The problem of defining the nature of artificial intelligence and its relationship to intellectual property rights according to international agreements

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Abstract

Currently, there are increasingly urgent calls to define the very nature of artificial intelligence and to establish its legal status. The issue arises when considering intellectual property rights. Therefore, the aim of the article is to define the nature of artificial intelligence and its correlation with intellectual property rights according to international agreements. The objects of study are the system of artificial intelligence and the system of intellectual property rights. For this, the scientific task will be to present a methodological approach to establishing connections between different aspects of artificial intelligence, which can be used in the context of intellectual property law. The methodology of graph theory has been applied, which graphically presented the definition of the nature of artificial intelligence and its correlation with intellectual property rights. The method of expert analysis helped establish this correlation. As a result, the key features of the nature of artificial intelligence and its correlation with intellectual property rights according to international agreements were characterized. The study has a limitation that involves not considering all possible aspects of this very nature.

Keywords: Artificial intelligence, Intellectual property rights, International agreements, Modeling

Introduction

1.1. Categories and terms used in the article

His nature of artificial intelligence is fundamentally transforming industries and redefining the boundaries of technology. Artificial intelligence systems are designed to mimic human cognitive functions such as learning, problem-solving, and perception (Al-Daboubi & Al-Ma'aita, 2023). Proponents argue that artificial intelligence has the potential to revolutionize fields like healthcare, by enabling early disease detection through pattern recognition, and transportation, by improving efficiency with autonomous vehicles (Abbasi, 2022). The justification for embracing artificial intelligence lies in its ability to process vast amounts of data faster and more accurately than humans, leading to advancements that can significantly benefit society (Hilal, 2022). Intellectual property rights are

essential for protecting creators' works and fostering innovation by granting exclusive rights to use and distribute creations. In the context of artificial intelligence, a significant debate revolves around the ownership of intellectual property generated by artificial intelligence systems (ALQuraan & Adouse, 2022). Supporters of granting intellectual property rights to artificial intelligence-generated content argue that it would incentivize investment in artificial intelligence research and development (Qoudjili, 2023). They contend that recognizing these rights could lead to increased creativity and technological advancements, as companies and individuals would be more willing to invest in artificial intelligence if they could secure legal protections for the outputs (Abuelghanam, 2022). Conversely, others argue that intellectual property rights should remain exclusive to human creators (Jarah, 2025). Since artificial intelligence lacks consciousness and cannot hold rights or responsibilities, attributing intellectual

property to artificial intelligence could undermine the legal framework designed to protect human innovation (Elalia, 2023). This perspective emphasizes that humans who develop or use artificial intelligence systems should retain ownership of any creations, ensuring that the benefits of artificial intelligence advancements accrue to people rather than machines (Susen, 2023). The challenge lies in adapting intellectual property laws to accommodate the unique aspects of artificial intelligence without eroding the incentives for human creativity (El-Bermawy, 2023).

International agreements play a crucial role in establishing common standards and facilitating cooperation among nations, especially in rapidly evolving fields like artificial intelligence (Ali, 2023). Advocates for international agreements on artificial intelligence argue that global challenges such as cybersecurity threats, ethical considerations, and the potential for an artificial intelligence arms race require coordinated international responses (Ababneh et al., 2024). By collaborating on setting standards and regulations, countries can ensure that artificial intelligence technologies are developed and used in ways that are safe, ethical, and beneficial to all (Tawfik, 2023).

1.2. Justification of the reasons for the relevance of the research topic

As artificial intelligence continues to advance rapidly, the lack of a clear and universally accepted definition poses significant challenges. Without a precise understanding of what constitutes artificial intelligence, it becomes difficult to create effective laws and regulations (Nedjar, 2023). This ambiguity can lead to inconsistencies in how artificial intelligence technologies are developed, deployed, and governed across different jurisdictions. Moreover, the relationship between artificial intelligence and intellectual property rights is a complex and pressing issue. Traditional intellectual property laws were designed with human creators in mind and may not adequately address creations generated by artificial intelligence systems. This raises questions about who owns the rights to works produced by artificial intelligence and how they should be protected. Resolving these issues is crucial to encourage innovation while ensuring that creators and stakeholders are fairly recognized and compensated. (Fig.1).
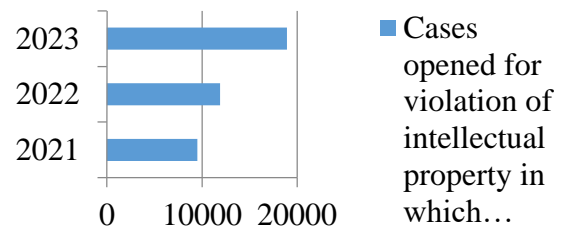

Figure 1. Cases opened for violation of intellectual property in which artificial intelligence systems appear in the world for 2021-2023

