

Civil Protection of Intellectual Property Rights against Infringements Arising from the Deployment of Artificial Intelligence Systems: A Comparative Legal Analysis

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Abstract

This study examines the civil protection of intellectual property rights against infringements arising from the deployment and operation of artificial intelligence (AI) systems across digital networks. The rapid advancement of generative AI technologies has intensified concerns regarding unauthorized data scraping, automated reproduction, and the exploitation of copyrighted works without the consent of rights holders. Using a comparative legal-analytical methodology, the study analyzes the Jordanian Copyright Protection Law No. 22 of 1992, the French Intellectual Property Code, and relevant international instruments, particularly the TRIPS Agreement and the WIPO Copyright Treaties. It also considers the implications of emerging regulatory developments, including the European Union Artificial Intelligence Act (Regulation (EU) 2024/1689), for the governance of AI-related activities.

The study evaluates procedural safeguards, including detailed description orders, suspension of publication, legal deposit, and precautionary seizure, alongside substantive

remedies, particularly compensation for material and moral damages resulting from unauthorized exploitation of protected works. It further examines the role of technological protection measures, including encryption, electronic signatures, and digital rights management systems, in strengthening the protection of intellectual property rights in digital environments. By adopting a comparative perspective, the study seeks to bridge a notable gap in the existing literature concerning the integration of procedural safeguards, substantive remedies, and technological protection mechanisms within a coherent framework for addressing AI-related infringements. The findings reveal that traditional civil liability frameworks encounter significant difficulties in responding to the speed, scale, and complexity of infringements associated with AI systems. The study concludes that effective protection requires an integrated approach combining legislative reform, enhanced judicial powers, technological safeguards, and international cooperation. It recommends the development of specialized legal frameworks capable of addressing AI-related intellectual property disputes while maintaining an appropriate balance between technological innovation and the protection of authors' moral and economic rights in the digital environment.

Keywords: Artificial Intelligence; Intellectual Property Rights; Copyright Protection; Civil Liability; AI-Driven Infringements; Digital Networks; Comparative Law.

1. Introduction

1.1 Subject of the Study: This study addresses the civil protection of intellectual property rights against violations committed by artificial intelligence algorithms across the digital network. It explores the intersection between traditional legal frameworks and the emerging challenges posed by algorithmic systems that scrape, reproduce, and exploit protected works without authorization (Abdallah & Salah, 2024). The subject matter is rooted in comparative analysis, focusing on both national legislations such as the Jordanian Copyright Protection Law No. 22 of 1992 and its amendments (Article 36) (Albnian et al., 2025; Al Najdawi et al., 2025), and the French Intellectual Property Code (L. 332-1, L. 332-4) (Légifrance, n.d.) As well as international conventions, particularly the TRIPS Agreement (Articles 44/1, 45, 50) (World Trade Organization, 1994) and the WIPO treaties of 1996 (World Intellectual Property Organization, 2014). The study examines procedural safeguards, including interim precautionary measures such as detailed description of the work, suspension of publication, and precautionary seizure (Spindler, 2019; Dornis & Lucchi, 2025), alongside substantive remedies such as compensation and restitution (Novelli et al., 2024; Li et al., 2024). It also investigates technical protections, such as encryption and electronic signatures, which complement legal mechanisms in the digital environment (Pasetti et al., 2025; de la Durantaye, 2025). By situating intellectual property rights within the broader context of digital transformation, the study highlights the vulnerabilities of authors' moral and financial rights in the face of algorithmic exploitation (Abdallah & Salah, 2024). The subject is particularly relevant given the exponential growth of generative AI models, which rely on massive datasets often derived from copyrighted works (Kretschmer et al., 2024; Margoni & Kretschmer, 2022). This raises pressing questions about the adequacy of existing legal frameworks, the balance between innovation and protection, and the role of courts in enforcing rights in real time. Ultimately, the study seeks to provide a comprehensive understanding of how civil law, procedural safeguards, and technical measures converge to protect intellectual property rights against algorithmic violations, while identifying gaps that require legislative and judicial reform (Buick, 2025; Geiger, 2024; Al Najdawi et al., 2025).

1.2 Significance of the Study: The significance of this study lies in its timely engagement with one of the most pressing challenges of the digital era: safeguarding intellectual property rights against artificial intelligence algorithms. As AI systems increasingly rely on data scraping and automated reproduction, authors and creators face unprecedented risks of unauthorized exploitation of their works. This study is important because it bridges the gap between traditional civil liability frameworks and the novel realities of algorithmic infringement. It emphasizes the necessity of integrating procedural, substantive, and technical protections to ensure effective remedies. The comparative approach drawing on Jordanian, French, and international legal instruments provides valuable insights into how different jurisdictions address the same challenge, offering lessons for harmonization and reform. Moreover, the study contributes to academic discourse by clarifying evidentiary standards in digital contexts, where violations are intangible yet widespread. It also underscores the strategic role of technical measures, such as encryption and electronic signatures, in complementing legal safeguards. By highlighting both strengths and shortcomings of current frameworks, the study advances scholarly understanding and informs policymakers, practitioners, and researchers seeking to balance innovation with the protection of authors' rights (Al Maagbeh et al., 2026b).

