

The Challenges of Artificial Intelligence and Intellectual Property Rights: An Exploration of the Mexican and Costa Rican Contexts.

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Abstract. The vertiginous advance of the digital economy at a global level represents significant challenges for humans from the technological, social, and cultural perspectives, especially the impact of artificial intelligence (AI) and other emerging technologies such as Neurotechnology, the Metaverse, and Blockchain, to mention some of the most important ones. Intellectual property (IP) rights acquire relevance in terms of the work, creativity, inventiveness, and authorship of products and services available to human beings. This paper aims to identify challenges to the use and applications of Artificial Intelligence concerning moral, ethical, and economic rights that emerge from the interactions between the physical and digital worlds. We argue in this contribution that, on the one hand, the nature and implications of AI require in-depth analysis and discussion; on the other hand, the possible associated repercussions on IP rights are minimized, ignored, and, in most cases, are unknown. As a result of our study, we identified the impacts, benefits, and risks of implementing AI applications in Mexico and Costa Rica.

1 Introduction

The development of human beings has been affected by the advance of knowledge (empirical, traditional, and cognitive) and the use of new technologies, which has generated new changes in its structure, as well as in society and the economy, particularly in the form of protection of its creativity and the concept of intellectual property (IP) [1], in his paper “Una breve historia del origen de las patentes” considers three relevant stages:

a) In the third century B.C. cites a writing that granted exclusive exploitation rights to the creators of unique culinary dishes and to the inventors of any new luxury or refinement.

b) The granting of the privilege of invention to the Florentine architect Filippo Brunelleschi by the Republic of Florence in 1421 for a barge with a lifting mechanism to transport marble.

c) The first known English patent, in 1449 to the Florentine glassmaker John de Utyman, for a process for tinting the glass used by Venetian glassmakers that was unknown in England. (pp. 2-3)

Regarding the development of industrial property rights, in accordance with the World Intellectual Property Organization (WIPO), two fundamental milestones are the Paris Convention of 1883 (patents, trademarks, industrial designs, utility models, etc.) [2] and with copyrights and related rights, the Berne Convention of 1886 (literary and artistic works, computer programs, software, videos, sculptures, photographs, etc.) [3].

In the case of Artificial Intelligence, a critical historical reference is the publication of Alan Turing's paper "Computing Machinery and Intelligence" [4]. Another essential part of this historical process is the paper that gave birth to a computer model for neural networks [5]. The convergence of the Internet and other computational technologies contributed to the advancement of Artificial Intelligence (AI) and the emergence of different key technologies such as Machine Learning (ML) and, more recently, Large Language Models (LLM).

The vertiginous advance of technology from machine learning to deep learning (DL) in a technological spiral and its use in different social, commercial, and industrial sectors is part of the so-called Industry 4.0 (I4.0), a term that was proposed and promoted by three German engineers: Henning Kagermann, Wolfgang Wahlster, and Wolf-Dieter Lukas in their publication *Industrie 4.0: Mit dem Internet der Dinge auf dem Weg zur 4. Industriellen Revolution* (original title) coined the I4.0 industry idea [6]. The concept was unveiled at the Hannover Messe industrial fair in 2011, a term coined in the same year by economist Klaus Schwab, founder of the World Economic Fund. The I4.0 strategy is a framework for communication between machines digitally and autonomously in its different application areas, such as Data Analytics, Simulation, Additive Manufacturing, Cybersecurity, Augmented Reality, Virtual Reality, Cloud Computing, Internet of Things, Cyber-Physical Systems, Robotics, Vertical and Horizontal Integration, Artificial Intelligence, and Blockchain.

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1.1 Human beings and Artificial Intelligence.

One aspect emphasized in this paper is preserving the concept of being human and its relationship with the use and applications of Artificial Intelligence associated with respect for intellectual property in terms of its moral, ethical, and patrimonial rights in the face of cognitive knowledge. This relationship has a relevant effect on sociocultural, demographic, technological, economic, political-legal, and environmental environments, as shown in Figure 1. The relationship between AI and IP maintains shared aspects in different areas of law, regulation and normative through a series of conventions and treaties, which has a direct impact on national and international legislation, rules, regulations, and treaties for the observation of copyright, industrial property, plant breeders' rights and the use of Creative Commons, including communication systems.