International agreements are essential in addressing these challenges because artificial intelligence technologies transcend national borders. By collaborating on defining the nature of artificial intelligence and harmonizing intellectual property laws, countries can create a cohesive legal framework that promotes innovation and protects intellectual property rights globally (Salloukh & Darwich, 2023). Such cooperation helps prevent legal conflicts, supports international trade, and ensures that the benefits of artificial intelligence are realized ethically and responsibly worldwide. Additionally, the urgency of addressing this topic is amplified by the rapid pace at which artificial intelligence technologies are evolving. As artificial intelligence systems become more sophisticated, they are increasingly capable of producing works that were traditionally created by humans, such as music, literature, and visual art (Chibani, 2023). This blurs the lines of authorship and challenges existing intellectual property frameworks, making it imperative to redefine legal concepts like originality and creativity in the context of artificial intelligence. Moreover, the lack of a clear definition of artificial intelligence complicates international efforts to regulate its use and manage its implications on intellectual property rights. Different countries may have varying interpretations of what constitutes artificial intelligence, leading to inconsistencies in laws and enforcement. This disparity can hinder cross-border collaborations and create legal uncertainties for businesses and innovators operating on a global scale. International agreements that address these definitions are essential for establishing a cohesive approach to governance and fostering international cooperation (Alqudah et al., 2024; Moghavvemi et al., 2025).

1.3. Purpose and structure of the article

The aim of the article is to define the nature of artificial intelligence and its correlation with intellectual property rights according to international agreements. The objects of study are the system of artificial intelligence and the system of intellectual property rights. The article contains sections including a literature review, a description of the methodologies used, a presentation of the key research results, their analysis and conclusions.

Literature Review

2.1. Literature review on the topic of the article

The rapid advancement of artificial intelligence technologies has sparked extensive academic and legal discussions regarding its nature and the implications for intellectual property rights within the framework of international agreements. Several studies have explored various facets of artificial intelligence, shedding light on its impact on different sectors and the challenges it poses to existing legal systems (Jarah et al., 2024; Jam et al., 2011). Arrieta et al. (2020) provided a comprehensive overview of explainable artificial intelligence, discussing concepts, taxonomies, and the challenges toward responsible artificial intelligence. Their work emphasized the importance of transparency and interpretability in artificial intelligence systems, which is crucial for addressing legal and ethical concerns, including those related to intellectual property rights. Similarly, Emmert-Streib et al. (2020) examined explainable artificial intelligence and machine learning from a reality-rooted perspective, highlighting the necessity of understanding the decision-making processes of artificial intelligence systems to ensure accountability and compliance with legal standards.

In the context of ethical considerations, Kwon (2023) investigated the changes in ethical awareness and education in an artificial intelligence society. The study underscored the need for ethical guidelines and education to keep pace with technological advancements, which is pertinent to intellectual property rights as the creation and distribution of artificial intelligence-generated content raise new ethical and legal questions. Bilan et al. (2022) conducted a systematic bibliometric review of artificial intelligence technology in organizational management, development, change, and culture. Their research identified trends in the adoption of artificial intelligence across organizations and highlighted the transformative impact of artificial intelligence on business practices. This has direct implications for intellectual property rights, as organizations increasingly rely on artificial intelligence for innovation, necessitating clear legal frameworks to protect proprietary technologies and outputs. Arora and Bhardwaj (2022) explored the integration of artificial intelligence in collaborative information systems. Their study emphasized how artificial intelligence enhances collaboration and information sharing, which can complicate the protection of intellectual property rights due to the ease of disseminating proprietary information across platforms. This highlights the need for robust legal mechanisms to safeguard intellectual property in the age of artificial intelligence-enhanced collaboration.

International legal challenges associated with artificial intelligence were addressed by Yan (2023), who examined the legal challenges of artificial intelligence in the field of criminal defense. While focusing on criminal law, the study sheds light on broader issues concerning the legal status of artificial intelligence and its outputs, which is relevant to intellectual property rights. The lack of clear legal definitions and regulations for artificial intelligence technologies can lead to uncertainties in enforcing intellectual property laws internationally. Furthermore, Alazzam et al. (2023b) discussed developing information models for e-commerce platforms in the context of global digitalization and legal compliance. Their work underscores the importance of aligning technological advancements with legal requirements, including international agreements that govern intellectual property rights. As e-commerce platforms increasingly incorporate artificial intelligence, understanding its nature becomes essential to ensure compliance with international intellectual property laws.

2.2. Identification of key gaps

Despite the growing body of research on artificial intelligence and its implications, several gaps remain, particularly concerning the legal definition of the nature of artificial intelligence and its relationship with intellectual property rights in international

agreements. Many studies focus on specific applications or ethical considerations without providing a comprehensive legal framework or definition (Almatarneh et al., 2023, Mohammadi et al., 2025).

