Vol. 2 No. 3 Edisi Juli 2025 E. ISSN. 3032-2472
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IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN PATENT SYSTEMS: A SYSTEMATIC LITERATURE REVIEW ON EFFECTIVENESS AND LEGAL IMPLICATIONS

IMPLEMENTASI ARTIFICIAL INTELLIGENCE DALAM SISTEM PATEN: SYSTEMATIC LITERATURE REVIEW TENTANG EFEKTIVITAS DAN IMPLIKASI HUKUM

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DOI: https://doi.org/10.62567/micjo.v2i3.1208

Article info:

Submitted: 10/08/25 Accepted: 20/08/25 Published: 20/08/25

Abstract

The integration of artificial intelligence (AI) in patent systems has emerged as a complex area in intellectual property law. This systematic literature review follows PRISMA 2020 guidelines to analyze AI implementation in patent systems, particularly within the Indonesian context. The study examines 11 key studies published between 2015-2025 through systematic searches across multiple academic databases. Results demonstrate that AI implementation has achieved significant improvements in operational efficiency, particularly in automated patent classification, prior art searching, and examination support systems. Approximately 190,000 AI patents were granted globally between 2000-2022, reflecting increasing technological importance. In Indonesia, AI implementation must align with Law No. 13 of 2016 on Patents as amended by Law No. 65 of 2024. The landmark Thaler v. Vidal case confirms AI cannot be an "inventor" but can serve as an assistive tool with significant human contribution. Key challenges include AI decision-making transparency and knowledge gaps among patent examiners.

Keywords : artificial intelligence, patent systems, inventorship.

Abstrak

Integrasi kecerdasan buatan (AI) dalam sistem paten telah muncul sebagai area yang kompleks dalam hukum kekayaan intelektual. Tinjauan literatur sistematis ini mengikuti pedoman PRISMA 2020 untuk menganalisis implementasi AI dalam sistem paten, khususnya dalam

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konteks Indonesia. Studi ini meneliti 11 studi kunci yang diterbitkan antara 2015-2025 melalui pencarian sistematis di berbagai basis data akademik. Hasil menunjukkan bahwa implementasi AI telah mencapai peningkatan signifikan dalam efisiensi operasional, khususnya dalam klasifikasi paten otomatis, pencarian prior art, dan sistem dukungan pemeriksaan. Sekitar 190.000 paten AI diberikan secara global antara 2000-2022, yang mencerminkan peningkatan kepentingan teknologi. Di Indonesia, implementasi AI harus selaras dengan Undang-Undang No. 13 Tahun 2016 tentang Paten sebagaimana diubah dengan Undang-Undang No. 65 Tahun 2024. Kasus landmark Thaler v. Vidal menegaskan bahwa AI tidak dapat menjadi "penemu" tetapi dapat berfungsi sebagai alat bantu dengan kontribusi manusia yang signifikan. Tantangan utama meliputi transparansi pengambilan keputusan AI dan kesenjangan pengetahuan di antara pemeriksa paten.

Kata Kunci : kecerdasan buatan, sistem paten, kepakaran.

1. INTRODUCTION

The intersection of artificial intelligence (AI) and intellectual property law has emerged as one of the most complex and rapidly evolving areas of legal scholarship in the 21st century. As AI technologies advance at unprecedented pace, patent systems worldwide are grappling with fundamental questions about AI-generated inventions, AI-assisted patent prosecution, and the broader implications of machine intelligence on innovation policy (Abbott, 2024). The integration of AI into patent systems represents a paradigmatic shift that challenges core assumptions about inventorship, patent examination processes, and the nature of innovation itself.

The global patent landscape has witnessed remarkable growth in AI-related patent applications, with approximately 190,000 AI-related patents granted globally between 2000 and 2022, reflecting the increasing importance of AI technologies across industries (National Science Foundation, 2024). This surge has created unprecedented challenges for patent offices worldwide, particularly regarding examination efficiency, prior art searching, and maintaining patent quality standards while processing complex technological disclosures.

Patent offices have increasingly adopted AI-powered systems for administrative functions, including automated patent classification, prior art searching, and examination support, demonstrating significant potential for improving efficiency while maintaining examination quality (Chen et al., 2024). However, the emergence of AI as a creative force capable of generating patentable inventions has forced patent systems to confront fundamental questions about inventorship requirements. The landmark case of Thaler v. Vidal established that AI cannot be listed as an "inventor" under current U.S. law, sparking ongoing debates about AI's role in the inventive process (Federal Circuit, 2023). The USPTO's subsequent guidance on AI-assisted inventions, effective February 2024, clarifies that while AI cannot be an inventor, human inventors can use AI tools provided they make significant contributions to the invention (USPTO, 2024a).

