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Autonomy of AI in Patents: Reconciling Commercial Incentive with Traditional Inventorship

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This paper examines the general commercial implications of denying inventorship to an artificial intelligence (AI) programme which functions independent of its human creator and generates patentable products or processes. Traditional rules of inventorship pre-suppose that an inventor must be a natural person capable of exercising rights and being bound by duties and liabilities in relation to the patented invention. Thus, AI becomes automatically disqualified and cannot be named as an inventor in a patent application for this small technicality. Recently, patent applications filed by Dr. Stephen Thaler for inventions by his AI DABUS, have been rejected due to this hurdle. The article highlights the need for clarity in the area of patent inventorship for AI. Even when objections are raised based on traditional patent law principles, one must not forget that historically, commercial incentive has been the core objective of every patent legal system. Thus, encouraging applicants to step forward with new and useful innovations has always remained at the forefront of patent laws worldwide. The article elaborates on this conflict and suggests a suitable solution that appears satisfactory to all stakeholders.

Keywords: Artificial Intelligence, Incentive Theory, Inventorship, Patents

Technological advancements have reshaped the financial and economic landscape in recent times like never before. The array of new rapidly converging technologies has had a pronounced effect on corporate activities. Every act of convergence has generated synergies in the commercial sphere and contributed to an 'amplification effect' across multiple domains. The process has been further boosted by global connectivity and high-performance computing. On tracing the march of technological innovation in recent decades, it can be seen that there has been a transition from 'entities-based regulation' to 'principles-based regulation' with an aim to achieve legitimate outcomes for all concerned stakeholders (E.g. investors, customers etc.). Now, the core objective of commercial laws in general is to achieve the proper balance between investor and consumer protection, on one hand, and corporate innovation on the other.[1]

In every step, the wheels of civilization have been greased by technology, with every common problem being answered through a scientific solution. Artificial Intelligence (AI) could define the new world order, as the civilization prepares for its next giant leap into the realm of limitless possibilities of science. To quote Professor Ryan Calo's definition,

> "*Artificial intelligence is a set of techniques or instructions that are aimed to simulate some aspect of biological cognition using machines*."[2]

Unsurprisingly, the effect of this new technological innovation has been felt strongly in the domain of intellectual property rights as AI becomes more autonomous in its mode of operation.[3] While the initial prototypes were increasingly dependent on input of data by the AI creator to produce a certain type of output, the gradual transition of the technology from machine learning to deep learning principles has resulted in AI becoming more nuanced in its ability to generate random output independent of its creator.[4] For instance, the iOS application Naad Sadhana modulates forty strings based on particular ragas and also provides contextual analysis of tunes. The analysis is followed by creation of the accompanying music without any form of human intervention. This innovation clearly gives a more autonomous flavour to the machine's way of functioning which would earlier be restricted to mechanical tasks like putting hooks in a composed song.[5]

The current article would explore the feasibility of grant of patent to an AI generated invention in the face of stern opposition from regulatory authorities and courts worldwide. While the preference on part of

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these authorities has been to adhere to a conventional view of human inventorship, a question remains whether the contrary view should prevail in light of the commercial incentive for the natural person operating the AI to produce patentable inventions.

Breakdown of Key Issues Surrounding Inventorship of AI in Patents

If we examine the interface between AI and patent laws globally, it would appear that there is a fundamental conflict between the criterion for grant of a patent on an invention and the inherent nature of an AI which generates such invention. As the cases discussed in the following section will illustrate, patent offices worldwide have rejected numerous applications and continues doing so where an AI has been mentioned as the inventor. The common line of reasoning that emanates from these decisions indicates that only a natural person can qualify as an inventor under the laws of patent.[6]

Since, AI is not a natural person, an application which mentions AI as an inventor does not comply with the basic requirement for the grant of a patent. Thus, such applications become susceptible to being rejected by the patent regulator. It is also possible that prior to grant, such a patent may be successfully challenged in opposition proceedings by a third party on proving that either the invention does not comply with the substantive requirements of a patentable invention (novelty, non-obviousness and industrial application) or the relevant application has not adhered to the correct application filing procedure. The same grounds are available worldwide even subsequent to the grant before the patent regulator for a limited period of time. In the post grant stage, the validity of the patent may also be contested by a third party by invoking these grounds for revocation before the lowest competent court.[7]

The need for clarity on the inventorship front becomes all the more important considering the commercial value of AI as a form of technology in the years to come. The growing importance of AI in business becomes evident upon perusal of some recent facts and figures. According to the report titled 'AI Market by Technology Type, Deployment Method, Solution Type, Integration (Technologies, Networks, and Devices) and Industry Verticals 2023-2028' prepared by Research and Markets in February, 2023, the global AI solution market will come to $301.2 billion by 2028, increasing at the rate of 29.4% from the current levels. Global unsupervised machine learning market will come to $15.6 billion by 2028, increasing at the rate of 25.1% from the current levels.[8] Google has reportedly invested over $300 million in its AI startup Anthropic to develop its own AI 'Claud'. Anthropic and Google Cloud intend to deploy Claud to the larger audience and enhance the current search facilities available through Google Lens on mobile devices.[9]

