CHAPTER 2
LEGAL RELATIONS: FROM THEORY TO PRACTICE

STRENGTHENING INTELLECTUAL PROPERTY PROTECTION IN THE EU: IT LAW AND ITS IMPACT ON THE COMPUTER GAMES INDUSTRY

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Abstract. *The exponential growth of digital entertainment and rapid technological advancements have elevated intellectual property (IP) protection as a cornerstone of innovation and economic development within the European Union (EU). The computer games industry exemplifies this dynamic, blending creativity, technology, and commerce. However, challenges such as piracy, copyright infringement, and cross-border enforcement necessitate robust IP frameworks to sustain growth and innovation. This study aims to analyze the role of IP protection in the EU, particularly within IT law, and its implications for the computer games industry. The objectives include evaluating current legal frameworks, identifying key challenges such as piracy and enforcement, exploring the role of emerging technologies like blockchain and AI, and proposing actionable strategies to strengthen IP protection and foster innovation. The study employs a comprehensive review of academic articles, legal texts, industry reports, and historical cases of IP disputes. A legal analysis of EU directives, regulations, and case law was conducted to assess their application in the gaming industry. This methodology provides a holistic understanding of the intersection between IP protection, IT law, and the computer games sector. Findings highlight the harmonization of national IP laws across EU member states through directives like the Copyright Directive (2001/29/EC), Digital Single Market Directive (2019/790), and GDPR. Challenges include inconsistencies in enforcement, piracy, and the complexities of emerging technologies such as AI and blockchain. The study identifies significant economic impacts, including vulnerabilities faced by small and medium-sized enterprises (SMEs) and the need for harmonized enforcement mechanisms. Future research should explore the ethical implications of IP enforcement, the scalability of blockchain for copyright management, and the integration of AI in real-time infringement detection. Expanding the focus to global collaborative mechanisms and cross-industry applications of emerging technologies will enhance understanding and policy development.*

Keywords: *intellectual property; European Union; IT law; computer games industry; copyright protection; trademark regulation; digital single market; piracy enforcement; blockchain technology; artificial intelligence; technological protection measures; cross-border enforcement; video game piracy; emerging technologies; harmonized IP laws; small and medium-sized enterprises; innovation; creativity.*

JEL Classification: F11, K12, K33, M15

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Introduction. In an era defined by rapid technological advancements and the exponential growth of digital entertainment, intellectual property (IP) protection has become a cornerstone of innovation and economic development. Within the European Union (EU), the computer games industry stands out as a dynamic and highly competitive sector, blending creativity, technology, and commerce. However, the rise of this industry has also brought challenges related to intellectual property rights, piracy, and the evolving legal frameworks that govern digital content.

Literature review. The European Union (EU) has established itself as a global leader in intellectual property (IP) regulation, particularly in the digital domain, where technology-driven industries like computer games have flourished. The intersection of intellectual property (IP) law and the computer games industry represents a complex and evolving domain, especially within the European Union (EU). This review synthesizes key findings and debates from recent scholarship, focusing on legislative frameworks, technological protection measures, market impacts, and challenges posed by digital and cross-border innovations.

Evolution of intellectual property laws in the EU. The foundation of the EU's IP framework lies in the harmonization of disparate national laws among its member states. McManis (1996) identifies the adoption of the European Patent Convention (1973) as a crucial starting point for regional collaboration in IP protection. The directive aimed to streamline patent applications and ensure consistent protections across member states.

The 1990s witnessed significant efforts to align copyright laws, particularly with the introduction of the Software Directive (1991), which granted uniform protections to software authors across the EU (Hargreaves, 2011). Similarly, the Trade Mark Directive (1988) and the establishment of the European Union Intellectual Property Office (EUIPO) provided mechanisms to simplify and centralize trademark registration.

The advent of the digital age necessitated a robust IP framework to address challenges such as piracy, copyright infringement, and digital rights management. Gibson (2007) underscores the significance of the Information Society Directive (2001), which extended copyright protections to digital works and introduced rights management systems.

The Digital Single Market Strategy (2015) marked a turning point in the EU's approach to IP law. Handke (2018) emphasizes that the strategy aimed to harmonize digital copyright laws and enhance cross-border access to online content. The Copyright Directive (2019) further strengthened protections for creators, including provisions to hold online platforms accountable for infringing content (Dimita, 2023).

