

Intellectual Property in the Digital Era: Legal and Ethical Issues

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Abstract

This paper explores the profound transformation of intellectual property (IP) law in response to emerging technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), blockchain, and the Metaverse. It highlights the challenges posed by automated creation, decentralized environments, and global digital networks, which disrupt traditional legal frameworks and raise complex questions of authorship, ownership, and enforcement. AI systems can autonomously generate creative works—music, code, literature—without human intervention, challenging the legal requirement of human authorship. Similarly, IoT devices collect and transmit data that may contain copyrighted content, often without clear legal attribution. The document emphasizes the need to revise national and European legislation to accommodate AI-generated works and content distributed via IoT. The Metaverse introduces new forms of trademarks and digital assets, such as avatars, motion marks, and virtual goods, requiring expanded legal definitions and cross-border enforcement mechanisms. Blockchain is presented as a transformative tool for IP management, offering secure timestamping, automated licensing via smart contracts, and enhanced transparency. However, limitations such as scalability, legal recognition, and conflicts with data protection laws (e.g., GDPR) are acknowledged. Patent law is also under pressure, as AI-generated inventions challenge the notion of mental conception and inventorship. Landmark cases such as *Thaler v. USPTO* and *DABUS* illustrate the global legal divide on whether AI can be recognized as an inventor. The paper calls for international harmonization and the development of *sui generis* legal frameworks. Trademark law faces similar disruptions, with AI and IoT altering consumer behavior and brand interaction. While AI enhances enforcement and market monitoring, it also raises risks of unintentional infringement and undermines the traditional concept of the “average consumer.” In conclusion, we advocate for coordinated international regulation, technological integration (e.g., blockchain for IP certification), and digital literacy. It stresses the strategic value of IP in the digital economy and the need to balance innovation with legal protection through continuous adaptation.

Keywords

Intellectual Property, Law, Legal protection, Patent law, Artificial Intelligence, the Internet of Things, Blockchain, the Metaverse.

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Introduction

Intellectual Property (IP) has now evolved into a strategic pillar of innovation, competitiveness, and corporate security, moving beyond its traditional role as a mere legal instrument. The digital era, marked by the rapid proliferation of Artificial Intelligence (AI), the Internet of Things (IoT), and the metaverse, necessitates a redefinition of legal frameworks and adaptation to new forms of creation and ownership. IP legislation must align with digital advancements so that protection mechanisms can develop in parallel with innovation. As emerging technologies reshape the landscape and introduce new complexities, IP becomes both more vulnerable to infringement and more valuable. It must therefore be capable of securing and conferring competitive advantage to enterprises that digitize their operations and content.

Globally, legislation strives to comprehend, assimilate, incorporate, and reflect these new technologies within the legal arsenal. However, numerous grey areas and ethical-philosophical as well as legal dilemmas remain unresolved. Should AI be recognized as a creator? How is privacy safeguarded when IoT devices record content? How can fair remuneration for human creators be ensured? Who bears responsibility for infringements arising from autonomous systems? How will the concept of authorship evolve when AI becomes a co-creator? Should a new category of rights be established for machine-generated works? And how can cultural identity be protected in an environment where creation is increasingly automated?

Copyright protects original works of authorship—such as literature, music, art, software, photography, and film—from unauthorized use, reproduction, or exploitation. The creator acquires the exclusive right to use, distribute, and commercially exploit their work. However, AI systems are now capable of generating music, images, text, and code. This raises a fundamental question: who is the author? The AI user? The developer? Or no one at all? AI systems can replicate or imitate existing works without clear attribution, potentially leading to copyright infringement and ethical concerns.

Similarly, IoT devices—such as smart cameras, speakers, and sensors—collect and transmit data that may contain creative content. Who holds the rights to this content? The user? The manufacturer? The service provider? The widespread use of AI for content creation may result in the displacement of human creators, loss of identity, and the commodification of art, raising profound ethical and cultural questions.

