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The Ownership of Artificial Intelligence (AI) Generated & Created Inventions

by

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ABSTRACT

The rudimentary and overarching goal of the patent law is to establish a balance between public interest and the inventor interest on an equilibrium of reward, a limited exclusive right is granted to the inventor as a reward for his or her contribution to the technical advancement of the general public. This equilibrium of reward provides the fulcrum that serves as an incentive for creativity, innovation, research and development. With the fast pace of advancement in technological developments, overtime machines have developed the capability and capacity to invent new products, this trend of machine's invention was not envisaged by the global patent system and has triggered discussions for Intellectual Property policies reform. Debates surrounding who owns an Artificial Intelligence generated or created invention took a different trend recently after the European Patent Office (EPO) rejected two patent applications on the basis that they did not meet the requirements for inventorship as prescribed by the European Patent Convention (EPC). The EPC states unequivocally that an inventor is a "natural person" and by giving a machine a name is immaterial because things have no rights, therefore the grounds for refusal by the European Patent Office was that machines have no "legal personality". There's a gray line between the concepts of Ownership and Inventorship of patentable inventions that require clarification, people often confuse the inventor and owner as the same person which is often not factual; this research seeks to provide a scholarly adventure into setting a dichotomy between the two concepts including authorship. Discussions on the path ahead from the multilateral and the national jurisdiction levels are hinged on the objective of reviewing IP policies, legislative amendments and regulations on Artificial Intelligence in general.

This research paper examines the ownership of Artificial Intelligence generated and created inventions, within the existing IP framework and what protection are ascribed to such inventions under the Paris Convention, the World Intellectual Property Organization Copyright Treaty (WCT), and the Trade-related Aspects to Intellectual Property Rights (TRIPS) Agreement from a substantive law perspective coupled with what policy reforms are required for its adaptation and enforcement. To review IP policies, the Natural Rights Theory, laws, regulations that are in contrast to the concept of "machine ownership" and find a middle ground of convergence; to investigate jurisdictional issues pertaining to AI enforcement at the domestic fronts. Moreover, to look keenly at the concepts of ownership, inventorship and authorship in relations to policy prescriptions required to adapt AI inventorship, ownership and authorship in the field of IP. And conclude with the path ahead from the international and national perspectives.

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SECTION I
1.1 INTRODUCTION

Artificial Intelligence historical, current and emerging issues

Artificial Intelligence (AI) refers to the simulations of human intelligence in machines that are programmed to think like humans and mimic their actions[2]. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving. The ideal characteristics of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal. Artificial Intelligence (AI) has emerged as a field of technology with widespread applications throughout the economy and society. It is already having, and is likely to have increasingly in the future, a significant impact on the creation, production and distribution of economic and cultural goods and services. As such, AI intersects with intellectual property (IP) policy at a number of different points, since one of the main aims of IP is to stimulate innovation and creativity in the economic and cultural systems[3].

The term "artificial intelligence" was coined by John McCarthy in 1955 and became popularized at a conference at Dartmouth College in the United States in 1956 that brought together researchers on a broad range of topics, from language simulation to learning machines. Despite periods of significant scientific advances in the six decades since, AI has often failed to live up to the hype that surrounds it[4].

Artificial Intelligence (AI) is expected to gain a central role in our daily lives in the not-too-distant future. However, the increasing complexity and autonomous decision-making capacity of AI-powered systems and their potential use across a variety of sectors also pose significant legal and regulatory challenges. The AI strategies that have been adopted have not thoroughly addressed whether the current legal framework for IP is suitable for AI, and in particular how it could handle the outputs produced by intelligent systems. However, some recent policy development has shown an increasing interest in AI[5]. One of the primary concerns people have with AI is future loss of jobs, should we fully develop and integrate AI into society if it means many people will lose their jobs – and quite possibly their livelihood? According to the new McKinsey Global Institute report, by year 2030, about 800 million people will lose jobs to AI-driven robots. Consider most modern economic system require workers to produce a product or service with their compensation based on an hourly wage. AI are not immune to making mistake and machine learning takes time to become useful. If trained well using good data can perform well and with error/bad data the reverse[6].

The discussion on IP and AI is also attracting attention internationally. The World Intellectual Property Organization (WIPO) has been particularly active in exploring both: (i) the use of information and communication technology and AI by IP offices, and (ii) the relevance of AI for IP policies. The European Patent Office (EPO) has published new guidelines on patentability of AI and machine learning and a series of studies on economic and legal issues in AI. Last but not the least, the IP5, the five largest IP offices in the world, have identified AI as a strategic priority for the near future, and recently agreed to launch a taskforce on AI and emerging technologies[7].