While Arrieta et al. (2020) and Emmert-Streib et al. (2020) delve into explainable artificial intelligence, they primarily address technical aspects and ethical implications rather than legal definitions. The absence of a clear legal characterization of artificial intelligence hinders the development of effective intellectual property laws that can accommodate the unique attributes of artificial intelligence-generated content. Kwon's (2023) exploration of ethical awareness highlights the evolving perceptions in an artificial intelligence society but does not extensively address how these changes translate into legal standards or intellectual property rights protection. Similarly, Yan (2023) identifies legal challenges in criminal defense but does not offer solutions for defining artificial intelligence within international intellectual property frameworks. The research by Bilan et al. (2022) and Arora and Bhardwaj (2022) underscores the transformative impact of artificial intelligence on organizations and collaboration but stops short of addressing the implications for international intellectual property rights. There is a lack of studies that bridge the gap between technological advancements in artificial intelligence and the evolution of international legal agreements governing intellectual property. Moreover, while some studies touch upon legal compliance in the context of digitalization (e.g., Alazzam et al., 2023b), they do not specifically focus on the harmonization of international intellectual property laws with respect to artificial intelligence. This indicates a need for research that explicitly addresses how international agreements can adapt to encompass the nuances of artificial intelligence-generated works.

In addition, methodological approaches that combine legal analysis with technological modeling, such as the application of graph theory and expert analysis used in this study, are scarce in the current literature. This gap suggests an opportunity for interdisciplinary research methodologies that can more effectively capture the complex relationship between the nature of artificial intelligence and intellectual property rights within international legal frameworks.

In summary, while existing literature provides valuable insights into various aspects of artificial intelligence, there is a clear need for focused research on defining its nature from a legal perspective and understanding its correlation with intellectual property rights according to international agreements. Addressing these gaps is essential for developing comprehensive legal frameworks that can keep pace with technological advancements and ensure the protection of intellectual property rights in the global arena.

Methodology

3.1. Graph theory method

In this study, graph theory was employed as a methodological framework to visually and analytically represent the complex relationships between the nature of artificial intelligence and intellectual property rights within the context of international agreements. Graph theory, a branch of mathematics that deals with the study of graphs consisting of nodes (or vertices) and edges (or links), allows for the modeling of relationships between different entities. By applying this theory, the research mapped out the various components of artificial intelligence systems and their interactions with elements of intellectual property law. The use of graph theory facilitated the creation of a graphical model where nodes represented key aspects of artificial intelligence and intellectual property rights, such as technological features, legal definitions, and policy considerations. Edges connected these nodes to illustrate the direct and indirect correlations between them. This visual representation made it easier to identify and analyze the intricate connections and dependencies that exist between artificial intelligence technologies and intellectual property frameworks.

Furthermore, graph theory enabled the identification of central nodes and critical pathways that significantly impact the relationship between artificial intelligence and intellectual property rights. By analyzing the structure of the graph, the study could pinpoint areas where legal ambiguities exist, such as the authorship and ownership of works generated by artificial intelligence. This methodological approach provided a systematic and quantifiable means to explore the multifaceted

nature of the subject matter, thus contributing to a more thorough and nuanced understanding of the issues at hand.

3.2. The method of expert analysis

Complementing the graph-theoretical approach, the method of expert analysis was employed to gain deeper insights into the correlations identified between artificial intelligence and intellectual property rights. Expert analysis involves consulting with and synthesizing the knowledge of specialists who have extensive experience and expertise in relevant fields.

In this study, experts from the domains of artificial intelligence technology, intellectual property law, and international legal agreements were engaged to provide their perspectives. The experts contributed by reviewing the graphical models generated through graph theory, offering interpretations, and validating the identified relationships. They provided qualitative data on how artificial intelligence technologies are currently being developed and utilized, and how these practices intersect with existing intellectual property laws and international agreements.

Through interviews, surveys, and collaborative discussions, the experts helped to elucidate complex legal concepts and technological nuances that may not be immediately apparent through graphical analysis alone.

This method allowed the study to incorporate practical considerations and real-world experiences into the analysis, ensuring that the findings are grounded in current industry practices and legal standards. The expert insights were crucial in interpreting ambiguous areas, such as the legal status of creations produced autonomously by artificial intelligence systems, and in assessing the applicability of international agreements to emerging technologies.

By integrating expert analysis, the research was able to provide more comprehensive and credible conclusions, ultimately enhancing the validity of the study's outcomes.

Research Results

4.1. List of initial data for modeling

To understand the correlation between artificial intelligence systems and intellectual property rights according to international agreements, it is essential to identify key positions on both sides. Below are eight positions for artificial intelligence systems and eight corresponding positions for intellectual property rights. By linking these positions, we can illustrate how different aspects of artificial intelligence relate to various elements of intellectual property law:

A1. Autonomous Creative Systems: Artificial intelligence capable of generating original content without human intervention.

A2. Machine Learning Algorithms: Algorithms that enable artificial intelligence to learn from data and improve over time.

A3. Natural Language Processing Systems: Artificial intelligence that understands and generates human language.

A4. Computer Vision Applications: Systems that interpret and analyze visual information from the world.

