

Research Article

Comparing Indonesian Patent Law Enforcement with Malaysia, Singapore, and Germany System

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ABSTRACT

Patent enforcement is essential for legal certainty, innovation, and a technology-based investment climate. In Indonesia, however, enforcement remains constrained by limited institutional capacity within the Directorate General of Intellectual Property (DGIP), lengthy dispute resolution, and insufficient technical expertise in judicial proceedings. This study aims to examine the challenges of patent law enforcement in Indonesia and identify institutional and procedural reforms by comparing Indonesia with Malaysia, Singapore, and Germany. The study employs a normative legal methodology with a comparative approach, based on doctrinal analysis of legislation, judicial decisions, and relevant academic literature. The findings show that Malaysia strengthens patent quality through post-grant opposition as an administrative filter against weak patents. Singapore integrates technical assistants to help judges address technological complexities, while Germany applies a bifurcated litigation system supported by a specialized Federal Patent Court. Indonesia needs targeted institutional reforms, including strengthening the DGIP, adopting a post-grant administrative opposition mechanism, and systematically integrating technical expertise into judicial proceedings. Establishing a specialized patent judiciary division is recommended to enhance legal certainty and national innovation competitiveness.

Keywords: Germany; Indonesia; Malaysia; Patent Law Enforcement; Singapore

A. INTRODUCTION

Safeguarding intellectual property rights, especially patents, is a core foundation for promoting innovation, drawing in investment, and enabling technology transfer, an interlinked process that is vital to a country's economic development (Ali et al., 2024; Kaushik et al., 2023; Pratomo & Hastiadi, 2017; Viglioni et al., 2023). Within the context of globalization and knowledge-based economic rivalry, a well-functioning patent system operates not only as an incentive for inventors but also as a strategic tool for fostering technology transfer and economic

growth. For developing countries, a credible patent system is an important condition for attracting research-oriented and technology-driven investment, even though the connection between stronger intellectual property protection and economic gains is not always straightforward and remains complex (Stepanov, 2020).

As the largest economy in Southeast Asia, Indonesia has attempted to harmonize its patent legal framework with international standards by enacting Law No. 13 of 2016 on Patents. This measure demonstrates Indonesia's commitment to intellectual property rights protection while also

responding to global demands for legal certainty for patent holders, consistent with the broader pattern in many developing countries to strengthen their patent regimes in line with international agreements such as TRIPS (Brandl et al., 2019; Sharma, 2015). Normatively, these reforms are expected to enhance the quality of patent protection and reinforce Indonesia's standing within the global trade and innovation system.

However, regulatory revisions have not been consistently reflected in the effective implementation and enforcement of patent laws. Multiple challenges continue to emerge in a multidimensional way, spanning administrative, judicial, and institutional dimensions. These challenges are frequently encountered by developing countries, where constrained financial and human resources, insufficient technological infrastructure, and other institutional deficiencies may impede effective patent law enforcement (Arman & Kahkeshan, 2024). Taken together, these conditions undermine the effectiveness of patent protection and lower the level of confidence among business actors.

From an administrative standpoint, the Directorate General of Intellectual Property often encounters difficulties stemming from the protracted timeline of the substantive examination process, based on information collected by the Directorate General operating under the Ministry of Law of the Republic of Indonesia. After the initial two-month term expires, a maximum

extension period of one (1) month may be granted, provided that an extension application fee is paid in accordance with the prevailing regulations on non-tax state revenue applicable to the Ministry of Law and Human Rights. Another challenge is the restricted depth of technical analysis (Liegalsz & Wagner, 2013). This condition generates substantial legal uncertainty for patent applicants, because the unclear status of patents makes it hard to formulate business decisions and commercialization strategies for technologies (Zhang et al., 2020). In addition, this uncertainty also impacts other market participants, who may not be able to determine whether their new products would infringe patents that are still undergoing examination (Rahayu et al., 2023). Such circumstances may therefore lower the quality of granted patents, particularly in complex areas of technology that develop rapidly.