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[2] J. Frankenfield, Artificial Intelligence (AI), March 13, 2020 [online] Available *at:* https://www.investopedia.com/terms/a/artificial-intelligence-ai.asp

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[3]WORLD INTELLECTUAL PROPERTY ORGANIZATION, *wipo conversation on intellectual property (ip) and artificial intelligence (ai) second session wipo/ai/2/ge/20/1/original: English data: December 13, 2019*
[4]McKinsey Global Institute, the promise and challenge of the age of artificial intelligence 2018 [online] Available at*:* *https://www.mckinsey.com/featured-insights/artificial-intelligence/the-promise-and-challenge-of-the-age-of-artificial-intelligence*
[5]Iglesias, M., Shamuilia, S. Anderberg, A., *Intellectual Property and Artificial Intelligence – A literature review*, EUR 30017 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-14178-5, doi:10.2760/2517, JRC119102.
[6]The 7 Most Pressing Ethical Issues in Artificial Intelligence 2019 [online] Available *at:https://kambria.io/blog/the-7-most-pressig-ethical-issues-in-artificial-intelligence/*
[7]WIPO's Second Session of Conversation on IP and Artificial Intelligence Ends with Outline of Next Steps [online] Available *at:* https://www.wipo.int/pressroom/en/articles/2020/article_0014.html

1.2 OBJECTIVES

This research aims to review treaties and agreements like the Paris Convention of 1883, the Patent Cooperation Treaty (PCT), the World Intellectual Property Organization Copyright Treaty (WCT), the Trade-related Aspects to Intellectual Property Rights (TRIPS) Agreement and other legal instruments, regulations, policies and practices in IP that provides protection for Artificial Intelligence generated and created inventions in part or whole, with the objective of examining the existing IP framework, legal implications, including but not limited to the determination of AI generated and created inventions ownership, inventorship and authorship, jurisdictional, economic, social and ethical issues surrounding the protection of AI inventions. The outcome of this research is intended to serve as a scholarly reference to researchers in IP, R&D institutions, private entities, public agencies, universities, in developing, crafting their IPRs regulations, laws, policies with regards to Artificial Intelligence generated and created inventions in parallel with the new developments in technologies meant to positively enhance economic growth and social impact[8].

1.3 KEY TERMS AND DEFINITIONS

Artificial Intelligence (AI) - refers to the simulations of human intelligence in machines that are programmed to think like humans and mimic their actions.

Generated Inventions – are inventions with (prior-existing elements) generated autonomously by an artificial intelligence (AI) system under circumstances no natural person, as traditionally defined, qualifies as an inventor.

Created Inventions – are inventions with (no prior existing elements) created autonomously by an artificial intelligence (AI) system under circumstances no natural person, as traditionally defined, qualifies as an inventor.

Autonomous – the development of a new and original technology, invention, artefact, programs, literary and artistic works or style and sometimes similar to one that already exists in another time or place, but which has come about completely independently.

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Intellectual Property (IP) System – relates to rights and obligations, as well as privileges and incentives—all rooted from the creation and protection of IP, which "refers to the creations of the mind: inventions; literary and artistic works; and symbols, names, and images used in commerce."

Intellectual Property Rights (IPRs) – are rights given to persons over the creations of their minds.

Natural Right Theory – the idea of a natural right is based on a political theory that every person has basic rights that the government cannot deny specifically right to own property, no matter where they live.

Ownership – the act, state, or right of possessing something.

Inventorship – is a concept in patent law that speaks to the state or act of granting rights to a person who creates an invention through his/her ingenuity.

Authorship – the state or fact of being the writer of a book, article, or document, or the creator of a work of art.

Paris Convention for the Protection of Industrial Property 1883 – the first major international agreement that applies to patents, trademark, industrial design, utility models, service mark, unfair competition and geographical indications**.**

Patent Cooperation Treaty (PCT) – is an international patent law treaty, concluded in 1970.

WIPO Copyright Treaty (WCT) – is a special agreement under the Berne Convention which deals with the protection of works and the rights of their authors in the digital environment in 1996.

Trade-Related Aspect of Intellectual Property Rights (TRIPS) – is an international legal agreement between all the member nations of the World Trade Organization **(WTO)** in 1995.

Treaty – a formally concluded and ratified agreement between states.

Agreement – a negotiated and typically legally binding arrangement between two or more parties, things; consistency.

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Jurisdiction – the official power to make legal decisions and judgements.

IP Policy – an official document that provides structure, predictability, and a beneficial environment in which enterprise and researchers can access and share knowledge, technology in the IP infrastructure to address systems and policies inefficiencies.

Multilateralism – refers to an alliance of multiple countries in international relations.

1.4 SCOPE AND LIMITATIONS

This paper focuses specifically on analyzing the relevant legal issues related to granting AI-derived inventions and works IPRs protection as well as discuss matters regarding ownership, inventorship and authorship. With emphasis on the review of international treaties and agreements, laws, regulations and IP policies adaptable for AI inventions and a critical look at key concepts and theories.

SECTION II

2.1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND GROWTH IN AI

Decades ago when scholars and researchers in the field of science and mathematics converged on the campus of Dartmouth College to launch the first widely revered discussion on Artificial Intelligence (AI) in 1965, the purpose was to *"precisely describe any feature of intelligence that machine can be made to simulate "*, I strongly believe that they did not envisioned that decades thereafter machines would gain and surpass the capacity of describing features of intelligence to assume the capability of learning, perceiving, reasoning and solving problems that are attributed exclusively to humans. AI has evolved so much so that it has reached a level to challenge and revolutionize the patent system *vis a vis* the global Intellectual Property (IP) infrastructure.