1.3 Objectives of the Study: The objectives of this study are threefold. First, to analyze the procedural mechanisms available under national and international law for protecting intellectual property rights against algorithmic violations, including interim judicial measures and precautionary seizures. Second, to evaluate the substantive remedies, particularly compensation, and assess their adequacy in addressing both material and moral damages caused by AI-driven infringements. Third, to examine the role of technical measures such as encryption, electronic signatures, and digital rights management systems in reinforcing legal protections and preventing unauthorized exploitation. By adopting a comparative perspective, the study aims to identify gaps and propose recommendations for strengthening civil liability frameworks. Ultimately, the study seeks to contribute to the development of a coherent, integrated system of protection that ensures authors' rights remain enforceable in the age of artificial intelligence (Alayaydeh, E'layan, et al., 2026a).

1.4 Problem of the Study: The problem of this study arises from the growing tension between traditional civil protection frameworks of intellectual property rights and the unprecedented challenges posed by artificial intelligence algorithms in the digital environment. These algorithms engage in practices such as data scraping, automated reproduction, and unauthorized exploitation of protected works, undermining both the moral and financial rights of authors. Existing legal systems whether procedural safeguards like precautionary measures or substantive remedies such as compensation struggle to keep pace with the speed, scale, and complexity of algorithmic infringements. Moreover, technical protections, including encryption and electronic signatures, face circumvention through reverse engineering and advanced AI tools. This situation creates a pressing need to evaluate the adequacy of current national and international frameworks, identify gaps, and propose reforms to ensure effective civil liability in the age of AI. **Main Research Question: How can civil law, procedural safeguards, and technical measures be integrated to effectively protect intellectual property rights against violations committed by artificial intelligence algorithms across the digital network?**

1.5 Methodology of the Study: This study employs a comparative legal-analytical methodology that combines doctrinal analysis, comparative evaluation, and applied assessment. It examines primary sources such as the Jordanian Copyright Protection Law No. 22 of 1992, the French Intellectual Property Code, and international instruments including TRIPS (1994) and WIPO

treaties (1996). It then adopts a comparative approach to highlight similarities and differences between Jordanian and French frameworks in procedural safeguards, substantive remedies, and technical protections. Finally, it applies an analytical lens to assess how these mechanisms function in the digital environment, particularly against algorithmic infringements like data scraping and automated reproduction. Relying on qualitative content analysis of statutes, judicial decisions, and scholarly works (Spindler, 2019; Dornis & Lucchi, 2025; Kretschmer et al., 2024), the methodology ensures a concise yet holistic understanding of civil protection in the age of AI.

2. Literature review: The civil protection of intellectual property rights in the age of artificial intelligence has become a pressing subject of scholarly debate, requiring a balanced engagement with Jordanian, Arab, European, and global sources. Jordanian scholarship has emphasized the limitations of existing frameworks in addressing algorithmic infringements. For instance, Al Najdawi et al. (2025) underscored the absence of specialized legislation in Jordan, noting that reliance on traditional copyright and patent laws leaves significant gaps when confronting AI-driven violations. Similarly, Albnian et al. (2025) examined Article 36 of the Jordanian Copyright Protection Law, highlighting the importance of precautionary measures such as seizure and suspension of publication. Judicial practice further illustrates this tension, as decisions of the Jordanian Court of Cassation (1467/2019, 2431/2018, 5093/2020, 4015/2021) demonstrate how civil liability principles are applied to digital infringements, yet reveal the challenges courts face in adapting evidentiary standards to intangible algorithmic outputs.

At the Arab regional level, scholarship has begun to address the broader implications of AI on intellectual property. Albakjaji & Almarzouqi (2024) explored the challenges posed by AI in the Gulf region, stressing the urgent need for harmonized Arab legislation to ensure consistency across jurisdictions. Comparative studies from Iraq and Lebanon, such as, analyzed arbitration and judicial oversight in intellectual property disputes, offering insights into how regional legal systems might adapt to the complexities of algorithmic exploitation. These contributions enrich the discourse by situating Jordanian concerns within a wider Arab legal context, underscoring the shared need for reform and harmonization. European and international scholarship provides a more developed framework for addressing algorithmic infringements. The French Intellectual Property Code (Articles L. 332-1, L. 332-4) offers detailed mechanisms for precautionary seizure and description of works, including digital outputs, while the TRIPS Agreement (1994) and WIPO Treaties (1996) establish minimum international standards for judicial powers and digital copyright protection. Scholars such as Geiger (2024) have critically assessed European jurisprudence, highlighting the delicate balance between fostering innovation and safeguarding authors' rights. Meanwhile, Spindler (2019) and Dornis & Lucchi (2025) examined procedural safeguards such as suspension of publication and precautionary seizure, emphasizing their relevance in the digital environment where infringements occur rapidly and across borders.