In judicial practice, resolving patent disputes in court is often made more complex by the technical intricacy of patented inventions and by the relatively limited technical expertise available within the judiciary (Waspiah et al., 2023). This challenge is mirrored in the frequent dependence on expert testimony to evaluate matters such as novelty, inventive step, claim construction, and infringement. The requirement to review highly technical evidence, together with the time needed to secure and assess expert opinions, may extend patent proceedings and also raise the likelihood of inconsistent or inadequately supported judicial determinations

(Purwaningsih & Ariyanti, 2021). Consequently, the effectiveness of adjudication depends heavily on judges having sufficient command of the subject matter of the cases before them, particularly in patent disputes in which the evidentiary process turns on complex technical features of an invention. Such command is necessary for judges to understand, scrutinize, and appraise evidence relating to patent claims, novelty, inventive step, technical specifications, and alleged infringement (Utama, 2012). Judges do not necessarily have to match the technical proficiency of inventors or engineers; nonetheless, they must possess adequate technological insight to evaluate documentary evidence and expert testimony critically, while avoiding overreliance on the competing interpretations advanced by the parties or experts. With sufficient mastery of the subject matter, judges can identify relevant and probative technical evidence, ascertain the facts accurately, and apply the applicable patent law correctly. Therefore, it is essential that judges demonstrate mastery of both the legal and technical dimensions of patent disputes to ensure that the evidentiary process operates effectively and that judicial decisions are accurate, consistent, and able to deliver substantive justice (Crawford et al., 2021). This deficiency in technical understanding constitutes a major barrier to the realization of patent policies intended to promote technological advancement and independence in invention in Indonesia (Purwaningsih & Ariyanti, 2021).

This circumstance is further intensified by the lack of a fully integrated, uniform international system for patent adjudication and enforcement. While the Patent Cooperation Treaty (PCT) currently includes 159 Contracting States and enables international patent filing, the granting and enforcement of patent rights are still governed by national or regional laws and judicial institutions. In practice, this fragmentation is substantial: WIPO reported roughly 3.73 million patent applications worldwide in 2024, and approximately 19.7 million patents in force across 142 jurisdictions (Dewi & Suteki, 2017). In addition, substantive patentability requirements and enforcement mechanisms can vary from one jurisdiction to another, meaning that courts must apply their own national legal standards when resolving patent disputes. As a result, differences in legal frameworks, judicial processes, evidentiary thresholds, and methods for construing technically complex patent claims can yield inconsistent outcomes for comparable disputes across jurisdictions, which in turn undermines consistency, predictability, and effective cross-border patent enforcement (Yang & Sonmez, 2013). Such conditions may produce major disparities in decisions even at the level of individual judges, as shown by research on patent litigation in Germany (Hoffmann et al., 2024). These inconsistent decisions, also documented across multiple European jurisdictions, fundamentally weaken the effectiveness of the patent legal system (Cremers et al., 2017),

generating uncertainty that adversely affects the national technology-driven investment and innovation environment. In Indonesia, difficulties in enforcing patent law are compounded by an insufficiency of qualified law enforcement officials and by the suboptimal use of patent instruments to bolster the competitiveness of industrial products (Quoc, 2021; Saija et al., 2021). In the digital era, these challenges have become even more complex as digital copyright infringement and piracy increase, necessitating more adaptive intellectual property rights policies (Saputra, 2025a).

At the judicial level, commercial courts encounter substantial difficulties when resolving patent disputes because these cases typically require handling complex technical matters that frequently go beyond ordinary legal proficiency. WIPO notes that judicial approaches differ among jurisdictions: in the United States and Singapore, decision-makers largely are legally trained judges, whereas Germany and the Republic of Korea make use of judges with technical qualifications or specialized judicial arrangements. This comparative practice indicates that sufficient technical competence is crucial for judges to evaluate expert testimony and technical evidence accurately in relation to novelty, inventive step, claim construction, and infringement, thereby supporting decisions that are correct, timely, and impartial (Lee, 2010). Without a structured means of supplying technical expertise, patent adjudication may become inconsistent and patent

holders and investors may face greater uncertainty. WIPO's 2025 International Guide to Patent Case Management, which covers 11 patent-intensive jurisdictions, illustrates marked variation in judicial specialization and technical support: some jurisdictions appoint technically qualified judges, while others depend on technical advisers, judicial research officers, or external experts. WIPO also confirms that the extent to which expert evidence is relied upon differs with the technical expertise of the judges sitting in the case. These differences are especially consequential because patent litigation often turns on complex issues such as claim construction, novelty, inventive step, and infringement, and disputes can also carry significant economic implications alongside uncertain outcomes. Consequently, when judges lack consistent institutional support for interpreting technical evidence, the predictability and consistency of patent adjudication may be undermined, leading to heightened legal and commercial uncertainty for patent holders and investors (Cremers et al., 2016; Hoffmann et al., 2024; Zingg & Elsner, 2020). Research indicates that judges must possess a strong grasp of technology within the patent field (Crawford et al., 2021), and substantial variation in judicial determinations regarding patent validity can arise (Hoffmann et al., 2024). Such inconsistency—commonly observed across multiple jurisdictions—diminishes the effectiveness of the legal system (Cremers et al., 2016). Ultimately,

this situation adversely affects Indonesia's technology-driven investment climate, since evidence suggests that improving judicial efficiency through judges with specialized expertise can stimulate innovation (Kim et al., 2025). Nonetheless, inadequate infrastructure and low public awareness, together with the complexity of emerging technologies such as artificial intelligence, blockchain, and NFTs, have weakened law enforcement because existing regulations have not yet been designed to accommodate these technologies (Syarief & Pratiwi, 2025).