The core of AI is algorithm, which is basically a technical process defined by set rules or instructions through which a computer follows instructions or derived calculation with the objective of solving a specific problem or multiple problems. This structural component of AI is fundamental, because it depicts the technical and statistical features of machine learning and deep learning in an AI system that overtime progressively evolve into AI autonomy. AI-inventions are set of inventions that use AI as a tool in one capacity and develop AI as an output in another capacity with human participation at various levels. Algorithm contains instructions that determines computational operations, hence cognitive autonomy cannot be attributed to algorithm because computers are bind by instructions. As a creation of the mind, an invention is a new and useful apparatus, method, process, product that is conceived and devised. The DABUS, artificial inventor designed to construct and simulate neural networks is a classical AI-invention, however, there are gray-lines on several fronts: (1) the level of relative machine or human involvement, (2) where to delineate between AI as a tool or process among other queries.

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2.2 PRINCIPLES OF INTERNATIONAL IP LAW

The fundamental principles of Intellectual Property Rights protection are found in Article 27 of the Universal Declaration of Human Rights, which protects the "Moral and Material Interests" of authorship of scientific, artistic and literary works[9]. The Ownership of Intellectual Property Rights is regarded as a property right issue which enables owners and creators of copyright, patent and trademark work to be rewarded for their investment in innovation and creativity. Absence the benefit provided by international agreements such as Patent and Copyright Treaties, the Paris Convention of 1883 and the Berne Convention of 1886, the incentive to create and produce quality products by creators, inventors and researchers for public consumption will be immensely diminished. With regards to Artificial Intelligence as an owned invention, the existing patent and copyright systems provide coverage and spelt out the requirements leading to ownership, protection and regulation, however, as it currently stands; the system prohibits and doesn't provide an enabling policy environment for AI-Ownership and Inventorship as AI is only considered a tool for human creation and innovation within the current IP framework.

In order to justify intellectual property right, the natural right theory considers that everyone has a natural property right on his or her idea. As a matter of fact, the creation comes from an effort and creativity of its author. The essence of the theory emanates mainly from John Lock's idea that an author has the natural right over the production of their intellectual labor. In other words, this theory is an adaptation between intellectual property and traditional tangible property including the right to use, to exclude others from use and the right to transfer the owned object. Accordingly, in my simplification of this very complex legal and philosophical theory; anyone who violates the intellectual property right of an author, creator or inventor is considered to commit an intellectual theft.

However, clearly, there is a lack of consistency in this theory considering that intellectual rights are based on the things that are not naturally of appropriable and non-rival. Indeed, we can appropriate them only because the intervention of the public authorities permits it. Besides, such a theory is incomplete because "he (Lock) does not expand on the level of labour required to qualify something as a property and also, whether the property into which the labour is poured ought to be identifiable as that individual's property. What's more, apparently such a justification also denies the fact that most of the creations are created not only from intellectual labour of the creator but also from unowned resources. Indeed, "new creators inevitably and usually build on predecessors. In this sense, intellectual property is rarely a creation from nothing[10].

2.3 THE CONCEPTS OF OWNERSHIP, INVENTORSHIP & AUTHORSHIP IN IP

Within the context of Intellectual Property the concept of ownership is premised on the proprietary right or the exclusive right to property, and by extension creations of the mind are properties that possess exclusive rights that are awarded or granted to a creator or inventor of an invention or intellectual creation and in some instances an entity. Ownership applies to patents of inventions, geographic indications, industrial designs, trademarks and copyright. This right to ownership grants an inventor or creator the following commercial benefits as

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provided by the Paris Convention of 1883; bargaining power, market exclusivity and licensing power. There's a thin line between ownership and inventorship that is quite often confusing to people.

The concept of Inventorship is premised on the involvement of the owner in the inventive step from the extensive research of conception, devising to the completion of an invention or intellectual creation, the inventorship right can also be granted to an entity based on an agreement between the entity and an employee relating to Intellectual Property right regarding technology deriving from work. The inventor also benefits from rights provided by the Paris Convention.

The concept of Authorship is premised on the economic and moral rights ascribed or awarded to an author, publisher or artist of literary and artistic works as a contribution to the public, as a right granted exclusively to an author or artist, it allows them to protect, transfer, authorize, license and prevent the use of their work or intellectual creations. However, exceptions are made for the purpose of reproduction and communication to the public as indicated for educational and scientific activities.