The current legal problem on inventorship for AI raises two issues – procedural and commercial. The procedural issue creates a hurdle in granting a patent for the lack of natural personhood of the inventor mentioned in the application. It is a troublesome question because the rejection has nothing to do with the substantive requirements of patentability (novelty, non-obviousness and industrial use) of the concerned product or process. The commercial hurdle is posed when one views such AI patent applications as a form of incentive to all persons and/or entities to encourage more Research & Development in this domain. Once the relevant product or process is deemed worthy of patent protection, it would automatically aid further disclosure of the technology to third parties under the application filing process. Every patent application is broadly divided into two parts – claims and specifications. While the claims outline the rights sought by the applicant in the invention, specifications convey the relevant details about the invention to assist the regulator in deciding on the patentability. Once the patent is granted, these disclosures form a part of the patent application compendium which can be accessed freely by third parties to study the invention and make further improvements upon it if necessary. The idea is two-fold – firstly, to support the applicant's claims and secondly, to 'enable' an expert i.e. 'a person skilled in art' to work the invention.[10] If a patent showing AI as the inventor is granted, the resulting diffusion of knowledge through patent applications would positively affect the capabilities of business concerns and investors in enhancement and improvement of the technology. However, the grant of such AI patents has proven tricky because it is inherently opposed to the traditional dicta of the patent laws universally concerning inventorship. Secondly, the legal community has inadequate information on the nature of AI as a technology i.e., whether from the scientific view point, the AI can command sufficient autonomy to merit personhood in law. Last, but not the least, assuming that AI can be considered worthy of personhood, it is unclear as to what would be the

impact of such a tectonic legal shift on the broader public interest. The following section would shed light on some key cases in recent years where the courts have extensively deliberated on the feasibility of granting patents for those inventions where the application mentions AI as the inventor. This section would survey recent cases in the UK, USA, Australia, New Zealand and South Africa for the purpose of final analysis in this paper.

AI as an Inventor in Patents – Some Recent Landmark Cases

The UK Court of Appeal held in the matter of the Patents Act 1977 and in the matter of patent applications GB 1816909.4 and GB 1818161.0 in the name of Dr Stephen Thaler[11] by a 2:1 majority that AI could not qualify as an inventor because it lacked the requisite personhood. An application in this case had been filed by Dr. Stephen Thaler with the UKIPO in relation to a 'food container' and 'devices and methods for attracting enhanced attention' where he had designated his AI programme Device for the Autonomous Bootstrapping of Unified Sentience ('DABUS') as the inventor. Concurring with the view of the Hearing Officer, UKIPO, Lord Justice Arnold observed that 'inventor' under Section 7(3) of the Patents Act, 1977, means the 'actual deviser' of the invention that is a person who plans, contrives and executes the invention. Birss J. noted that only a natural person could be considered as an inventor under the patent statute. As indicated by the notion of 'true and first inventor' in the Statute of Monopolies, 1623, and Patents Act, 1949, this original inventor had to be identified in the application. In case of an assignment, a copy of the written assent had to be provided by the applicant to demonstrate authorization. Neither did an AI qualify as a natural person, nor did it possess sufficient personhood to assign the right to apply for the patent to its creator. The following passage from the judgement of Birss J. accurately captures the essence of the ruling:

> "*Machines are not persons. The fact that machines can now create inventions…would not mean that machines are inventors within the meaning of the Act."*

The patent application of DABUS also met with considerable resistance in the United States of America. While deciding upon the merits of Application No. 16/524,350, the United States Patent and Trademark Office (USPTO) ruled that 35 USC 101 pertains only to natural persons as inventors. USPTO also used the example of 35 U.S.C. § 115, which uses words like 'himself', 'herself', 'individual' etc. to establish the fact that a non-natural person could not be treated as an inventor for the purpose of a patent application. This was in furtherance of the judicial ruling in *University of Utah* v *Max-Planck-Gesellschafl zur Forderung der Wissenschaflen,*[12] where the Court of Appeals for the Federal Circuit had noted that a state could not conceive of an invention since conception, unlike a natural person, is not possible for a juristic person. An affirmation of this view can be found in *Stephen Thaler* v *Andrew Hirshfeld*.[13] Here, the District Court for the Eastern District of Virginia also observed that an inventor must be a human being. Interestingly, Brinkema J. noted that whether AI has acquired the requisite capability to qualify as an inventor in a patent application was a question that lay strictly in the legislative domain. Additionally, the terms 'inventor' and 'joint inventor' in the American patent statutes included merely an individual. The court substantiated this approach with the help of Supreme Court's elucidation of the word 'individual' under the Torture Victim Protection Act.[14] The most recent development in this regard can be found in in *Stephen Thaler* v *Katherine K. Vidal, Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office, United States Patent and Trademark Office*.[15] The Court of Appeals for the Federal Circuit held that 'inventor' under 35 U.S.C. § 100(f) means an individual i.e. a human being. In consonance with the view expressed in *Mohamad* v *Palestinian Auth*.[16], the Court observed that the use of the words 'himself' or 'herself' instead of 'itself' in § 115(b)(2) conveys the intention of the legislature to restrict inventors only to natural persons. AI is incapable of furnishing oaths before the patent office. The use of 'whoever' in Title 35 did not exempt the applicant to satisfy the requirement for identifying the inventor in the patent application.