Significant advancements in EU IP law have aimed to modernize protections, particularly addressing the complexities of digital environments. Dimita (2023) highlights the EU's proactive stance in updating IP frameworks to protect digital media, including video games, against piracy and infringement.

Technological protection measures and the video game industry. The application of technological protection measures (TPMs) in the gaming industry has been pivotal. Raval (2016) provides a detailed analysis of how TPMs, such as encryption and anti-

piracy software, enforce copyright protections, although critics argue these measures may stifle innovation. Hubanov et al. (2021) argue that TPMs must balance protecting IP with enabling fair use, as overly restrictive measures could lead to consumer dissatisfaction.

TPMs are digital mechanisms designed to safeguard copyrighted materials by restricting unauthorized use and duplication. Raval (2016) provides a comprehensive analysis of TPMs, such as digital rights management (DRM), encryption, and hardware locks, emphasizing their role in mitigating piracy and protecting intellectual property. Boni (2021) notes that TPMs serve as a gatekeeper for controlling access to proprietary content, particularly for online games and subscription services.

TPMs have evolved significantly alongside advancements in technology. Early methods included simple access keys or physical hardware requirements, which have now advanced to more sophisticated solutions like cloud-based DRM systems and blockchain technologies. Deng and Chen (2023) highlight the shift towards adaptive TPMs that can dynamically respond to new threats, such as hacking or reverse engineering.

The legal landscape supporting TPMs varies across jurisdictions. In the European Union (EU), TPMs are reinforced by the Directive 2001/29/EC, which requires member states to ensure the legal protection of technological measures against circumvention. Hargreaves (2011) points out that while this directive strengthens protections, it also raises concerns about fair use rights and interoperability with other software.

Challenges of cross-border enforcement. Cross-border enforcement remains a significant challenge, particularly with online piracy and counterfeit digital goods. Kovacic and Reindl (2004) note that the lack of harmonized international standards complicates enforcement efforts.

A major challenge in cross-border IP enforcement is the divergence in legal systems among countries. McManis (1996) identifies the lack of harmonization in national IP laws as a primary barrier to effective enforcement. Differences in judicial processes and evidentiary standards complicate the prosecution of IP infringement cases across borders.

Similarly, Jain (1996) highlights that enforcement efforts are often hindered by jurisdictional limitations, where IP holders face difficulties in pursuing cases in foreign courts. This is particularly problematic in regions where IP protections are underdeveloped or inconsistently applied.

The rise of digital technologies has further complicated cross-border IP enforcement. Raval (2016) explores how the internet enables the proliferation of pirated content across jurisdictions, making it difficult to identify and prosecute infringers. Online marketplaces and peer-to-peer networks often operate across multiple countries, exploiting legal loopholes and differences in enforcement standards.

Deng and Chen (2023) argue that existing international frameworks, such as the TRIPS Agreement, are insufficient to address the unique challenges posed by digital

piracy. They call for greater international cooperation and the development of technology-specific enforcement mechanisms.

While international agreements like the TRIPS Agreement aim to provide a unified framework for IP enforcement, their effectiveness is often questioned. Gervais (2017) critiques TRIPS for its lack of enforceable mechanisms, particularly in developing countries where legal and infrastructural capacities are limited. Deere (2008) echoes this concern, highlighting that the implementation of TRIPS standards varies widely, resulting in uneven enforcement outcomes.

Shadlen et al. (2005) note that bilateral and multilateral trade agreements often include IP enforcement provisions, but these are typically biased in favor of developed nations, creating an imbalance in global IP governance.

The role of emerging technologies. Emerging technologies, such as blockchain and AI, are transforming IP protections in the gaming industry. Gibson (2007) highlights how blockchain can secure digital ownership and facilitate transparent licensing agreements. Lisenco (2021) adds that AI-driven tools can help monitor and combat piracy more effectively.

AI has emerged as a powerful tool in the management and enforcement of IP rights. Gervais (2017) highlights the growing use of AI algorithms to monitor and detect copyright infringement in digital environments. Automated systems can scan vast amounts of online content for unauthorized use of protected materials, significantly reducing the time and cost of enforcement.