A5. Expert Systems: Artificial intelligence designed to solve complex problems within a specific domain using knowledge and inference rules.

A6. Generative Models: Systems that can create new data samples, such as images or music, similar to the training data.

A7. Robotics and Autonomous Agents: Physical embodiments of artificial intelligence that can perform tasks in the real world.

A8. Decision-Making Systems: Artificial intelligence that makes decisions based on data analysis, often in fields like finance or healthcare.

Positions on the Side of Intellectual Property Rights:

P1. Liability and Accountability: Legal responsibility for actions and decisions made by or through artificial intelligence systems.

P2.   Authorship and Ownership: Legal recognition of the creator of a work and their exclusive rights over it.

P3. Trade Secrets: Protection of confidential business information from unauthorized disclosure or use.

P4. Copyright Protection: Laws that protect original works of authorship, including literature, art, and software.

P5. Derivative Works: Works based upon one or more pre-existing works, raising questions about rights and permissions.

P6. Data Rights and Privacy: Legal considerations regarding the use and protection of data.

P7.   International   Compliance: Adherence   to international treaties and agreements governing intellectual property rights.

P8. Patent Eligibility: Criteria determining what inventions can be legally protected by patents.

4.2. Setting up possible connections

A possible relation is established through the corresponding equality according to graph theory (1):

$$CL = A_i \in P_i \qquad (1)$$
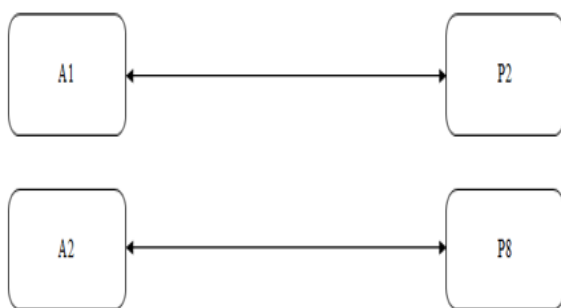
Build appropriate relationship models(fig 2.)

Figure 2. Links model between A1, A2 and P2, P8

Autonomous creative systems generate original content, raising questions about who is the legal author and owner. Traditional copyright laws assume a human creator, so there is ambiguity when content is produced independently by artificial intelligence.

Determining authorship affects who holds the rights to reproduce, distribute, or monetize the work, which is critical for enforcing intellectual property rights. Machine learning algorithms can be innovative processes potentially eligible for patent protection. However, patent laws require inventions to be novel, non-obvious, and useful.
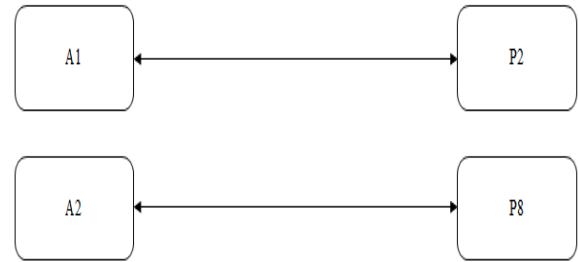
Build next relationship model (Fig.3).

Figure 3. Links model between A3, A4 and P4, P6

Artificial intelligence that generates text may create works that qualify for copyright protection or infringe on existing copyrights if they replicate existing works. Establishing whether the output is original and who holds the copyright is complex, affecting how such works can be used or distributed legally. Computer vision systems often rely on large datasets that may include personal images or proprietary content, implicating data rights and privacy laws.
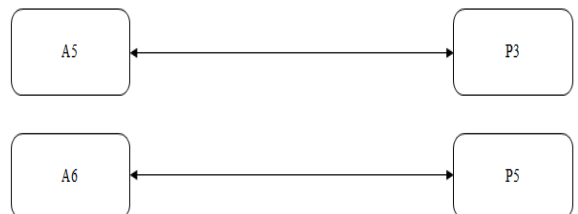
Build next relationship model (Fig.4).

Figure 4. Links model between A5, A6 and P3, P5

Expert systems use specialized knowledge that may be proprietary, and the underlying databases and rules can be considered trade secrets. Protecting this information is crucial for maintaining competitive advantage, but sharing or exposing the system may risk disclosing trade secrets. Generative models produce new content based on existing data, potentially creating derivative works that infringe on

the original creators' rights.
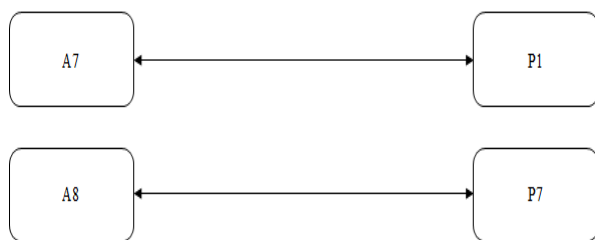
Build next relationship model (Fig.5).