The Metaverse is an evolving, continuously operating digital ecosystem that integrates technologies such as Virtual Reality (VR), Augmented Reality (AR), blockchain, Artificial Intelligence (AI), and Web 3.0 to create interactive, three-dimensional environments. It enables users to immerse themselves through specialized technological devices in order to perform everyday activities such as work, entertainment, social networking, and transactions via digital identities (avatars). Within the Metaverse, users generate avatars, virtual objects, artworks, and software, all of which may be subject to copyright protection. In this metaversal digital environment, traditional legal concepts and protection mechanisms are being challenged,

raising critical legal issues such as data privacy, liability, and competition regulation.

Metaverse platforms (e.g., Roblox, Decentraland) adopt varying policies regarding ownership and content management. Responsibility for infringements may lie with both creators and platform administrators. Ultimately, the Metaverse questions the territorial applicability of IP laws, as users and platforms operate globally, offering continuous accessibility regardless of physical presence. It is not limited to commercial purposes but functions as a platform for global collaboration, the removal of physical barriers, and the enhancement of social media.

The impact of the Metaverse on consumer profiles and businesses, emotional intelligence, and marketing strategies constitutes a complex phenomenon that influences online behavior. The Metaverse is emerging as both a technological and human-centered ecosystem, offering opportunities but also posing risks such as alienation and the loss of connection with reality.

Artificial Intelligence (AI) profoundly impacts intellectual property (IP) law, generating legal, ethical, and technological challenges and disruptions. AI can autonomously produce music, paintings, poetry, software, and other creative works. Can a machine-generated work be protected by copyright? Current legislation requires human creativity for the recognition of rights—an assumption that AI fundamentally challenges. The concept of “originality” is called into question when AI generates works based on data that are already protected by copyright. Who is considered the author? The developer, the user, or the machine itself?

AI relies on large-scale data collection and analysis (text and data mining) for training and development, often incorporating copyrighted materials (texts, images, music, etc.). This raises legal concerns regarding the legitimacy of using such works without authorization, and whether exceptions for data mining (TDM) adequately cover these practices—particularly within the EU under Directive 2019/790 (DSM Directive). Most legal systems (EU, US) do not recognize AI as an author. However, if the user provides substantial creative input (e.g., through complex prompts or post-processing), they may be recognized as the author and the work may be eligible for protection.

Case law and legal theory increasingly examine whether the creation of complex prompts can constitute original creative contribution and be protected as intellectual property. AI challenges the traditional boundaries of IP—both in terms of training inputs and generated outputs. While legislation is evolving, significant gaps and uncertainties remain, especially regarding the protection of creators and the allocation of liability. International legal scholarship and jurisprudence are in constant flux, as traditional IP laws struggle to accommodate the unique characteristics of AI.

The Internet of Things (IoT) consists of an ecosystem of interconnected devices that autonomously collect, exchange, and process data. These data may contain copyrighted works (e.g., images, designs) or derive from protected technologies. This technological evolution gives rise to new forms of

creation, such as embedded software, automated functions, and smart products, which often involve both hardware and software components.

Traditional IP law faces difficulties in addressing the specifics of IoT, as such works are frequently the result of collective creation, automated processes, and the integration of multiple technologies. The software controlling IoT devices is subject to copyright and often protected by patents. The complexity of IoT systems makes it challenging to identify infringements and enforce rights. Moreover, IoT devices are vulnerable to cyberattacks, which may result in the theft of intellectual property. Given the vast amounts of data collected and transmitted by IoT devices, a critical question arises: who holds the rights to these data?

Patents in AI and IoT: Legal and Ethical Issues

There is a growing global trend in patent filings, with China appearing to lead the way. A brief overview of the recorded patent numbers submitted over the past two years highlights the strategic importance of securing emerging technologies for commercial exploitation and global competitiveness.

According to the official 2023 report by the World Intellectual Property Organization (WIPO), China filed over 38,000 GenAI patent applications between 2014 and 2023—six times more than the United States, which submitted approximately 6,276 applications. The Chinese filings cover applications such as autonomous driving, document management, telecommunications, life sciences, and security, with patents encompassing image, text, audio, and music data, as well as biological data (molecules, genes, proteins). In 2023 alone, over 25% of all GenAI patents worldwide were filed, marking rapid growth. The 2024 United Nations report confirms these findings.

Leading applicants include Tencent, Ping An, Baidu, Alibaba, ByteDance, and Microsoft. Similarly, the United States saw a significant increase in AI-related patents in 2024, as reported by the Stanford Human-Centered AI Institute, with a 56% rise reaching 51,487 filings. Patent grants increased by 32%. Google surpassed IBM in the number of applications, while Nvidia, Intel, and Microsoft remain at the top of the list.