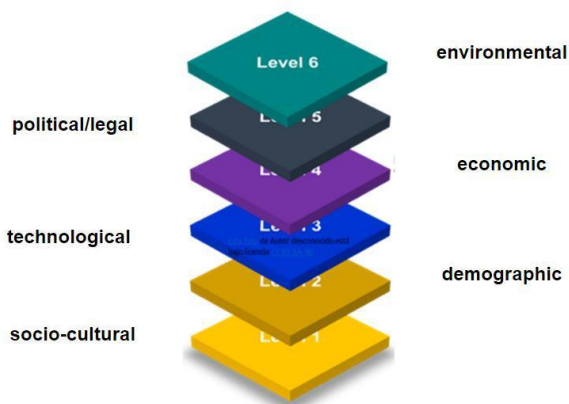


Fig. 1. AI in different contexts of human activity

This relationship between AI and IP starts with the analysis of the particular context as shown in Figure 2.

2 Methodology

The present work uses a heuristic perspective; our qualitative methodology focuses on analyzing reports of national and international organizations, scientific articles, statistical data, and case studies of global reach. We reviewed the most significant events, milestones, and paradigms that shape technological, cultural, and economic changes related to intellectual property, as well as the emergence of Industry 4.0 and its relationship with artificial intelligence.

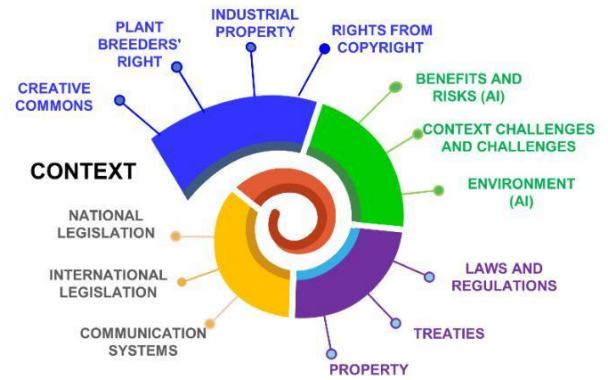


Fig. 2. Relationship between AI and IP

3 Results and Discussion

3.1 Globalization and regionalization

There is no doubt about the fundamental role that Intellectual Property has played in technological development, the protection of knowledge, its registration and legalization, and the preservation and strengthening of an environment of order and respect for property for the benefit of creators, designers, and developers. As mentioned above, there is evidence of the emergence of IP initiatives long before the last century; however, critical elements in the strengthening of IP in its path of consolidation at a global level were the Paris and Berne Conventions of 1883 and 1886, respectively, and other initiatives that together gave birth to what is now known as the World Intellectual Property Organization (WIPO), which joined the United Nations Organization in 1974.

In this path of consolidation, various support systems of global scope (national and international) give rise to an ecosystem that promotes innovation in its technological conception and sustainability, which is crucial for this article. This ecosystem adapts to digital transformation processes resulting from a technological explosion with enormous consequences at the global and regional levels. Another aspect of the relevance of IP rights is their incorporation in multilateral trade treaties carried out between Mexico and Costa Rica and economic sectors [7]. In other words, IP has become an element of considerable importance in the geopolitics of the world economic scenario and is a critical link in the value chain of technological innovation [8].

Based on the above, this contribution highlights two challenges that the IP system is currently facing, which have significant implications for its operation and efficiency: The first is the accelerated technological change driven by digital transformation, the second refers to the initiatives and concerns of a geopolitical and global governance nature arising from regional blocs and countries of the Global South and the Periphery, which attempt to reduce hegemonies in

the power of application, dissemination and fair and equitable distribution of knowledge and the commercialization and marketing of tangible and intangible products and services Thoron L.C. et al [9].

The traditional IP environment for preserving the key elements of ownership, protection, and dispute resolution has been profoundly altered by the information revolution, gradually reaching a breaking point in the confluence of technological, geopolitical, and socioeconomic forces of the current post-pandemic conjuncture. In such circumstances, the traditional models of patent, trademark, and design registration are the subject of analysis and reflection by the WIPO, academia, governments, international organizations, society, and the industry itself as Fronfía and Dush suggest [10].

These two challenges are relevant in countries such as Mexico and Costa Rica, which have innovation and educational systems trying to reduce knowledge gaps about advanced industrialized economies. The challenge is enormous, given the exponential technological development and the hegemony of digital platforms fueled by a system of investment and financialization that accelerates competition and the struggle to acquire higher revenues and global dominance [11]. In this scenario, the following questions arise, for example: How will Mexico and Costa Rica face the paradigmatic change that IP is experiencing around the challenges identified in this article, and at the same time, what are the strategies that respond to the deficit of human resources with the necessary training and skills to mitigate the growing gaps and inequalities that will affect their progress to better conditions of social and cultural welfare? In this situation, it is necessary to develop a framework that can, from a complexity perspective, answer the above questions and many others. Time is running out, and societies in developing countries such as Mexico and Costa Rica require, in the face of the prevailing inertia and confusion, short-term action and long-term vision that will allow them to take advantage of the opportunities that the current situation demands.