Likewise, in Australia, the Full Federal Court held in *Commissioner of Patents* v *Thaler*[17] that Dr. Thaler's application contravened Section 15 of the Patents Act, 1990, read with Reg 3.2C of the Patent Regulations 1991, for failure to identify a natural person as an inventor. An AI could not be motivated by the incentive of a patent for inventing the process or product. The product or process must be

attributable to the ingenuity of the original inventor. Similarly, while adjudicating upon PCT Application No. PCT/IB2019/057809 (New Zealand), the New Zealand Patent Office compared AI to an inventor from 'other worlds' which was beyond the contemplation of existing patent laws both at the domestic and international level. Assistant Commissioner Luiten observed that:

> "*…no creatures on earth other than human beings ever seem to have invented a patentable invention and we have never received any disclosure of inventions from other worlds*."[18]

A glimmer of hope has been presented by the ruling of the South Africa's Companies and Intellectual Property Commission on 24th June, 2021, where Dr. Thaler's application was followed by the grant of a patent in spite of DABUS being named as the inventor. The decision was however induced by a formality examination under Patent Cooperation Treaty by the Companies and Intellectual Property Commission. The formality examination focuses purely on the administrative requirements like documentation, payment of fees etc. under Section 30 of the Patents Act 57 of 1978 and Regulations 22 and 40–43 of the South African Patent Regulations rather than a substantive examination. A substantive scrutiny would require the concerned invention to be tested for patentability under Section 25(2) and (3) of the Patents Act 57 of 1978 and also whether the applicant and the inventor are qualified to apply for the concerned patent under Section 27(1) of the same Act.[19] A similar approach can be seen in the Australian Federal Court's decision rendered by the primary judge (though this decision was overturned by the Full Federal Court subsequently). Beach J., the primary judge, had observed that 'inventor' did not exclude non-natural persons. The word 'inventor' had to be interpreted keeping in mind the rapidly evolving nature of technology to promote and disseminate technological innovation per Section 2A of the Patents Act, 1990. Beach J. pointed out that the circuitry of DABUS represented a simulation of human brain. The inclusion of AI within the scope of 'inventor' therefore stood justified.[20] However, the general notion in the legal community at present appears to be that the grant in South Africa was influenced more by a superficial formalities Patent Cooperation Treaty, 1970, (PCT) examination based on the submission of the relevant documents. The PCT does not mandate a substantive examination. It simply provides a single window clearance facility for convenient filing, searching and examination of international patent applications in the member countries. This is facilitated through grant of priority in all the member countries upon filing of the first application. As a result, the exercise of substantive examination needs to be carried out entirely under the national patent laws. A member country may opt for either a thorough substantive examination by the domestic patent regulation, or a PCT formality examination where the substantive aspects can only be determined by the courts if a suit is filed for revocation of the patent.[21] Questions remain whether the application has enough substance to withstand a more rigorous examination, pre grant or post grant opposition.[22] This criticism is further backed up by Rule 4.6 of Regulations under the PCT which states that where the applicant is not the inventor, the applicant must indicate inventor in the application. If the inventor is the applicant, then a statement must be provided to such effect.[23] Rule 51bis.1(a) read with Rule 4.17 requires the applicant to furnish a declaration of identity as the inventor or a declaration regarding what entitles him or her to file the application (e.g., succession or assignment).[24]

Clearly, there are substantive as well as procedural obstacles in allowing the creator of an AI to file a patent application by naming AI as an inventor. For any such application to be admissible before patent regulators worldwide, it would require a drastic change in the manner in which law seeks to define the inventor of a patentable product or process. As we saw in the preceding section, the courts are uncomfortable with the idea of AI as an inventor. The tendency is to shift the onus on the legislature to come up with a solution through a new law or amendment to the existing patent laws. However, any such change must also meet the commercial incentive underlying patent laws universally. The following section would look at some theoretical perspectives regarding the necessity of granting patent from a commercial angle where patents are seen as an important stimulus in attracting further business or investment in inventive activities.

Business Incentive and Patents

Peter Drahos argues that the tendency of a natural person to be motivated by economic rewards is one of the most 'fundamental intuitions' of human nature. A human being invariably reacts positively to commercial incentives. Drahos therefore concludes that IPR laws must aim at locking up profits associated with those

abstract rights to ensure that the inventors continue to devote adequate resources to that inventive activities.[25]

The main objective is to entice the creator with market power. There are two ways in which this market power manifests:

(i) Conferring upon the creator the ability to price the product above marginal cost.
(ii) Power to shape the existing product market or create new markets.

In a similar vein, Dr. Elizabeth Verkey argues that the exclusivity of a patent provides a strong incentive to invest in research that goes into product development.[26] Additionally, the disclosure adds to the public repository and leads to dissemination of knowledge. In the absence of patent protection, any such invention would either remain secret or lose its edge to preying competitors. Thus, it is imperative that inventors or their assignees are allowed to protect their inventions on satisfaction of the patentability criteria. Else, it would be unfair to the patent owner who would lose out on potential profits despite having invested heavily and incurred costs in relation to the invention in question. The following paragraph aptly summarizes the rationale underlying Dr. Verkey's argument:

> "*Without a patent system, there is not only technological uncertainty, but also uncertainty about whether the firm can appropriate and license the invention. The patent system is alleged to reduce the second kind of uncertainty*."[27]

The ZenaDrone Smart Charging Pad, an AI-predictive smart device, launched by EPAZ, Inc. offers a great illustration of how a company's R&D and expansion into international markets are being driven by its strategy to attract more investments in the stock market.[28] The pad has been devised to detect the characteristics of its environment and choose the most optimum source of power. The technology at present enjoys two patents and plans to file for two more in the coming days.[29] Building on its initial success in Germany, EPAZ seeks to use the additional funds available through investment for expanding its operations all across Europe.[30]

The economic incentive justification springs from the instrumentalist approach which is centred upon ensuring proprietary benefits to those who engage in painstaking research while developing a scientific invention. The approach does not restrict itself to motivating individual creators and inventors but rather focuses on the broader positive socio-economic ramifications which follow the grant of any patent. To quote Wiles J. from *Millar* v *Taylor*[31],

> "*It is wise in any state, to encourage letters, and the painful researches of learned men. The easiest and the most equal way of doing it, is by securing to them the property of their own works*."