What happens when new inventions are the result of joint creation between humans and technology, and who, in such cases, could be considered the inventor?

Under traditional patent law, only a human can be recognized as an inventor. However, this legal axiom is now being strongly challenged by the involvement of emerging technologies, creating “grey areas” and legal gaps within the field of intellectual property. The use of protected content for AI training has sparked legal disputes. Cases such as *Authors Guild vs. OpenAI* and *Getty Images vs. Stability AI* question the legality of using data without authorization. Courts are examining whether such use constitutes “fair use” or infringement, focusing on the commercial nature and extent of reproduction. Data licensing is being considered as a potential solution, offering legal certainty, quality assurance, and fair compensation to creators.

Nevertheless, legislation still requires human creativity for a work to be protected. In 2025, the Washington Court of Appeals reaffirmed that copyright protection cannot be granted solely to AI. The U.S. Copyright Office allows protection only when there is substantial human involvement in the selection, editing, or composition process. Courts remain cautious and skeptical about recognizing AI as an author, reinforcing the legal requirement of a natural person. In the U.S., the case *Thaler vs. USPTO* ruled that the term “inventor” under the Patent Act refers exclusively to human beings. Similarly, in the UK, the case *Thaler vs. Comptroller General* held that an invention must originate from human “mental conception,” something AI cannot fulfill. A surprising development came from the Federal Court of Australia in *Thaler vs. Commissioner of Patents*, which initially accepted the application, recognizing AI as the inventor on the grounds that the legislation did not explicitly prohibit it. However, this decision was overturned by the Full Federal Court, reinstating the requirement for human inventiveness.

A notable exception and subject of international debate is the DABUS case, in which an AI system submitted patent applications as the inventor. In 2025, Australia and South Africa temporarily accepted the application, while the European Patent Office (EPO) and the U.S. Patent and Trademark Office (USPTO) rejected it, citing the lack of legal personality of AI. The central question remains: who is the true inventor when creation originates from a machine?

Legal and Ethical Arguments Supporting the Recognition of Artificial Intelligence (AI) as an Inventor:

- Recognizing a human as the inventor in cases where AI is the actual creator is legally inaccurate and misleading. It leads to artificial declarations of human inventorship by individuals who have not made substantial contributions, undermining the integrity of the system, transparency, and accountability in technological development, while obstructing the traceability of machine-generated innovation.
- The refusal to recognize AI as an inventor compromises the integrity of the patent system, especially in jurisdictions (e.g., Australia) where legislation does not explicitly require the inventor to be a natural person. This opens the door to a technologically neutral interpretation, allowing for legal adaptation. Consequently, there is a growing call for international harmonization of legal frameworks through legislative reform.
- AI autonomously generates inventions and should be acknowledged as the inventor, while the programmer or algorithm developer—who has made a substantial contribution to the creation of the AI—could be considered the rights holder, particularly when the AI operates without further human intervention. Recognizing rights in AI could lead to the establishment of a new legal framework (*sui generis* protection), whereby rights would belong to the AI or be managed by its owner/developer as a legal custodian.
- Promoting innovation and the development of advanced systems is facilitated by granting rights to AI, ensuring that all inventions can be protected and not left unexploited. This recognition would incentivize technological progress

and ensure that machine-generated inventions are not excluded from the scope of intellectual property protection.

In contrast to the aforementioned arguments, legal principles governing the concept of inventiveness emphasize the notion of mental conception, which is considered fundamental for recognizing a person as an inventor. The prevailing legal framework remains anthropocentric and is not yet prepared to incorporate AI as an autonomous creator. Key points include:

- Mental conception requires intention, consciousness, creative contribution, and subjective judgment—qualities that AI does not possess. Although artificial intelligence can generate technical solutions, it does not meet the criteria of personal creativity. Creativity in intellectual property is linked to the creator's intent, choice, and judgment. AI operates based on algorithms and statistical analysis, without consciousness or creative will.
- Inventiveness may be attributed to the programmer or operator of the AI system, provided they have made a substantial contribution to the creation or implementation of the invention.
- International intellectual property law requires that creation be the result of human creativity, and courts have repeatedly ruled that only humans can be considered authors, as the concept of "author" presupposes human creative input.
- AI is regarded as a tool, not a creator.
- AI lacks legal personality; it cannot bear responsibility, enter into contracts, or manage rights. Intellectual property is based on rights and obligations that only natural or legal persons can assume.
- Works generated exclusively by AI are considered part of the public domain.
- Recognizing AI as a creator would create market imbalance, as AI can produce works at scale, undermining the value of human creativity and the protection of human creators.