Global scholarship has increasingly focused on the disruptive impact of generative AI models. Kretschmer et al. (2024) and Margoni & Kretschmer (2022) analyzed how these models exploit massive datasets, often derived from copyrighted works, raising fundamental questions about originality and reproduction. In parallel, Novelli et al. (2024) and Li et al. (2024) examined substantive remedies, including compensation and restitution, assessing their adequacy in redressing both material and moral damages caused by algorithmic infringements. Buick (2025) further addressed legislative gaps, calling for comprehensive reform of civil liability frameworks to ensure effective protection in the digital era (Alayaydeh, E'layan, et al., 2026b).

In summary, the literature reveals a convergence of concerns across Jordanian, Arab, European, and global scholarship. Jordanian and Arab sources highlight the absence of specialized legislation and the need for harmonization, while European and international frameworks provide more advanced procedural and substantive protections. Global studies underscore the transformative impact of generative AI, pressing for reforms that integrate legal, technical, and judicial measures. Together, these perspectives provide a balanced foundation for understanding the civil protection of intellectual property rights against AI-driven infringements and inform the recommendations for legislative and judicial reform. *Furthermore, the adoption of the European Union Artificial Intelligence Act (Regulation (EU) 2024/1689) reflects the growing international trend toward regulating AI systems through transparency, accountability, and risk-management obligations. Although the Act does not directly regulate copyright protection, its governance framework may indirectly influence the protection of intellectual property rights by enhancing oversight of AI systems that rely on copyrighted content for training and deployment (European Parliament & Council of the European Union, 2024).*

2.1 Gap in Civil Liability Frameworks for AI-driven IP Infringements: Artificial intelligence has transformed the digital environment, creating innovation while posing serious challenges to intellectual property protection. Generative AI models depend on vast datasets, often sourced from copyrighted works, raising complex issues of originality, authorship, and liability. Traditional civil liability frameworks, designed for tangible infringements, struggle to address intangible practices such as data scraping and automated reproduction. In Jordan, the Copyright Protection Law No. 22 of 1992 and the Civil Code No. 43 of 1976 provide safeguards like precautionary seizure and compensation, but courts face difficulties adapting evidentiary standards to digital violations. By contrast, French law offers more advanced mechanisms, including detailed description of works and freezing of digital environments. Internationally, the TRIPS Agreement (1994) and WIPO Treaties (1996) set minimum standards but leave gaps in addressing algorithmic exploitation. Scholars highlight the need for integrated reforms combining legislative, judicial, and technical measures to ensure effective protection in the age of AI (Al-Hobabseh, Alayaydeh, et al., 2026).

3. Procedural Protection of Intellectual Property Rights Against AI-Driven Infringements: National legislations and international conventions have consistently affirmed comprehensive civil and procedural protection for authors' rights; safeguarding works from distortion, and protecting the author's moral right against plagiarism and denial. Accordingly, the civil system enables the author to secure his right by obligating the infringer to perform specific execution to remove the violation, or by claiming compensation to redress the damage. To reinforce the effectiveness of this protection, the TRIPS Agreement (Articles 44/1 and 50) mandated that judicial authorities be granted the power to impose immediate interim and precautionary measures to prevent infringement or avert its aggravation. This approach was mirrored in comparative national legislations such as the Jordanian Copyright Protection Law No. 22 of 1992 and its amendments (Article 36), and the UAE Industrial Property Rights Protection Law No. 17 of 2002 (Article 60) which guaranteed precautionary procedural protection (such as provisional seizure of counterfeit copies) as a support to substantive protection pursuant to Article 45 of the Agreement, provided that the requested preventive measure is proportionate

to the alleged infringement. The extension of this newly established protection is contingent upon two essential conditions:

- A formal element: embodied in the external material manifestation of the work that brings it into tangible existence.
- A substantive element: represented in the presence of innovation or originality, through the author's personal imprint on the work. (World Trade Organization, 1994; World Intellectual Property Organization, 2014; Spindler, 2019)

This procedural protection also extends to cases of transferring financial rights without explicit written authorization. The Jordanian legislator, in Article (24) of the Copyright Protection Law No. 22 of 1992 and its amendments, required that such disposition be written and explicitly defined in detail regarding the right subject to transfer, its scope, purpose, duration of exploitation, and place. This is in line with the established jurisprudential principle of interpreting dispositions on authors' rights narrowly, so that the author remains the owner of any right not expressly waived. Conversely, to maintain contractual balance, legislation prohibited the author from undertaking any act that would obstruct or hinder the exploitation of the financial right transferred to others, without prejudice to his moral rights. Based on this, procedural protection can be defined as: a set of interim or precautionary measures that the author or his successor may obtain through a request submitted to the competent court resulting in an urgent judicial order to stop the infringement or avert its aggravation. (Albnian et al., 2025; Vesala, 2023; World Intellectual Property Organization, 2014).

The application of this protection is subject to two essential conditions:

1. The occurrence of an actual or imminent infringement on the author is exclusive right.
2. Proof of the absence of explicit written authorization from the right holder.