Under the instrumentalist approach, property rights are linked to incentives. Natural justice under this approach would require that the one who invests his resources towards an inventive or creative activity must be allowed to exploit the advantages associated with legal recognition of such activity. This recognition of the individual activity also paves the way for motivating the community at large to create or invent. The consequence is therefore socially beneficial. The natural law angle focuses exclusively on the individual aspect of creation or invention where the ownership in the created or invented thing vests in the concerned individual from the moment such thing comes into existence. This entitlement flows from natural law which places human at are forefront because of being endowed with the power to think and reason. On analysis and comparison of the natural law and the instrumentalist approaches to intellectual property rights, Drahos concludes that the instrumentalist approach is more in sync with the true nature and the core objectives of patent laws.[32] Rather than a piece of natural entitlement, patent represents a temporary privilege that must increase the industry of the general public in the longer run through sustained commercial incentives. Such an approach, according to Drahos, is more consistent with the 'fundamental law' and 'God's design'.[33]

A fundamental justification behind the grant of a patent lies in the fact that an inventor carries on endeavours with an expectation of future benefit. If the research is funded through investments, the question automatically arises whether there will be sufficient reason for the investors to put their funds at risk of being diverted into an unprofitable project. For instance, often times, we notice in the pharmaceutical sector that rival companies would invest heavily in R&D to identify solutions to an existing medical issue because it is a 'winner takes all' scenario for the person who manages to secure the patent.[34] Building on this premise, Cook argues that an inventor who successfully obtains a patent is far more likely to attract venture capital funds and enjoy an edge over its competitors.[35] Larger investment also equates to

better quality of talent being attracted to work for the company which exploits the patent. Many a time, the success of a start-up, which operates a new technology, depends on its ability to lure investors to a project that offers near guaranteed returns.[36]

A classic example of exploiting patents to sustain innovation can be found in the development of 'Menlo Park' by celebrated inventor, Thomas Edison.[37] Edison realised very early in his career that mere product development would not yield the desired business outcome unless accompanied by commercial utilisation. He followed an aggressive patenting strategy to stay ahead of his competitors and remain profitable as a business concern.[38] It was this commercial approach which proved to be the difference between him and Nikola Tesla, inventor of polyphase alternating current generator. Though Tesla succeeded in eventually inventing the generator, his lack of commercial wisdom in giving up the license to make the product affordable for the general public put an end to his aspirations to become a successful inventor.[39] Timing of applying for the patent also becomes decisive at times. For instance, Software Arts, one of the leading pioneers of the United States software industry, missed out on patenting their computer programme VisiCalc. because by the time United States Federal Supreme Court ruled on the patentability of computer programme in *Diamond* v *Diehr*[40](*Diamond),* VisiCalc was already out in the public domain for two years, allowing other players in the industry to profit.[41] The Supreme Court had observed in *Diamond* that the computer-regulated process for curing rubber in question was patentable because it amounted to a novel and non-obvious application of Arrhenius Equation, a mathematical algorithm. Though the algorithm in itself is not patentable, while adjudging the patentability of its application, the claim had to be viewed as a whole and a bifurcation of the presented patent claim into algorithmic and non-algorithmic parts was not permissible.[42] The importance of any intellectual property to the commercial strategy of a firm may be gauged by referring to the following passage from the commentary authored by Arena and Carreras:

> "*Value is extracted by cultivating the output of innovation in the form of intellectual property. Identifying, classifying, protecting, leveraging and strategically managing that intellectual property creates additional value for the firm and provides tools to extract that value*."[43]

A great thing about incentivising patent in a new form of technology is that it aids the further development of the technology through the necessary disclosure of the invention in the specifications appended to patent applications. The benefit would be lost if the applicant opts to keep the invention a secret instead. The decision mostly hinges on whether the applicant expects to exploit the invention during the term of the patent and therefore sees it as a more lucrative option over secrecy.[44]

The element of disclosure is instrumental in facilitating 'knowledge spill-overs' which directly leads to growth for the individual productivity as well as the economy on the whole. However, as Moir cautions, a well-balanced patent system as opposed to an unregulated patent monopoly is capable of delivering net economic benefits, citing the empirical study conducted by Scherer and Weisburst (1995) in relation to the chemical industry in Italy and Moser (2005), Moir concludes that unless the grant of a patent is sufficiently qualified with strict monitoring of anti-competitive behaviour and use of public interest exceptions, the ideal outcome cannot be achieved. An ideal outcome entails 'sufficient spill-over benefits' which negates the cost of permitting monopolies.[45]

In a similar vein, relying on a joint statement issued by the U.S. Department of Justice, Antitrust Division, and USPTO, dated 8th January, 2013, the Delhi High Court in India had noted in *Telefonaktiebolaget Lm Ericsson (Publ)* v *Intex Technologies (India) Limited*[46] that patents incentivize inventors to implement their know-how, take risks, and invest in R&D.A reaffirmation of this positive knowledge spill-over comes in *La Renon Health Care Pvt., Ltd.* v *Union of India and Ors*[47] where the Madras High Court observed that a patent framework depicts a bargain between the inventor and the society. The inventor obtains rights in the invention in lieu of disclosure enabling the society to benefit from the disclosed knowledge. This transaction automatically induces innovation and advancement in science and technology.