Figure 5. Links model between A7, A8 and P1, P7

Hen robots or autonomous agents perform actions that result in legal issues, questions arise about who is liable—the manufacturer, the programmer, or the user. Establishing clear accountability is necessary to enforce intellectual property rights and address any violations effectively. Decision-making systems used globally must comply with international intellectual property agreements, which may vary between jurisdictions.

The links proposed between the positions of artificial intelligence systems and intellectual property rights are effective because they directly map specific technological aspects of artificial intelligence to corresponding legal considerations. By establishing these connections, we can clearly see how each facet of artificial intelligence poses unique challenges and implications for intellectual property law. For example, linking autonomous creative systems to authorship and ownership addresses the pressing question of who holds the rights to works generated without human intervention. This connection highlights the inadequacy of current laws that presume a human creator, thereby underscoring the need for legal reform to accommodate artificial intelligence-generated content.

By dividing the analysis into these eight positions on both sides and linking them accordingly, we can see how the evolution of artificial intelligence systems directly impacts various facets of intellectual property rights. This structured approach highlights the areas where legal frameworks may need to adapt to address the unique challenges posed by artificial intelligence, ensuring that intellectual property laws remain effective and relevant in the face of rapid technological advancement.

Discussions

5.1. Comparison with existing literature

Our study aimed to define the nature of artificial intelligence and its correlation with intellectual property rights according to international agreements, utilizing graph theory and expert analysis. In comparing our results with existing literature, we find both alignment and divergence with other scholarly works, which enriches the discourse on this complex subject.

Kryshtanovych et al. (2024) focused on developing new information systems incorporating artificial intelligence to optimize work for both men and women. Their methodological approach to assessment and selection resonates with our use of graph theory to systematically analyze the relationships between artificial intelligence and intellectual property rights. Both studies emphasize the importance of structured methodologies in addressing the complexities introduced by artificial intelligence technologies. Vashkevych et al. (2021) delved into the philosophical discourse on the development and enhancement of human intellectualization. They explored how artificial intelligence influences human nature, suggesting that intellectual property laws must evolve accordingly. Our findings align with this perspective, as we highlight the necessity of redefining legal frameworks to accommodate the unique attributes of artificial intelligence-generated works, thereby ensuring that intellectual property rights remain relevant and effective.

In the educational sphere, Kronivets et al. (2023) examined the legal foundations for utilizing artificial intelligence in educational processes. They identified a lack of clear legal guidelines governing the use of artificial intelligence in education, which mirrors our observation of insufficient international agreements addressing the legal status of artificial intelligence in relation to intellectual property rights. Both studies call for more comprehensive legal frameworks to manage the integration of artificial intelligence in various sectors. Lim (2017) discussed moral education in the age of artificial intelligence from a consumer ethics standpoint. The study underscored the ethical considerations and the need for moral guidelines as artificial intelligence becomes more

prevalent. Our research complements this by emphasizing that ethical considerations must be integrated into legal definitions and intellectual property rights, ensuring that artificial intelligence developments align with societal values and norms.

Serediuk (2024) explored the possibilities of using artificial intelligence and natural language processing to analyze and interpret legal norms. His findings support our assertion that artificial intelligence can aid in legal processes but also necessitates clear definitions and regulations to manage its application effectively. Our methodological approach using expert analysis parallels his emphasis on leveraging expertise to navigate the complexities of integrating artificial intelligence into legal frameworks.

Conversely, studies like that of Syahputri et al. (2020) questioned whether artificial intelligence-based systems require traditional software engineering methods. While their focus was on software development methodologies, it highlights the broader debate about the applicability of existing frameworks to artificial intelligence technologies. Our research contributes to this discourse by suggesting that new or adapted methodologies, such as graph theory, may be necessary to address the unique challenges posed by artificial intelligence in the legal domain.

5.2. Implications and contributions to the field

The comparison with existing literature reveals a consensus on the urgent need to redefine legal frameworks in light of artificial intelligence advancements. Our study contributes to the field by providing a novel methodological approach that combines graph theory and expert analysis to visualize and understand the intricate relationships between artificial intelligence and intellectual property rights.

The work of Alparslan (2024) on the adequacy of global legal norms concerning digitalization and artificial intelligence reinforces our findings that international agreements are currently insufficient. Our graphical representation aids in identifying specific areas within these agreements that require revision or enhancement, offering a practical tool for policymakers. Additionally, the emphasis on explainable artificial intelligence in cybersecurity by

Mendes and Rios (2023) aligns with our focus on transparency and understanding the nature of artificial intelligence. Their systematic literature review underscores the importance of making artificial intelligence systems interpretable, which is crucial for legal accountability and enforcing intellectual property rights. Our study's methodological approach supports this by making complex relationships more accessible and understandable.

The exploration of artificial intelligence's impact on personal data by Chałubińska-Jentkiewicz and Nowikowska (2022) highlights another dimension of legal challenges. Their findings suggest that artificial intelligence blurs the lines between data protection and intellectual property. Our research acknowledges this overlap and suggests that international agreements need to address these intersections to provide comprehensive legal coverage.