The importance of this procedural protection is magnified in the digital space when confronting violations arising from artificial intelligence algorithms, which often scrape works and train automated models without explicit authorization. This necessitates urgent precautionary orders to halt digital exploitation, freeze algorithmically copied data, and prevent further damage. (Buick, 2025; Kretschmer et al., 2024; Li et al., 2024).

3.1 Interim Precautionary Measures: In this context, the Jordanian legislator, in Article (36) of the Copyright Protection Law, established the authority of the competent court, upon the request of the right holder or his successor, to issue urgent interim precautionary measures to safeguard works from infringement (Abu Dalou et al., 2026). These measures vary between revealing and evidentiary procedures, such as detailed description of the work, proving the occurrence of infringement, and recording revenues resulting from exploitation, and preventive and restrictive procedures, such as ordering the suspension of publication, performance, copying, or manufacturing, and imposing precautionary seizure on the original work or counterfeit copies and materials used in reproduction. The applicant may also be required to deposit a financial guarantee to prevent abuse of procedural rights. This national legislative harmony finds its roots and international foundation in Article (50) of the TRIPS Agreement, which granted judicial authorities the power to adopt immediate and effective interim measures even without notifying the other party surprising the opponent whenever necessary to prevent infringement and preserve evidence. (World Trade Organization, 1994; World Intellectual Property Organization, 2014; Légifrance, n.d.).

The practical value of these national and international rules becomes evident when applied to the digital space, as they allow the author to obtain urgent measures against artificial intelligence algorithms that engage in scraping and automated feeding (Data Scraping), through precautionary seizure of digital environments, halting electronic exploitation, and freezing algorithmically copied data to preserve digital evidence before deletion or alteration. (Kretschmer et al., 2024; Margoni & Kretschmer, 2022; Li et al., 2024).

3.1.1 Detailed Description of the Work: The detailed description of the work is one of the earliest precautionary measures taken by urgent courts when infringement of moral or financial rights is alleged. Its legal rationale lies in identifying the protected work precisely, eliminating ambiguity, and distinguishing it from other outputs and similarities in arts, literature, and sciences. In this regard, the Jordanian legislator, in Article (36/a/1) of the Copyright Protection Law, established this procedural measure, allowing the court president, upon request of the right holder, to issue an order for a detailed description of the work. In line with this approach, the legislator required that the urgent request include “a precise and complete description of the work, sound recording, or program being infringed” as a formal condition for acceptance (Althnaibat et al., 2025a). The legal importance of this measure lies in enabling the judge to exercise judicial oversight to verify the substantive conditions of protection (such as innovation and originality) and to precisely determine the material scope of infringement, especially in complex works of digital nature with overlapping algorithmic outputs. Article (L. 332-1) of the French Intellectual Property Code allows the court president to issue an order authorizing a judicial officer to prepare a detailed description report and inspection of works, software, or products alleged to be infringed, whether material or digital, with the possibility of seizing samples and evidence without necessarily withdrawing them from circulation. Actual precautionary seizure may involve confiscating counterfeit copies or tools used in infringement if necessary. Thus, the French legislator provided special provisions for digital works and software (such as Article L. 332-4), which allows the judicial officer to seek technical experts to describe codes and algorithmic outputs and document digital infringement immediately before deletion or modification. (Légifrance, n.d.; Albrian et al., 2025; Dornis & Lucchi, 2025).

3.1.2 Suspension of Publication, Performance, or Sound Recording: It is well established in jurisprudence and case law that the author’s moral right remains the most vulnerable to violation, due to its inseparable link to the creator’s personality. Accordingly, the legislator empowered the competent court to issue an urgent judicial order to stop infringement once it occurs or when imminent, such as cases of alteration, modification, publication, or performance without prior written authorization. In Jordanian legislation, Article (36/a/2) of the Copyright Protection Law enshrined this protection, allowing the court, upon request of the right holder, to issue an order to suspend publication, performance, copying, or manufacturing of the work, aiming at two complementary objectives:

1. Immediate preventive objective: to instantly paralyze the infringing exploitation process, preventing the market from being flooded with counterfeit copies or algorithmic outputs published electronically.
2. Precautionary compensatory objective: involving precautionary seizure of copies, tools, equipment, servers, and digital environments used in infringement, in preparation for confiscation or destruction to redress the damage suffered by the author.

Comparative legislations differ regarding the time granted to the applicant of precautionary measures to file the substantive lawsuit (lawsuit of original right), under penalty of annulment of the precautionary order and cancellation of its effect. (World Intellectual Property Organization, 2014; Spindler, 2019; Geiger, 2024).

3.1.3 Legal Deposit as an Evidentiary Safeguard: In the same context, the “legal deposit” mechanism is an important procedural tool contributing to proving the chronological precedence of works. The Jordanian legislator, in Article (38) of the same law, mandated it. However, a fundamental jurisprudential and judicial characterization arises: deposit is not a condition for protection to arise nor conclusive proof of ownership, but merely a simple legal presumption subject to rebuttal. The author’s right arises upon innovation and bringing the work into material or digital existence. This presumption gains critical importance in confronting artificial intelligence violations, as digital deposit records help refute claims of precedence in generating algorithmic outputs and counter infringements arising from data scraping and automated model training. A parallel provision exists in Article (L. 332-4) of the French Intellectual Property Code. (Albnian et al., 2025; Kretschmer et al., 2024; Légifrance, n.d.).