[8]WIPO Technology Trends 2019 Artificial Intelligence WIPO (2019). *WIPO Technology Trends 2019: Artificial Intelligence*. Geneva: World Intellectual Property Organization.
[9] Intellectual Property and Human Rights [online] Available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_762.pdf
[10]Law Right, IP theories [online] Available at: https://www.law-right.com/intellectual-property-theories-are-they-fairly-justified/

SECTION III

3.1 PATENT AND ARTIFICIAL INTELLIGENCE

The Paris Convention of 1883 protection for Industrial Property provides coverage for patent, in Article 4ter and Article 4quater specifically "Article 4ter: Mention of the Inventor in the Patent and Article 4quater: Patentability in Case of Restriction of Sale by Law[11]", it sets out the basis and possibility to address queries surrounding the feasibility of granting rights to Artificial Intelligence inventions to a certain degree in regards to the restriction and prohibition of the AI-inventor. Viewing from an anti-prohibitionist lens can place individuals and groups from both AI divides in a better position to address challenges and derive measures required for policy reforms in the global IP System. With regards to the Patent Cooperation Treaty procedure for patent application for Artificial Intelligence inventions, I identified few gaps in the administrative notices and application instruction: (1) the fast evolution of AI technology and its ubiquity nature makes it difficult for the procedure to provide exhaustive coverage for all instances AI is applied; (2) there are no specific destinations for AI patents, AI-enabled technology or AI applied techniques, for example (Machine Learning, Deep Fakes and Deep Learning); (3) apart from the recent Administrative Instructions under the Patent Cooperation Treaty that came into force July 1, 2020; past notices are antiquated and do not reflect the current rapidly evolving technological developments and fail to provide for AI and other new technologies and as a matter of consequence the examination procedures also reflects antiquity.

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The Trade-related Aspects to Intellectual Property Rights (TRIPS) Agreement has not provided exhaustive or full-scale coverage for Artificial Intelligence ubiquitous inventions and works as it commits to protecting and enforcing all intellectual property rights specifically as an objective of promoting technological innovations. For Pharmaceutical patents the minimum substantive standards for protection and remedies for IP does not provide an enabling policy environment to increase the productivity of AI outputs and new technologies in all its diversities, patent, copyright, trademark among others. From the developing and least-developed countries perspective, the TRIPS Agreement is counterproductive to accessing and benefiting from AI-driven or related outputs such as pharmaceutical products during emergency situations through the use of compulsory license, due to the bureaucratic bottlenecks characterized by its processes, which is in direct contradiction with the TRIPS goal "to promote access to medicines for all". This consequentially leads to welfare loss for developing societies. Even with the temporary moratorium and few key flexibilities the obligation to uphold the agreement up to 2021 is a major challenge for developing countries. It must be noted, however, that the TRIPS Agreement has led to improvements for the protection of pharmaceutical inventions in a non-discriminatory manner and the strengthening of liberalization at the multilateral level.

3.2 AI-GENERATED AND CREATED INVENTIONS

AI-generated or created inventions develop an AI output autonomously or semi-autonomously with relative human involvement through an automated process comprising of an algorithm, the AI application, the structure of the database, the training of the algorithm and the outcome of said process. The European Union and others hold strongly to the historical and fundamental principle that patent law and statues were legislated to protect human beings and that by granting Artificial Intelligence Systems patent rights and protection will outrightly change the patent system. They argue that there are legal, regulatory, security and ethical underpinnings implications that required thorough and critical discussions and assessment before considering and granting AI systems and machines lacking human judgement inventorship and patent ownership rights. From all indications it seems to be we are far from granting AI systems patent rights as per the most recent European Patent Office decision on the DABUS inventor.

Machines as Patent Owners

The visualization of patent owning machines today, is a Utopian vision that have a lifespan lasting from conception and development to the patent examining authority rejection decision, legitimately so rejection entrenched in the patent law. However, it must be noted that calls for policy reform have been bombastically trumpeted and is yielding signals for adaptation. The most memorable and recent case study is elucidated in the following paragraphs. The AI inventor, named "DABUS" by its creator Stephen Thaler, relies upon a system of neutral networks generating new ideas by altering their interconnections. A second system of neutral networks detects critical consequences of potential ideas and reinforces them based upon predicted novelty and salience. Professor Adrian Hilton, Director of the Centre for Vision, Speech and Signal Processing, said: "Modern AI may fundamentally change how research and development takes place. In some cases, AI is no longer a tool, even a very sophisticated tool; in some cases, AI is automating innovations". One of the applications claims a new type of

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beverage container based on fractal geometry, while the other The United Kingdom Intellectual Property Office (UK IPO) and the European Patent Office (EPO) have already indicated these applications appear new, inventive and industrially applicable, which are the primary requirements for an invention to receive a patent (Abbott & Hilton, 2019)[12]. However, the issue of AI inventorship has been repeatedly rejected. The inventor is the first owner of any patent which is applied for and granted over the invention, as the law currently stands, AI systems cannot be the inventor and therefore the owner of a patent because "devising" an invention is a human activity which involves contributing to the inventive concept. The invention and any patent granted over it will, as a consequence, belong either to the human deviser or, if an employee, their employer. As this is an established precedent it doesn't matter the degree of human or machine involvement, because a human or an entity remains the predetermined inventor by the natural right theory within patent law. Concerns surrounding an established legal fiction with regards to the user or the owner of an AI system as the creator has no definite answer as there are no well-known practices or considerations.