However, the integration of AI also raises questions about ownership and authorship. Deng and Chen (2023) discuss the complexities of attributing IP rights to AI-generated works. Current legal frameworks often fail to address whether creators of AI systems or users who direct these systems should hold the rights, leading to legal uncertainty.

Blockchain technology has garnered significant attention for its potential to revolutionize IP protection by providing immutable records of ownership and transactions. Handke (2018) underscores how blockchain can streamline the IP registration process, offering a decentralized and tamper-proof method for proving authorship and priority dates. Raval (2016) highlights the role of blockchain in creating smart contracts that automate licensing agreements and royalty payments. This reduces the risk of disputes and ensures that creators receive fair compensation for the use of their works. However, the adoption of blockchain faces challenges, including interoperability and scalability issues.

Big data analytics is transforming IP enforcement by enabling more effective identification of infringement patterns. Boni (2021) explores how big data tools analyze vast datasets to detect counterfeit goods in global supply chains. By identifying trends and suspicious activities, these tools help authorities prioritize enforcement actions and allocate resources more efficiently.

Dimita (2023) emphasizes that big data analytics also enhances market intelligence for rights holders, allowing them to understand how their IP is being used and to identify unauthorized uses. However, concerns about privacy and data security must be addressed to ensure ethical implementation.

The proliferation of IoT devices has introduced new dimensions to IP law. Deere (2008) notes that interconnected devices often incorporate software, hardware, and design elements, creating complex layers of IP protection. Disputes frequently arise over ownership and licensing of these components, particularly in cross-border contexts.

Kovacic and Reindl (2004) argue that the IoT ecosystem demands a more flexible approach to IP enforcement. Traditional legal frameworks may struggle to address the interconnected nature of these devices, requiring international collaboration and harmonized standards.

Emerging technologies are also playing a role in improving IP education and awareness. Boni (2021) highlights the use of virtual reality (VR) and gamification to educate creators about their rights and responsibilities. These tools make complex legal concepts more accessible, particularly for small and medium-sized enterprises (SMEs) and independent creators.

The integration of emerging technologies into IP law is not without ethical concerns. Handke (2018) warns against over-reliance on automated systems, which may inadvertently penalize legitimate uses or fail to account for fair use exceptions. Similarly, Deere (2008) raises concerns about the environmental impact of technologies such as blockchain, which consume significant energy resources.

Raval (2016) advocates for the development of ethical guidelines to govern the use of emerging technologies in IP enforcement. These guidelines should prioritize transparency, accountability, and inclusivity to ensure equitable outcomes.

The strengthening of IP laws in the EU has had a profound impact on the computer games industry. While these measures enhance protections and promote innovation, challenges persist, including cross-border enforcement, ethical considerations, and the need to balance corporate interests with consumer rights. Ongoing developments in technology and policy will likely continue to shape this dynamic field.

Aim. The aim of this article is to analyze the role of intellectual property (IP) protection within the European Union (EU) in the context of IT law, focusing specifically on its implications for the computer games industry. The study seeks to identify challenges, evaluate current legal frameworks, and propose actionable strategies to enhance IP protection in this rapidly evolving sector.

The main objectives of research are:

- to examine the current state of intellectual property protection in the EU with a focus on IT law and its relevance for the video games industry;
- to identify key challenges faced by stakeholders in protecting intellectual property, including issues such as piracy, copyright infringement and cross-border enforcement;
- to analyse the effectiveness of existing EU legal frameworks, such as the Digital Single Market Directive, and their application to the video games industry;
- to identify the role of new technologies, such as blockchain and artificial intelligence, in strengthening IP protection in this sector;
- to propose recommendations for improving legal mechanisms and policy frameworks to strengthen the protection of intellectual property rights and foster innovation in the video games industry.

Methodology. To achieve the objectives, the study conducted a comprehensive review of academic articles, legal texts and industry reports on EU intellectual property law, IT law and the computer games industry, as well as an analysis of historical cases of intellectual property disputes in the sector to identify trends and recurring issues. A legal analysis of EU directives, regulations and case law on intellectual property protection and their application to computer games was conducted. By employing this methodology, the article aims to provide a comprehensive understanding of the intersection of intellectual property protection, IT law, and the computer games industry within the EU, offering actionable insights for stakeholders.