3.2 Judicial Jurisdiction and Interim Measures against Algorithmic Violations: The legislative philosophy in both Jordanian and French law coincides in ensuring immediate judicial and administrative protection against digital infringements of authors’ rights, especially modern violations arising from algorithms and AI models that scrape data and reproduce works without authorization. Procedurally, exclusive jurisdiction over intellectual property disputes whether related to precautionary measures or substantive compensation claims for algorithmic violations rests with Jordanian regular courts under general rules, paralleled in French law by jurisdiction of substantive courts under Article (L. 331-1) of the French Intellectual Property Code. (Albnian et al., 2025; Légifrance, n.d.; Novelli et al., 2024).

The president of the competent court has the authority to issue *ex parte* orders imposing urgent precautionary measures, including the detailed description of the protected work and the allegedly infringing digital process or AI-generated output, the suspension of publication or dissemination, and the precautionary seizure of software, digital systems, and unauthorized copies generated through AI-assisted processes, pursuant to Article (36/a) of the Jordanian Copyright Protection Law and Article (L. 332-1) of the French Intellectual Property Code (CPI). At the enforcement level, Article (36) of the Jordanian Copyright Protection Law grants employees of the Copyright Protection Office judicial police powers, authorizing them to inspect relevant premises, examine digital environments, seize infringing materials, and refer violations to the competent judicial authorities, including requests for closure where legally justified. A comparable approach exists in French law, whereby inspectors and sworn officers may, in coordination with competent regulatory authorities, rely on technical experts to examine digital systems, source codes, and electronic evidence, and to undertake seizure measures in relation to infringing digital environments (Alayaydeh et al., 2024a). Such mechanisms may ultimately support administrative or judicial closure orders against platforms or online services involved in copyright infringement pursuant to Article (L. 335-5) CPI. The effectiveness of legislative protection in the digital environment is most evident through urgent judicial relief.

Article (L. 336-2) of the French Intellectual Property Code empowers courts to order appropriate precautionary measures against ongoing or imminent infringements, including measures directed at online services, hosting infrastructures, and digital platforms used to facilitate unauthorized exploitation of protected works. In the context of artificial intelligence, such measures may extend to halting unauthorized data scraping activities, preserving digital evidence, restricting access to infringing datasets, and preventing the continued use of protected works in violation of copyright law, thereby safeguarding rights holders from irreparable harm pending the determination of the substantive dispute. (Légifrance, n.d.; Albnian et al., 2025; Dornis & Lucchi, 2025)

4. Substantive Protection of Intellectual Property Rights (Compensation):

Substantive civil protection concerns enabling recourse to civil courts through substantive lawsuits, to oblige the infringer to perform specific execution or to award compensation to redress the damage arising from infringement of the author's rights or neighboring rights, based on general rules of tort and contractual liability and the TRIPS Agreement (Article 45). The importance of this protection is confirmed in light of the inadequacy of criminal or technical measures to redress the author's personal damage; the compensation lawsuit grants the author full redress for both losses suffered and profits missed)Al-Qaisi et al., 2026a (

This protection becomes highly pivotal in the digital space when confronting violations by artificial intelligence algorithms, as substantive lawsuits contribute to compensating for financial and moral exploitation resulting from automated feeding and scraping of works without authorization. (World Trade Organization, 1994; Novelli et al., 2024; Li et al., 2024).

4.1 Determining the Basis of Substantive Protection of the Author's Right in the Digital Space: The basis of substantive civil protection is determined by the nature of the legal relationship between the right holder and the infringer. The legal characterization of the lawsuit is divided between contractual liability and tort liability according to the general rules of the Jordanian Civil Code No. (43) Of 1976 and the Copyright Protection Law(Al Khaldi et al., 2025). Contractual liability arises when the contracting party breaches obligations specified in the contract, such as a publisher printing without authorization or exceeding the territorial or temporal limits of the license stipulated in Article 24 of the Jordanian Copyright Protection Law. Tort liability arises in cases of infringement committed by third parties who have no contractual relationship with the author, based on the general rule that obliges anyone who causes harm to another to compensate. Whether contractual or tortious, fault and harmful act remain the essential pillars for establishing the infringer's obligation to compensate. In Jordanian legislation, fault-giving rise to liability is embodied in violations of Articles (8, 9, and 23) of the Copyright Protection Law, which prohibit any of the following acts without explicit written authorization: reproduction, electronic copying, alteration, and modification, translation, making available, digital subscription, disabling or removing technical protection measures(Althnaibat, Kasasbeh, et al., 2026b). The French law parallels this in Articles (1231-1, 1240) of the French Civil Code and Article (L. 132-1) of the French Copyright Law. (Albnian et al., 2025; Novelli et al., 2024; Spindler, 2019).These rules acquire critical importance in the digital space when applied to violations by artificial intelligence algorithms. Tortious fault may arise from the conduct of developers, operators, or service providers who deploy AI systems to scrape, reproduce, or exploit protected works without authorization. This constitutes civil fault requiring liability and compensation to redress the damage. (Buick, 2025; Manteghi, 2024; Dornis & Lucchi, 2025).