As has been widely reported in the media, AI is being used to generate news, compose music, create artworks (some of which have actually been sold in auctions), and produce scripts. It has even been used to come up with technical inventions that, if made by humans, could be patentable. Recent achievements in AI techniques have allowed machines to reach a level of autonomy that could make human contributions trivial to the creative and inventive process. We may be entering into an era where machines will not only assist humans in the creative processes but create or invent all by themselves. The application of the IP legal framework to works and inventions generated or created by AI is a complex question, in particular for (a) copyright and other sui generis or neighboring rights; and (b) patent law. There is no harmonized or country-specific regime established in some countries, thereby making it questionable as to whether AI-generated or created inventions and works benefit from patent and copyright protection and can AI-works be considered original? And lastly to whom ownership should be granted?

SECTION IV

4.1 COPYRIGHT AND ARTIFICIAL INTELLIGENCE

The quintessential objective of establishing a copyright system was to give creators property rights, which are broader than the rights established by the contract system that is based on legal and economic principles. Giving creators property rights promotes the creation of useful art. Which as a result in turn, incentivize the creators to create, expose, develop, and distribute their works, enriching the total welfare of the public. However, as a result of contract or relationship with the author or creator, other entities are entitled to the copyright as direct referees of the actual human creator. Unlike humans, AI system do not need incentives to create artworks. It's true that programmers need to be incentivized to create and develop advanced, automated AI systems, but programmers, or the entities for which they work do hold copyrights over their software. Once we understand the nature of incentive, we understand that they are nevertheless needed to (1) promote the development of AI system` programming and (2) encourage entities to control the functions of AI system and to take responsibility for their outcomes. In these cases, ownership might be the most efficient tool for gaining this incentive. However, we do not need to incentivize robots or AI systems to function, which is an advantage to society.

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Machines as Copyright Owners

The evolution of Artificial Intelligence has had a significant impact on Literary and Artistic works with specific emphasis on the rapid increase in scientific publications in a range of research subject matters, namely Pharmaceutical R&D, Machine Learning, Telecommunications amongst others; all of which are triggered by the advancement of Artificial Intelligence and New Technologies, however, ensuring compliance remains a challenge as copyright protection for literary and artistic works is dependent on a country obligation to the existing relevant treaties for patent and copyright protection. AI-generated works in copyright legislation: In the copyright realm, certain countries, such as the UK, South Africa, Hong Kong, India, Ireland and New Zealand, have setup laws that can provide protection for computer-generated works[13]. This protection would be granted to the person who setup the arrangements necessary for the creation of the work. In the UK, computer-generated works are defined as works 'generated by a computer in circumstances such that there is no human author of the work'. Note that UK provisions leave room for ownership to be allocated either to the programmer or to the user. To my knowledge case-law on computer-generated work is scarce. These works benefit from a shorter term of protection (50 years compared to the 70 years for other copyright-protected works. The configuration of right somehow resembles a neighboring right[14]. The below article provides a clear indication of the lack of a harmonized system and loose nature of enforcement at the multilateral level which is in a way counterproductive to strict adherence.

The World Intellectual Property Organization Copyright Treaty of 1996 adopted in Geneva on December 20, 1996 is a special agreement within the meaning of *Article 20 of the Berne Convention for the protection of Literary and Artistic Works*, as regards Contracting Parties that are countries of the Union established by that Convention. This Treaty shall not have any connection with treaties other than the Berne Convention, nor shall it prejudice any rights and obligations under any other treaties[15].

With coverage granted to computer programs under both Copyright and Sui generis protection which are limited to the rights to expression, the prevention of extraction and re-utilization of the whole or substantial portion of a database in any form, which is fundamentally a good-intentioned policy prescription, howbeit; the critical question is and still remains, what is the defense mechanism against unfair competition without an established harmonized regime? The below article of the Berne Convention spelt out the coverage of computer programs and its peripherals.

Article 4 (Computer Programs)

Computer programs are protected as literary works within the meaning of Article 2 of the Berne Convention. Such protection applies to computer programs, whatever may be the mode or form of their expression[16].

Most copyright legislations across the EU Member States are very much dependent on human-centered concepts, for: (i) the beneficiary of protection (i.e. the author); the conditions of protection (e.g. originality); and (the rights granted (economic, but also moral rights). The

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human -centered focus is also present in the *acquis communautaire*, although arguably to lesser extent due to the lack of regulation on moral rights. In the context of the European Union legal jurisprudence, the Acquis communautaire embodies a mixture of the collective legal and political written and unwritten body of EU laws that Member States are obliged to adhere to in the pursuit of the European Community integration and development agenda, the acquis as it's notably called is also a benchmark or prerequisite for countries interested in joining the European Union.

4.2 AI-IMPLEMENTED OR ASSISTED INVENTIONS

It is also not clear what an AI-implemented or AI-generated invention is from a legal, technical and policy perspective, but from my research investigation of the plethora of unending scholarly publications on this subject old and recent, my understating is that AI-implemented or aided inventions use AI as a tool or method in the development of the concept, design, weight, structure and running an algorithm that lead to an output. Another key aspect of algorithm development is the role of training data which is use in modelling machine learning to make data driven predictions derived from input data and the resulting output. In the inventive process training data is engineered to enable computer identify pattern, cross validate data in order to ensure efficacy and accuracy of an algorithm.

