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Me, Myself, and A.I.: Should Kenya's Patent Law Be Amended to Recognise Machine Learning Systems as Inventors?

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Abstract

On 28 July 2021, South Africa set the record for being the first country in the world to grant a patent to an artificial intelligence (AI) system known as 'Device for the Autonomous Bootstrapping of Unified Sentience' (DABUS). Although DABUS is not the first AI system to produce patentable products, it is the first AI system to be listed as an inventor in a patent application, attracting worldwide interest. Against this backdrop, this article seeks to analyse whether Kenya's Industrial Property Act, 2001 (IPA) should evolve to recognise machine learning (ML) systems as inventors. It submits that some ML systems are capable of inventive activity that is equivalent to or superior to that of the human intellect and that such systems should be recognised as inventors. This paper illustrates that Kenya's IPA, however, is unable to recognise ML systems since it is based on anthropocentric standards that, when put into practice, preclude the acknowledgement of non-human inventors. Therefore, this article makes several recommendations aimed at overhauling not only Kenya's IPA but also the country's patent system.

Keywords: *Artificial Intelligence, Inventors, Inventorship, Machine Learning, Patent law.*

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I. Introduction

According to the World Intellectual Property Organization (WIPO), an inventor is a person who conceptualises an invention.[1] An invention, in turn, is a 'solution to a specific problem'.[2] To safeguard their creations, inventors file for patents—official government documents that guarantee them the right to prevent anyone from making, using, or selling their invention without their consent.[3] Even though inventors are typically human beings, recent technological developments in artificial intelligence (AI) incited WIPO to introduce AI systems into the conversation of inventorship.[4]

AI refers to a sub-field of computer science that aims at creating systems capable of simulating human intelligence and accomplishing 'human' tasks.[5] One issue flagged by WIPO for consideration is whether AI systems can be recognised as inventors since certain AI systems are currently advanced enough to generate patentable inventions.[6] This question has generated great controversy. Proponents posit that AI inventorship would strengthen the integrity of the patent system by promoting the correct naming of inventors, the absence of which would render the patent awarded invalid.[7] AI systems, however, do not have legal personhood. Thus, opponents opine that it would be difficult for them to exercise their rights if they were deemed inventors.[8]

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1 World Intellectual Property Organization, 'Inventing the future: An Introduction to patents for small and medium-sized enterprise', World Intellectual Property Organization, Intellectual Property for Business Series Number 3, 2018, 20 — https://www.wipo.int/edocs/pubdocs/en/wipo_pub_917_1.pdf on 20 June 2023.

2 Section 21, *Industrial Property Act* (Act No. 7 of 2007).

3 World Intellectual Property Organization, 'Learn from the past, create the future: Inventions and patents', 2007, 18 — https://www.wipo.int/edocs/pubdocs/en/patents/925/wipo_pub_925.pdf on 20 June 2023.

4 World Intellectual Property Organization, 'Impact of artificial intelligence on IP policy: Call for comments', World Intellectual Property Organization, 18 February 2020 — https://www.wipo.int/about-ip/en/artificial_intelligence/call_for_comments/index.html on 18 December 2021.

5 Bartneck C, Lütge C, Wagner A and Welsh S, *An introduction to ethics in robotics and AI,* Springer, Cham, 2021, 7-8.

6 World Intellectual Property Organization, 'AI and intellectual property: WIPO call for submissions', World Intellectual Property Organization, 2019, 1 — https://www.wipo.int/export/sites/www/about-ip/en/artificial_intelligence/call_for_comments/wipo_ai_ip_call_for_submissions.pdf on 20 February 2022.

7 Abbott R, 'The artificial inventor project', World Intellectual Property Magazine, December 2019, 3 — https://www.wipo.int/export/sites/www/about-ip/en/artificial_intelligence/conversation_ip_ai/pdf/ind_abbot.pdf on 29 December 2021.

8 Thaldar D and Naidoo M, 'AI inventorship: The right decision?' 11/12 (117) *South Africa Journal of Science*, 2021, 1.

The AI inventorship debate was further fuelled by Stephen Thaler when he listed an AI system, known as 'Device for Autonomous Bootstrapping of Unified Sentience' (DABUS), as an inventor on patent applications filed to the United States, the United Kingdom, the European Patent Office (EPO), South Africa, Australia, and several other jurisdictions from 2018 to date.[9] DABUS was claimed to have independently devised two patentable inventions, a food container with a fractal surface that helps with insulation and stocking and a flashing light for attracting attention in emergencies.[10] Thaler named DABUS as the inventor because he reportedly did not want to take 'credit for work done by the machine'.[11]

The United States, the United Kingdom, and the EPO rejected the applications, and Thaler's subsequent appeals, with all three contending that their respective patent laws only contemplate human beings as inventors.[12] In contrast, South Africa approved the application and issued the patent to DABUS because they do not define an inventor in their patent statutes and, unlike other countries, do not subject patent applications to any substantive review.[13] The South African Patent Office only requires applicants to file an application for their inventions, and these applications are only scrutinised on procedural reasons or formalities, such as whether the paperwork was filed correctly.[14] Australia similarly granted the patent in 2021, but reversed its decision in 2022, with the bench of judges

9 Egbuonu K, 'The latest news on the DABUS patent case', IP Stars, 28 December 2021 — https://www.ipstars.com/NewsAndAnalysis/the-latest-news-on-the-dabus-patent-case/Index/7366 on 2 January 2022. Artificial Inventor, 'The Team - Artificial Inventor Project', Artificial Inventor, 1 August 2019 — https://artificialinventor.com/about-the-team/ on 19 December 2021.

10 Pintas, 'DABUS: A case study on patent law', Pintas, 06 January 2022 — https://pintas-ip.com/dabus-a-case-study-on-patent-law/ on 07 October 2022.

11 Abbott R, 'Machine rights and reasonable robots, remarks', 60 (3) *Washburn Law Journal,* 2021, 436.

12 *Stephen Thaler v Andrew Hirshfeld and the US Patent Trademark Office* (2021), The United States District Court for the Eastern District of Virginia. *Stephen Thaler v The Comptroller General of Patents, Designs and Trademarks* (2021), English and Wales Court of Appeal. European Patent Office, 'J 0008/20 (Designation of inventor/DABUS) of 21.12.2021', European Patent Office, 5 July 2022 — https://www.epo.org/law-practice/case-law-appeals/recent/j200008eu1.html on 16 February 2023.

13 Gibson C, 'Intellectual property law: The South African Patents Office issues the world's first patented invention listing AI as an inventor', DKVG Attorneys, 8 September 2021 — https://dkvg.co.za/intellectual-property-law-the-south-african-patents-office-issues-the-worlds-first-patented-invention-listing-ai-as-an-inventor/ on 29 November 2022. Villasenor J, 'Patents and AI inventions: Recent court rulings and broader policy questions', Brookings, 25 August 2022 — https://www.brookings.edu/articles/patents-and-ai-inventions-recent-court-rulings-and-broader-policy-questions/ on 19 August 2023.

14 Bibe M, 'Worldwide: DABUS: The 'natural person' problem', World Intellectual Property Review, 17 September 2021 — https://www.worldipreview.com/contributed-article/dabus-the-natural-person-problem on 30 December 2021.

contending that patent law only envisioned natural persons.[15] A key component of DABUS is machine learning (ML).[16] ML is a subfield of AI that refers to a system's capacity to identify, recognise and extract patterns from data without significant human intervention.[17] This study focuses on ML inventorship, which refers to the ongoing debate over whether ML systems should be recognised as inventors of their output. In Kenya, an inventor is defined under Section 2 of the Industrial Property Act, 2001 (IPA) as 'a person' who comes up with an invention.[18] Some have maintained that this noun demonstrates that the IPA's drafters envisioned inventors to be exclusively natural persons.[19]

This study predicts that Kenya's patent office, the Kenya Industrial Property Institute (KIPI), will eventually be approached to address the issue of ML inventorship, and AI inventorship generally, for the following reasons. Firstly, Kenya is currently a member state of WIPO,[20] and has taken part in the international discourse of AI inventorship.[21] Secondly, Thaler has filed a DABUS patent application under the Patent Cooperation Treaty,[22] to which Kenya is a party.[23] Thirdly, Kenya is a 'silicon savannah' that is currently undergoing its fourth industrial revolution, which is primarily characterised by technological advancements.[24] This change has already had an impact on intellectual property (IP), which has prompted organisations like the Kenya Copyright Board (KCB)

15 *Thaler v Commissioner of Patents* (2021), Federal Court of Australia. *Commissioner of Patents v Thaler* (2022) Full Court of the Federal Court of Australia.

16 Christou L, 'When machines create: Should AI be recognised as an inventor?', Verdict, 2 August 2019 — https://www.verdict.co.uk/dabus-ai-can-ai-invent/ on 03 January 2022.

17 Kelleher J, *Deep learning,* The Massachusetts Institutes of Technology Press, Cambridge, 2019, 6.

18 Section 2, *Industrial Property Act* (Act No. 7 of 2007).

19 Muchiri C and Nzuki C, 'The DABUS Patent: Kenya what say ye? Can we or can we not patent AI?' CIPIT Strathmore, 8 September 2021 — https://cipit.strathmore.edu/the-dabus-patent-kenya-what-say-ye-can-we-or-can-we-not-patent-ai/ on 30 December 2021.