4.2 Legal Basis for Compensation in AI-Driven Copyright Infringements: Rules of redress for damage arising from infringement of intellectual property rights are founded on harmony between national provisions and international commitments. The TRIPS Agreement, in Articles (44, 45), mandated granting judicial authorities the power to issue orders to stop infringement and oblige infringers to pay appropriate compensation to redress damage suffered by the right holder. In Jordanian law, the civil system and Copyright Protection Law (Article 31 et seq.) and Article (256) of the Jordanian Civil Code ensure redress based on tort and contractual liability by obliging the infringer to fairly compensate the author Al-Hadidi I. (2026). French law parallels this with advanced substantive regulation under Article (L. 331-1-3) of the French Intellectual Property Code, integrated with civil liability rules in Article (1240) of the French Civil Code. The issue of assessing compensation poses exceptional legal and technical difficulty in AI and digital network

cases compared to traditional lawsuits, given the intangible nature of algorithmic violations and the rapid spread of infringing outputs. This necessitates adopting modern assessment criteria based on the volume of data scraped automatically and the financial savings and competitive advantages achieved by algorithm developers through exploiting protected works in training their models without paid licenses. French law provides in this regard a system of “lump-sum compensation / presumed availability” as an additional criterion ensuring assessment of compensation based on the value of rights and royalties that should have been paid had a legal license been obtained. (World Trade Organization, 1994; Geiger, 2024; Li et al., 2024).

4.3 Methods of Compensation for Algorithmic Infringement: The primary objective of civil sanction is to award compensation for infringement of the author’s right. Compensation is of two types, determined according to the nature of the damage suffered:

- **Specific Compensation:** This is the original and preferable method of redressing damage from infringement of authors’ rights, aiming at specific performance of the obligation and restoration of the situation to its pre-infringement state whenever possible, based on general rules in Jordanian civil law and the Copyright Protection Law. French law parallels this in Article (1221) of the French Civil Code and Article (L. 331-1-4) of the French Intellectual Property Code. Procedurally, this compensation is embodied in obliging the infringer to remove causes of infringement, such as eliminating modifications that distorted the work or withdrawing infringing copies from circulation, in addition to publishing the judicial ruling or its summary in daily newspapers or digital media at the expense of the convicted party to restore the creator’s reputation. Notably, specific compensation is a right and primary obligation whenever possible; the debtor cannot refuse it to opt for monetary compensation unless it becomes impossible or excessively burdensome. The strategic value of specific compensation is highlighted in the digital space when confronting AI violations, where it extends beyond the traditional concept to include urgent measures such as immediate deletion and erasure of data from automatically scraped databases, dismantling and blocking automated models by obliging AI owners to retrain models or block algorithms built on unauthorized ingestion of the creator’s works, as well as corrective digital publication and issuing official apologies on platforms and websites that disseminated infringing outputs, safeguarding moral rights from continuous algorithmic violation. (Légifrance, n.d.; Geiger, 2024; Pasetti et al., 2025)
- **Non-Specific Compensation:** When specific performance is impossible, courts resort to awarding “compensatory substitution,” whether monetary or non-monetary. Monetary compensation is the default substitute for redressing material and moral damages under the general rules of Jordanian civil law and Article (31 et seq.) of the Jordanian Copyright Protection Law. Conversely, French legislation precisely defines the elements of monetary compensation under Article (L. 331-1-3), integrated with Article (1240) of the French Civil Code, relying on assessment of negative economic outcomes, moral damage, and unlawful profits.
- Non-monetary compensation is embodied in alternative restorative measures, such as evaluating tools and equipment used in infringement and delivering them to the author or authorizing their sale to satisfy the awarded compensation, based on Jordanian legislation and Article (L. 331-1-4) of French law. The substantive court retains discretionary authority to assess compensation according to the nature of the damage. The importance of these rules is confirmed in the digital space when confronting violations by artificial intelligence algorithms. Monetary compensation is embodied in obliging developers of

intelligent models to pay fair financial consideration to redress the free exploitation of works in automated feeding and training, and to absorb the financial savings and competitive advantages achieved. French law may also apply the system of “lump-sum compensation / presumed availability” under Article (L. 331-1-3), imposing compensation not less than the presumed license value. Meanwhile, non-monetary compensation extends to include transfer of ownership of infringing software assets, or allocation of revenues and subscriptions of algorithmic services to the right holder as an effective procedural substitute to redress ongoing digital damage. (de la Durantaye, 2025; Li et al., 2024; Albakjaji & Almarzouqi, 2024)