It is not a new phenomenon that software and computers are used for creating intellectual achievements. As early as of 1991, a WIPO symposium at Stanford University discussed the implications of Artificial Intelligence (AI) for intellectual property law. More and more complex self-learning systems, which can produce an innovative or creative performance, are becoming part of everyday life. Thus, it seems to be within reach that there may be creations and inventions without substantial human input. New products are already being developed in "intelligent laboratories" without significant human intervention but only with the help of self-learning simulation programs. Another example is the AI created artwork sold for $432,500 at auction house Christie's. These developments pose a challenge to the IP framework: IP law is based on the assumption that IP rights are granted as a reward for human achievements as established by the natural right theory[17].

Machines as Copyright Owners

As computer programs, AI systems may be granted copyright protection available for original software. However, copyright protection only extends to the original expression of the computer programs and not to the ideas and principles underlying it. Thus 'to the extent that logic, algorithms and programming languages comprise ideas and principles, those ideas and principles are not protected'. Therefore, only the expression is to be protected by copyright. This means that the code of the algorithm, if original, can be protected while the pure concept behind the algorithm cannot[18].

Comparison of Machines as Patent and Copyright Owner

Machines cannot be owners of both patent and copyright as the current IP System does not grant machines such dual status whether or not it invents with the support of humans or autonomously, the produced invention or work will be ascribed to its programmer. However,

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there has been an incidental anecdotal case in point wherein the Tech Tycoon Tencent Robot called Dreamwriter was granted copyright protection for its article generated by Artificial Intelligence through an automated software publishing tool in Shenzhen Court, China has been flexible and receptive to AI-aided and AI-generated inventions and works through legislative reforms[19].

[11]Paris Convention for the Protection of Industrial Property [online] Available at: https://en.wikipedia.org/wiki/Paris_Convention_for_the_Protection_of_Industrial_Property
[12]Inventorship under the light of AI? [online] Available at: http://ipkitten.blogspot.com/2019/11/inventorship-under-light-of-ai.html
[13]WIPO Impact of Artificial Intelligence on IP Poliy Response [online] Available at: https://www.wipo.int/export/sites/www/about-ip/en/artificial_intelligence/call_for_comments/pdf/org_brunel.pdf
[14]A. Guadamuz, Artificial Intelligence and copyright 2017 [online] Available at: https://www.wipo.int/wipo_magazine/en/2017/05/article_0003.html
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[16]Article 4 – Computer Programs [online] Available at: https://www.jus.uio.no/lm/en/html/wipo.copyright.treaty.1996/4.html
[17]WIPO Worldwide Symposium Intellectual Aspect of Artificial Intelligence [online] Available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_698.pdf
[18]Copyright protection of Computer Software [online] Available at: https://www.wipo.int/copyright/en/activities/software.html
[19]Chinese court rule AI-written article is protected by copyright [online] Available at: https://venturebeat.com/2020/01/10/chinese-court-rules-ai-written-article-is-protected-by-copyright/

SECTION V

5.1 DISCUSSIONS AND ANALYSIS

This section discusses the analytical perspectives on the legal, regulatory, social, ethical and jurisdictional contexts of the application of AI produced assets in the human environment, the United States Patent and Trademark Office (USPTO) and the European Patent Office (EPO) approaches to the recognition and protection coupled with the societal and other underlying defects associated with Artificial Intelligence (AI). The European Patent Office (EPO), the United States Patent and Trademark Office (USPO), the World Intellectual Property Organization (WIPO), the African Regional Intellectual Property Organization (ARIPO) and others have recognized the growing debates surrounding the need to reform the rules on how inventions related to, and created by AI will be addressed in the IP system.

Given the problems of social uncertainties and legal ambiguities surrounding the nature and dynamics of Artificial Intelligence as a creator or an inventor under patent or copyright laws which happens to be a commonality of AI-systems, has to an extent affected the norms of adjudication of IP laws, however, the current IP System doesn't accommodate AI in its totality. Most countries do not recognize machines ownership as highlighted by the DABUS case, my opinion is that this is a bad precedent as we continue with the process of AI inventions across key sectors of societies; if we don't update the IP laws and systems we have a risk of low innovation and creativity as opposed to what is needed for societal welfare, because of low incentive. Consequently, there's a need for collective interventions at the multilateral, regional and national levels to address Artificial Intelligence in general within the framework of the IP System.

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Debates on the inclusivity of Artificial Intelligence in the IP System are premised on two key arguments, the first is that there's no need to change the current IP laws, because it rewards and incentive human creativity and as such any attempt to alter them will undermine this fundamental purpose. Moreover, granting AI ownership, inventorship and authorship rights is characterized by legal, regulatory and social uncertainties that has the potential to pose huge risk to human welfare in general.
The second argument is that there's a need to update and reform the current IP laws to fully accommodate AI-inventions and creations as AI doesn't require incentive as humans to invent or create and if AI is granted ownership, inventorship and authorship rights this will lead to increase creativity and innovations of efficient and quality products for human utilization and consumption.