The 2025 annual report of the Stanford Human-Centered Artificial Intelligence Institute (HAI) is one of the most reliable indicators of global progress in artificial intelligence. It includes data from over 50 countries and collaborates with international organizations, academic institutions, and governments. It serves as a foundation for policymaking on issues such as inventiveness, AI ethics, and IP regulation. The report confirms that legislation in most countries continues to require human inventiveness for patent protection. AI is considered a tool, not a creator—even when it contributes significantly to the development of new technical solutions. The report highlights the need for international coordination and potential revision of the definitions of "author" and "inventor" in the age of machine-generated creation.

Similarly, legal and ethical issues arise concerning Patents and the Internet of Things (IoT), which in many respects mirror those discussed above, as IoT constitutes a network of devices operating based on programmed algorithms and sensors, without consciousness, intent, or creative will. Additionally, the following points can be summarized:

- IoT systems consist of multiple devices that may be owned or operated by different entities, making it difficult to prove patent infringement.
- Many IoT products rely on software, which often falls into a "grey area" regarding patentability. Moreover, IoT interoperability requires the use of technical standards protected by patents, creating complex licensing and competition issues.
- IoT systems combine hardware, software, and services, complicating the delineation of the invention and the appropriate formulation of patent claims.
- The need for interoperability leads to the use of standard essential patents (SEPs), which raise intricate licensing and antitrust concerns.
- The collection and use of data by IoT devices raise questions about data ownership and protection, whether as trade secrets or intellectual property.
- The mass collection and transmission of data by IoT devices pose serious ethical concerns regarding privacy, security, and the protection of personal information.
- Users are often unaware of what data is being collected and how it is used, undermining autonomy and informed consent.
- Liability for security breaches or misuse of data is frequently unclear, especially in distributed systems.
- International legislative initiatives on artificial intelligence (AI) are rapidly expanding, as governments and global organizations seek to regulate its development and use in a manner that is safe, ethical, and compatible with human rights. The following are among the most significant global efforts:

The European Union leads with the AI Act, adopted in June 2024, which establishes a risk-based framework for AI systems, promoting transparency and the protection of fundamental rights. Simultaneously, the Council of Europe adopted the Framework Convention on AI, the first legally binding international agreement aimed at safeguarding human rights in the age of artificial intelligence. In the United States, the 2023 Executive Order on AI sets national priorities for safety, innovation, and data protection. Japan and UNESCO have also issued ethical guidelines and recommendations, reinforcing the global effort toward responsible AI development. The World Intellectual Property Organization (WIPO) has published guidance addressing the challenges AI poses to intellectual property law. The United Kingdom promotes a "pro-innovation" approach, focusing on sector-specific governance rather than a unified legislative framework, regulating AI in a way that encourages innovation rather than restricting it. Other countries—such as China, Japan, and Canada—focus on national standards, security, transparency, and data protection, with varying degrees of regulatory strictness. These initiatives underscore the urgent need for global cooperation and legal adaptation in a rapidly evolving technological landscape.

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Blockchain and Patent Rights

Blockchain is a distributed and immutable database that enables secure transaction recording without the need for a central authority. Initially introduced in 2008 as the foundational technology for Bitcoin and decentralized digital currencies, blockchain has since expanded into numerous sectors, including finance, supply chain management, healthcare, identity verification, intellectual property, and digital contracts (smart contracts).

In the realm of intellectual property, blockchain is not merely a technological innovation but a transformative tool that enhances protection and transparency while reducing cost and complexity. It is used for:

Proof of creation and ownership, as it allows for secure and immutable timestamping of a work's creation.