Furthermore, the philosophical insights provided by Vashkevych et al. (2021) on the intellectualization of human nature suggest that artificial intelligence not only affects legal and ethical norms but also challenges our understanding of creativity and ownership. Our study contributes to this philosophical discourse by examining how intellectual property rights can adapt to these changes, ensuring that human creativity is protected even as artificial intelligence becomes more capable of generating original works. Lastly, the roadmap analysis by Sandfreni and Budiardjo (2024) on artificial intelligence engineering methods emphasizes the need for standardized practices in artificial intelligence development. Our application of graph theory offers a standardized methodological framework that can be utilized in legal analyses, bridging the gap between technological development and legal regulation.

In summary, our study's findings are consistent with the broader scholarly recognition of the challenges posed by artificial intelligence to existing legal frameworks, particularly concerning intellectual property rights. By providing a methodological approach that combines graph theory and expert analysis, we offer a valuable tool for policymakers, legal practitioners, and researchers to better understand and address these challenges within

international agreements.

Conclusions

6.1. Key findings

This study addressed the urgent need to define the nature of artificial intelligence and establish its legal status in relation to intellectual property rights as outlined in international agreements. By focusing on the systems of artificial intelligence and intellectual property rights, the research presented a methodological approach to establishing connections between different aspects of artificial intelligence within the context of intellectual property law. The application of graph theory effectively facilitated a graphical representation of these definitions and correlations, providing a clear and structured visualization of the complex relationships involved.

Through expert analysis, the study successfully characterized the key features of the nature of artificial intelligence and its correlation with intellectual property rights according to international agreements. The findings highlight the intricate interplay between technological advancements and legal frameworks, emphasizing the necessity for a well-defined understanding of artificial intelligence to ensure that intellectual property laws remain relevant and effective. This research contributes to the ongoing discourse by offering a structured approach to examining these issues, thereby facilitating better-informed policy-making and legal interpretations.

6.2. Prospects for further research

While the study made significant strides in defining the nature of artificial intelligence and its relationship with intellectual property rights, it acknowledged the limitation of not considering all possible aspects of artificial intelligence's nature. Future research should aim to explore these additional facets, potentially incorporating interdisciplinary perspectives from fields such as ethics, sociology, and international relations. Expanding the scope of the methodological approach could provide a more comprehensive understanding of artificial intelligence and its broader implications. Moreover, there is a need to examine how evolving artificial intelligence technologies might challenge existing international

agreements on intellectual property rights. Subsequent studies could investigate the adaptability of current legal frameworks to emerging artificial intelligence applications, proposing modifications or new models as necessary. Engaging in comparative analyses across different jurisdictions might also yield valuable insights into best practices and innovative solutions.

References

Ababneh, A. M. D., Jarah, B. A. F., Al-Kharabsheh, A., Al-Zaqeba, M. A. A., & Basheti, I. (2024). The role of human resources management in the development of total quality management in the public and private sectors in Jordan. Humanities and Social Sciences Letters, 12(2), 319-330.

Abbasi, O. (2022). International Liability Resulting From Operations Related To Harmful Waste. The Jordanian Journal of Law and Political Science, 14(3). https://doi.org/10.35682/jjlps.v14i3.457.

Jarah, B. A. F. (2025). The Role of Corporate Governance on the Development of Accounting Information Systems in Jordanian Companies: Organizational Performance as a Moderating. Salud, Ciencia Y Tecnología, 5, 1533. https://doi.org/10.56294/saludcyt20251533.

Abuelghanam, S. (2022). Legal Consequences of Patent Invalidation Upon Corporation in the Jordanian Law. The Jordanian Journal of Law and Political Science, 14(1). https://doi.org/10.35682/jjlps.v14i1.343.

Alazzam, F. A. F., Tubishat, B. M. A.-R., Savchenko, O., Pitel, N., & Diuk, O. (2023a). Formation of an innovative model for the development of e-commerce as part of ensuring business economic security. Business: Theory and Practice, 24(2), 594–603. https://doi.org/10.3846/btp.2023.19781

Alazzam, F.A.F., Shakhatreh, H.J.M., Gharaibeh, Z.I.Y., Didiuk, I., Sylkin, O. (2023b). Developing an information model for E-Commerce platforms: A study on modern socio-economic systems in the context of global digitalization and legal compliance. Ingénierie des Systèmes d'Information, Vol. 28, No. 4, pp. 969-974. https://doi.org/10.18280/isi.280417

Al-Daboubi, D., & Al-Ma'aita, K. (2023). Legal

Framework for Liability resulting from Handling the Hazardous Goods in the Port of Aqaba: Critical Analysis of International Conventions and Jordanian Law. The Jordanian Journal of Law and Political Science, 14(4). https://doi.org/10.35682/jjlps.v14i4.356.

Ali, M. (2023). The Egyptian Zakat and Charity House: The Social Role of Al-Azhar between Community Service & State Support. Hikama, 6(3), 144-166, doi: 10.31430/ENBR4320.