Results. The foundation of the EU's IP framework lies in the harmonization of disparate national laws among its member states. McManis (1996) identifies the adoption of the European Patent Convention (1973) as a crucial starting point for regional collaboration in IP protection. The directive aimed to streamline patent applications and ensure consistent protections across member states.

The 1990s witnessed significant efforts to align copyright laws, particularly with the introduction of the Software Directive (1991), which granted uniform protections to software authors across the EU (Hargreaves, 2011). Similarly, the Trade Mark Directive (1988) and the establishment of the European Union Intellectual Property Office (EUIPO) provided mechanisms to simplify and centralize trademark registration.

The advent of the digital age necessitated a robust IP framework to address challenges such as piracy, copyright infringement, and digital rights management. Gibson (2007) underscores the significance of the Information Society Directive (2001), which extended copyright protections to digital works and introduced rights management systems.

The Digital Single Market Strategy (2015) marked a turning point in the EU's approach to IP law. Handke (2018) emphasizes that the strategy aimed to harmonize digital copyright laws and enhance cross-border access to online content. The Copyright Directive (2019) further strengthened protections for creators, including provisions to hold online platforms accountable for infringing content (Dimita, 2023).

Significant advancements in EU IP law have aimed to modernize protections, particularly addressing the complexities of digital environments. Dimita (2023) highlights the EU's proactive stance in updating IP frameworks to protect digital media, including video games, against piracy and infringement.

The EU's intellectual property protection framework is grounded in directives and regulations that aim to harmonize laws across member states. Key legislation includes:

- Copyright Directive (2001/29/EC);
- Digital Single Market (DSM) Directive (2019/790);
- Trademark Regulation (EU) 2017/1001;
- Trade Secrets Directive (2016/943);
- General Data Protection Regulation (GDPR).

Copyright Directive (2001/29/EC). This directive serves as a cornerstone for digital copyright law within the EU, offering a harmonized approach to the protection of intellectual property in the online environment. It ensures that creators and rights

holders are fairly compensated for the use of their works in digital formats, encompassing music, films, software, and video games. Its implementation has been instrumental in combating unauthorized reproduction and distribution of copyrighted material. Specifically, for the computer games industry, it provides legal grounds to address piracy and protect creative assets while navigating challenges such as peer-to-peer sharing and content streaming platforms. Lays the foundation for protecting creators' rights in the digital environment, ensuring remuneration for copyrighted works. It has been pivotal in addressing online piracy, a persistent challenge for the computer games industry.

Digital Single Market (DSM) Directive (2019/790). This directive represents a significant step in modernizing copyright laws within the EU to address the complexities of the digital economy. It includes critical provisions such as those on text and data mining, aimed at fostering research and innovation by allowing exceptions for these activities under specific conditions. Article 17 is particularly impactful, as it imposes accountability on online platforms for user-uploaded content, requiring them to obtain licenses or implement measures to prevent unauthorized distribution of copyrighted works. This directive has sparked significant debate among stakeholders, with proponents arguing it strengthens creators' rights and opponents raising concerns about potential overreach and impacts on user-generated content platforms. Its application to the computer games industry is vital, as it provides a framework for combating piracy, unauthorized sharing of game assets, and protecting developers' intellectual property in an increasingly interconnected digital ecosystem. Designed to modernize copyright rules, it includes provisions on text and data mining, platform liability, and fair remuneration for creators. Article 17, which addresses platform responsibility for user-uploaded content, is particularly relevant to combatting piracy and unauthorized game distribution.

Trademark Regulation (EU) 2017/1001. This regulation establishes a comprehensive and unified system for trademark protection within the EU, facilitating the registration and enforcement of trademarks across all member states. It streamlines the process for developers and publishers in the computer games industry to safeguard their brands, logos, and distinctive identifiers. This protection is crucial in an industry where brand identity often represents significant value, ensuring that game titles, character names, and associated marks are protected from unauthorized use. By simplifying cross-border trademark enforcement, this regulation provides a vital tool for maintaining brand integrity in an increasingly competitive and globalized market. Provides a unified system for trademark registration, allowing game developers to protect their brands and unique identifiers across the EU.