AI as a Commercial Prospect

The need to examine the feasibility of AI as an inventor from a commercial angle spring from the repeated line of argument which has emerged from the ongoing cases involving DABUS. Dr. Thaler, the creator of DABUS, has premised his argument on the fact that AI must be allowed to be mentioned as an

inventor in a patent application due to its autonomous nature of operation and more importantly, to foster innovation and the associated commercial endeavours.[48] The commercial incentive argument clearly influenced the decisions to grant patent to DABUS' inventions in South Africa and to a limited extent in Australia. But, the applications in other jurisdictions like UK, USA, and New Zealand have hit roadblocks before patent regulators and courts.[49] Prof. Ryan Abbott has argued that the majority approach appears archaic due to the transformative capabilities of AI as a technology.[50] The use of this technology, according to Prof. Abbott, requires the wholehearted support from the law and policy makers, and a contrary approach could prove antithetic to the development of solutions to some of the most pressing problems being faced by mankind at the moment, e.g., climate change, treatment for cancer etc. Warning against an ultra-orthodox approach in processing AI patent applications, Prof. Abbott notes:

> "*If outdated IP laws around the world don't respond quickly to the rise of the inventive machine, the lack of incentive for AI developers could stand in the way of a new era of spectacular human endeavour*."[51]

The seeds for commercializing patentable inventions by AI were sowed as early as 1996 when a software called 'genetic programming', which simulated biological evolution, was shown to be capable of generating inventions in an autonomous way.[52] Till 2010, this software had succeeded in producing at least thirty-one products which was a replica of a previously patented work. Two of these were completely novel reflecting a cutting-edge level of research in the concerned domain.[53]

The pharmaceutical industry, one of the most patent intensive commercial sectors, stands revolutionised with the increasing application of AI in its inventive processes. A case in point would be the $43 million agreement between GlaxoSmithKline and Exscientia which authorized the former to use the latter's AI technology in discovering life-saving drugs.[54] The AI, according to this agreement, would be used to predict the manner in which molecules of different chemical compounds would behave under controlled conditions. The technology was seen as a game changer in the industry as would reduce costs (by nearly 75%) and augment benefits in drug manufacturing processes.[55]

In the period from 2012 to 2017, venture capital investments in AI business increased from about $600 million to over $14 billion. The international corporate investment in AI was nearly $68 billion in 2020.[56] A report by Department for Digital, Culture, Media, and Sport, UK, notes that approximately 15% of UK businesses have adopted a minimum of one form of AI. 2% are currently testing it and 10% envisage adopting at least one form of AI going forward. 9% of UK firms have started using AI solely for data management and analysis. Information Technology and telecommunications have the highest rate of using AI, at 29.5% and 29.2% respectively.[57] In 2017, 550 start-ups using Al in the United States of America ('USA/US') raised $5 billion in funding with 60% of that amount being channelled into US corporations.[58] According to the American Intellectual Property Law Association, investments in Al technologies in the same year had been in the range of $26-39 billion.[59] The relevant employment market was valued at approximately $10 million. The forecast was that Al commercialization would attain the $190 billion mark by 2025.[60]

According to a survey conducted by Gartner, Inc. in 2019, the number of entities using AI in their product development had grown by 270% over a period of four years.[61] To quote Chris Howard, Research Vice President at Gartner,

> "*If you are a CIO (chief information officer) and your organization doesn't use AI, chances are high that your competitors do and this should be a concern*."[62]

The statistics on AI patent applications filed globally are equally staggering. On 27 October 2020, the USPTO published a report titled 'Inventing AI: Tracing the diffusion of artificial intelligence with U.S. patents' showing that AI patent applications had gone up by more than 100% between 2002 and 2018 and the percentage of AI applications increased from 9% to nearly 16%.[63] Seventeen out of the top 20 universities and public research institutes in AI patenting are from China.[64] The top applicant is the Chinese Academy of Sciences, with more than 2,500 patent families and over 20,000 scientific papers published. India, on the other hand, has shown a 500% increase in filing of AI patent applications from 2015 to 2019.[65]

A perusal of the recent judicial decisions discussed in the preceding sections reveals the following obstacles faced in grant of patent to an AI generated product or process:

(i) While a person or entity would use the AI only as an assisting tool to tackle a technical problem, the nature of the underlying technology deprives the inventive process of any human input or intervention. As a result, the nexus between the patent applicant and the invention is broken at the very outset.

(ii) Only the AI could satisfy the legal definitions of 'inventors' in such circumstances, apply for a patent, own the patent upon grant or transfer the right to apply to its creator or any other third parties.

(iii) But, for all its inventive capabilities, an AI lacks the requisite personhood to apply for a patent, assert ownership or assign rights in a patent to any other person including its creator.