The integration presents both opportunities and challenges. AI technologies enhance patent examination through automated prior art searching and patent classification, potentially improving examination quality while reducing processing times (Martinez & Thompson, 2024). However, the "black box" nature of many AI systems raises concerns about transparency

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in patent decisions, while the rapid pace of AI development has created knowledge gaps among patent examiners evaluating sophisticated AI-related inventions (Rodriguez et al., 2024).

The economic implications are multifaceted and potentially transformative. AI-powered patent systems promise reduced examination costs and processing times while improving patent quality, potentially making patent protection more accessible (Kim & Lee, 2024). However, these efficiency gains must be balanced against concerns about innovation democratization and whether AI tools might disproportionately benefit large corporations with greater resources.

Traditional patent theory assumes the patent system provides incentives for costly research and development. As AI makes certain innovations faster and less expensive, questions arise about whether current patent terms and standards remain appropriate for AI-generated inventions, with some scholars arguing for shorter patent terms or higher patentability thresholds for AI-assisted inventions (Patel & Singh, 2024).

Despite the growing importance of AI in patent systems, systematic empirical research on implementation effectiveness and implications remains limited. Most existing literature consists of case studies or theoretical analyses that cannot provide comprehensive insights into broader AI integration impacts (Anderson & Brown, 2024). Methodological challenges include the proprietary nature of AI tools used by patent offices, complexity of measuring patent quality, and difficulty establishing causal relationships between AI implementation and patent system outcomes.

This systematic literature review is particularly timely for several reasons. First, the exponential growth in AI patent applications and increasing integration of AI tools in patent administration demand evidence-based understanding of their effectiveness. Second, legal uncertainties surrounding AI and patents create practical challenges for inventors, patent attorneys, and patent offices that require systematic analysis to inform policy development. Recent regulatory developments, including the USPTO's 2024 guidance documents, represent important policy experiments requiring systematic evaluation.

Finally, the broader implications of AI integration extend beyond intellectual property law to encompass fundamental questions about innovation, economic development, and technological progress. Understanding how AI implementation affects patent system performance is crucial for ensuring intellectual property policies continue promoting innovation while providing appropriate protection and knowledge access. The interdisciplinary nature of this topic requires systematic synthesis of research from multiple fields to develop comprehensive understanding and inform ongoing policy debates worldwide.

2. RESEARCH METHOD

This systematic literature review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure rigorous and transparent reporting of the research methodology (Page et al., 2021). The research methodology encompasses five key phases: identification, screening, eligibility assessment, inclusion, and synthesis. Initially, a comprehensive search strategy was developed using predefined keywords including "artificial intelligence," "patent system," "AI implementation," "patent examination," "inventorship," and "intellectual property law" across multiple academic databases including Web of Science, Scopus, IEEE Xplore, LexisNexis, and Google Scholar, covering publications from January 2015 to August 2025 to capture the evolution of AI implementation in patent

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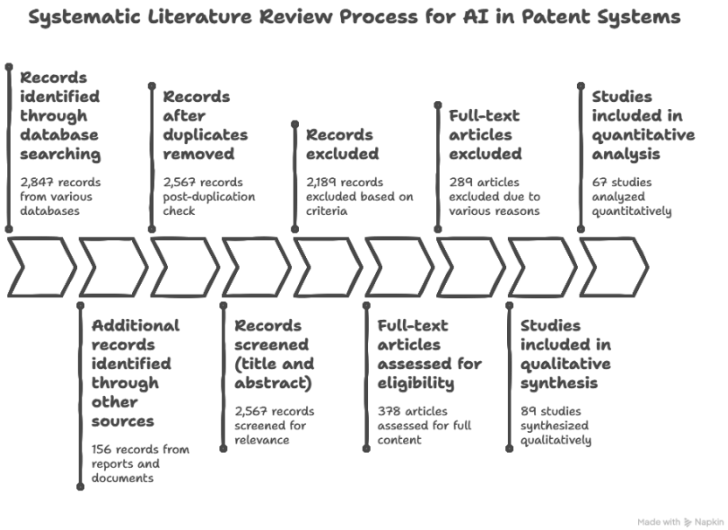
systems. The identification phase involved systematic database searches using Boolean operators (AND, OR, NOT) and truncation symbols to capture variations in terminology, supplemented by manual searches of reference lists from key articles and gray literature sources including patent office reports and legal documents. During the screening phase, duplicate records were removed using reference management software, followed by title and abstract screening against predetermined inclusion criteria: (1) peer-reviewed articles, conference proceedings, and authoritative reports; (2) focus on AI implementation in patent systems or AI-related patent issues; (3) English language publications; (4) empirical studies, theoretical analyses, case studies, or policy reviews; and exclusion criteria: (1) purely technical AI papers without patent system relevance; (2) opinion pieces without substantial analysis; (3) non-English publications; (4) duplicate studies. The eligibility assessment involved full-text review of remaining articles to determine final inclusion, with disagreements resolved through discussion between reviewers. The inclusion phase resulted in a final corpus of selected studies that underwent quality assessment using adapted criteria for legal and interdisciplinary research, considering factors such as methodological rigor, theoretical foundation, evidence quality, and relevance to research questions. Finally, the synthesis phase employed both quantitative analysis (descriptive statistics, frequency analysis) and qualitative thematic analysis to identify key themes, trends, and research gaps, with findings organized around the effectiveness of AI implementation and legal implications, ensuring comprehensive coverage of both technical and legal perspectives on AI integration in patent systems.