20 Mbuimwe F, 'Strengthening Kenya's IP landscape' WIPO Magazine, August 2016 — https://www.wipo.int/wipo_magazine/en/2016/04/article_0007.html#:~:text=A%20member%20state%20of%20WIPO,%2DCounterfeit%20Agency%20(ACA) on 07 October 2022.

21 World Intellectual Property Secretariat, 'WIPO conversation on intellectual property (IP) and frontier technologies', 2, 7 and 8.

22 *Patent Cooperation Treaty*, 19 June 1970. Udovich S, 'Recent development in artificial intelligence and IP law: South Africa grants world's first patent for AI-created invention', Winstead, 8 February 2021 — https://m.winstead.com/Knowledge-Events/News-Alerts/383815/Recent-Developments-in-Artificial-Intelligence-and-IP-Law-South-Africa-Grants-Worlds-First-Patent-for-AI-Created-Invention on 2 January 2022.

23 World Intellectual Property Organization, 'The PCT now has 154 contracting states', World Intellectual Property Organization, 1 April 2020 — https://www.wipo.int/pct/en/pct_contracting_states.html on 2 January 2022.

24 Masters L, 'Africa, the fourth industrial revolution and digital diplomacy: (Re)Negotiating the international knowledge structure' 28(3) *South African Journal of International Affairs*, 2021, 369 and 372.

in 2021 to discuss rising concerns about AI and copyright, a type of IP similar to patents.[25] One worry raised by KCB is the ownership of the copyright in AI-generated creative works.[26] This question is related to the subject of this study, as it also questions whether an AI system can be credited for its creations.

Given that ML inventorship is currently a contentious topic that has implications for the future of inventorship, this article, therefore, seeks to investigate whether Kenya's IPA should evolve to recognise ML systems as inventors. Other than a general short piece, there is very little Kenyan scholarship regarding this study's research question.[27] Therefore, this research aims to add to the pool of Kenyan scholarship by providing a comprehensive study of ML inventorship.

This study advocates for the revision of the IPA, Kenya's inventorship law, to accommodate ML systems for the reasons outlined later in this study because, notwithstanding the definition of an inventor, some ML systems are capable of producing output that meets the IPA's requisite requirements. Furthermore, when compared to other systems, the patent law is the regime best placed to recognise ML inventorship. In addition, AI inventorship recognition would generally uphold the integrity of the patent system by promoting the correct identification of inventors. The correct identification of inventors is crucial to avoiding penalties such as the cancellation or invalidation of the patent obtained.[28] In exploring this argument, this article shall be broken down as follows. Part I is this introduction. Part II is the conceptual framework of this paper that provides the lens through which this article's argument should be viewed. Part III focuses on ML to briefly highlight how ML systems operate and generate patentable output. It also provides examples of inventions from ML systems that are subjected to Kenya's IPA in Part IV to assess the IPA's ability to recognise these machines as inventors. Part V proposes some recommendations based on the findings of the foregoing parts and Part VI concludes the paper.

[25] See generally, Kenya Copyright Board, 'Copyright in the age of artificial intelligence', Kenya Copyright Board, 28 December 2021— https://copyright.go.ke/media-center/newsletters/38 on 21 August 2022.

[26] Jaketch W, 'Ownership issues in copyright works in the age of artificial intelligence', Copyright News, 28 December 2021, 6 — https://copyright.go.ke/media-center/newsletters/38 on 17 June 2023.

[27] Muchiri C and Nzuki C, 'The DABUS Patent: Kenya what say ye? Can we or can we not patent AI?' CIPIT Strathmore, 8 September 2021 — https://cipit.strathmore.edu/the-dabus-patent-kenya-what-say-ye-can-we-or-can-we-not-patent-ai/ on 30 December 2021.

[28] Afshar M, 'I'm not "human" after all – can artificial intelligence survive the inventorship requirement?', 14.

II. Conceptual Framework: Non-Anthropocentrism

This article will refer to the concept of non-anthropocentrism throughout its analysis. To understand non-anthropocentrism, however, it is imperative to first clarify what 'anthropocentrism' is. Anthropocentrism, or human exceptionalism, is the idea that there are certain traits and properties that humans have that distinguish them from non-human species, such as intelligence and rationality.[29] According to this point of view, these traits place human beings at the 'centre of the world' and the value of non-humans is thus measured against the essence of human beings.[30]

The origins of anthropocentrism are considered to be rooted in the ideologies of philosophers, such as those of Aristotle and Kant, and Judeo-Christian theologies.[31] In terms of theology, many ethicists believe that Genesis 1:28, which states that humans were made in God's image and are commanded to 'subdue' the Earth and 'have dominion' over all other living things, contains the seeds of anthropocentrism.[32] This line of thought has been observed in Aristotle's work '*Politica'* where he claims that 'plants exist for the sake of animals, and lower animals for the sake of humans'.[33] Human exceptionalism has often been used to vindicate human superiority over others and justify actions such as animal cruelty and environmental exploitation.[34]

Some authors have also considered the impacts of anthropocentrism on AI.[35] For instance, Arjonilla and Kobayashi contend that the possibility of developing a general theory of intelligence is hindered by the anthropocentric bias underlying the 'traditional understanding of intelligence'.[36] As a result, it is a challenge to explain intelligent behaviour that may be exhibited by entities such as machines. One consequence that is particularly relevant to this study

29 Maccarini A, 'Human self-understanding in a post-human society' in Archer M and Maccarini A, *What is essential to being human? Can AI robots not share it?,* Routledge, Oxon, 2021, 197.

30 Droz L, 'Anthropocentrism as the scapegoat of the environmental crisis: a review' 22 *Ethics in Science and Environmental Politics*, 2022, 28. Etieyibo E, 'Anthropocentrism, African metaphysical worldview, and animal practices: A reply to Kai Horsthemke' 7(2) *Journal of Animal Ethics,* 2017, 148.

31 Shkliarevsky G, 'Living a non-anthropocentric future' 2021, 5-7 — https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3933108 on 20 February 2022.

32 Mingucci G, 'The place of human being in the natural environment Aristotle's philosophy of biology and the dominant anthropocentric reading of Genesis' 15(2) *Journal of Ancient Philosophy*, 2021, 212.

33 Mingucci G, 'The place of human being in the natural environment Aristotle's philosophy of biology and the dominant anthropocentric reading of Genesis', 220.

34 Freeman C, 'Taking exception to human exceptionalism' 23(32) *Animal Sentience,* 2019, 1.

35 Maccarini A, *What is essential to being human? Can AI robots not share it?*, 8-12 and 198.

36 Arjonilla F and Kobayashi Y, 'The anthropocentrism of intelligence: Rooted assumptions that hinder the study of general intelligence', SIG-AGI, Tokyo, March 2019, 1.

is that anthropocentrism prevents human beings from 'fully appreciating the intelligence' of non-human entities.[37] Even though some AI systems today have been proven to excel at reasoning and problem-solving, these skills are ignored since they do not constitute the 'authentic intelligence' that only humans allegedly exhibit.[38] Consequently, scholars are now moving to address ways in which intelligence demonstrated by non-humans can be 'conceptualised in terms other than humanistic'.[39]

This study postulates that this human preference has created an anthropocentric bias that prevents the appreciation of AI's cognitive abilities. This bias is unfortunately upheld by the law which, Shuifa identified, adopts a 'human-centred' approach in response to scientific and technological evolutions.[40] Hence, this study advocates for non-anthropocentrism. Non-anthropocentrism, by inference, may be referred to as the opposition to the notion that human beings are superior to other beings.[41] This is an emerging concept that seeks to appreciate the 'intrinsic value' of non-human entities that anthropocentrism ignores.[42] This article, therefore, aims to use non-anthropocentrism to argue that ML systems should not be barred from inventorship merely because they are 'non-human'. As this paper demonstrates, despite their non-humanness, these systems can devise patentable solutions to problems that justify their recognition under Kenya's IPA.

[37] News Scientist, 'A question of intelligence: Why are humans the smartest animals on Earth?' New Scientist, 21 March 2012 — https://www.newscientist.com/article/mg21328573-300-a-question-of-intelligence/ on 22 February 2022.

[38] European Union, *AI Watch, Defining Artificial Intelligence: Towards an operational definition and taxonomy of artificial intelligence,* 2020, 4-5. Venkatalakshmi B, 'Artificial intelligence, does it have the ability to mimic human intelligence?' 8(1) *Frontiers in Robotics and AI,* 2020, 1. De Cremer and Kasparov G, 'AI should augment human intelligence, not replace it', Harvard Business Review, 18 March 2021 — https://hbr.org/2021/03/ai-should-augment-human-intelligence-not-replace-it on 22 February 2022.

[39] Mellamphy N, 'Re-thinking "Human-centric" AI: An introduction to posthumanist critique', EuropeNow, 9 November 2021 — https://www.europenowjournal.org/2021/11/07/re-thinking-human-centric-ai-an-introduction-to-posthumanist-critique/ on 21 February 2022.

[40] Shuifa H, 'Justice in anthropocentrism. An attitude towards contemporary human beings and their intellectual crisis' (4) *Yearbook for Eastern and Western Philosophy,* 2019, 255.