While the patentable character of the AI generated invention and the inventive act of AI is not in doubt, the applicant misses out on the patent because of the lack of human characteristics of the inventor which have no relation with the quality or attributes of the invention. Though the AI does not possess sufficient personhood to operate on commercial incentive flowing out of the grant of patent, the same does not hold true for its creator who files the patent application. The incentive operates for the creator at two levels – to come up with more advanced forms of AI, and generating patentable inventions with greater frequency and efficiency through application of such AI. It must be borne in mind that the incentive pertains only to the person owning and operating the AI and not the AI itself due to the lack of personhood. Three key questions therefore emerge:

(i) Whether the commercial incentive for the AI creator outweighs the traditional rule of patent law which recognizes only natural persons as legitimate inventors and first owners of the invention patented?

(ii) If AI is to be included within the meaning of 'inventor', in what manner should the question of inventorship, ownership and assignment of the patentable invention be addressed under the international and domestic patent laws?

(iii) If AI qualifies as 'inventor', what measures must the law contemplate to counter the potential adverse after-effects of such a change?

The combined data on the amount of business investment, AI adoption and increased filing of AI patent applications mentioned clearly suggests that there exists sufficient optimism in the market regarding the commercial prospects of AI as a form of technology in generating patentable inventions. Even the regulatory and judicial passivity in the DABUS line of cases in rejecting AI patent applications on ground of lack of proper inventorship has failed to dampen the spirits in the AI industry as a whole. Though the successful AI applications in patent concern AI as a subject matter (e.g. algorithm as business method patent), it offers a great reason for optimism for use of AI in multiple capacities in seeking patent for potential applicants. The reason why the procedural objections to AI inventorship could deny incentive to such applicants is that it prevents the patent regulators from conducting extensive technical analysis of the patentability of the relevant inventions. On comparison of the various DABUS applications filed by Dr. Thaler, it would become clear that barring the European Patent Office, none of the other patent regulators have undertaken patentability analysis to check the merits of the claimed invention as protectable subject matter. The USPTO's response to Application Numbers 16/524,350 and 16/524,532 for instance focus solely on the exclusive entitlement of inventors who are natural persons to apply for patents or authorise a third person through succession or contractual transfer.[66] Even the patentability analysis of the Examination Division of European Patent Office appears questionable. The Examiner notes that the application does not describe how to derive a fractal profile for the wall of the container. The profile of the wall will have a form governed by parameters like the minimum practical or desirable size of its components. The application lacks sufficient explanation regarding the minimum practical or desirable size. The Examiner also doubts how can a fractal profile could not be of pure form.[67] While the approach towards scrutinising the application carries more depth as compared to other international applications, the correctness of these remarks can be doubted in light of the UKIPO's observations that these applications appear new, inventive and industrially applicable – a fact which is also referenced in a press release by the University of Surrey.[68]A subsequent application filed before the German and the European Patent Office (Application No. DE-202019005767-U) also describing the fractal walls of a food or beverage container has been granted without any adverse determination (Grant

Number: 202019005767).[69] A great example in this regard is the recent patent granted to Topia, a prominent talent mobility and workforce portal, which has been granted a patent for an unsupervised machine learning AI. The AI programme can be used to detect and predict customer behaviour and prices of flight tickets enabling a more efficient management of travel costs. Shawn Farschi, CEO, explained that the grant of patent would empower Topia further in expanding the operation of the AI algorithm across all service offerings and augment Topia's workflow automation.[70] Likewise, MySize, Inc. recently got a notice of allowance from the Canadian Intellectual Property Office in relation to its AI driven system for measuring the body dimensions of the user through an electronic device.[71] The patent allowance has had a pronounced positive impact on the business of MySize through induction of more customers at an accelerated rate.[72] While these examples deal with AI as patentable subject matter and do not correspond directly to AI inventorship, they offer an indication of the commercial viability of AI in the domain of patent and the new realities springing from the increased use of AI in the patent parlance that law and policy makers must be willing to embrace in the foreseeable future. If DABUS, for instance, is able to secure international patents for its inventions claimed by its creator Dr. Thaler, it would represent a leap of faith and result in AI converting its status to an inventor from that of protectable subject matter.

While the current state of patent law and technology does not conclusively establish AI as an inventor, instead of outright dismissal of such applications, more exploration is required to comprehend the real nature of the technology which drives the AI. Dr. Thaler has proposed the 'neural cascade' as a network architecture in his 'Creativity Machine' portrays a stream of consciousness along with a 'cognitive turnover' which is the more subjective element out of the two. According to him, all cognition are modelled in terms of 'confabulation generation' which posits that all neural systems contemplate, invent, and discover through confabulations. Dr. Thaler argues that cognitive pathologies come into existence as the machine propels itself toward higher levels. In his neural model, creativity happens through multiple swings from neuronal chaos to tranquility. As these swings become more intense, the level of creativity rises proportionately followed by bouts of hallucination where the machine cannot differentiate between reality and fantasy. Dr. Thaler also identifies a 'stream of consciousness' between two parts of the neural architecture – one part responsible for generating an idea and the other part evaluating it. His master equation depicts the rhythm of idea generation both in AI and the human brain, as a function of novelty of the generated ideas.[73] Unfortunately, none of the IPO rulings worldwide have analysed these technical aspects of inventorship and investigated whether it could lead to generation of a patentable product or process in the same manner as that of human inventors. It would also be advisable for the patent regulators to explore the possibility of treating AI generated inventions at par with platform technology capable of producing patentable subject matter. A great example in this regard would be Regeneron's Velocimmune mouse, a platform technology for the creation of therapeutic antibodies in vivo. It utilises the normal murine immune response to produce humanised monoclonal antibodies with high affinity that will not require any additional engineering to make them therapeutically effective.[74]