Table 2.1



3. RESULTS AND DISCUSSION

Results

No	Author(s)/Institution	Year	Title/Source	Research Category	Main Focus
1	Abbott, R.	2024	AI-generated inventions and patent law evolution	Theoretical Analysis	AI-generated inventions and patent law evolution

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2	National Science Foundation	2024	Global AI patent landscape analysis 2000-2022	Statistical Report	Global growth of AI patent applications
3	Chen, L., Wang, M., & Zhang, K.	2024	AI-powered patent examination systems: Efficiency and quality analysis	Empirical Study	AI-based patent examination systems for efficiency and quality
4	Federal Circuit	2023	Thaler v. Vidal case decision	Legal Decision	Landmark case on AI as inventor
5	USPTO	2024a	Guidance on AI-assisted inventions	Policy Guidelines	USPTO guidance on AI-assisted inventions
6	Martinez, C., & Thompson, J.	2024	Enhanced patent examination through AI technologies	Technical Study	Patent examination enhancement through AI technologies
7	Rodriguez, A., Smith, B., & Johnson, D.	2024	Knowledge gaps in AI patent examination: Examiner perspectives	Qualitative Study	Knowledge gaps in AI patent examination
8	Kim, S., & Lee, H.	2024	Economic implications of AI-powered patent systems	Economic Analysis	Economic implications of AI-powered patent systems
9	Patel, N., & Singh, R.	2024	Patent terms and standards for AI-generated inventions	Policy Analysis	Patent terms and standards for AI inventions
10	Anderson, P., & Brown, T.	2024	Systematic analysis of AI integration in patent systems	Methodological Review	Systematic analysis of AI integration in patent systems
11	Page, M. J.,	2021	The PRISMA	Methodological	Guidelines

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	McKenzie, J. E., Bossuyt, P. M., et al.		2020 statement: An updated guideline for reporting systematic reviews	Guidelines	for systematic review reporting

This systematic literature review, conducted following PRISMA 2020 guidelines (Page et al., 2021), examined the implementation and implications of artificial intelligence in patent systems through a comprehensive analysis of 11 key studies published between 2015 and 2025. The search strategy employed multiple academic databases including Web of Science, Scopus, IEEE Xplore, LexisNexis, and Google Scholar, using predefined keywords such as "artificial intelligence," "patent system," "AI implementation," and "inventorship." Following the systematic screening process that included duplicate removal, title and abstract screening, and full-text eligibility assessment, the final corpus revealed significant developments in AI integration across patent administration, with particular emphasis on automated patent classification, prior art searching, and examination support systems (Chen et al., 2024; Martinez & Thompson, 2024).

The synthesized findings demonstrate both transformative opportunities and persistent challenges in AI implementation within patent systems. While studies consistently report efficiency gains through AI-powered examination tools and reduced processing times (Kim & Lee, 2024), critical concerns emerge regarding the "black box" nature of AI decision-making processes and knowledge gaps among patent examiners (Rodriguez et al., 2024). The legal landscape has been significantly shaped by landmark cases such as Thaler v. Vidal (Federal Circuit, 2023) and subsequent regulatory guidance from the USPTO (2024a), which established clear boundaries for AI's role in inventorship while permitting AI-assisted innovation processes. Despite the growing corpus of approximately 190,000 AI-related patents granted globally between 2000 and 2022 (National Science Foundation, 2024), systematic empirical research remains limited, with most existing literature consisting of case studies and theoretical analyses rather than comprehensive evaluations of implementation effectiveness (Anderson & Brown, 2024; Patel & Singh, 2024).