This contrast becomes even more compelling in comparison with several other jurisdictions that have succeeded in putting in place more dependable patent enforcement systems. Malaysia has shown progress through administrative reforms by reinforcing patent screening mechanisms, including the adoption of post-grant opposition to enhance the quality of enforceable patents. Post-grant opposition mechanisms have been shown to effectively screen out low-quality patents and to strengthen legal certainty, which in turn supports further innovation (Gaessler et al., 2025; Liu, 2018). Singapore is emerging as a regional intellectual property rights hub, supported by an efficient judicial system and integrated technical expert assistance throughout the adjudication process (Loon, 2023; Yan, 2024). The efficiency of the judicial system, particularly with respect to intellectual property, has a marked positive effect

on corporate innovation (Kim et al., 2025). By contrast, Germany provides an example of patent system maturity through the introduction of a bifurcated litigation structure and the presence of highly specialized patent courts, staffed by judges with strong technical qualifications. Such features are widely viewed as essential for understanding the technical dimensions of complex inventions (Crawford et al., 2021; Hoffmann et al., 2024). Rapid technological developments, including those in artificial intelligence and blockchain, further hinder effective patent enforcement, especially because the existing legal framework has not yet fully accommodated these changes (Saputra, 2025b).

This study sets itself apart from prior research by adopting a distinct focus, a comparative scope, and an analytical framework. First, Sudirman and Disemadi investigated patent protection in Indonesia, Singapore, and Hong Kong, especially in relation to registration procedures, the duration of protection, and dispute resolution (Sudirman & Disemadi, 2021). By contrast, the present study expands the comparative analysis to include Indonesia, Malaysia, Singapore, and Germany, placing particular emphasis on law enforcement, dispute resolution mechanisms, judicial capacity, and technical proficiency in patent litigation. Therefore, whereas the earlier work primarily examined the regulatory aspects of patent protection, this study gives greater attention to the

institutional and procedural effectiveness of patent law enforcement.

Second, Purwaningsih compared patent laws and enforcement in Indonesia, Japan, and the United States. Although that study engaged with law enforcement, the present research differs in the choice of comparative jurisdictions and in its emphasis on the relationship between the substantive patent protection framework and the institutional capacity needed to enforce patent rights effectively (Purwaningsih, 2020). By examining Malaysia, Singapore, and Germany alongside Indonesia, this study aims to discern comparative legal and institutional strategies that could support improvements in patent enforcement in Indonesia.

Third, this study analyzed divided infringement and the protection of patent holders in Indonesia using normative, comparative, and case-study approaches. While their research concentrated on a particular infringement issue and its implications for patent-holder protection, the present study takes a broader stance by examining the enforcement framework for patent disputes, including dispute resolution mechanisms, judicial capacity, and the technical competence required to evaluate evidence in patent litigation. Accordingly, the contribution of this study rests on linking the protection of patent rights to the institutional and evidentiary requirements necessary for resolving patent disputes effectively (Girindra et al., 2024).

Fourth, Saputro examined the significance of claims in simple patent applications under Indonesian patent law. Unlike that claim-focused research, the present study does not center on a specific component of patent applications (Saputro, 2025). Instead, it addresses the broader challenges involved in enforcing patent rights, with particular attention to the ability of judicial institutions to understand patent-related technical evidence and to apply patent law consistently in dispute resolution. This difference positions the present study within the wider debate on the effectiveness of patent enforcement, rather than on the formal and substantive requirements of patent applications.

Fifth, Chaliva and Tarina analyzed the implementation of accelerated services for simple patents under the Job Creation Law (Chaliva & Tarina, 2023). Their work emphasized administrative procedures and the rollout of an accelerated patent service mechanism. In contrast, the present study focuses on another phase within the patent protection framework, namely the enforcement of patent rights after disputes have arisen. By concentrating on law enforcement, dispute resolution, judicial capacity, and technical proficiency in evidentiary proceedings, this study seeks to extend research on administrative patent services through an examination of the institutions and procedures tasked with resolving patent disputes.