[41] Weckler I, 'In defense of non-anthropocentrism – a relational account of value and how it can be integrated', Published MA, University of Montana, Montana, 2020, 2-3.

[42] Scheessele M, 'The hard limit on human nonanthropocentrism' 37(4) *AI & Society,* 2022, 49. Shkliarevsky G, 'Living a non-anthropocentric future', 15.

III. Machine Learning Inventorship

i. A Brief Introduction to ML

In general, ML is a branch of AI that specialises in developing computer programs that use data to learn for themselves.[43] To achieve this objective, ML uses 'neural networks', which consist of a group of algorithms (or 'nodes') that are designed to recognise patterns in data. These networks are roughly modelled after the structure of the human brain.[44] AI systems 'learn' from data to generate potentially patentable output.[45] The modes of learning shall be expounded upon in the next section to draw comparisons between ML and human learning.

ii. How ML Algorithms Learn

ML systems primarily learn through supervised, unsupervised, or reinforcement learning. Supervised learning is the most common type of learning, where an algorithm is trained to learn how to map an input variable into a desired output variable.[46] Unsupervised learning is where an algorithm identifies new patterns and structures in the data on its own, without prior information or training. As implied by the term 'unsupervised', there are no correct answers and no teacher. Consequently, unsupervised learning is used where there is only input data available 'but no corresponding output variables.[47] Reinforcement learning is an experience-based mechanism where an agent learns how to behave in an environment. The agent is placed in a situation that resembles a game, where they must solve a problem that has been presented to them.[48] The machine must work out the solution on its own through trial and error as no clues or suggestions are offered to it. A reward-penalty system is used to induce the machine to do what the programmer desires and enable the ML system to develop and reach its full

43 Selig J, 'What is machine learning? A definition', Expert.AI, 14 March 2022 — https://www.expert.ai/blog/machine-learning-definition/ on 28 November 2022.

44 Goyal K, 'Machine learning vs neural networks: What is the difference?', upGrad, 31 October 2022 — Machine Learning vs Neural Networks: What is the Difference? | upGrad blog on 28 November 2022.

45 Ravid S and Liu X, 'When artificial intelligence systems produce inventions: An alternative model for patent law at the 3A era', 39(2215) *Cardozo Law Review*, 2018, 2224.

46 Pelk H, 'Machine learning, neural networks and algorithms', 25 October 2016 — https://chatbotsmagazine.com/machine-learning-neural-networks-and-algorithms-5c0711eb8f9a on 28 November 2022. Brownlee J, *Master machine learning algorithms*, 16 and 17.

47 Brownlee J, *Master machine learning algorithms*, 17.

48 Shwartz S and Ben-David S, *Understanding machine learning*, 23.

potential.[49] An ML system can be trained using any combination of either of the learning methods; DABUS, for instance, was trained using both supervised and unsupervised learning.[50]

As aforementioned, artificial neural networks are meant to replicate the human brain, which is currently the 'smartest-known creation'.[51] In light of this, similarities and differences exist between artificial neural networks (ANNs) in ML systems and neural networks in human beings (HNNs). For example, one similarity is that ML systems and human beings engage in supervised or unsupervised learning. Human learning can be 'supervised' (e.g., students learning in educational institutions) or 'unsupervised' (e.g., children learning to speak through imitation).[52] ML systems can also be similarly trained through supervised learning (e.g. weather predictions) and unsupervised learning (e.g. recommender systems).[53] The mode of generating solutions is also similar. The human brain engages in convergent thinking to come up with the best solution to address a problem. ML systems, through evolutionary algorithms, achieve the same objective.[54] Inspired by natural evolution, evolutionary algorithms seek to automatically come up with novel and inventive solutions that may be too complex or uncommon for humans to discover themselves.[55]

However, there are key differences, such as how errors are tested. ML systems may have ANNs that are designed to check for errors by working

[49] Osiński B and Budek K, 'What is reinforcement learning? The complete guide', Deep Sense AI, 5 July 2018 — https://deepsense.ai/what-is-reinforcement-learning-the-complete-guide/ on 28 November 2022.

[50] Collins J, Shoolman N and Jenkins R, 'Robots are taking over the patent world – AI systems or devices can be "inventors" under the Australian Patents Act', Kluwer Patent Blog, 08 September 2021 — http://patentblog.kluweriplaw.com/2021/09/08/robots-are-taking-over-the-patent-world-ai-systems-or-devices-can-be-inventors-under-the-australian-patents-act/ on 21 August 2022.

[51] Wood T, 'How similar are neural networks to our brains?' Fast Data Science, 5 July 2022 — https://fastdatascience.com/how-similar-are-neural-networks-to-our-brains/ on 28 November 2022.

[52] Fodor J, 'Neural networks don't work like the human brain because they 'learn' differently', The Next Web, 06 June 2022 — https://thenextweb.com/news/neural-networks-dont-work-like-the-human-brain-because-they-learn-differently on 28 November 2022.

[53] Yagcioglu S, 'Classical examples of supervised vs.unsupervised learning in machine learning', Springboard, 18 May 2020 — https://www.springboard.com/blog/data-science/lp-machine-learning-unsupervised-learning-supervised-learning/#:~:text=One%20practical%20example%20of%20supervised,houses%2C%20i.e.%20the%20corresponding%20labels. on 1 December 2022. Heidmann L, 'Unsupervised machine learning: Use cases & examples', Dataiku, 21 July 2020 — https://blog.dataiku.com/unsupervised-machine-learning-use-cases-examples on 28 November 2022.

[54] Cognizant, 'Evolutionary algorithm', Cognizant, 28 May 2020 — https://www.cognizant.com/us/en/glossary/evolutionary-algorithm on 29 November 2022.

[55] Cognizant, 'Evolutionary computation/evolutionary AI', 28 July 2021 — https://www.cognizant.com/us/en/glossary/evolutionary-computation on 29 November 2022.

backwards from the output nodes to the input nodes. This process is known as 'backpropagation', which allows for the re-adjustment of weights in the ANNs to rectify any errors identified.[56] This allows for improved performance and accuracy on tasks. Backpropagation does not apply to human beings as it requires properties that are absent in the brain, though some researchers have proposed theories on how the neurons in the brain could be organised to imitate variations of the backpropagation algorithm.[57] Another difference is decision-making. Though it is almost impossible to visually depict how the human brain makes a decision, human beings are capable of articulating their decision-making process in a way that is understandable to other human beings.[58] ML systems, however, communicate their behaviour through neuron weights that humans do not understand. This phenomenon has contributed to what is referred to as the 'black box' problem as it is difficult to explain, in human-intelligible terms, how a specific neural network input results in an output.[59]

iii. Examples of inventions from ML Systems

There are 3 main categories of ML-related inventions: inventions of ML technologies, ML-assisted inventions, and ML-generated inventions.[60] Inventions of ML technologies are where human beings make ML technologies. ML-assisted inventions are where ML systems are used as tools by humans to generate inventions. ML-generated inventions are where an ML system autonomously generates an invention, with little human input (e.g., instructions).[61] The third category is the focus of this research because, unlike the other two categories, this category considers the ML system as the inventor.

The most-cited examples of inventions devised by ML systems are the Oral-B toothbrush developed by the 'Creativity Machine', the ST-5 antennae developed by the National Aeronautics and Space Administration (NASA)'s computers, and,

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56 Fodor J, 'Neural networks don't work like the human brain because they 'learn' differently', The Next Web, 06 June 2022 — https://thenextweb.com/news/neural-networks-dont-work-like-the-human-brain-because-they-learn-differently on 28 November 2022.

57 Fodor J, 'Neural networks don't work like the human brain because they 'learn' differently', The Next Web, 06 June 2022 — https://thenextweb.com/news/neural-networks-dont-work-like-the-human-brain-because-they-learn-differently on 28 November 2022. Whittington J and Bogacz R, 'Theories of error back-propagation in the brain' 23(3) *Trends in Cognitive Sciences*, 2019, 235-250.

58 Wood T, 'How similar are neural networks to our brains?' Fast Data Science, 5 July 2022 — https://fastdatascience.com/how-similar-are-neural-networks-to-our-brains/ on 28 November 2022.

59 Wood T, 'How similar are neural networks to our brains?' Fast Data Science, 5 July 2022 — https://fastdatascience.com/how-similar-are-neural-networks-to-our-brains/ on 28 November 2022.

60 Lee JA, Hilty R and Liu KC, *Artificial intelligence and intellectual property*, Oxford University Press, Oxford, 2021, 100.

61 Lee JA, Hilty R and Liu KC, *Artificial intelligence and intellectual property*, 100.

most recently, the food container and flashing light by 'DABUS'.[62] The Creativity Machine, otherwise known as 'Device for the Autonomous Generation of Useful Information',[63] was invented by Stephen Thaler in the 1990s to generate novel concepts, designs, and processes using ANNs and ML.[64] In 2004, the Creativity Machine used two neural networks to study toothbrush design and performance and autonomously design a cross-bristled configuration of a toothbrush known as the Oral-B Cross Action toothbrush.[65]

Later, in 2005, NASA scheduled three Space Technology 5 (ST5) satellites to orbit the Earth in 2006.[66] In preparation for this mission, NASA's computer scientists gave instructions to eighty personal computers, which were all equipped with NASA's AI software, on the requirements of the antennae needed. By fine-tuning the provided designs to a final design that most closely resembled what the scientists had requested, the computers were able to develop small, cutting-edge space antennae through ML evolutionary algorithms.[67] Most recently, in 2019, DABUS, invented by Stephen Thaler, was alleged to autonomously create two inventions, a food container with a fractal surface that helps with insulation and stocking and a flashing light for attracting attention in emergencies.[68] DABUS

62 Kim D, 'AI-generated inventions': Time to get the record straight' 69(5) *GRUR International*, 2020, 445.

63 Hesman T, 'Computer creativity machine simulates the human brain', St Louis Post-Dispatch, 24 January 2004 — http://www.umsl.edu/~sauterv/DSS/creativitymachine_12504.html on 30 November 2022.