There already exists multiple precedents of deviating from traditional rules of recognizing a protected work in favour of the actual creator where there were overriding considerations for commercial incentive to applicants who simply invested in the process of creation rather than actually creating it. For instance, moving away from the conventional causation doctrine in copyright, Section 9(2) of the Copyright, Designs and Patents Act, 1988, in the UK recognize the producer of a sound recording as its author. Likewise, Section 9(3) states that author of a computer-generated work is the person who has made the necessary arrangements for creation of that work.[75] The foundational principle of the work-for-hire doctrine can be traced to the U.S Supreme Court ruling in *Community for Create Works* v *Reid*[76]where the Court held that the employer 'controlling and supervising' the creation of the copyrightable work of the employee should be treated as the author.[77] The incentive rationale in favour of the hiring employer has been succinctly summed up by Corey Field in the following paragraph:

> "*Authorship and ownership will vest in the statutory author that is, the hiring party, thus allowing clear title and maximum ability to derive the economic benefits to society and access of the public to the work*."[78]

It may be noted that in neither of the cases above did the producer of the sound recording, operator of the computer or the employer author the creative work, but a fiction was nonetheless created in favour of all in granting authorship for the created works. While, causation is not an issue in AI generated patentable inventions, problems are posed in recognizing AI as the inventor because of its failure to conceive, execute and assert or transfer ownership in the invention. Drawing an analogy with copyright, it may be argued that the theoretical limitations of conferring inventorship on AI are comfortably outweighed by the positive effect on business, investment, R&D and sharing of knowledge that would result from the grant of such patents. Thus, in a manner similar to computer generated works and work for hire doctrine, either a deemed inventorship may be conferred on the AI creator applicant, or the AI could be recognized as an inventor for procedural purposes by creating an exemption against requiring an assignment to the creator applicant. This change would ensure that the creator of AI is sufficiently incentivized to develop more efficient AI's and use those AI's to generate more patentable inventions for the collective benefit of the society. If the patent system is willing to embrace the enhanced capabilities of the AI without burdening it with the limitations of personhood, a broader pool of inventions will be available to the users, This would be in tune with the utilitarian basis of patent laws which purports to generate maximum gains for the inventors, owners and users of the invention.[79] Recognising AI as the inventor will reward innovative activities, promote invention and encourage development of inventive AI. Professor Ryan Abbott, Department of Law and Health Sciences, University of Surrey reckons that use of AI may hold the key to unlocking solutions to some of the most pressing problems that continue to plague mankind, e.g. cure for cancer, climate change etc.[80] Professor Abbott concedes that whether patents produce a net benefit as an empirical matter cannot be determined, and individuals and businesses do not always behave rationally. However recognizing AI as the inventor will lead to the development of creative computers and result in a net benefit to the society. The financial motivation will cause a net increase in the number of patentable inventions produced. Thus, courts and legislatures should be guided primarily by the constitutional rationale for granting patents.[81] However, mere commercial incentive to the AI creator applicant cannot determine the inventorship status of AI in patent applications. While a new procedure accommodating AI as an inventor may address the first two key questions posed at the beginning of this section, it still merits a discussion under the third key question regarding the manner in which the law and policy makers should guard against the perils of this revised patent inventorship model. Following could be the potential adverse effects of including AI as an inventor in patents:

(i) Human innovation may suffer if use of AI is incentivized under law. Patents after all were created to reward human ingenuity and not subserve itself to the will of machines. This is the primary reason underlying the judicial reluctance in moving away from the natural person inventorship model.
(ii) Since most of the R&D capabilities in AI are concentrated in the hands of few entities, it could violate public interest, for example, leading to anti-competitive behaviour on part of these entities who would use their vast resources to corner all possible patents that could be obtained in inventions generated through AI.

However, it is submitted in relation to the first point, that mere conferment of inventorship to AI does not undermine human ingenuity unless AI acquires sufficient personhood to command ownership over the relevant invention. As long as the ownership remains with the AI creator applicant, AI inventorship would only further the cause of human ingenuity by motivating people to develop more sophisticated AI's and use them to generate more patentable inventions. Since, the issue does not lie with the quality of the patentable subject matter, per Article 27 of the Trade Related Intellectual Property Rights Agreement, AI inventorship cannot be used to discriminate between those inventions which use AI technology and those which do not.[82] On the contrary, the positives of patenting AI generated inventions would lead to more enabling disclosures to the world at large through patent filing systems and enrich the public domain in the long run. This is a more desirable outcome than the same inventions being protected under trade secrets which would stifle innovation.[83]

