourage research. Based on the latest figures from His Majesty's Revenue and Customs for the tax year 2021-2022 around 1,510 companies made claims for reduction of taxes, resulting in nearly £1,363 million approved relief[237]. In the UK, the patent box tax rate is 10% for intellectual property income from

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[232] Ma, *supra* note 84, pp.11-12,35-36.

[233] United States of America. 89 FR 10043, pp.10045-10046. Available on: https://www.govinfo.gov/content/pkg/FR-2024-02-13/pdf/2024-02623.pdf . Accessed May 10, 2024.

[234] Gassmann and Bader, *supra* note 33, p.253.

[235] Robin Jacob, Matthew Fisher and Lynne Chave, *Guidebook to Intellectual Property*, Seventh Edition (Oxford: Hart Publishing / Bloomsbury Publishing Plc, 2022), p.62.

[236] United Kingdom. *Her Majesty Revenue and Customs Office Guidance: Use the Patent Box to reduce your Corporation Tax on profits*. Available on: https://www.gov.uk/guidance/corporation-tax-the-patent-box . Accessed May 10, 2024.

[237] United Kingdom. *Her Majesty Revenue and Customs Office: Patent box relief statistics* (September 2023). Available on: https://www.gov.uk/government/statistics/patent-box-reliefs-statistics/patent-box-relief-statistics-september-202. Accessed May 10, 2024.

patents, supplementary protection certificates, plant varieties, while the standard statutory income tax rate is 19%.

In the EU 13 out of the 27 Member States have implemented a patent box regime[238]. These are Belgium, Cyprus, France, Hungary, Ireland, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia and Spain (federal, Basque Country and Navarra).

The reduced tax rates provided under the EU patent box regimes are between 1.75 % in Malta (against a statutory rate of 35%) and 10.5 % in Slovakia (against a statutory rate of 21%).

The United States has yet to adopt a patent box system within the US Internal Revenue Code[239].

By agreeing to consider AI technologies as potential inventors, it would be appropriate to counterweight the powers - enhanced scrutiny of each application for AI-assisted or AI-aided inventions should also be AI-engined to ensure there is a justification for creating exclusive rights. If this fact is overlooked, the legislation could ultimately lead to dysfunctional effects that negatively impact social welfare.

In addition, the risk of concentration of economic power in certain areas or markets increases due to the availability of resources provided by individual AI systems to obtain entire arrays of patents.

[238] Tax Foundation Europe. *Patent Box Regimes in Europe* (2023). Available on: https://taxfoundation.org/data/all/eu/patent-box-regimes-europe-2023/. Accessed May 10, 2024.

[239] Alexandra Tasev, 'Comparative Analysis of Global Patent Box Systems'*, Pace International Law Review* (29 October 2023). Available on: https://pilr.blogs.pace.edu/2023/10/29/comparative-analysis-of-global-patent-box-systems/. Accessed May 10, 2024.

Conclusions

The development of AI has brought many interesting possibilities for solving everyday problems.

At this point of a special interest is AI with independent data generation capabilities and with all its distinctive capabilities of learning, searching, analysing, generating and presenting information, and which represent synergy with traditional AI, though complementing it with even more powerful generative capabilities. The range of generative AI capabilities includes not only the trivial possibilities of creating multimedia content, translations, texts, collecting and presenting information, but also more intriguing possibilities such as identifying a real-world problem and finding a scientific and technological solution. The potential of AI systems can be boundless, varying across different fields and industries. For those who are seeking to monetise their inventions, failure to protect AI generated inventions could lead to loss of profits. Nevertheless, factual and legal queries emerge when distinguishing between an invention assisted by AI and one autonomously created by AI. The primary issue at hand is the problem of inventorship.

History includes many examples of inventions aided and assisted by AI, which have been applied for patents, but named human scientists as the sole inventors. Now, in a recent development, scientists chose to apply for patents and request that an AI agent be allowed to be named as the sole inventor. This has sparked intense debates about the adequacy of the traditional patent regimes and whether current patent laws can identify AI agents, as well as about the protectability of such inventions in general.

The main objective of this thesis was to determine whether the current patent regime became inadequate due to the unexpected advent of AI, or if it can be conclusively stated that the traditional framework, built on the premise that intellectual property needs only be acknowledged and protected when humans contribute to its creation, is still justified. If the latter is true, a related secondary question that naturally arises is how to classify inventions generated by AI agents within the existing patent system.

The primary arguments stated by the experts advocating for recognising AI agents as inventors include the need for transparency and the belief that the public has the right to know that an invention is the creation of an autonomous AI agent. It is also argued that creators of AI agents, which are capable of identifying problems and finding scientific and technological solutions without human intervention, should be incentivised. But refusing to name AI agents as inventors might potentially demotivate them. Additionally, it is claimed that since it is the very requirement of the patent laws to identify true inventors, not allowing to identify AI agents as inventors prevents the scientists from filing their inventions for patent protection or, as the extreme, forces them blatantly breach the law by naming themselves as inventors, thus misleading the public about actual inventorship.

Examining these arguments through the lens of technical and legal characterisation of existing AI technologies, established patent law doctrines, as well as through philosophical theories underpinning the patent rights, allowed for a conclusion that the stated arguments do

not sufficiently justify the necessity for redesigning of the existing regime. Moreover, the requested changes may potentially lead to more confusion and legal uncertainties and risks.