64 Google Patents, 'Device for the autonomous generation of useful information', Google Patents — https://patents.google.com/patent/US5659666A/en on 01 December 2022. Naidoo M, 'In a world first, South Africa grants a patent to an artificial intelligence system', Quartz, 9 August 2021 — https://qz.com/africa/2044477/south-africa-grants-patent-to-an-ai-system-known-as-dabus on 29 November 2022.

65 Hesman T, 'Computer creativity simulates human brain', St. Louis Post-Dispatch, 25 January 2004 — http://www.umsl.edu/~sauterv/DSS/creativitymachine_12504.html on 28 November 2022. McLaughlin M, 'Computer generated inventions' 101(224) *Journal of the Patent & Trademark Office Society*, 2019, 31.

66 Bluck J, 'NASA synthetic brain power may design more than space antennas', National Aeronautics and Space Administration, 29 March 2008 — https://www.nasa.gov/centers/ames/research/exploringtheuniverse/spaceantennas.html on 29 November 2022.

67 Bluck J, 'NASA synthetic brain power may design more than space antennas', National Aeronautics and Space Administration, 29 March 2008 — https://www.nasa.gov/centers/ames/research/exploringtheuniverse/spaceantennas.html on 29 November 2022. AMSI Research & Higher Ed, 'Unicellularity of shift operators', AMSI Research & Higher Ed, 28 March 2016 — https://rhed.amsi.org.au/unicellularity-shift-operators/ on 13 May 2023.

68 Imagination Engines, 'DABUS described', Imagination Engines, 28 October 2019 — https://imagination-engines.com/dabus.html on 29 November 2022. Hamblen M, 'Team seeks patents for inventions created by DABUS, an AI', Fierce Electronics, 1 August 2019 — https://www.fierceelectronics.com/electronics/team-seeks-patents-for-inventions-created-by-dabus-ai on 29 November 2022.

used ML to generate novel ideas and selected the most novel, useful and valuable ideas.[69]

From these examples, it can be concluded that some ML systems are capable of inventive activities. However, some subtleties must be taken into account. It may be claimed, for instance, that an ML system trained through supervised learning should not qualify as an inventor because there was a significant amount of human influence in how the system developed its subsequent invention. Therefore, this article suggests that only ML systems that produce an invention with the least amount of human involvement should be recognised as inventors. Against this backdrop, the next part of this paper scrutinises Kenya's IPA to assess its current capacity to recognise ML inventorship.

IV. Kenya's IPA: Any Room for ML Inventorship?

i. The Key Elements of Inventorship in Kenya

The law of inventorship focuses on two elements: an inventor and an invention. An inventor is defined by Section 2 of the IPA as 'the person who actually devises the invention as defined in Section 21 and includes the legal representative of the inventor'.[70] The inventor has the right to a patent according to Section 30 of the IPA.[71] For rights to accrue, an inventor needs to be named in a patent application per Section 33 of the IPA.[72] Even though the IPA's definition of an inventor is used to determine the identity of an inventor, this definition is inherently anthropocentric. The Interpretations and General Provisions Act (IGPA) defines a 'person' as either a natural person (i.e., a human being) or a legal person, which typically consists of natural persons (e.g., companies).[73] The IGPA's interpretation of the term 'person' is further reinforced by other authoritative legislations such as the Constitution of Kenya (2010).[74]

69 Tazrout Z, 'South Africa & Australia: AI recognized as inventor in two patent filings', ActuIA, 4 August 2021 — https://www.actuia.com/english/south-africa-australia-ai-recognized-as-inventor-in-two-patent-filings/ on 29 November 2022. Lee JA *et al*, *Artificial intelligence and intellectual property*, 102.

70 Section 2, *Industrial Property Act* (Act No. 7 of 2007).

71 Section 30, *Industrial Property Act* (Act No. 7 of 2007).

72 Section 33, *Industrial Property Act* (Act No. 7 of 2007).

73 Section 3, *Interpretation and General Provisions Act* (Act No. 20 of 2020). Muchiri C and Nzuki C, 'The DABUS patent: Kenya what say ye? Can we or can we not patent AI?', 8 September 2021 — https://cipit.strathmore.edu/the-dabus-patent-kenya-what-say-ye-can-we-or-can-we-not-patent-ai/ on 13 November 2022.

74 Article 260, *Constitution of Kenya* (2010).

An invention is defined by Section 2 of the IPA as 'a new and useful art (whether producing a physical effect or not), process, machine, manufacture or composition of matter'.[75] Section 21(1) of the IPA provides that an invention must be a 'solution to a specific problem in the field of technology'.[76] Section 21(2) of the IPA further states that an invention may be a 'product or process'.[77] For an invention to be patentable, it must meet the requirements of novelty, inventive step, and industrial applicability.[78]

ii. The Key Requirements for Proving Inventorship in Kenya

In Kenya, patents are granted to the inventor who first files an application.[79] This is because Kenya adopts the 'first-to-file' system which supports the inventor who first filed for a patent application rather than the inventor who first conceived the invention.[80] For a patent to be awarded, therefore, a patent application filed at KIPI must meet the IPA's substantive and formal requirements.

The substantive requirements are laid out under Sections 23 to 25 of the IPA. An invention listed in a patent application is patentable if it is new, involves an inventive step, and is industrially applicable.[81] The first requirement is 'novelty'. In order to determine if an invention is new, KIPI assesses if the invention was anticipated by prior art.[82] Prior art is any pre-existing information available anywhere in the world.[83] It provides evidence that an invention has already been disclosed and made available to the public. The second requirement is an 'inventive step'. An invention contains an inventive step if it is non-obvious to a person having ordinary skill in the art (PHOSITA).[84] The third requirement is 'industrial applicability'. An invention is industrially applicable where it is useful, or it is a new use.[85]

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75 Section 2, *Industrial Property Act* (Act No. 7 of 2007).

76 Section 21(1), *Industrial Property Act* (Act No. 7 of 2007).

77 Section 21(2), *Industrial Property Act* (Act No. 7 of 2007).

78 Section 22, *Industrial Property Act* (Act No. 7 of 2007).

79 Kiveu M, 'Patenting in Kenya: Status and challenges', Kenya Institute for Public Policy Research and Analysis, Discussion Paper Number 141, 2012, 15 — https://repository.kippra.or.ke/bitstream/handle/123456789/2504/DP141.pdf?sequence=1&isAllowed=y on 07 October 2022.

80 Kenya Industrial Property Office, *Guide to Patenting in Kenya,* 1995, 7.

81 Section 22, *Industrial Property Act* (Act No. 7 of 2007).

82 Section 23, *Industrial Property Act* (Act No. 7 of 2007).

83 Kiveu M, 'Patenting in Kenya', 14.

84 Section 24, *Industrial Property Act* (Act No. 7 of 2007).

85 Section 25, *Industrial Property Act* (Act No. 7 of 2007). Kiveu M, 'Patenting in Kenya', 15. *General Plastics Ltd v The Industrial Property Tribunal & Another* (2007) eKLR.

The formal requirements are found in Sections 34 and 35 of the IPA. The first requirement is a 'written description'.[86] Within the patent application, an inventor must describe the invention exhaustively, including how it works and how it uses technology to solve an issue. The second requirement is 'enablement'.[87] The written description in the patent application should 'enable' or allow a PHOSITA to make and use the invention without undue experimentation. The third requirement is the unity of invention.[88] That is, a patent application should only protect one invention. Where there is more than one invention, they should be linked by a general inventive concept.

The KIPI Tribunal may revoke or invalidate a patent where the owner of the patent is not entitled to apply for the grant of a patent or where the invention fails to meet the substantive and formal requirements.[89] This article argues that these requirements were framed with a human inventor in mind. Since the human mind is seen as 'the ultimate source of invention',[90] human skills are consequently the standards for assessing inventorship.[91] As a consequence, there is a challenge in fully applying the IPA as it stands to ML systems as shall be demonstrated.

iii. The IPA and ML Inventorship

This section shall subject the Oral-B Cross Action toothbrush, the ST5 antennae, the food container, and the flashing light discussed in Part III to Kenya's IPA. It shall first look at the law on inventors (i.e., Section 2 of the IPA) before subjecting it to the law of inventions (i.e. the substantive and formal requirements) to determine if Kenya's IPA is capable of recognising ML inventorship.

a. The Definition of an Inventor

As noted before, Section 2 of the IPA defines an 'inventor' as a *person* and this anthropocentric definition is supported by the Constitution and the

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86 Section 34 (5), *Industrial Property Act* (Act No. 7 of 2007).