Trade Secrets Directive (2016/943). This directive provides a harmonized legal framework across the EU for the protection of confidential business information. It is particularly crucial for industries like computer games, where proprietary technologies, such as game engines, algorithms, and development strategies, form the backbone of competitive advantage. The directive defines trade secrets broadly, encompassing any business information that derives value from not being widely known and that has been subject to reasonable steps to keep it confidential. For the computer games industry,

this includes source codes, design documents, and other sensitive data. It also introduces legal remedies for misappropriation, ensuring that companies can seek redress for theft or unauthorized use of their trade secrets, thereby fostering innovation and trust within the digital economy. Protects confidential business information, which is critical for safeguarding proprietary game engines, algorithms, and development strategies.

General Data Protection Regulation (GDPR). The GDPR, implemented in 2018, is a landmark regulation that establishes a unified data protection framework across the EU. Although not specific to intellectual property, it significantly affects the IT and gaming sectors by dictating how personal data is collected, stored, and used. For the computer games industry, this includes managing user data collected through online interactions, in-game transactions, and user profiles. GDPR compliance is essential to avoid substantial penalties and to ensure user trust in a market increasingly focused on personalized gaming experiences. The regulation's impact extends to data portability, user consent, and the implementation of privacy-by-design principles, all of which influence game development and operational practices within the EU. Although not specific to IP, GDPR significantly impacts the IT and gaming sectors by regulating how personal data is collected and utilized in online gaming environments.

Table 1 presents a comparison of key directives and regulations.

Table 1. Results of the comparison of the analysis of key directives and regulations

Legislation	Purpose	Key Provisions	Impact on Computer Games Industry
Copyright Directive (2001/29/EC)	Protects creators' rights in digital content	Ensures fair compensation, combats piracy, and safeguards creative assets	Provides legal grounds to address piracy and protect intellectual property in games
Digital Single Market (DSM) Directive (2019/790)	Modernizes copyright rules for the digital economy	Text/data mining exceptions, platform liability (Article 17), and fair creator remuneration	Framework for combating piracy, unauthorized game sharing, and platform accountability
Trademark Regulation (EU) 2017/1001)	Establishes a unified trademark system across the EU	Simplifies trademark registration and enforcement across member states	Protects game brands, logos, and unique identifiers to maintain brand integrity in global markets
Trade Secrets Directive (2016/943)	Protects confidential business information	Broad definition of trade secrets, remedies for misappropriation	Safeguards proprietary game engines, algorithms, and development strategies
General Data Protection Regulation (GDPR)	Regulates personal data collection and usage	Data portability, user consent, privacy-by-design principles	Ensures responsible handling of user data in online games and builds trust in personalized gaming experiences

Source: systematized by the author

Reports from industry bodies, such as the European Games Developer Federation (EGDF) and the International Intellectual Property Alliance (IIPA), provide valuable insights into the practical implications of EU IP law:

– *Economic impact of IP infringement.* The EGDF (2022) reports that the computer games industry loses billions annually due to piracy and unauthorized distribution. This infringement undermines the financial stability of developers, leading to reduced revenue streams and a diminished capacity for reinvestment in innovation. Small and medium-sized enterprises (SMEs), which dominate the EU gaming market, are particularly vulnerable due to their limited resources for legal action and enforcement. Piracy not only devalues creative efforts but also impacts consumer trust and market growth by fostering illegitimate platforms and counterfeit products. Addressing these challenges is critical for sustaining the industry's growth and protecting its intellectual assets.

– *Effectiveness of current frameworks.* The IIPA (2021) highlights that while EU directives provide a strong legal basis, gaps in enforcement—especially on digital platforms—undermine their effectiveness. These gaps arise due to the fragmented nature of national enforcement mechanisms within member states, inconsistent application of penalties, and the difficulty of monitoring and regulating online activity across borders. Furthermore, the rapid evolution of technology and the sophistication of infringers—including the use of VPNs and decentralized file-sharing systems—pose additional challenges. Addressing these issues requires coordinated efforts among member states, enhanced technological tools for monitoring, and updated legislation to keep pace with emerging threats.