Automated rights management (DRM) through smart contracts, which automate licensing and payments. Smart contracts on the blockchain enable automatic licensing of intellectual works without human intervention. These contracts are programmed code that executes automatically when predefined conditions are met. For example, a music creator can set terms so that each time their work is used, a fee is auto-

matically charged and royalties are paid. This reduces delays, administrative costs, and legal uncertainties often associated with traditional licensing processes. Blockchain facilitates direct interaction and transactions between creators and users, eliminating intermediaries such as publishers, collecting societies, or legal representatives. Creators can define usage terms and embed them into the blockchain. Users gain transparent access to works, knowing exactly what is permitted and what is not. This model strengthens creator autonomy and promotes immediacy in cultural exchange.

Transparency and traceability, as all actions are recorded publicly or privately, offering a complete history. Blockchain provides a decentralized system for recording and managing intellectual property rights, particularly useful for digital works such as images and graphics, music tracks, videos and films, software, and code. Its decentralized nature ensures that no single entity controls the information. All entries are immutable and transparent, fostering trust between creators and users.

Prevention of forgery, guaranteed by the immutability of blockchain, making it difficult to alter or falsely claim ownership. Blockchain technology enables the creation of global intellectual property databases that record the creation of a work, the identity of the creator, and the terms of use and licensing. Through tokenization, IP rights can be converted into digital assets (tokens), which can be bought, sold, or transferred. These tokens accurately represent the right to use, reproduce, or commercially exploit a work. They support the monetization of creativity in new ways (e.g., NFTs for artworks).

Despite its transformative potential, blockchain technology in the field of intellectual property (IP) presents several limitations and challenges, which can be summarized as follows:

- Limited scalability and performance, particularly in public networks such as Ethereum, which suffer from low processing speeds and high energy consumption. This hinders its application in IP systems that require rapid and large-scale registration.
- Unreliable input data ("Garbage-in, garbage-out"), as blockchain does not guarantee the accuracy of the information entered. If false or incomplete data about a work is recorded, it remains permanently in the system without the possibility of correction.
- Lack of a unified legal framework for the recognition of blockchain-based IP registrations at the international level. Smart contracts are not legally binding in all jurisdictions, creating uncertainty regarding their enforceability.
- Conflict with data protection laws, such as the GDPR, due to blockchain's immutability. Requirements like the "right to be forgotten" and the ability to rectify personal data pose legal obstacles to its implementation within European regulatory frameworks.
- Technical complexity and high implementation costs, as the development and maintenance of blockchain systems require specialized knowledge, significant resources, and financial investment. Small creators or organizations may struggle to adopt such solutions.

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Trademarks, AI, and IoT

Trademarks are a fundamental tool for identifying and differentiating products and services in the marketplace. With the emergence of Artificial Intelligence (AI) and the Internet of Things (IoT), their protection and management acquire new dimensions—both technological and legal.

The Metaverse, as a multidimensional digital environment combining virtual reality (VR), augmented reality (AR), blockchain, and AI, radically transforms the nature of trademarks. Marks are no longer limited to physical products or services but acquire digital form and interactive functionality. AI and IoT have led to the emergence of new types of marks, such as sound marks, motion marks, avatars, digital wearables, and marks within virtual environments. Trademark use now extends to virtual goods and services. Companies like Nike, Gucci, and McDonald's have filed applications for virtual products on platforms such as Roblox and Fortnite. The legal challenge lies in defining "use" within virtual environments and protecting brand identity in decentralized systems.

Multisensory marks—such as sounds (e.g., Netflix's "tadum"), colors, movements, and holograms—are gaining legal recognition. However, the functionality doctrine limits protection for shapes that serve practical purposes. Jurisdiction within the Metaverse remains an open issue. Trademark infringement through avatars, NFTs, and virtual storefronts is increasing, causing consumer confusion. It is recommended that trademark registrations be expanded to include new classes for virtual goods and digital experiences.

The integration of AI and IoT into trademark management offers significant advantages but is accompanied by legal and technical challenges. Legal and ethical questions arise in an environment where creativity is increasingly automated. Who is responsible and who holds the legal rights when trademark creation originates from AI algorithms? Current laws do not recognize AI as a rights-bearing entity, creating gaps in registration and protection.