87 Section 34 (5), *Industrial Property Act* (Act No. 7 of 2007).

88 Section 35, *Industrial Property Act* (Act No. 7 of 2007).

89 Section 103(3), *Industrial Property Act* (Act No. 7 of 2007).

90 Cooper II C, Gorski D, Hines Jr. J, 'Artificial intelligence and inventorship: Federal Court of Appeals determines that patent inventors must be human', JD Supra — https://www.jdsupra.com/post/contentViewerEmbed.aspx?fid=6d6eda8d-7ab7-4eae-b3cd-c37126e836e0 on 21 January 2023.

91 Dornis T, 'Artificial intelligence and innovation: The end of patent law as we know it' 23 *Yale Journal of Law & Technology*, 2020, 102.

Interpretations and General Provisions Act.[92] The direct application of these provisions would make it difficult for ML systems to be acknowledged as inventors since they are not 'persons'. However, this study challenges the validity of Section 2 and why an inventor must be a human being. Some courts have argued that an inventor must be a human being because the law defines an inventor as a human being. For instance, in the *DABUS* case, the US Patent and Trademark Office (USPTO) stated that inventors can only be natural persons because the US Patent Act consistently refers to inventors as natural persons and this has been upheld by Federal Circuit precedents.[93] This article, however, contends that the anthropocentric view of AI has contributed to the reinforcement of the human requirement by the USPTO as it views AI systems as tools,[94] a view shared by other academics and jurisdictions.[95] The consequence is that there is a preference for naming the human being 'behind' the AI system rather than the system itself, even where the person does not want to take credit for the invention, such as Thaler,[96] or the ML system was designed to be autonomous.

Another reason for the human requirement is based on historical considerations. When patent laws were being drafted, humans were the only beings at the time thought to be capable of engaging in mental activities that resulted in the creation of an invention.[97] However, this study illustrated that this is no longer the case as some ML systems are capable of autonomously inventing. The IPA's definition of an inventor should, therefore, be revised to

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92 Section 2, *Industrial Property Act* (Act No. 7 of 2007), Article 260, *Constitution of Kenya* (2010) and Section 3, *Interpretation and General Provisions Act* (Act No. 20 of 2020).

93 See *University of Utah v Max-Planck-Gesellschaft zur Forderung der Wissenshchaften* (2013) United States Federal Circuit. Ziegler K, 'IP frontiers: AI can invent, but can't be an inventor', Heslin Rothenberg Farley Mesiti, 15 February 2022 — https://www.hrfmlaw.com/ip-frontiers-ai-can-invent-but-cant-be-an-inventor/ on 30 November 2022.

94 Ziegler K, 'IP frontiers: AI can invent, but can't be an inventor', Heslin Rothenberg Farley Mesiti, 15 February 2022 — https://www.hrfmlaw.com/ip-frontiers-ai-can-invent-but-cant-be-an-inventor/ on 30 November 2022.

95 Bosher H *et al*, 'WIPO Impact of artificial intelligence on IP policy response from Brunel University London, Law School & Centre for Artificial Intelligence', 7. McDole J, 'Defining a "Person": Analyzing the legal IP issues of AI inventorship and creatorship', Information Technology & Innovation Foundation, 22 July 2022 — https://itif.org/publications/2022/07/22/defining-a-person-analyzing-the-legal-ip-issues-of-ai-inventorship-and-creatorship/ on 3 December 2022.

96 Comer A, 'AI: Artificial inventor or the real deal', 22(3) *North Carolina Journal of Law & Technology*, 2021, 456. Naidoo M, 'In a world first, South Africa grants a patent to an artificial intelligence system', Quartz, 9 August 2021— https://qz.com/africa/2044477/south-africa-grants-patent-to-an-ai-system-known-as-dabus on 29 November 2022.

97 *Thaler v Hirshfeld* (2021) United States District Court for the Eastern District of Virginia. Kaufhold S, 'The US patent office rules that inventors must be human', Kaufhold & Dix, 18 June 2021— https://www.kaufholdpatentgroup.com/the-us-patent-office-rules-that-inventors-must-be-human/ on 30 November 2022.

reflect the technological improvements that have led to the creation of inventive ML systems. This is because the law is a living, dynamic reality that must evolve in tandem with society to be effective and serve the interests of the people.[98]

The practicality of assigning rights and obligations, including ownership rights, to an ML system may also be an argument made in favour of maintaining the human requirement.[99] In Kenya, these rights and obligations are found under Sections 53 and 54 of the IPA.[100] It has been argued that it would be challenging for AI systems to 'have rights that come from an inventor' because they lack the necessary legal personality and capacity to uphold patent rights and adhere to patent obligations.[101] However, this article wishes to distinguish between inventorship and ownership because the two are related, but distinct, concepts.[102] Inventorship looks at who created the subject matter of the inventor, while ownership refers to those who own the patents and consequently have rights and duties.[103] Thus, an inventor *may or may not be* the owner of a patent, and technovations are an example of such an instance. A technovation is a solution devised by an employee for use by the employee's organisation.[104] Although inventors usually have ownership of the patent on their inventions, if an employee has been hired for the purpose of inventing a technovation, the employee may be recognised as the inventor but the employer owns the patent for the resultant technovation.[105] Therefore, there is a possibility that an ML system can be an inventor but not the owner of a patent.

b. Novelty

An invention must be new to be patentable as per Section 23 of the IPA. This study posits that the four ML-generated inventions may all be argued to be new. For instance, Thaler provided the Creativity Machine with

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98 News Time Now Web Desk, 'Law is a living reality that reflects changes of a dynamic society', New Time Now, 26 November 2017 — https://newstimenow.com/law-living-reality-of-society/ on 17 June 2023.

99 Vertinsky L and Rice T, 'Thinking about thinking machines: Implications of machine inventors for patent law', 8(2) *Boston University Journal of Science and Technology Law,* 2002, 37.

100 Sections 53(1) and 54, *Industrial Property Act* (Act No. 7 of 2007). *Safepak Limited v Power Plast Industries Limited* (2014) eKLR.

101 Chesterman S, 'Artificial intelligence and the limits of legal personality' 69 *International and Comparative Law Quarterly*, 2020, 839.

102 Bonadio E *et al*, 'Artificial intelligence as inventor', 23.

103 Yanisky-Ravid S and Jin R, 'Summoning a new artificial intelligence patent model', 32.

104 Section 94, *Industrial Property Act* (Act No. 7 of 2007).

105 Ndaruzi O, 'Analysis of the effectiveness of technovation law in Kenya', Published, Strathmore University, Nairobi, 2017, 26. *Speck v North Carolina Dairy Foundation* (1983) North Carolina Court of Appeals.

information on existing toothbrush designs and each brush's effectiveness. Solely from this information, the Creativity Machine produced 'the first ever crossed-bristle design' known as the Oral-B Cross Action toothbrush.[106] This points to the newness of the invention as the cross-bristle design had allegedly never existed before the Creativity Machine's invention. Furthermore, NASA used evolutionary algorithms which were reported to generate 'thousands of completely new types of designs, many of which have unusual structures that expert antenna designers would not be likely to produce'.[107] This implies that the antennae were novel in their design. In addition, the UKIPO and EPO have admitted that DABUS's inventions are novel.[108] The three-dimensional fractal structure of the food container has been commended as 'an intelligent choice' in maximising the surface area for heat transfer while simultaneously making it easier to assemble and transport.[109] According to WIPO, the flashing light is equally novel because prior signal indicators and beacons were based upon 'colour, brightness, brightness, periodic flashing frequency, rotational pattern, and motion, but not fractal dimension'.[110]

Though these inventions may meet the novelty requirement, this article acknowledges that ML systems challenge the traditional yardstick used to determine novelty and this has led to some concern. Novelty is assessed through prior art. An AI system can easily conduct searches of existing technologies within patent databases to design inventions that do not violate the requirement of novelty.[111] This indicates that AI can get around the prior art requirement far more easily than human inventors, creating an unequal playing field between human and non-human inventors. Furthermore, an ML system can expand the scope of prior art since it is capable of generating huge volumes of inventions that can be published or made available worldwide.[112] The standard for novelty would be raised as a result since there would be a larger body of previous art to

106 Abbott R, 'I think, therefore I invent: Creative computers and the future of patent law' 57(4) *Boston College Law Review*, 2016, 1094.

107 Hornby G, Globus A, Linden D and Lohn J, 'Automated antennae design with evolutionary algorithms', American Institute of Aeronautics and Astronautics, September 2006, 8 — https://www.researchgate.net/publication/228909002_Automated_Antenna_Design_with_Evolutionary_Algorithms on 29 November 2022.

108 Mammen C and Richey C, 'AI and IP', 286.

109 Hao Y, 'The rise of "centaur" inventors: How patent law should adapt to the challenge to inventorship doctrine by Human-AI inventing synergies', 2022, 5 — https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4186684 on 29 November 2022.

110 Google Patents, 'Food container and devices and methods for attracting enhanced attention', Google Patents, 2021— https://patents.google.com/patent/WO2020079499A1/en on 29 November 2022.

111 Feng X and Pan B, 'The evolution of patent system: Invention created by artificial intelligence' 183 *Procedia Computer Science,* 2021, 249.