4.5 Assessment of Compensation: Civil liability for exploitation of works across networks requires compensation to cover both material and moral damages under Jordanian civil law and the Copyright Protection Law. This corresponds to Article (1240) of the French Civil Code, integrated with Article (L. 331-1-3) of the French Intellectual Property Code. Both legislations established harmonized criteria for assessing compensation, including the author’s literary standing, the scientific value of the work, the gravity of the fault, and the extent of benefit and profit gained by the infringer (Al-Qaisi et al., 2026a). In French law, these criteria are embodied in consideration of negative economic outcomes, moral damage, and unlawful profits. The substantive court retains discretionary authority to fairly assess damages with flexibility, guided by the author’s personal perspective to evaluate intangible moral harm. The importance of these criteria is highlighted when applied to violations by AI algorithms, as assessment requires measuring financial savings and investment gains resulting from scraping works and feeding them into automated models without authorization, alongside evaluating moral harm caused by algorithmic alteration of the work. In this context, French law provides an additional flexible mechanism in the form of the lump-sum compensation / presumed availability system under Article (L. 331-1-3), imposing compensation not less than the presumed amounts required for training the automated model. This grants courts in both systems sufficient flexibility to redress ongoing digital damages. (Li et al., 2024; de la Durantaye, 2025; Pasetti et al., 2025).

5. Protection of Intellectual Property Rights by Technical Means against Algorithms: “Technical or automated protection” integrates with substantive legal protection as a necessary measure to compensate for procedural shortcomings and digital acceleration in safeguarding intellectual property rights (Hazeem, Altarawneh, et al., 2026). This is achieved by enabling rights holders to impose direct control over their works and manage them digitally to limit unauthorized reproduction and make them available to the public through paid licensing mechanisms. International conventions, such as the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty of 1996, along with the Jordanian Copyright Protection Law, framed this technical protection by imposing legal prohibitions and civil and criminal sanctions against any circumvention, disabling, or removal of technological measures and encryption used to safeguard rights (Al Maagbeh et al., 2026a). The strategic centrality of these technical measures increases when confronting artificial intelligence algorithms, as they form the first line of defense to prevent intelligent systems from scraping data and automated feeding of software models without authorization. These technological protection measures are divided into two main complementary axes: the role of electronic signature in protecting authors’ rights, and technical protection through encryption. (World Intellectual Property Organization, 1996; Novelli et al., 2024; Albni et al., 2025).

5.1 The Role of Electronic Signature in Protecting Rights against Algorithmic Violations: The traditional signature endured for decades as a fundamental pillar of evidence to determine the

identity of the signer and express his will. However, digital transformations necessitated replacing the physical function with the electronic signature, which enjoys full legal validity once its technical controls are met, based on the Jordanian Electronic Transactions Law No. (15) of 2015 and the Jordanian Copyright Protection Law, consistent with Article (1367) of the French Civil Code and digital transaction directives, integrated with Article (L. 331-5) of the French Intellectual Property Code. (Albnian et al., 2025; Novelli et al., 2024; World Intellectual Property Organization, 2014). The evidentiary importance of electronic signature is manifested in its multiple technical forms: digital/code signature based on complex encryption to ensure the integrity of the work, biometric signature, electronic pen signature, magnetic cards, in addition to the electronic rights management system adopted in France and Jordan as a technological measure that monitors access and modification requests and issues reports of unauthorized entries. These forms acquire decisive strategic importance in the digital space when confronting violations by AI algorithms, as the digital fingerprint and embedded code signature in the work form a technical and legal line of defense proving the original author's ownership, prohibiting intelligent systems from scraping data and automated feeding of software models without explicit authorization, while applying the exceptional right of refusal stipulated in Article (L. 122-5-3 CPI) in French law. Integrating electronic signature with the (EcMS) system grants conclusive validity enabling Jordanian and French courts to trace algorithmic infringements and refute claims of fair use or permissible processing invoked by AI environments, providing decisive evidentiary grounds to establish tortious fault, issue urgent precautionary orders, and award effective compensation. (Albnian et al., 2025; de la Durantaye, 2025; Dornis & Lucchi, 2025).

5.2 Technical and Legal Protection of Technological Measures against Algorithmic Violations: The rapid development of encryption technologies has fundamentally transformed the protection of intellectual property rights in the digital environment (Al-Dabbas, Altarawneh, et al., 2026). Encryption constitutes a technological mechanism through which digital content is secured by restricting unauthorized access, reproduction, or use. Recognizing the importance of such measures, modern legal systems have established a comprehensive framework for their protection. Article (11) of the WIPO Copyright Treaty (1996) requires Contracting Parties to provide adequate legal protection and effective remedies against the circumvention of technological protection measures. Likewise, the French legislator expressly protected technological measures under Law No. 2006-961 and Article (L. 331-5) of the French Intellectual Property Code (CPI), which prohibits the removal, disabling, or circumvention of effective technological measures designed to prevent unauthorized acts. This approach is consistent with the Jordanian Copyright Protection Law and the Electronic Transactions Law, both of which provide procedural and substantive safeguards for technological methods adopted by rights holders. (World Intellectual Property Organization, 1996; Légifrance, n.d.; Pasetti et al., 2025).