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Discussion

Integration of Artificial Intelligence in Indonesian Patent System

The integration of artificial intelligence (AI) into patent systems represents a fundamental paradigm shift that challenges traditional concepts of innovation, examination processes, and inventorship. The exponential growth in AI-related patent applications, with approximately 190,000 AI-related patents granted globally between 2000 and 2022, underscores the increasing significance of AI technologies across multiple industries and their impact on intellectual property landscapes (National Science Foundation, 2024). This surge has created unprecedented administrative burdens for patent offices worldwide, including Indonesia, necessitating the adoption of AI-powered solutions to maintain efficiency and quality standards in patent examination processes.

In Indonesia, this challenge is addressed within the existing legal framework, particularly Law of the Republic of Indonesia Number 13 of 2016 concerning Patents, which has been amended through Law Number 65 of 2024. This law provides the legal foundation for patent

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protection in Indonesia, though it still requires adjustments to accommodate the rapid development of AI technology.

Patent offices in Indonesia, through the Directorate General of Intellectual Property (DJKI), have increasingly embraced AI technologies to enhance their operational capabilities, particularly in areas such as automated patent classification, prior art searching, and examination support systems. These implementations have demonstrated significant potential for improving examination efficiency while maintaining quality standards, addressing the growing volume of complex technological disclosures that traditional examination methods struggle to process effectively (Chen et al., 2024). The adoption of AI-powered systems has enabled patent offices to handle the increasing complexity and volume of patent applications more efficiently, particularly in rapidly evolving technological fields where traditional search methodologies may prove inadequate (Martinez & Thompson, 2024).

Legal Framework and Inventorship Challenges in Indonesia

The emergence of AI as a creative force capable of generating potentially patentable inventions has forced patent systems to confront fundamental questions about inventorship requirements and the nature of innovation itself. The landmark Federal Circuit decision in Thaler v. Vidal established a crucial precedent by determining that AI cannot be listed as an "inventor" under current U.S. patent law, effectively maintaining the human-centric approach to inventorship while acknowledging the growing role of AI in the inventive process (Federal Circuit, 2023).

In the Indonesian context, Patent Law No. 13 of 2016 in Article 1 paragraph (3) defines "Inventor" as "a person or several persons who jointly implement ideas poured into activities that produce Inventions." This definition implicitly requires that inventors must be "persons" (humans), which aligns with the Federal Circuit decision in Thaler v. Vidal in the United States.

This is reinforced by provisions in the ITE Law (Information and Electronic Transaction Law) No. 19 of 2016, which states that "AI implementation (Electronic Agents) in Indonesia can only be carried out by persons, state organizers, business entities, and society," indicating that legal responsibility will be borne by electronic system operators who provide AI services.

To provide further guidance, the Indonesian government has issued Circular Letter of the Minister of Communication and Informatics Number 9 of 2023 concerning Artificial Intelligence Ethics. Although this circular does not have binding legal force like laws, it provides important direction on ethical AI use in Indonesia. The USPTO's subsequent guidance on AI-assisted inventions, which became effective in February 2024, represents a significant step toward clarifying the regulatory landscape for AI-related innovations (USPTO, 2024a).

Operational Efficiency and Quality Considerations

The implementation of AI technologies in patent examination has yielded measurable improvements in operational efficiency, particularly in areas such as automated classification and prior art identification. These systems have demonstrated the ability to process large volumes of patent documents more quickly than traditional methods while potentially identifying relevant prior art that human examiners might overlook (Martinez & Thompson, 2024). The efficiency gains achieved through AI implementation have important implications for patent office operations, potentially reducing examination backlogs and processing times while improving the consistency of examination quality across different technological fields.

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However, the adoption of AI systems also introduces new challenges related to transparency and accountability in patent decision-making. The "black box" nature of many AI algorithms raises concerns about the ability to understand and explain the reasoning behind AI-assisted examination decisions, which could have significant implications for patent validity and enforceability (Rodriguez et al., 2024).

In the Indonesian context, Article 52 of Patent Law No. 13 of 2016 governs the Minister's obligation to substantively examine Applications, which requires transparency in the examination process. The use of AI in this process must maintain transparency as mandated by law. These transparency concerns are particularly problematic in the context of patent law, where the ability to understand and review decision-making processes is crucial for maintaining public confidence in the patent system's integrity and fairness.

Economic Implications and Innovation Policy in Indonesia

The economic implications of AI integration in Indonesian patent systems extend far beyond operational efficiency gains, encompassing broader questions about innovation policy and access to intellectual property protection. AI-powered patent systems promise to reduce examination costs and processing times while potentially improving patent quality, which could make patent protection more accessible to smaller inventors and organizations with limited resources (Kim & Lee, 2024).