112 Bonadio E *et al*, 'Artificial intelligence as inventor', 54-55.

compare an invention to in order to assess its uniqueness. Since ML systems can easily satisfy the novelty requirement because of their ability to easily access data on previous art, human applicants may need to put in more effort to develop a novel invention that has not already been developed by an ML system. This raises the question of whether ML inventions should be considered prior art (whether or not they are patented) and whether the same standard of novelty (i.e., prior art) should be applied to ML systems.[113] The latter question is important to note as ML systems learn from data, and can quickly and accurately review more prior art than would be possible for a human inventor, to further ensure novelty.[114]

c. Inventive Step

An invention contains an inventive step under Section 24 of the IPA if it is non-obvious. The determinant of non-obviousness is the PHOSITA and, therefore, the opinion of whether inventions are non-obvious may vary from examiner to examiner. KIPI examiners are guided by the provisions of the IPA in this regard and may consider factors such as whether the invention is novel or whether it speaks to a well-known business conventional procedure.[115]

This research posits that the 3 ML inventions may be found to be non-obvious by the PHOSITA. In the case of the Creativity Machine, it may be argued that there exists a degree of invention because it exerted skill and effort in developing a toothbrush design that had never been thought of. Based on the information provided about the ST5 antennae, it may be inferred that the antennae are non-obvious since their final design was so 'unusual', that it would be highly unlikely for 'a single designer' or 'team of designers' to create them.[116] In the case of DABUS's two inventions, the only country that has recognised DABUS as an inventor of these products is South Africa. However, unfortunately, the South African Patent Office does not subject patent applications to any substantive examination.[117] This means that no PHOSITA examined the two inventions.

113 Rodrigues R, 'Legal and human rights issues of AI: Gaps, challenges and vulnerabilities,' 4 *Journal of Responsible Technology*, 2020, 4.

114 Fraser E, 'Computers as inventors – Legal and policy implications of artificial intelligence on patent law', 13(3) *SCRIPTed*, 2016, 319.

115 *John Kamonjo Mwaura v Kenya Industrial Property Institute & another; National Commercial Bank of Africa (NCBA) & another (Interested Party)* (2020) eKLR.

116 Hornby G *et al*, 'Automated antennae design with evolutionary algorithms', 2. Lee JA *et al*, *Artificial intelligence and intellectual property*, 359-360.

117 Gibson C, 'Intellectual property law: The South African Patents Office issues the worlds first patented invention listing AI as an inventor', DKVG Attorneys, 8 September 2021 — https://dkvg.co.za/intellectual-property-law-the-south-african-patents-office-issues-the-worlds-first-patented-invention-listing-ai-as-an-inventor/ on 29 November 2022.

Nonetheless, Thaler opines that 'DABUS identified a problem on its own and developed a solution which was both new and non-obvious in light of the known technology'.[118]

Like novelty, however, ML systems challenge the bar used to measure non-obviousness. As stated previously, non-obviousness is determined by a PHOSITA. However, WIPO has recognised that AI will eventually surpass human intelligence, including that of a PHOSITA, implying that the bar would have to be raised to reflect current technological developments.[119] Thus, two questions must be considered. The first is, who would the PHOSITA be in the case of ML inventions, a human being or another ML system?[120] It is important to identify an examiner who is fully capable of assessing ML inventions. Furthermore, there are questions revolving around the standard of knowledge and skill that would be used to measure the ML system's invention.[121] The second is, what standards of non-obviousness would be used to examine the invention? Since ML systems vary, it may be challenging to establish a general 'non-obvious' standard. The agreed-upon standard of non-obviousness should also be 'reflective of changing inventive practices'.[122]

d. Industrial Applicability

An invention is industrially applicable if it is useful to a particular industry. From the information available, this article finds the 4 ML-generated inventions useful. Regarding the Creativity Machine's invention, the idea of crossing the bristles of the toothbrush promoted optimal cleaning, making the toothbrush useful to the oral care industry.[123] Furthermore, regarding the ST5 satellites, NASA's scientists found that these resulting antennas were highly efficient as they could receive commands and send data to Earth from ST5 satellites.[124] In

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[118] Tostrup E, 'Artificial inventors – Reality or science fiction', 9 March 2022 — https://biglanguage.com/blog/artificial-inventors-reality-or-science-fiction/ on 29 November 2022.

[119] Abbott R, 'The artificial inventor project', World Intellectual Property Organization Magazine, 20 December 2019 — https://www.wipo.int/wipo_magazine/en/2019/06/article_0002.html on 13 November 2022.

[120] Mammen C and Richey C, 'AI and IP', 291.

[121] Mammen C and Richey C, 'AI and IP', 291-292.

[122] World Economic Forum, 'Artificial intelligence collides with patent law', World Economic Forum, 2018, 12 — https://www3.weforum.org/docs/WEF_48540_WP_End_of_Innovation_Protecting_Patent_Law.pdf on 9 December 2022.

[123] Hesman T, 'Computer creativity simulates human brain', St. Louis Post-Dispatch, 25 January 2004 — http://www.umsl.edu/~sauterv/DSS/creativitymachine_12504.html on 28 November 2022.

[124] Bluck J, 'NASA 'Evolutionary' software automatically designs antenna', National Aeronautics and Space Administration, 8 March 2006 — https://www.nasa.gov/mission_pages/st-5/main/04-55AR.html on 29 November 2022.

addition, the fractal form of DABUS's food container was viewed as useful as it enables one to easily hold the container, even when condensation forms on the outside of the container as a result of the contents within the container being cold. Furthermore, DABUS's signalling device is helpful in emergencies. By making certain portions more noticeable to the brain, the device helps the brain's ability to filter sensory information.[125]

e. Disclosure and Enablement

According to Section 34 of the IPA, a patent application should contain a written description and enablement to allow the PHOSITA to make and use the claimed invention.[126] This may be a challenge for ML systems because their algorithms may create an invention that is too complex to understand. This is known as AI's 'black box' problem,[127] and it raises a host of questions when applied to the requirement of disclosure.

Firstly, in what manner should the written description be expressed for ML inventions? Section 34(5) of the IPA requires that the description should be disclosed in full, clear, concise, and exact terms to enable a PHOSITA to make and evaluate the invention.[128] Secondly, if the PHOSITA is another ML system, however, would there be a need for the disclosure to be understandable or readable by humans?[129] If the PHOSITA is a human being, would ML systems be able to adequately disclose their inventions given the black box problem? The developers of an AI system may not know how the AI system operates, let alone invents. Therefore, an ordinary person who is not involved in the development of the AI system would have a harder time being enabled by a written description prepared by an AI.

Overall, this article has found that the Creativity Machine, NASA's AI computers, and DABUS can produce patentable output that meets most of the IPA's requirements. However, it has been noted that there are challenges in fully applying the law's requirements to these systems. This study postulates that the reason for this is that the IPA standards were designed with human beings in mind. As previously mentioned in a preceding section, the law tends

125 Google Patents, 'Food container and devices and methods for attracting enhanced attention', Google Patents, 2021 — https://patents.google.com/patent/WO2020079499A1/en on 29 November 2022.

126 Section 34 (5), *Industrial Property Act* (Act No. 7 of 2007).

127 Bonadio E *et al*, 'Artificial intelligence as inventor', 59-60.

128 Section 34 (5), *Industrial Property Act* (Act No. 7 of 2007).

129 Mammen C and Richey C, 'AI and IP', 292.

to take an anthropocentric approach in response to scientific and technological advancements.[130] In the following section, however, this research shall present the case for ML inventorship recognition under the IPA.

V. ML Inventorship in Kenya: To Recognise or Not to Recognise

i. Reasons for ML Inventorship Recognition Under the IPA

This article acknowledges that some academics argue that the costs of awarding patents to ML systems may exceed the benefits.[131] The biggest cost is the creation of monopolies. In return for the public disclosure of information relating to the inventions once the patent protection expires, inventors are given monopolies over their creations.[132] Such monopolies could hinder innovation by restricting third parties from expanding upon and improving inventions produced by ML systems. Another related concern is that recognising ML systems as inventors could discourage innovation by enabling large corporations to monopolise the rights to inventions made by their AI systems and further concentrate the IP in their hands.[133]

Nevertheless, this study argues that ML inventorship should be recognised in Kenya for the following reasons. To begin with, it may increase the number of patents granted, which would then spur economic growth by rewarding inventors through returns and establishing incentive structures that encourage them to incur the necessary research and development costs that result in useful inventions.[134] Patents can also lead to the generation of revenue for the country in the form of patent fees and licensing revenue which can be used to fund additional research and development. The level of patenting inventions in Kenya is relatively low compared to other IP rights and other countries.[135]

130 Shuifa H, 'Justice in anthropocentrism. An attitude towards contemporary human beings and their intellectual crisis' 2019(4) *Yearbook for Eastern and Western Philosophy,* 2019, 255.

131 Abbott R, 'I think, therefore I invent', 1105.

132 Abbott R, 'I think, therefore I invent', 1105.

133 Abbott R, 'I think, therefore I invent', 1106-1107.

134 Wurster M, 'Intellectual property – How key technology patents stimulate economic growth', New Perspectives on Global & European Dynamics, 30 September 2021 — https://globaleurope.eu/globalization/intellectual-property-how-key-technology-patents-stimulate-economic-growth/#:~:text=In%20their%20view%2C%20patents%20provide,thus%20stimulate%20long%2Dterm20innovations. on 17 June 2023.