– *Need for harmonized approaches.* Industry reports frequently call for greater harmonization of IP enforcement across member states to address inconsistencies that hinder developers from fully leveraging the EU market. These inconsistencies stem from varying legal interpretations, enforcement capabilities, and resource allocations among member states. The lack of a standardized approach often creates loopholes that infringers exploit, undermining the effectiveness of intellectual property protections. Harmonization efforts would streamline processes, reduce administrative burdens, and foster a more predictable legal environment for developers. This is particularly critical for small and medium-sized enterprises (SMEs), which often lack the resources to navigate complex, fragmented legal systems. Coordinated policies and enforcement mechanisms would not only enhance IP protection but also promote innovation and competitiveness across the EU’s digital economy.

In Table 2, we have systematized information on the practical consequences of EU intellectual property law, presented in Reports from industry organizations such as the European Games Developers Federation (EGDF) and the International Intellectual Property Alliance (IIPA).

The study identified key trends and future challenges that could shape the future of intellectual property protection in the EU gaming industry in the areas of User-Generated Content, the Role of Artificial Intelligence and Cross-Border Enforcement.

Table 2. Systematized information on the practical consequences of EU intellectual property law

Insight	Description	Impact
Economic Impact of IP Infringement	The EGDF (2022) reports that the computer games industry loses billions annually due to piracy and unauthorized distribution.	Undermines developers' financial stability, reduces capacity for reinvestment, and fosters illegitimate platforms.
Effectiveness of Current Frameworks	The IIPA (2021) highlights gaps in enforcement due to fragmentation among member states and technological sophistication of infringers.	Calls for coordinated efforts, technological tools for monitoring, and updated legislation to address emerging threats.
Need for Harmonized Approaches	Industry reports emphasize greater harmonization of IP enforcement across member states to eliminate inconsistencies and loopholes.	Streamlines processes, reduces administrative burdens, and fosters innovation across the EU's digital economy.

Source: systematized by the author

User-Generated Content (UGC). UGC refers to content created by players, such as custom levels, mods, skins, and other creative assets integrated into games. This trend has become a cornerstone of player engagement, fostering communities and extending the lifespan of games. However, it raises complex questions around intellectual property ownership, licensing, and revenue sharing. Developers often navigate a fine line between encouraging creativity and protecting proprietary assets. The DSM Directive provides initial guidance, but ambiguities persist, particularly in scenarios where player-created content significantly alters or monetizes game assets. Addressing these issues requires clearer legal frameworks and collaborative approaches between developers and players to balance creativity with IP protection. As players increasingly create and share content within games, questions arise about ownership, licensing, and fair use. The DSM Directive offers some guidance, but more clarity is needed.

Role of Artificial Intelligence (AI). AI-driven tools are revolutionizing game development and content creation by automating processes such as asset generation, level design, and personalized gaming experiences. However, these advancements introduce complex challenges for copyright law. Determining authorship and ownership of AI-generated works raises critical legal questions: does the copyright belong to the developer of the AI, the user who provides input, or the AI system itself? Additionally, the use of AI to replicate or modify copyrighted assets, such as character models or game mechanics, further complicates IP protection. Addressing these issues requires updated legal frameworks that account for the unique capabilities and implications of AI in the gaming industry. AI-driven tools for game development and content creation pose novel challenges for copyright law, particularly in determining authorship and ownership of AI-generated works.

Cross-Border Enforcement. The global nature of online gaming complicates IP enforcement due to jurisdictional differences, inconsistent legal frameworks, and the technical challenges of monitoring digital content across borders. Current enforcement mechanisms often rely on bilateral agreements and cooperation between national authorities, which can be slow and resource-intensive. Additionally, the rapid pace of technological advancement outstrips existing regulations, enabling infringers to exploit

loopholes and evade detection. Collaborative mechanisms, such as standardized enforcement protocols and shared technological resources among EU member states and international bodies, are crucial to effectively address these issues. Emphasizing real-time monitoring, data-sharing, and uniform legal standards could significantly improve the efficacy of cross-border enforcement efforts. global nature of online gaming complicates IP enforcement. Collaborative mechanisms between the EU and international bodies will be essential to address infringement effectively.

Table 3 summarises key information on emerging trends that could shape the future of intellectual property protection in the EU video games industry.