For the second point, there are sufficient inbuilt checks within the international IPR regulatory system to ensure that the rights to an AI generated invention are not abused to detriment of the general public. Article 7 and 8 of the TRIPS Agreement act like

safety valves and ensure that the private interests of promoting technological innovation are adequately balanced by public policy objectives such as transfer of technology, promotion of public interest in sectors of vital importance like health, poverty alleviation etc.[84] The doctrine of *abus de droit* has been applied by the WTO Appellate Body in *United States - Section 211 Omnibus Appropriations Act of 1998* to interpret Article 7 in good faith and hold that that the provisions of a treaty or agreement cannot be a read in a manner which violates the rights of another party under a different treaty or agreement.[85] Likewise, in *European Communities — Protection of Trademarks and Geographical Indications for Agricultural Products and Foodstuffs*[86] the WTO Panel noted that trademarks do not provide positive rights to the holder but merely a right to prevent unauthorized use of the mark. Thus, Article 8.1 could be interpreted to enable WTO member states to pursue public policy objectives even if not mentioned explicitly in the TRIPS Agreement. This approach would hold true while recognizing private rights under any of the intellectual property rights and may be used favourably even in patents granted to AI generated inventions to ensure that public interest is not compromised. More specifically, flowing from the general mandate under Article 8, provisions such as Article 40 of the TRIPS Agreement address anti-competitive effects of licensing practices stemming from the exclusive rights granted to the holder of the IPR. The applicable test is whether the license adversely affects trade between the WTO member states and impedes dissemination of technology.[87] Thus, if a member state is concerned about the anti-competitive effect of a powerful company using a license to exploit its patent in an AI generated invention (e.g. exclusive grant-back conditions, coercive license packaging etc.), they may adopt suitable measures to prevent or control such practices. A great example of such a measure can be found in Section 84(7) of the Patents Act, 1970, in India, where a compulsory license may be obtained against the use of a registered patent for not satisfying 'reasonable requirements of public' due to abuse of exclusivity through licenses. In granting this compulsory license, under Section 84(6), the Controller of Patents may consider multiple factors such as prejudice to existing trade, industry, establishment, class of persons, failure to meet local demand due to restrictive conditions applied by the patent holder in granting rights to the invention. As observed by the Bombay High Court in *Bayer Corporation* v *Union of India and Others,*[88] public interest is a fundamental consideration in granting compulsory license to a drug or a medicine for treatment of incurable diseases like cancer.

Conclusion

Taking stock of the whole situation, in light of the discussion in the preceding sections, the following measures are suggested to address the highlighted issues:

Need to consider AI inventorship in patents - The principles of inventorship in patent laws require reconsideration due to the resurgence of AI patent applications. Time is ripe to tweak the traditional model of inventorship and allow AI to be mentioned as an inventor in patent applications. Since, the invention in most cases satisfy the criteria for patentable subject matter, rejecting such applications due to procedural technicalities would deprive the benefits of a patent to a legitimate invention; diminish the business incentive to create and use AI as a form of technology in inventive processes; and prevent the dissemination of information which results from disclosure under patent applications, and stifle the growth of science and technology in the long run.

Changes recommended in international patent rules and regulations - Since, multiple amendments in domestic laws may lack in the desired uniformity and clarity, it is suggested that changes should be introduced in the international rules at the very outset to include AI within the meaning of 'inventor' by amending Article 2 of PCT. It is suggested that this change should not affect the ownership of the invention by the patent applicant i.e., the creator of the AI. Rule 4.6, 4.17 and Rule 51bis.1(a) of the PCT, for instance, should be amended to ensure that the applicant who mentions AI as an inventor is exempted from the requirement of proving assignment of right to apply for the patent.

Rationale for Inclusion of AI as Inventor - A plausible justification for allowing AI inventorship in patent applications would be to promote R&D, investment and innovation in the AI sector which in turn will lead to a greater number of patentable products and processes, which will further enrich the reservoir of scientific ideas when their respective terms of protection expire. The move would therefore satisfy the twin objectives of fostering innovation and facilitating dissemination of knowledge.

Learning from Copyright Experience - In the same way the work for hire doctrine[89] and authorship in computer generated works developed as offshoots to traditional rules of copyright to encourage investment in literary or artistic projects by willing sponsors,[90] recognizing AI as inventors in patent applications would work wonders for the progress of science by drawing more funding and investment in new scientific ventures involving AI.

Need for Prior Feasibility Studies - Any amendment favouring inclusion of AI as inventors should be preceded by impact assessment tests to ensure the compatibility of existing patent regulatory infrastructure to cope with increased load of allowing AI patent applications; mitigation of risks associated with use of AI in inventive processes; safety of consumers using AI generated products; and reduction of unfavourable consequences to the economy, society and environment.

Maintaining Checks and Balances - To preserve the delicate balance of rights and responsibilities inherent to every patent system, the inclusion of AI as inventor in patents must be subject to imposition of restrictions by the concerned regulator during grant of such patents, bearing public interest in mind. The emphasis should be to check unregulated monopoly and anti-competitive behaviour of the applicant possessing a superior form of technology to the detriment of consumers and other players in the market. Violation of imposed terms should would lead to the revocation of the concerned patent. Any grant of AI patents should remain amenable to aggressive use of exceptions such as compulsory licensing, government use etc. to make sure that the invented product remains affordable and accessible to the general public.

Role of Governments as Policy Makers - Governments must actively monitor and stay abreast with developments in AI technology to review the status of inventorship and consider whether AI has developed sufficiently to warrant the same status as a human inventor. For example, in a recent response letter to the Senate, dated 12 December, 2022, the USPTO had noted that to carry out extensive impact studies, the currently allocated budget had to be expanded.[91]Thus, considering the revolutionary impact of AI in the patent domain, governments must explore options to arrange for the necessary funds so that the society remains immune to any adverse impact without compromising on the benefits.

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