Almatarneh, Z., Zaqeeba, N., Jebril, I., & Jarah, B. A. F. (2023). The role of financial accounting technology in improving customer relationship management in Jordanian banks. Asian Economic and Financial Review, 13(12), 1008-1019.

Alparslan, G. (2024). The adequacy of global legal norms on legal issues related to digitalization and artificial intelligence. International Journal of Law and Politics Studies, 6(1), 68-75. https://10.32996/ijlps.2024.6.1.8

Alqudah, A. M. A., Jaradat, Y. M., AlObaydi, B. A. A., Alqudah, D., & Jarah, B. A. F. (2024). Artificial Intelligence in Design and Impact on Electronic Marketing in Companies. Journal of Ecohumanism, 3(4), 170-179.

ALQuraan, S., & Adouse, H. (2022). The Role of Social Media in Creating Human Rights Culture Among Jordanian University Students. The Jordanian Journal of Law and Political Science, 14(1). https://doi.org/10.35682/jjlps.v14i1.342.

Arora, M., Bhardwaj, I. (2022). Artificial intelligence in collaborative information system. International Journal of Modern Education and Computer Science, 14(1): 44-55. https://doi.org/10.5815/ijmecs.2022.01.04

Arrieta, A.B., Díaz-Rodríguez, N., Del Ser, J., Bennetot, A., Tabik, S., Barbado, A., Herrera, F. (2020). Explainable artificial intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI. Information Fusion, 58: 82-115. https://doi.org/10.1016/j.inffus.2019.12.012

Bilan, S., Šuleř, P., Skrynnyk, O., Krajňáková, E., Vasilyeva, T. (2022). Systematic bibliometric review of artificial intelligence technology in organizational management, development, change and culture. Business: Theory and Practice, 23(1): 1-13. https://doi.org/10.3846/btp.2022.13204

Borisova, A., Rakhimberdinova, M., Madiyarova, E., Riazantseva, I., Mikidenko, N. (2020). Staffing search and recruitment of personnel on the basis of artificial intelligence technologies. Entrepreneurship and Sustainability Issues, 7(3): 2456-2469. https://doi.org/10.9770/jesi.2020.7.3(66)

Chałubińska-Jentkiewicz, K., & Nowikowska, M. (2022). Artificial intelligence v. Personal Data. Polish Political Science Yearbook, 51, 183-191. https://10.15804/ppsy202240

Chibani, M. (2023). Populism In Its National And Transnational Dimensions: A Review Of: The People Want: When Democracy Is Eroded By Aymen Boughanmi And Populism And World Politics Exploring Inter-and Transnational Dimensions By Frank A. Stengel. Siyasat Arabiya, 11(61), 139-147, doi: 10.31430/NXYL2256.

Danylenko, S., Nagornyak, M., Bielousova, N., Yakovets, A., & Fursai, O. (2024). Human rights preservation and protection in the face of global risks and threats: The importance of democracy and ways to enhance it. Social and Legal Studios, 7(2), 9-18. https://doi.org/10.32518/sals2.2024.09

De, T., Giri, P., Mevawala, A., Nemani, R., Deo, A. (2020). Explainable AI: a hybrid approach to generate human-interpretable explanation for deep learning prediction. Procedia Computer Science, 168: 40-48. https://doi.org/10.1016/j.procs.2020.02.255

Elalia, N. (2023). Typology of Digital Religious Identity: A Sociological Study of Youth's Religious Expressions on Facebook. Omran, 12(45). 7-36, doi:10.31430/TJQC1033.

El-Bermawy, A. (2023). Government AI Readiness Index 2022. Hikama, 6(3), 214-221, doi: 10.31430/PXNI5918.

Emmert-Streib, F., Yli-Harja, O., Dehmer, M. (2020). Explainable artificial intelligence and machine learning: A reality rooted perspective. Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 10(6): e1368. https://doi.org/10.1002/widm.1368

HILAL, G. (2022). Faculty of law - University of Jordan – Jordan . The Jordanian Journal of Law and

Political Science, 14(3). https://doi.org/10.35682/jjlps.v14i3.458.

Jarah, B. A. F., Alshehadeh, A. R., Al-Zaqeba, M. A. A., Al-Bataineh, F. A., & Al-khawaja, H. A. (2024). Review of the literature related to audit quality and integrated reporting quality in Jordanian companies. Edelweiss Applied Science and Technology, 8(6), 124-133.