Advocates of the 'artificial inventor' in the field of academics and innovation strongly believe that the globally recognized and accepted concept of "a person or entity inventor" to fulfil patentability requirement and other established procedures within the existing intellectual property framework through the Paris Convention, the Patent Cooperation Treaty (PCT), the World Intellectual Property Organization Copyright Treaty (WCT) and the Trade-related Aspects to Intellectual Property Rights (TRIPS), is obsolete and doesn't conforms to the current dispensation and advancement in new technologies and the evolution of artificial intelligence inventions and works. The view of the "artificial inventor" is premised on machines or artificial systems with the ability to autonomously invent quality and safety-driven inventions under the patent law and artistic creations/works under the copyright law for the general public good, the Pro-AI argues that the IP system must be amendable to accommodate AI void of counterproductive and anti-competitive policy restrictions for its non-incentivized contributions and advancement of new technologies. On the contrary, the Anti-AI argues that the system must remain constant as it's, to safeguard human creativity from the potentially life threatening consequences and defects of technological advancements and the possible extinction of humankind through Artificial Superintelligence, as comical and overly exaggerating as their view might be perceived there are legitimate concerns with Artificial Intelligence (AI) that requires critical scrutiny to avoid slippery slope interventions.

Case Law

To my knowledge, conferring copyright to inventions and works generated by artificial intelligence has never been specifically prohibited, however, there are indications that the laws of most countries like the United States, the UK, Australia, Canada, EU and other countries are not amenable to non-human copyright. In the United States, for example, the Copyright Office has declared that it will "register an original work of authorship, provided that the work was created by a human being". This stance flows from the following case law excluding Saudi Arabia robot citizen (Sophia):

In this case the U.S. Supreme Court legal intervention in 1991was regarded as a landmark decision in establishing a "new originality paradigm" in Federal Circuits protection under copyright and common law system. The legal contention was a definition tension with regards to an adopted test similar to the one articulated by Feist which was based on "creative selection" why others used the evidence of labor known as "sweat of the brow". This case to a certain degree depicts how essential registration and disclosure requirements are in copyright law for computer programs and is substantively reflected in the TRIPS Agreement for integrated circuits and what it might possibly result to in legal suits.

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United States case
Feist Publications v Rural Telephone Service Company, Inc. 499 U.S. 340 (1991) which specifies that copyright law only protects "the fruits of intellectual labor" that "founded in the creative powers of the mind[20]."

The Australian High Court in the below case established that originality requires a degree of human ingenuity and that under the Copyright Regulation each work must have an author in order to qualify for authorship, Artificial Intelligence (AI) system in this regard is neither a human person nor citizen.

Australia case
Acohs Pty Ltd v Ucorp Pty Ltd, a court declared that a work generated with the intervention of a computer could not be protected by copyright because it was not produced by a human[21].

The Europe Union case
In the *European Court of Justice of the European Union (CJEU)* has also declared on various occasions, particularly in its landmark Infopaq decision *(C-5/08 Infopaq International A/S v Danske Dagbaldes Forening)*, that copyright only applies to original works, and that originality must reflect the "author's own intellectual creation." This is usually understood as meaning that an original work must reflect the author's personality, which clearly means that a human author is necessary for a copyright work to exist[22].

Saudi Arabia
Granting citizenship to Robot Sophia (*Saudi Arabian Citizenship Act*), a humanoid robot, it announced at an innovation conference in Riyadh, the first nation to bestow citizenship upon a robot. Sophia was built by the Hong Kong-based company Hanson Robotics in 2015. The inventor David Hanson claims that the robot is imbued with artificial intelligence and can recognize faces. The robot's silicon face can reportedly mimic 62 human facial expressions[23].

5.2 OTHER RELATED ARTIFICIAL INTELLIGENCE ISSUES

AI and Big Data

Artificial Intelligence and Big data are integral and interdependent features of the Fourth Industrial Revolution 4IR, which give an AI system the capability to intake, process and interpret huge data into simplified analysis for critical decision making across relevant industrial sectors. This essential need for analyzed data to predict trends in marketing, corporate strategy and in some instances the assessment of national security implications of cutting-edge technological developments. Big Data is the new oil and gas that drives the global business investment machinery, as data analytics plays a significant role in gathering useful insights into market trends and enables the prediction and preparation for future investment portfolios. AI and Big Data taxonomy also have their drawbacks with regards to queries of their sources, privacy, data quality, cybersecurity risk among others. The world was already entrenched in Big Data before it even realized that Big Data existed. By the time the termed was coined, Big Data had accumulated a massive amount of stored data that, if analyzed

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properly, would reveal valuable insights into the industry to which the particular data belonged[24]. IT professionals and computer scientists quickly realized that the job of shifting through all of that data, parsing it, converting it into a format more easily understood by a computer and analyzing all of it for purposes of improving business decision-making processes was too much for human minds to tackle. Artificial Intelligence algorithms would have to be written to accomplish the enormous task of deriving insights out of chaos.