As discussed, the solutions delivered by AI technologies can indeed be unique and innovative, and potentially in need of patent protection. However, the existing legal regime for the protection of inventions is based on the fundamental human-centric theories aimed at inducing humans to dedicate their full mental capacities to finding solutions for scientific and technological progress. Undoubtedly, such dedication requires mental sacrifice from scientists, not to mention time and the material costs and expenses. This sacrifice needs motivation and should be compensated. That is why the traditional protection regime, established mostly during the times unaware of AI capabilities, is based on the universally recognised need to stimulate human inventive thought. It rewards those extraordinary minds who are ready to dedicate all their mental energy, time and effort to scientific and technological breakthroughs for the common benefit and welfare of the public.

It is true that these very minds have developed technology to the point where many tasks, previously requiring ongoing human intervention, can now be delegated to AI agents. But it should also be admitted that AI, that is not endowed with feelings, self-consciousness, aspirations of serving science for the benefit of mankind, actually does not need encouragement or recognition. To a greater extent, the motivation, reward and recognition can be expected and demanded by creators of such AI-machines, and AI 'coaches'. However, there is a dilemma - what kind of contribution do we actually evaluate? The AI technology itself (creation of AI machine) or the fruits of AI agents, which are two distinct concepts. It is obvious that the contribution to the creation of AI itself is subject to remuneration. However, this is not necessarily correlated with the outputs produced by AI agents, and no justifiable ground and valid argument has been presented so far why the society should be charged twice for the same benefit. As trivial as it may sound, society is already rewarding the creators of AI machines by recognising their usefulness and enthusiastically deploying them in everyday life. The past decades have shown that progress was driven by market demand and appreciation, while no promises were made in respect of patents. Furthermore, AI agents themselves, as intellectual property, can enjoy sufficient protection under the current intellectual property protection regime. This provides their creators with the opportunity to be rewarded for their remarkable creation of AI machines by obtaining exclusive rights over the use and exploitation of such machines, and through the possibility to commercialise AI agents as an object of intellectual property.

An invention should continue to be defined as the highly advanced realisation of a technical concept of the human mind.

The probable risk that applicants may be forced to formally breach the patent laws by identifying themselves as inventors instead of disclosing the AI agent and other concerns identified by the applicants, can be addressed by less intrusive solutions. For this there is no need to revolutionise the traditional patent system that is well-established and whose fundamental pillars have been proven over the years. For example, the deployment of the AI agent could be disclosed in the descriptions, as an alternative. Additionally, the term 'inventor' could be interpreted to include the person responsible for deployment and

supervision of the AI agent. Such disclosure could also be accompanied by the description of the actual role of the AI agent and explanations of its deliverables and appropriate certifications.

When assessing the necessity of adapting the patent laws to AI needs, it is indeed important to appreciate evolving AI's capabilities. However, at the same time, it's equally important to understand the technical nature of AI - a system operating within the boundaries defined by its creators and coaches - and to adequately evaluate its limitations and inherent risks. Based on numerous assessments by field experts, the prevailing consensus is that the current landscape of AI predominantly comprises what is commonly referred to as 'narrow' AI. Existing AI lacks volition and does not possess consciousness, emotions, or subjective experiences. It operates based on predefined algorithms and lacks the ability to act or make decisions fully autonomously. In certain circumstances, AI-outputs may also appear unexplainable. It is also acknowledged that technologies driven by AI have inherent vulnerabilities. AI systems rely heavily on data. The performance of the AI system can be compromised by data that is insufficient, inaccurate, or biassed. Moreover, AI systems are susceptible to cybersecurity threats, due to which adequacy of its outputs may be compromised or corrupted. The fallout from a cybersecurity violation can be substantial. Imagine an AI agent that is tasked with autonomously creating medicinal formulas, but suddenly falls victim to a cyber attack, leading to the deliberate creation of harmful or lethal compounds. Consequently, it is of paramount importance to ensure that the outputs of any AI agent, particularly those engaged in critical tasks, are rigorously reviewed and validated by human scientists, who then can check, specify, respecify, prove and certify operability and safety of the invention.

Inevitably, scientists may not be deprived of the right to use AI agents as a tool in their scientific research and invention process, as for instance, any other supporting tool that was used before the advent of AI. It should be left at their discretion. But the AI agent should remain a tool under the supervision and responsibility of its human deployer. Even if AI invents independently, there should ideally be a human scientist who confirms the verification of results and AI outputs. The deployer of the AI agent must be able to explain and defend the outputs produced by its AI agent, especially if it is addressed to the public. This inevitably will require human intervention, supervision, significant input into the determination of the research direction, selecting appropriate solutions and putting them in practice.

Accordingly, liability and safety considerations and associated risks, including black box problems, is one more argument in support of the current human-centric approach.

Moreover, the delivery of a new solution for AI agents may be a matter of weeks or less. Therefore, as AI is admitted in the innovation process, measures should be taken to prevent the creation of fake patent portfolios, avoid patent thickets, and prevent other manipulations with weak patents that could be mass-produced by AI and submitted for patenting potentially with the sole aim of crafting dead inventions which will be used only for creating fictitious intellectual property portfolio or for tax evasion or any other abuse.

On the other hand if the scientists claim that the output is a result of fully autonomous actions of an AI agent and there is no human intervention or significant contribution to the

inventive concept, reduction to practice or specification, such inventions should be subject to special attention. Here the need arises to research and address further dilemmas as regards subject matter eligibility, obviousness and enablement. Most probably such inventions should be left in the public domain.

If it is claimed that AI systems attain the capability to invent truly autonomously, rendering human inventors completely redundant, it might be necessary to contemplate not the modification of the patent system to recognise AI entities as sole inventors, but potentially its abolition, as it would no longer fulfil its intended purpose.

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