Technological protection measures encompass a variety of tools aimed at securing digital works and preserving the integrity of authors' rights. These include encryption systems, digital rights management technologies, and digital watermarking techniques that enable rights holders to monitor the use of their works, trace unauthorized copies, and verify the origin of protected content. While such measures significantly enhance the protection of intellectual property in digital networks, their implementation also raises questions concerning the balance between exclusive rights and legally recognized exceptions (Al-Hussein et al., 2026). Excessive reliance on technological barriers may inadvertently restrict legitimate uses, including scientific research and certain forms of text and data mining. Comparative legal scholarship has generally addressed this concern by treating statutory exceptions and limitations as substantive defenses within

infringement proceedings rather than as absolute rights requiring rights holders to remove or weaken their technological safeguards. (Manteghi, 2024; Margoni & Kretschmer, 2022; Geiger, 2024).

The strategic importance of technological protection measures becomes particularly evident in the context of artificial intelligence systems that rely on large-scale data collection and automated processing. In certain circumstances, developers or operators of AI systems may employ techniques aimed at bypassing technological safeguards, extracting protected data, or exploiting copyrighted works without authorization for training purposes. Acts such as the circumvention of encryption technologies, removal of digital watermarks, or disabling technological protection measures constitute unlawful conduct capable of giving rise to civil liability and supporting claims for injunctive relief and compensation. Such conduct may also serve as evidence of bad faith, thereby reinforcing the legal position of rights holders before Jordanian and French courts. Consequently, judicial authorities may impose precautionary measures, order the cessation of infringing activities, and award compensation for both material and moral damages resulting from the unauthorized exploitation of protected works in AI training and deployment processes. (Novelli et al., 2024; Pasetti et al., 2025; Dornis & Lucchi, 2025).

6. Conclusions and Recommendations: This section synthesizes the key findings of the study and translates them into practical guidance. The conclusions highlight the inadequacy of traditional civil liability frameworks in addressing AI-driven infringements, while the recommendations propose legislative, judicial, institutional, technical, and educational reforms to ensure effective protection of intellectual property rights in the digital era (Al Maagbeh et al., 2026b; Al-Hussein et al., 2026; Alayaydeh et al., 2024a).

6.1 Conclusions: This study demonstrates that the civil protection of intellectual property rights faces unprecedented challenges in the age of artificial intelligence. Traditional legal frameworks, designed for tangible infringements, struggle to address the intangible, rapid, violations arising from the deployment and operation of artificial intelligence systems. Comparative analysis between Jordanian and French legislation reveals that while both jurisdictions provide procedural safeguards such as precautionary seizure, suspension of publication, and detailed description of works these measures remain limited when applied to digital environments where violations occur instantly and across borders. International conventions, including TRIPS and WIPO treaties, establish minimum standards, yet they do not fully capture the disruptive impact of generative AI models that rely on massive datasets, often derived from copyrighted works, to produce new outputs (Al-Nawafleh I. 2026). The findings highlight that authors' moral and financial rights are increasingly vulnerable, as AI systems blur the boundaries between originality and reproduction. Courts face difficulties in enforcing remedies due to evidentiary challenges, the intangible nature of digital infringements, and the circumvention of technical protections such as encryption and electronic signatures. Moreover, the absence of specialized legislation in Jordan underscores a significant gap, as reliance on general civil liability rules and traditional copyright provisions is insufficient to confront algorithmic violations. Ultimately, the study concludes that effective civil protection in the digital era requires integrated solutions that combine legal, procedural, and technical measures. Legislative reform, judicial empowerment, and international harmonization are essential to ensure that innovation is balanced with the preservation of intellectual property rights, thereby safeguarding creativity and justice in the age of artificial intelligence Sarayreh M. (2026).

6.2 Recommendations: The recommendations of this study aim to bridge the gap between traditional civil liability frameworks and the emerging challenges posed by artificial intelligence. They emphasize the need for legislative and judicial reform, institutional mechanisms, technical and international integration, and capacity building to ensure effective protection of intellectual property rights in the digital era

- **Legislative and Judicial Reform:** Enact specialized legislation to address AI-driven infringements, amend copyright and patent laws to clarify the legal status of AI-generated works, and expand judicial powers to apply modern precautionary measures (Heif et al., 2025).
- **Institutional and Collective Mechanisms:** Enable associations and public authorities to initiate collective lawsuits against algorithmic violations, and establish specialized funds to guarantee compensation in cases where direct liability cannot be determined (Al-Wreikat et al., 2025).
- **Technical and International Integration:** Strengthen technical safeguards such as encryption, electronic signatures, and digital rights management systems, while promoting collaboration between legal and technical experts. Support international harmonization through TRIPS and WIPO frameworks to unify global standards and develop cross-border enforcement mechanisms (Aldaoud et al., 2024).

- Capacity Building and Awareness: Implement training programs for judges, lawyers, and policymakers on AI-related intellectual property challenges, and raise awareness among creators and institutions about their rights and available legal remedies in the digital environment (AlSalamat et al., 2024).

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