3.2 Structural changes

Developing knowledge through science and technology has directly impacted global innovation processes in social, cultural, commercial, governmental, and industrial areas. Changing how we live, work, and relate to others, communication has gone from analog to digital communication between humanity and machines. This paradigm shift is due to the different disruptive technologies, which implies a change of intellectual property concepts and rules and the rise of Generative Artificial Intelligence (GenAI) in its various modalities. Beyond the massive dissemination of practical applications and use cases of GenAI, significant advances in product design, operational processes, and enterprise business models are available now.

Intellectual property considers three fundamental principles: exclusivity, territoriality, and temporality, as established in the Berne Convention of 1886.

WIPO states that intellectual property (IP) "refers to creations of the mind, such as inventions, literary works, symbols, names and images used in commerce. It is a system of laws of each country and international treaties to which the same countries are attached to safeguard the rights of individuals and organizations (public or private, profit or non-profit) concerning their intangible assets to make them available to other individuals or organizations through products and services. Intellectual property protection is the legal mechanism through which the authors or creators of artistic works and technical-scientific knowledge protect their contribution and, if required, dispose of these intangible assets in the most convenient way".

In all its forms, IP protects new developments, which, in the Knowledge Society, is vital for individuals and organizations to protect their efforts and investments. As in all other fields, intellectual property impacts the use and applications of digital technology. It is necessary to have a new conceptual structure of intellectual property in areas such as augmented reality and virtual reality included in the Metaverse narrative and the Blockchain, where it is not clear whose rights are both copyright and industrial property given that physical territoriality is not complied with according to the Berne Convention and the Paris Convention. For this, the European Union Intellectual Property Office has been working on new proposals for this new digital rights type [12]. Currently, no existing copyright regime covers the products generated by the GenAI without doctrinal inconsistencies or imbalances between the works created by human beings and those generated by the same GenAI.

3.3 The Mexican and Costa Rican Societies

The German Government included Artificial intelligence in the Industry 4.0 proposal of 2011, but it took more than six years for the Mexican Government adoption; it was not until February 2018 when, through the Ministry of Economy [12], the Mexican Public Policy Model for I4.0 was endorsed, becoming widely known in general, leaving implicit the use and applications of AI in Mexican society (individuals and legal entities). Figure 1 describes the benefits, challenges, and risks impacting different contexts.

This Mexican proposal and its strategic vision include new business models, technology adoption, human capital, research, and the implementation of the I4.0 industry model [13]. Regarding research and innovation in the Public Research Centers, the academy-industry binomial, much work is needed to set up a curricular structure towards I4.0 and AI to include the fundamental challenges of upskilling and reskilling to mitigate the lack of talent.

In March 2018, the report, "Towards an Artificial Intelligence (AI) Strategy in Mexico: Harnessing the AI Revolution" was published with participation of Oxford Insights and C-Minds [14]. The document included ethics, regulation, data infrastructure, skills and education, research and development, governance and public services, and government public policy. Mexico was one of the first ten countries to have a strategic initiative to advance Artificial

Intelligence. Likewise, the National Development Plan 2019-2024 [15] mentions that the Federal Government will promote scientific and technological research and support students and academics with scholarships and other incentives to promote R&D activities in the field. CONACYT will coordinate the National Plan for Innovation to benefit society and national development with the participation of universities, people, scientists, and companies.

Currently, the National Alliance of Artificial Intelligence (ANIA) [16] has been created as a plural and multidisciplinary group of experts in Artificial Intelligence and other emerging areas of technology and law seeking to obtain benefits from academia, private initiative, national and international organizations, as well as government and non-governmental organizations. Among its activities and objectives is establishing, recognizing, and strengthening the artificial intelligence ecosystem in Mexico with a comprehensive, plural, inclusive, and multidisciplinary perspective.

From the academic and scientific point of view, the Mexican Society of Artificial Intelligence SMIA [17] promotes research and application of artificial intelligence in Mexico. It brings together professionals and academics in the area, offering an organizational and management framework to share and publish their research projects. It also brings together undergraduate and graduate students whose interests involve artificial intelligence. The Mexican International Congress on Artificial Intelligence (MICAI) is organized annually, among other relevant activities, to establish a strategic management of artificial intelligence in Mexico.