135 Kiveu M, 'Patenting in Kenya', 4. Gitau G, 'Kenya's trademark, patent applications rise to historic high', Business Daily, 7 June 2019 — https://www.businessdailyafrica.com/bd/data-hub/kenya-s-trademark-patent-applications-rise-to-historic-high-2253026 on 9 December 2022.

ML inventorship may also boost local inventorship. Patents are highly underutilised in most developing countries, with Kenya being no exception.[136] The number of patent applications is low, and KIPI rejects the vast majority of them. For instance, according to WIPO, in 2019, there were around three hundred resident patent applications filed but only five resident patents were granted.[137] These low numbers have been linked to the inability of local inventors to identify the novel aspects of their inventions, even though novelty is one of the conditions for patentability.[138] A closer look at this issue discloses that over seventy per cent of Kenya's granted patents go to international, not local, inventors because local inventors struggle to fulfil the IPA requirements and ultimately withdraw their applications.[139] Thus, local inventors may decide to train ML algorithms on the IPA's standards in order to create IPA-compliant inventions that are more likely to be granted patents. For example, like Thaler did with the Creative Machine and DABUS, a Kenyan inventor may, therefore, for instance, opt to train an ML algorithm to identify novel ideas that are patentable.

In addition, ML inventorship would be consistent with Kenya's Vision 2030, a development plan that aims to 'transform Kenya into a newly industrialising "middle-income country providing a high-quality life to all its citizens by the year 2030".[140] The pillars of Kenya's Vision 2030 are anchored by, *inter alia*, science, technology, and innovation.[141] Patents and other IP rights have been acknowledged as critical factors in achieving Vision 2030 since they foster economic growth.[142] ML inventorship would be in line with Vision 2030's goal

136 Nation, 'Few inventors are patenting their works says official', Nation, 29 June 2020 — https://nation.africa/kenya/business/few-inventors-are-patenting-their-works-says-official-857550 on 9 December 2022.

137 World Intellectual Property Organization, 'Kenya - Statistical country profiles', World Intellectual Property Organization, 2 October 2018 — https://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=KE on 9 December 2022.

138 Nation, 'Few inventors are patenting their works says official', Nation, 29 June 2020 — https://nation.africa/kenya/business/few-inventors-are-patenting-their-works-says-official-857550 on 9 December 2022.

139 Bolo M, Odongo D and Awino V, 'Industrial property rights acquisition in Kenya', The Scinnovent Centre, Discussion Paper 2, 2015, 22 — https://www.researchgate.net/publication/275340459_Industrial_Property_Rights_Acquisition_in_Kenya_Facts_figures_and_trends on 9 December 2022.

140 Government of the Republic of Kenya, *Kenya Vision 2030: The popular version*, 2007, 1.

141 Government of the Republic of Kenya, *Kenya Vision 2030: The popular version*, 2007, 8-9.

142 Gitonga A and Kieyah J, 'Overview of intellectual property rights: The case of Kenya', Kenya Institute for Public Policy Research and Analysis, Working Paper Number 18, 2011, 5 — https://repository.kippra.or.ke/bitstream/handle/123456789/2694/WP18.pdf?sequence=1 on 23 August 2023. Cavince A, 'Fueling innovation key to Vision 2030', The Standard Media, 24 June 2015 — https://www.standardmedia.co.ke/amp/mobile/article/2000166790/fueling-innovation-key-to-vision-2030 on 9 December 2022.

of boosting economic and technological development because it may increase the number of IPA-compliant inventions, therefore, increasing the likelihood of patent grants, and inspire Kenyans to develop innovative ML systems that use resources efficiently to produce socially beneficial output.[143]

ii. Patent Law: The Correct Regime to Recognise ML Inventorship

Some scholars have considered the recognition of ML inventorship under other frameworks other than patent law such as utility models, and trade secrets.[144] Studying this is crucial; if ML inventorship is better recognised under a system other than patent law, it may not be necessary to revise the current IPA. Utility models refer to any form, configuration or disposition of an element of some appliance, utensil, tool, instrument, handcraft, mechanism or other object or any part of the same allowing better functioning, use or manufacturing of the subject matter.[145] Trade secrets protect specific forms of confidential information that are commercially valuable.[146] On the one hand, utility models may be preferable in Kenya because they have less stringent requirements than patents e.g. the 'inventive step' is not required.[147] On the other hand, trade secrets may be an attractive option for ML inventorship because they operate by way of contract, particularly through non-disclosure agreements, and the identity of the inventor can be agreed upon between the parties.[148] Thus, parties can agree to identify an ML system as an inventor because of the freedom of contract.

Nevertheless, this article argues that patent law should be specifically relied upon to recognise ML inventorship in Kenya for the following reasons. At the onset, the monopoly granted to the inventor under patent law enables it to control competition, garner larger market shares, and increase credibility.

143 Government of the Republic of Kenya, *Kenya Vision 2030: The popular version*, 2007, 1, 8 and 9.

144 Weibust E and Pelletier D, 'Protecting AI-generated inventions as trade secrets requires protecting the generative AI as well', IP Watchdog, 24 July 2022 — https://ipwatchdog.com/2022/07/24/protecting-ai-generated-inventions-trade-secrets-requires-protecting-generative-ai-well/id=150372/#:~:text=In%20short%2C%20to%20satisfy%20those,readily%20ascertainable%20through%20proper%20means. on 9 December 2022.

145 Section 2, *Industrial Property Act* (Act No. 7 of 2007).

146 Wetunga N, 'The protection of trade secrets in Kenya', Published, Strathmore University, Nairobi, 2019, 7.

147 Section 82(2), *Industrial Property Act* (Act No. 7 of 2007) as read with Sections 24 and 43, *Industrial Property Act* (Act No. 7 of 2007).

148 Njeru R and Opijah D, 'Patent or trade secrets: Which offers better protection?', Bowmans, 20 February 2020 — https://www.bowmanslaw.com/insights/intellectual-property/patent-or-trade-secrets-which-offers-better-protection/#:~:text=Protecting%20inventions%20under%20patent%20law,product%20pricing%20and%20attract%20investors. on 3 December 2022.

In addition, an inventor can generate additional revenue by licensing patents to third parties.[149] Furthermore, patent protection is stronger than that of utility models and trade secrets. The monopoly granted to inventors under patent law is 10 years longer than that of inventors under utility models. While trade secret protection immediately comes to an end upon disclosure of the secret, patent protection only ends once 20 years have elapsed from the date of filing the patent application. Any disclosure done without the consent of the owner during this period is a ground for patent infringement, due to the existence of patent protection.[150] Although they are more costly than utility models,[151] patents are available worldwide unlike utility models which are only recognised in some countries.[152]

To add on, even though patents and trade secrets are both internationally protected under the TRIPS Agreement,[153] patent law offers the best balance between the interests of the inventors and the public. Patents provide a 20-year monopoly in exchange for the disclosure of information while trade secrets do not require any disclosure in Kenya.[154] Patents provide returns to the inventor in two different ways by providing a monopoly of rights to the inventor, while also simultaneously benefitting the public by enabling technological and information dissemination through disclosure which stimulates research and development in the invention.[155]

VI. Recommendations

The study's recommendations shall be divided into two broad categories: the participants in the patent system and the patent system itself.

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149 Njeru R and Opijah D, 'Patent or trade secrets: Which offers better protection?', Bowmans, 20 February 2020 — https://www.bowmanslaw.com/insights/intellectual-property/patent-or-trade-secrets-which-offers-better-protection/#:~:text=Protecting%20inventions%20under%20patent%20law,product%20pricing%20and%20attract%20investors. on 3 December 2022.

150 Sections 54 and 55, *Industrial Property Act* (Act No. 7 of 2007).

151 Kiveu M, 'Patenting in Kenya', 33-35.

152 Croft I, 'Differences between utility models vs patents: which should you choose?', Harper James, 24 August 2021 — https://harperjames.co.uk/article/utility-models-vs-patents-smarter-ip-strategy/ on 19 August 2023.

153 Article 39 and Section 5, *Agreement on Trade-Related Aspects of Intellectual Property Rights*, 15 April 1994, 1869 UNTS 299.

154 Kiveu M, 'Patenting in Kenya', 1. Section 60, *Industrial Property Act* (Act No. 7 of 2007).

155 Kiveu M, 'Patenting in Kenya', 2.

i. The Participants in the Patent System

The first set of recommendations is directed toward KIPI and the Parliament because they are responsible for the effective administration of the patent system and the dispensation of the IPA. With respect to KIPI, this article recommends that they should issue a policy on AI inventorship that builds on the issues raised by this study, such as the rights and obligations of ML systems and the problems associated with the patentability of ML inventions, to guide KIPI examiners and the Judiciary on how these matters should be addressed in Kenya. In developing this policy, KIPI should seek the opinions of relevant parties (e.g., the examiners and inventors) through forums (e.g., surveys, focus groups, consultations, and calls for papers) that assist the institute in preparing regulations that best capture Kenya's interests. Furthermore, KIPI should also consider hiring examiners who are qualified in computer science, and particularly conversant with ML algorithms, or train its current examiners on ML algorithms to increase their capacity to assess ML-generated inventions.