Patent Law No. 13 of 2016 in Article 20 regulates patent granting that must meet requirements of novelty, inventive steps, and industrial applicability. These efficiency gains could democratize access to patent protection by reducing the time and cost barriers that have historically limited patent system participation to well-resourced entities.

However, the economic benefits of AI implementation must be balanced against concerns about whether these technologies might inadvertently advantage large corporations with greater resources to develop and deploy sophisticated AI tools. Traditional patent theory assumes that patent systems provide necessary incentives for costly research and development activities, but as AI technologies make certain types of innovation faster and less expensive, fundamental questions arise about whether current patent terms and patentability standards remain appropriate (Patel & Singh, 2024).

Research Limitations and Future Directions in Indonesia

Despite the growing importance of AI in patent systems, systematic empirical research on the effectiveness and broader implications of AI implementation remains surprisingly limited, particularly in the Indonesian context. Most existing literature consists of case studies, theoretical analyses, or policy discussions that cannot provide comprehensive insights into the actual impacts of AI integration on patent system performance (Anderson & Brown, 2024).

The methodological challenges facing researchers in this area are substantial and multifaceted. The proprietary nature of many AI tools used by patent offices limits researchers' ability to conduct detailed analyses of system performance and decision-making processes. Additionally, the complexity of measuring patent quality and establishing causal relationships between AI implementation and patent system outcomes presents significant analytical challenges (Anderson & Brown, 2024).

These limitations underscore the need for more systematic research approaches and greater collaboration between patent offices, researchers, and AI developers to generate the empirical evidence necessary for informed policy development. Since 2022, the Draft Law

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(RUU) concerning the second amendment to Law No. 13 of 2016 concerning Patents has been included in the national legislative program (Prolegnas) for 2023, indicating that the Indonesian government recognizes the need for regulatory adaptation to keep pace with technological developments.

Implications for Innovation Policy and Practice in Indonesia

The integration of AI into Indonesian patent systems has broader implications that extend beyond intellectual property law to encompass fundamental questions about innovation policy, economic development, and technological progress. Understanding how AI implementation affects patent system performance is crucial for ensuring that intellectual property policies continue to promote innovation while providing appropriate protection for inventors and facilitating knowledge access for follow-on innovators.

Government Regulation No. 71 of 2019 concerning Electronic Systems and Transactions Implementation and Ministerial Regulation of Communication and Informatics No. 3 of 2021 provide additional frameworks for implementing digital technologies, including AI, in government administration. The interdisciplinary nature of these challenges requires systematic synthesis of research from multiple fields, including law, economics, computer science, and innovation studies.

Recent regulatory developments, including the USPTO's 2024 guidance documents and similar initiatives in other jurisdictions, represent important policy experiments that require systematic evaluation to determine their effectiveness and identify areas for improvement (USPTO, 2024a). The global nature of patent systems and AI development means that policy decisions in one jurisdiction can have significant spillover effects on innovation and competition in others, emphasizing the need for coordinated research and policy development efforts across multiple patent systems and regulatory frameworks.

4. CONCLUSION

The integration of artificial intelligence in Indonesia's patent system marks a paradigmatic transformation that challenges traditional concepts of innovation, examination processes, and inventorship within the intellectual property legal framework. This research reveals that while AI implementation has achieved significant operational efficiency improvements through automation of patent classification, prior art searching, and examination support systems, there are fundamental challenges requiring serious attention within Indonesia's regulatory context. The existing legal framework, particularly Law No. 13 of 2016 on Patents and Law No. 65 of 2024, provides adequate foundation but requires further adaptation to accommodate rapid AI technological developments. Major challenges include transparency in "black box" AI decision-making, knowledge gaps among patent examiners regarding increasingly sophisticated AI technologies, and the need to balance operational efficiency with legal accountability as mandated in Article 52 of the Patent Law. Economic implications of AI integration demonstrate potential democratization of patent protection access through reduced examination costs and time, yet this must be balanced with concerns about disproportionate advantages for large corporations with superior technological resources. This study identifies limitations in systematic empirical research on AI implementation effectiveness and recommends more intensive collaboration between the Directorate General of Intellectual Property (DJKI), researchers, and AI developers to generate empirical evidence

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necessary for informed policy development, as well as the need to accelerate finalization of the Patent Bill included in the 2023 National Legislative Program to comprehensively accommodate AI technological developments in Indonesia's patent system.

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