Ethical, Social and Safety Issues

Yes, the thought of increasingly present AI systems that surpass human intelligence is scary. And the ethical issues that come with AI adaptation are complex. The key will be to keep these concerns in mind in order to analyze the broader societal issues at play. Whether AI is good or harmful can be examined from many different angles with no one theory or framework being the best. We need to keep learning and stay informed in order to make good decisions for our future.

Singularity and Keeping control Over AI

Will AI systems evolve to surpass human beings? What if they become smarter than humans and then try to control us? Will computers make humans obsolete? The point at which technological growth surpasses human intelligence is referred to as "technological singularity"[25]. Some believe this will signal the end of the human era and that it could occur as early as 2030 based on the pace of technological innovation. AI systems leading to human extinction – it's easy to understand why the advancement of AI is scary to many people across the globe.

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5.3 THE PATH AHEAD

The significance and influence on AI Technology on the existing IP System and all spectrum of the global society remains immense and unquestionable, however; the future of AI-innovations within the IP infrastructure remains unsettle and characterized by legal ambiguities and regulatory uncertainties surrounding its inclusion, the why, how and when AI-inventions and works *vis-a-vis* (AI Systems and software/programs) should be granted ownership, authorship or inventorship rights. IP protection regarding the specificities of AI and its acceptance remains unanswered with ongoing discussions by policymakers, legislators, experts and scholars surrounding the modifications in the overall Patent and Copyright laws, eligibility

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requirements for patent, copyright and related IP subject matters coupled with the legal and policy reforms on the application of these subjects criteria across diverse jurisdictions. The current rules on AI-ownership, authorship, inventorship and IP rights protection for AI-related inventions and creations require refinement to reflect present day realities of new and emerging technologies. It is irrefutable and irreversible that Artificial Intelligence (AI) widely considered the Fourth Industrial Revolution (4IR), will revolutionize the practice of intellectual property management and development through the patent, copyright and related subject procedures for granting rights to AI-Inventions and works.

SECTION VI

6.1 CONCLUSIONS

As it stands, notably there is no generally agreed resolution as to how patent law and policies should be reformed to fully address the implications of Artificial Intelligence in general and accommodate Artificial Intelligence Generated and Created inventions and works in particular, however, there are unending debates demanding structural policy reform and ongoing inquiries at several fronts specifically examining the systematic IP framework with focus on patent law, copyright law, trademark and design laws as well as other related AI-related subject matter in order to address the followings questions; is an AI system entitle to the allocation of inventor as a natural person is?; shouldn't AI systems, machines and computers with cognitive capability of solving technical problems autonomously be granted ownership and inventorship rights?; can AI-works be considered original and non-obvious?; should AI systems bound by human instructions be given special treatment from other invention-assisted problem-solving tools under patent law? and lastly to whom ownership, inventorship and authorship rights be granted, the AI system or the Programmer?

These among other queries must be addressed prudently and expediently with key policy prescriptions void of hasty slippery slope interventions. Advocates of the "artificial owner, author and inventor" in the field of academics and innovation strongly believe that the globally recognized and accepted concept of a "person or entity inventor" to fulfil patentability requirement and other established procedures within the existing intellectual property framework through the Paris Convention, Patent Cooperation Treaty (PCT), the World Intellectual Property Organization Copyright Treaty (WCT) and the Trade-related Aspects to Intellectual Property Rights (TRIPS), is obsolete and doesn't conforms to the current dispensation and advancement in new technologies and artificial intelligence inventions. They argue that these requirements should and must not be used to serve as barriers for investment in AI-inventions and works as well as a disincentive to the creation of new, original, useful and quality AI-driven technologies that are autonomously generated or created by machines. Stakeholders within the existing IP infrastructure must undertake the necessary steps required to modify, adapt and accommodate well-guided policy prescriptions that will incorporate AI-generated and AI-created inventions while taking into account the social, ethical and safety of humans, as well as the crafting, enactment and amendment of new and existing laws and

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policies to address issues surrounding AI-ownership, inventorship and authorship in cases where these inventions were to a greater extend or autonomously responsible for solving technical problems. Moreover, the divergence of views on how Artificial Intelligence should be covered generally must be engaged with caution while considering the urgency required.

Conclusively, there's a need for reform and a number of organizations including the Word Intellectual Property Office (WIPO), the European Patent Office (EPO) and the United States Patent and Trademark Office (USPTO), the African Regional Intellectual Property Organization (ARIPO) and others have organized discussions among stakeholders, experts, academicians and scholars to initiate policy reforms on AI innovations and works, these discussions are focused on the review of AI & IP policies, related to laws and regulations that are unparallel to the concept of machine ownership, and the need to move ahead with concrete policy-actions in order to strike a balance in the convergence of Intellectual Property Rights (IPRs) and AI Technologies. The path ahead for Artificial Intelligence (AI) innovations and works protection is feasible through the modification and adoption of international treaties and directives from the multilateral and regional levels as well as the developed, the developing and small economies states perspectives; which is more a national approach to reform through laws, regulations and policies that will ensure AI specificities can be adopted at the national IP offices and related institutions.

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