The use of AI and IoT in trademarks is not covered by a unified international legal framework, complicating cross-border enforcement and creating inconsistencies between national laws. The use of AI for monitoring or creating marks requires clarity regarding who controls the data and decision-making processes. Lack of accountability may lead to opaque branding practices and strategies of imitation or deception, raising

ethical concerns for the market.

Product counterfeiting via IoT or the use of misleading marks by AI can damage consumer trust and undermine authenticity. The registration and protection of such marks require new legal tools and adjustments to distinctiveness and graphical representation criteria. Finally, a critical ethical question concerns the substitution of human creativity, raising issues about the value of human creative expression and the ethics of its replacement.

Focusing on the advantages of using AI and IoT, we may note the following:

- AI can detect trademark infringements in real time by analyzing data from e-commerce platforms, social networks, and search engines. It is already used by major corporations and trademark offices for automated infringement detection, similarity searches, and market monitoring. In particular, deep learning systems improve accuracy in recognizing marks in images and videos.
- Machine learning systems enable faster and more accurate searches for conflicting marks, reducing the time and cost of registration and optimizing registration procedures.
- IoT sensors can be embedded in products to verify authenticity, protecting the trademark from counterfeiting.
- AI can predict the commercial value of a trademark through analysis of consumer behavior and market trends.

As for the disadvantages, the following are noted:

- Legal ambiguity in AI-generated marks, as the creation of trademarks by AI raises questions regarding ownership and liability, due to the lack of clear legal recognition of non-human creators.
- The transformation of the role of the average consumer, since AI alters the decision-making process in purchasing, as consumers rely on AI assistants, chatbots, and algorithms to select products. This challenges the traditional concept of the "average consumer" and the doctrinal foundations of trademark law, such as the "likelihood of confusion."
- The enhancement of management and enforcement, as AI is used for automated similarity searches, infringement detection, and market surveillance, improving the efficiency of trademark professionals and authorities.
- The risk of infringement due to similarity, which may lead to unintended violations of existing trademarks, due to morphological or phonetic resemblance. AI can generate logos, slogans, and brand names with speed and precision, but this increases the risk of accidental or intentional infringement of existing trademarks, as AI systems may produce content that resembles or is inspired by already registered marks without human intent.
- The absence of harmonized international rules for AI and IoT complicates trademark protection at the global level.
- Specifically regarding IoT, devices (e.g., smart refrigerators, voice assistants) can make purchases or select products automatically, without human intervention. This shifts the focus of trademark protection from the human consumer to the device-consumer, challenging fundamental princi-

ples of trademark law. With IoT and automation, the significance of the mark may diminish, as devices select products based on algorithms rather than brand recognition. The need for interoperability among IoT devices creates new requirements for trademark protection, while the security and authenticity of marks in a distributed environment are critical. IoT networks are vulnerable to cyberattacks, which may lead to product counterfeiting and trademark infringement. Finally, the global nature of IoT and the internet creates challenges for the territoriality of trademarks and the application of law across multiple jurisdictions.

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Conclusion

The digital era has radically transformed the way creative works are produced, disseminated, and exploited. The traditional concept of intellectual property struggles to meet the demands of the online environment. The ease of copying and sharing content on the internet has led to a surge in infringements, while enforcement mechanisms are often insufficient or slow. The global nature of the internet calls for coordinated international regulations to ensure effective rights protection.

Artificial Intelligence (AI) generates works without human intervention, raising questions about ownership and legal protection. IoT devices collect and manage content that may fall under intellectual property rights, often without clear legal coverage. A revision of national and European laws is required to address works created by AI, introduce specific provisions for content distributed via IoT, and develop digital tools for monitoring and detecting infringements.

Collaboration with platforms (e.g., YouTube, Meta) is essential for the prompt removal of infringing content, alongside the promotion of international agreements for IP protection online. Strengthening the role of organizations such as WIPO and EUIPO, and educating creators, users, and businesses about their rights and responsibilities, is equally important. Integrating intellectual property into digital literacy, leveraging technology for protection—such as using blockchain for timestamping and certification of works, and developing AI tools for plagiarism and infringement detection—will be key.

Intellectual property is a strategic asset that goes beyond legal protection. Inventions generated by AI raise new ethical and legal questions. Balancing innovation with protection is essential, and continuous adaptation is the key to future success in the field of intellectual property.