Table 3. Key trends that could shape the future of intellectual property protection in the EU video games industry

Emerging Trend	Description	Key Challenges and Recommendations
User-Generated Content (UGC)	UGC refers to player-created content like mods, skins, and custom levels that enhance engagement and foster communities.	Complex IP issues around ownership, licensing, and monetization. Clearer legal frameworks and collaboration needed.
Role of Artificial Intelligence	AI automates game development processes, creating assets and enhancing player experiences.	Questions on authorship and ownership of AI-generated works. Updated copyright laws to address AI's unique implications.
Cross-Border Enforcement	Online gaming's global nature demands uniform IP laws and real-time enforcement across jurisdictions.	Jurisdictional inconsistencies and rapid technological advances necessitate standardized protocols and resource-sharing.
Blockchain Technology	Blockchain provides immutable records of IP ownership, distribution, and usage.	High implementation costs and scalability concerns. Encourages IP transparency and combats piracy through tamper-proof records.

Source: systematized by the author

New technologies such as blockchain and artificial intelligence (AI) are revolutionizing IP protection mechanisms in the gaming industry. We believe it is necessary to systematize in Table 4 the main challenges to IP protection mechanisms in the gaming industry that are caused by the use of blockchain and artificial intelligence (AI).

Table 4. Main challenges to IP protection mechanisms in the gaming industry that are caused by the use of Blockchain and Artificial Intelligence

Feature	Description	Challenges
Blockchain Technology		
IP Transparency	Blockchain's decentralized ledger allows developers to create tamper-proof records of ownership, ensuring transparency and trust in IP transactions.	High costs, energy consumption, and scalability concerns remain key barriers to widespread adoption.
Anti-Piracy Measures	By embedding smart contracts, blockchain can automate licensing and usage agreements, reducing unauthorized distribution.	
Artificial Intelligence		
Content Protection	AI-powered tools can identify and remove infringing content across platforms in real-time, reducing the spread of pirated games.	The reliance on AI for enforcement raises concerns about accuracy, biases, and potential overreach.
IP Enforcement	Machine learning algorithms can analyze patterns of infringement, helping authorities target repeat offenders.	Challenges arise in distinguishing fair use from infringement and ensuring unbiased, accurate enforcement actions.

Source: systematized by the author

By integrating these technologies into IP frameworks, the computer games industry can enhance its ability to protect intellectual property while fostering innovation and collaboration.

To address the challenges and foster innovation, we propose the following recommendations for improving legal mechanisms and policy frameworks:

1. Harmonizing enforcement mechanisms:

- establish standardized enforcement protocols across EU Member States to eliminate jurisdictional inconsistencies;
- establish a pan-European IP enforcement authority dedicated to digital content and games to ensure uniform application of laws.

2. Adopting new technologies:

- develop a mechanism to integrate blockchain technology for IP tracking, licensing and anti-piracy measures;
- develop AI-based tools to monitor, detect and enforce IP infringements in real time.

3. Enhanced cooperation:

- promote partnerships between developers, platforms and regulators to create joint IP protection strategies;
- promote public-private initiatives to finance technological solutions aimed at protecting IP rights.

4. Education and awareness:

- develop specific courses to educate developers and users on their rights and obligations to protect IP;
- develop campaigns to raise awareness of the impact of piracy and the importance of supporting legitimate game development.

5. Updated legal framework:

- revise copyright laws to address the complexity of user-generated content and AI-generated works.
- introduce clear guidance on cross-border enforcement of intellectual property rights in the context of online games.

By adopting these measures, the EU can strengthen its legal and technological capacity to protect intellectual property, foster innovation and support the development of the computer games industry.

The EU has established a comprehensive and evolving framework for intellectual property protection that serves as a cornerstone for the computer games industry. However, the dynamic nature of technology and the unique challenges of the gaming sector necessitate ongoing adaptation of these legal frameworks. By addressing gaps in enforcement, embracing emerging technologies, and fostering greater harmonization across member states, the EU can strengthen its position as a global leader in intellectual property protection for the digital age.