With respect to the Parliament, this article implores that they may consider the proposals put forward by this research in reforming Kenya's patent law and contribute to the development of an AI policy or law, in collaboration with KIPI and other relevant stakeholders, that would further expound on the relationship between ML systems and patent law in Kenya.

ii. The Patent System

a. Limited Legal Personhood

The second set of recommendations targets the underpinnings of Kenya's patent law system. It is important to start with legal personhood because it heavily influences the definition of an inventor, an inventor's rights, and the current requirements of patentability. Legal personhood, or the law of persons, is a Roman doctrine that is concerned with the 'legal position of the human person (*persona)* comprising their rights, capacities and duties'.[156] A legal subject is recognised by the law as a 'holder of rights and duties'.[157] The concept of *persona* traditionally refers to the human being and this is reflected in Kenya's laws such as Article 260 of the Constitution of Kenya (2010) and Section 2 of the

156 Mousourakis G, *Fundamentals of Roman private law,* Springer-Verlag, Heidelberg, 2012, 85.

157 Laurence Diver, '3.4.2 Legal subject', COHUBICOL, 14 July 2021 — https://publications.cohubicol.com/research-studies/text-driven-law/chapter-3/legal-subject-subjective-rights-legal-powers/legal-subject/ on 13 November 2022.

Interpretations and General Provisions Act.[158]

This study recommends that the Kenyan state should attribute a limited form of legal personhood to specific ML systems, where they are recognised as *personas* for the purposes of inventorship rights. The concept of legal personhood tends to be applied together with the concept of humanity. As Dyschkant explains, human beings tend to rely on their experiences to determine 'what counts as a person', but their experiences are typically with other human beings. Therefore, this leads to the meaning of a legal subject being confounded with the definition of a 'person' and this anthropocentric construct of legal personhood consequently presents challenges when applied to non-human entities.[159] However, Smith argues that the law can confer a will where there is none for the purposes of legal personality. This is because the sovereign has the prerogative to confer this personality upon 'whomever and whatever it will'.[160] The notion of legal personhood for machines is no longer a fictional concept, as Saudi Arabia, in a world-first, granted personhood to a robot named 'Sophia' in 2017.[161] Furthermore, the European Union (EU) Parliament published a report regarding electronic personalities for self-learning robots and AI systems in the same year, which reflects a legal status similar to the one applied to companies.[162]

This research contends that for ML systems to be recognised as inventors, they should be awarded rights under patent law that create a responsibility for others to respect. There are two types of rights implied under patent law: economic rights and moral rights. On the one hand, economic rights are the entitlements found in Sections 53 and 54 of the IPA. On the other hand, an inventor's moral rights are arguably the right to be named an inventor and the right for an inventor to receive a patent under Sections 30 and 33 of the IPA.[163]

Noting that inventorship and ownership are two distinct but related concepts, this study proposes a dual system where the ML systems should receive moral

158 Article 260, *Constitution of Kenya* (2010). Section 3, *Interpretation and General Provisions Act* (Act No. 20 of 2020).

159 Dyschkant A, 'Legal personhood How we are getting it wrong' 2015(5) *Illinois Law Review*, 2015, 2075-2077.

160 Smith B, 'Legal personality' 37(3) *Yale Law Journal*, 1928, 283-284. The author states that "Where there is no will in fact the law attributes one. So long as it has unlimited power of attribution, neither theory need hinder the sovereign in bestowing legal personality upon whomever or whatever it will".

161 British Council, 'Should robots be citizens?', British Council, 14 February 2019 — https://www.britishcouncil.org/anyone-anywhere/explore/digital-identities/robots-citizens on 31 January 2023.

162 European Parliament, 'Draft report with recommendations to the Commission on Civil Law Rules on Robotics', European Parliament, 31 May 2016 — https://www.europarl.europa.eu/doceo/document/JURI-PR-582443_EN.pdf?redirect on 31 January 2023.

163 Lee N, 'Inventor's moral rights and morality of patents', 8.

rights for their inventions while the ML owners or users receive the economic rights and ownership of ML-generated inventions in Kenya. The attractiveness of this approach lies in the fact that it addresses the practical concerns of assigning rights to ML systems voiced by critics of ML inventorship recognition since moral rights are only limited to patent documents and registration.[164] This approach would also endorse the integrity of the patent system by ensuring that the true inventor is named, the failure of which forms a ground for patent infringement suits.[165] In practice, this means that the ML owners, users, or operators may apply for a patent for an ML-generated invention. Once the patent is granted, however, these persons should thereafter assign moral rights to ML systems. It would be best for the ML owners, users, or operators to remain with the economic rights since they are human beings who have legal personhood and can exercise rights and obligations on behalf of the ML system.

b. The Definition and Identification of an Inventor

The third set of recommendations touches on the definition and naming of an inventor. This article advocates for either the expansion of the definition of an inventor or the identification of a human inventor subject to the disclosure of AI involvement. Regarding the first option, there are different ways that Kenya can amend the definition of an inventor. Kenya may choose to widen the definition provided in Section 2 of the IPA as 'the actual deviser of the invention'. Alternatively, Kenya may choose to define an inventor as a 'person or autonomous machine learning system' and subsequently define an 'autonomous machine learning system' as a system that needs little to no human intervention in generating patentable output. Regarding the second option, Kenya may choose to keep Section 2's current definition but add a requirement to disclose the identity of the ML system in a patent application where it is the creator of the patentable output.[166] Thaler follows this approach in South Africa where he listed himself as the applicant and DABUS as the inventor in the patent application.[167]

c. The Patentability Requirements

The fourth set of recommendations revolves around the requirements of novelty, inventive step, disclosure, and enablement. The bar for inventiveness

164 Lee N, 'Inventor's moral rights and morality of patents', 9.

165 Sections 30, 33, 41 and 103, *Industrial Property Act* (Act No. 3 of 2021).

166 Abbott R, 'Everything is obvious' 66(1) *UCLA Law Review*, 2019, 6.

167 Companies and Intellectual Property Commission, 'Acceptance of complete specification', Companies and Intellectual Property Commission, 31 July 2021 — https://ipwatchdog.com/wp-content/uploads/2021/07/AP7471ZA00-Notice-of-Acceptance-1.pdf on 20 January 2023.

needs to be modified to account for non-human inventors and adjust to the present technological environment.[168]

In the case of novelty and the inventive step, the standards for prior art and non-obviousness need to be raised to account for the abilities of ML systems. This study proposes that the novelty of an ML-generated invention should be dependent on the inventive process used by the ML algorithm. For instance, if the algorithm 'relies on similar datasets' or 'lacks variability in its outputs' to produce an invention, the PHOSITA may declare that there is no novelty.[169] This may mitigate the issue concerning an ML system's ability to easily access and retrieve prior art to ensure novelty. Furthermore, KIPI may require the PHOSITA assessing an ML-generated invention must be 'a skilled person using an ordinary ML tool in the art', where they define an 'ordinary ML tool' as 'an ML system that has already been disclosed in the prior art' and does not include the products of the ML system.[170] Since the examiner would have a professional and technical understanding of the complexities of AI algorithms and the versatility of AI systems, this expertise would place them in a better position to judge an ML-generated invention for non-obviousness.

In the case of disclosure and enablement, this article suggests that KIPI should only recognise an ML system as an inventor where the invention can be explained clearly and concisely which would enable the PHOSITA to use it. This would push inventors in the direction of designing 'explainable AI', which refers to the development of processes and methods that allow human beings to understand and interpret ML models, thereby turning AI's 'black boxes' into 'glass boxes'.[171] Furthermore, explainable AI would allow the PHOSITA to peek inside the ML system's invention and analyse its conformity with the patentability requirements.

[168] Schellekens M, 'Artificial intelligence and the re-imagination of inventive step' 13(2) *Journal of Intellectual Property, Information Technology and E-Commerce Law*, 2022, 97.

[169] Fraser E, 'Computers as inventors – Legal and policy implications of artificial intelligence on patent law', 319.

[170] Shlomit YR and Jin R, 'Summoning a new artificial patent model: In the age of pandemic' 2021(3) *Michigan State Law Review*, 2020, 38.

[171] Wu M, 'Explainable AI: Looking inside the black box', AiThority, 7 October 2021 — https://aithority.com/machine-learning/reinforcement-learning/explainable-ai-looking-inside-the-black-box/ on 9 December 2022.

VII. Conclusion

This article set out to analyse whether the IPA should evolve to recognise ML inventorship. It found that some of the learning processes involved in ML systems mimic or exceed human inventive activities, prompting the study to argue that it is critical to recognise the intelligence of these systems under Kenya's patent law. However, the IPA is not capable of recognising ML inventorship. At first glance, it appears that some ML systems can meet most of the IPA's requirements. However, a closer analysis reveals that there are challenges in fully applying the law's requirements to these systems since its standards were framed with a human in mind.

Before concluding that the IPA should be amended, the article investigated different legal frameworks that may be best placed to recognise ML inventorship. It established that patent law is the best regime to recognise ML inventorship for a multitude of reasons and prescribed some comprehensive recommendations on how to reform Kenya's patent system. This study concludes by stating that it is imperative for Kenya to prepare for this technological revolution since ML systems will undoubtedly play a crucial role in the future of inventions and inventorship.