Kopytko, M., Sylkin, O. (2023). Modelling information support for combating corruption in the economic security management system of the state. Social and Legal Studios, 6(3): 60-66. https://doi.org/10.32518/sals3.2023.60

Kronivets, T., Yakovenko, O., Tymoshenko, Y., Ilnytskyi, M., Lasechko, S., Lasechko, M. (2023). The legal foundations for the utilization of artificial intelligence in educational processes. Relocoes Internacionais no Mundo Atual, 4(42): 686-702. https://doi.org/10.21902/Revrima.v4i42.6556

Kryshtanovych, M., Snihur, L., Buzhyna, I., Tiurina, D., Imeridze, M. (2024). Development of new information systems with the involvement of artificial intelligence for the men and women's work: A methodical approach to assessment and selection of the optimal. Ingénierie des Systèmes d'Information, Vol. 29, No. 2, pp. 723-730. https://doi.org/10.18280/isi.290234

Kwon, J. (2023). A study on ethical awareness changes and education in artificial intelligence society. Revue d'Intelligence Artificielle, 37(2): 341-345. https://doi.org/10.18280/ria.370212

Lim, S. (2017). Moral education in the age of artificial intelligence: From the perspective of consumer ethic. Journal of Ethics: The Korean Association of Ethics, 1(117): 89-116. https://doi.org/10.15801/je.1.117.201712.89

Mendes, C., Rios, T.N. (2023). Explainable artificial intelligence and cybersecurity: A systematic literature review. arXiv preprint arXiv:2303.01259. https://doi.org/10.48550/arXiv.2303.01259

Nedjar, M. (2023). Why is there No "Arab" International Relations Theory? Causes of the Deficiency of Arab Contributions into IR Theory. Siyasat Arabiya, 11(61), 54-77, doi: 10.31430/ROPK9457.

Qoudjili, S. (2023). War and State Formation in Europe (1300–1800): Revisiting the Bellicist Theory. Omran, 12(46). 41-76, doi:10.31430/IIZF1776.

Salloukh, B., & Darwich, M. (2023). Teaching International Relations in the Arab World: Knowledge Production and Theoretical Challenges. Siyasat Arabiya, 11(61), 78-93, doi: 10.31430/CIRL1108.

Sandfreni, Budiardjo, E.K. (2024). Roadmap analysis of Artificial Intelligence Engineering method. Revue d'Intelligence Artificielle, Vol. 38, No. 3, pp. 787-793. https://doi.org/10.18280/ria.380305

Sarp, S., Kuzlu, M., Wilson, E., Cali, U., Guler, O. (2021). The enlightening role of explainable artificial intelligence in chronic wound classification. Electronics, 10(12): 1406. https://doi.org/10.3390/electronics10121406

Serediuk, V. (2024). Possibilities of using artificial intelligence and natural language processing to analyse legal norms and interpret them. Social and Legal Studios, 7(2), 191-200. https://doi.org/10.32518/sals2.2024.191

Susen, S. (2023). Is a Reconciliation between Pierre Bourdieu and Luc Boltanski Possible? Towards a Dialogue between Critical Sociology and the Pragmatic Sociology of Critique) (M, Mourchid, translated). Omran, 11(44). 133-171, doi:10.31430/XVES4243.

Syahputri, I.W., Ferdiana, R., Kusumawardani, S.S. (2020). Does system based on artificial intelligence need software engineering method? Systematic review. In 2020 Fifth International Conference on Informatics and Computing (ICIC), Gorontalo, Indonesia, pp. 1-6. https://doi.org/10.1109/ICIC50835.2020.9288582

Tawfik, R. (2023). Migration Policies and Regional Integration: The Case of Migration between Egypt and Sudan. Hikama, 7(4), 111-133, doi: 10.31430/NZFE2825.

Vashkevych, V., Krokhmal, N., Qi, C., Mordous, I., Ratushna, T. (2021). Philosophical discourse for the development and improvement of the intellectualization of human nature. WISDOM, 20(4): 148-156. https://doi.org/10.24234/wisdom.v20i4.55

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Yan, Q. (2023). Legal challenges of artificial intelligence in the field of criminal defense. Lecture Notes in Education Psychology and Public Media, 30, 167-175. https://10.54254/2753-7048/30/20231629

Yarovoy, T.C. (2023). Opportunities and risks of the use of artificial intelligence in public administration. Economic Synergy, 2, 36-47. https://10.53920/ES-2023-2-3

Zemlickienė, V. (2018). Adaptation set of factors for assessing the commercial potential of technologies in different technology manufacturing branches. Business, Management and Economics Engineering, 16, 206-221.
https://doi.org/10.3846/bme.2018.5402.

Moghavvemi, S., Jam, F. A., & Iqbal Khan, T. (2025). The Impact of Motivation, Opportunity, Financial Ability, and Willingness on Resident Support for Tourism Development. Tourism Planning & Development, 22(1), 63-84.

Jam, F. A., Sheikh, R. A., Iqbal, H., Zaidi, B. H., Anis, Y., & Muzaffar, M. (2011). Combined effects of perception of politics and political skill on employee job outcomes. African Journal of Business Management, 5(23), 9896-9904.

Mohammadi Moeinalzoafa, Omid, and Maryam Tahmasebpoor. "Improving performance of nanocrystalline cellulose adsorbent in carbon dioxide adsorption process by amine modification method." Environment and Water Engineering 11, no. 2 (2025): 70-77.