Discussion. The European Union (EU) has made significant strides in intellectual property (IP) protection, particularly in the context of the rapidly evolving computer games industry. As highlighted in the document, the legal frameworks and technological measures adopted within the EU provide a robust foundation for protecting intellectual property, yet several challenges and opportunities persist.

The harmonization of IP laws across the EU has been instrumental in creating a consistent approach to protecting intellectual property. Directives such as the Copyright Directive (2001/29/EC) and the Digital Single Market Directive (2019/790) have modernized copyright laws to address digital challenges. These measures have enhanced the ability of creators to safeguard their works and ensure fair remuneration. However, enforcement remains a critical challenge, particularly in cross-border contexts. The divergence in national enforcement mechanisms, inconsistent penalties, and the global nature of digital piracy underscore the need for more harmonized legal processes.

The Trademark Regulation (EU) 2017/1001 and Trade Secrets Directive (2016/943) have further strengthened protections for proprietary assets like game engines, characters, and brand identities, which are critical for fostering innovation and maintaining competitive advantages in the gaming sector.

Technological Protection Measures (TPMs), such as Digital Rights Management (DRM) and encryption technologies, have become pivotal in mitigating piracy and unauthorized use. These mechanisms offer a first line of defense against infringement. However, their effectiveness is often undermined by sophisticated hackers and the challenges of balancing IP protection with consumer rights. The implementation of adaptive TPMs, including blockchain-based and AI-driven solutions, offers promising pathways for enhanced protection but requires further innovation to address scalability and cost barriers.

Emerging technologies, particularly blockchain and artificial intelligence (AI), are transforming IP protection mechanisms. Blockchain's decentralized ledger provides immutable records of ownership, streamlining licensing processes and ensuring transparency. AI-powered tools have enhanced the detection and removal of infringing content across platforms, reducing enforcement costs and time. Nevertheless, these technologies bring their own set of challenges, such as questions around the authorship of AI-generated content and the scalability of blockchain applications.

Cross-border enforcement of IP rights remains one of the most pressing issues in the EU. The lack of harmonized international standards and the jurisdictional complexities of prosecuting IP infringement cases in foreign courts hinder effective enforcement. The proliferation of digital piracy across jurisdictions further exacerbates these challenges. Enhanced collaboration between EU member states and international organizations, coupled with real-time monitoring and standardized enforcement protocols, is crucial for addressing these issues.

The EU's comprehensive approach to IP protection has significantly benefited the computer games industry, fostering innovation and protecting creative assets. However, evolving technologies and global challenges demand continued adaptation of legal frameworks and enforcement mechanisms. By embracing technological advancements and harmonizing legal standards, the EU can strengthen its leadership in IP protection while supporting the sustainable growth of the gaming sector.

Conclusion. The European Union has demonstrated significant progress in developing a robust intellectual property (IP) framework to address the challenges

posed by the dynamic and rapidly evolving computer games industry. Key legislative advancements, such as the Copyright Directive, the Digital Single Market Directive, and the Trade Secrets Directive, have provided essential protections to creators and developers. These efforts have been instrumental in combating piracy, safeguarding innovation, and fostering economic growth across member states.

However, as this study highlights, critical challenges remain. Cross-border enforcement, the integration of emerging technologies, and the management of user-generated content (UGC) require continuous refinement of legal mechanisms and policies. Furthermore, balancing corporate interests with consumer rights and fostering equitable access to digital goods remains an ongoing ethical and operational concern.

Emerging technologies like blockchain and artificial intelligence (AI) present transformative opportunities for IP protection by enhancing transparency, automating enforcement, and combating piracy. Nevertheless, their implementation comes with challenges, including high costs, scalability issues, and the need for updated legal frameworks to address their unique implications.

To strengthen IP protection and foster innovation in the computer games industry, the EU must prioritize harmonizing enforcement mechanisms, leveraging technological advancements, and fostering collaboration among stakeholders. Promoting education and awareness about IP rights and responsibilities will further empower creators and consumers to contribute positively to this dynamic sector.

The EU's comprehensive approach to intellectual property protection underscores its commitment to fostering innovation while addressing the unique challenges of the digital age. By embracing ongoing advancements and maintaining a balanced perspective, the EU can solidify its position as a global leader in intellectual property governance, ensuring sustainable growth for the computer games industry and beyond.

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