Costa Rica was the first country in Central America to work on an Artificial Intelligence strategy. By signing an agreement with the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Ministry of Science, Innovation, Technology, and Telecommunications [18] (MICITT) of Costa Rica, the country committed to work on an action plan for Costa Rica to develop an Artificial Intelligence (AI) strategy by the "Recommendation on Ethics in Artificial Intelligence" UNESCO [19], also supported by the Andean Development Cooperation (CAF). It is essential to highlight the intention that ethics should be present in AI-related activities. All this is because AI has enormous potential for the country's development, but at the same time, its implementation is an excellent challenge in ethical terms. From the legislative point of view, three strategies for AI policies in the country were established: a) in May 2023, a group of congressmen presented in the Legislative Assembly of the Republic of Costa Rica the Draft Bill for the Regulation of Artificial Intelligence in Costa Rica, file 23771 [20]. "This bill was structured using a Large Modeling Language, ChatGPT-4, by requesting it, under a written instruction, command or requirement known as a prompt:".

In agreement with the Legislative Assembly of the Republic of Costa Rica [21] for the enactment of the Law for the Regulation of Artificial Intelligence, another bill was structured to consider regulation issues. Other initiatives are:

- a) The Digital Transformation Strategy, which promotes the use, strengthening and implementation of technological solutions based on the application of AI in the public sector;
- b) Through the legislative assembly itself, the Bill for the Responsible Promotion of Artificial Intelligence in Costa Rica, file 23919, is presented, having as its object the promotion of the use, research, design, development, and application of AI in Costa Rica, by the principles of ethics, responsibility, human dignity, equality, equity and, transparency, to promote the development of capacities supported by these new technologies in the country to protect the rights of people in the face of technological innovation and contribute to the improvement of social, labor, economic, environmental, productive and human conditions in the country;
- c) Analysis of the draft law on the regulation of artificial intelligence in Costa Rica shows that AI has significant potential for technological progress and the transformation of multiple sectors. However, its progressive use poses challenges and risks that the administration must adequately address to safeguard individuals' fundamental rights and values. To protect and promote individuals' dignity, human rights, and welfare. The proposed bill in Costa Rica establishes a series of ethical principles and fundamental freedoms that should guide the regulation of artificial intelligence in the country. These principles include equity, accountability, transparency, privacy and data protection, and security. Ensuring equal treatment and opportunities for all individuals is essential to avoiding discrimination and unfair bias in AI systems. Likewise, the regulatory authorities must promote transparency in the operation of these systems to ensure the privacy of personal data and minimize risks to the security of individuals and society in general.

The Comptroller General of the Republic recommended that the regulation administration harmonize AI with the recent law enacted by the European Parliament, AI Law: different rules for different risk levels, transparency requirements and supporting innovation [22]. There are companies in Costa Rica that either already use AI as part of their processes or have even made developments for the use of AI in processes of various kinds. Even so, lack of capital and knowledge limit the progress to take better advantage of this powerful tool.

Both countries must consider the societal implications of GenAI appropriation and the challenges of entrepreneurship in the era of artificial intelligence, as seen in Figure 3. Privacy and data protection are crucial to generating trust in regulation, health, cybersecurity, education, and ethical and moral development.

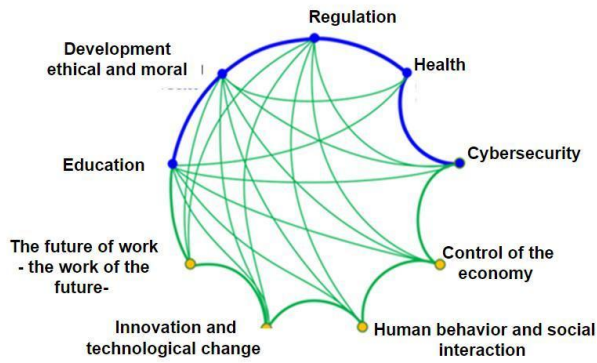


Fig. 3. Implications on the social appropriation of Artificial Intelligence and related branches. Source: [23].

4 Conclusions

The complexity of intellectual property, from machine learning, the use of algorithms, and large amounts of data capable of generating images, texts, or videos associated with GenAI, is leading to the examination of the root and foundation of human creativity, raising questions about who is the creator of the works, the human being or a set of machines. GenAI use, applications, and new developments open an extensive global discussion and debate about the relationship between human communication and machines. Mexico and Costa Rica face the challenge of fostering strategic management initiatives to impulse a culture of ethics and legality, which are essential for intellectual property and GenAI. Finally, both countries should consider other implicit and explicit aspects at the intersection of intellectual property and GenAI. Addressing these issues requires collaboration between technologists, lawyers, legislators, and ethicists to ensure that innovation flourishes while respecting and protecting the rights of all involved.

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