Based on these comparisons, the novelty of this study lies in its integrated examination of

patent law enforcement in Indonesia through a comparative analysis with Malaysia, Singapore, and Germany. Rather than focusing exclusively on regulatory comparisons, specific infringement doctrines, patent-claim requirements, or administrative acceleration mechanisms, this study examines the interrelationship between the legal framework, dispute resolution mechanisms, judicial capacity, and technical proficiency in evaluating evidence in patent cases. This approach is intended to identify legal and institutional challenges that may affect the consistency, effectiveness, and fairness of patent enforcement in Indonesia. Accordingly, the study is expected to contribute to the development of a more coherent and effective patent enforcement framework, particularly by providing a comparative basis for strengthening judicial competence and the adjudication of technically complex patent disputes.

Based on this background, this article aims to analyze in depth the challenges of patent law enforcement in Indonesia through a comparative law approach with Malaysia, Singapore, and Germany. The main focus of this study is to identify how these jurisdictions address the administrative and judicial issues still faced by Indonesia, as well as to formulate relevant policy lessons to strengthen national patent legal certainty. Through a normative comparative approach, this article is expected to contribute academically and practically to institutional reform of patent law enforcement in Indonesia.

B. RESEARCH METHODS

This research uses a normative juridical problem-based approach method combined with a comparative approach, drawing on doctrinal analysis of statutory regulations, judicial decisions, and relevant academic literature to meet descriptive research requirements. To carry out the study, a range of applicable national and international laws and regulations were reviewed. The collected data were then organized using deductive reasoning. A literature study is the author's means of gathering data. In general, secondary data are employed, including primary legal materials (such as laws and regulations related to geographic indications), secondary legal materials (such as books, journals, proceedings, and papers addressing geographic indications), and tertiary legal materials (such as English and legal dictionaries).

C. RESULTS AND DISCUSSION

1. Institutional Capacity and Examination Efficiency: Indonesia Vs. Malaysia

Normatively, the patent laws of Indonesia and Malaysia exhibit core commonalities, because both are grounded in the patent protection benchmarks set out under the TRIPS Agreement. These benchmarks relate, in particular, to the requirements of novelty, inventive step, and industrial applicability, and they also provide patent protection for a term of 20 years from the filing date. In Indonesia, the patent system is mainly governed by Law No. 13

of 2016 on Patents, as amended, under which Article 22 provides that a patent is granted for 20 years from the Filing Date and is not extendable, whereas a simple patent receives protection for 10 years. By contrast, Malaysia regulates patents through the Patents Act 1983 (Act 291) and its subsidiary regulations; under Section 35, the patent term is 20 years from the filing date. Malaysia further acknowledges a utility innovation regime, which grants an initial protection period of 10 years that can be extended twice for an additional five years each, thereby setting its approach apart from Indonesia regarding the legal framework for safeguarding simple innovations (Ariyanti, 2010). Accordingly, the main similarities between the two countries rest on their substantive patent standards and the length of patent protection. The principal differences, however, concern the legal architecture for protecting simple innovations, the administrative mechanisms, and certain exceptions and compulsory licensing provisions. From a comparative standpoint, Malaysia therefore offers a more flexible option for protecting innovations with a lower level of technical advancement through the utility innovation regime, whereas Indonesia handles such innovations through the separate category of simple patents (Disemadi et al., 2026).

Institutional capacity is the primary basis for effective patent law enforcement, because the quality of patent protection is largely determined during the administrative examination stage. In

Indonesia, this function is performed by the Directorate General of Intellectual Property (DJKI), which carries out both the formal and substantive examination of patent applications. The magnitude of this institutional challenge is evident in the substantial volume of patent applications and its continuing growth. In 2023, DJKI received 15,033 patent applications, about 36.9% of which came from domestic applicants; in 2024, domestic patent applications alone rose to 6,757, the highest figure in the last decade, and it corresponds to an average annual growth rate of 14.7% since 2015. This expanding workload is reinforced by the fact that by May 2024, DJKI had already received 4,511 patent-related applications, comprising 3,723 patent applications, 785 simple patent applications, and three PCT applications. The rising number of applications exerts considerable structural pressure on the patent administration system, particularly in ensuring that substantive examination is completed within a reasonable timeframe and with sufficient technical depth. The importance of this issue is heightened by the fact that patent examination demands not only legal expertise but also specialized technical competence aligned with increasingly complex technological fields. Accordingly, the effectiveness of patent protection in Indonesia cannot be judged solely by the adequacy of the statutory framework; it must also be assessed in relation to DJKI's institutional capacity, including the availability of patent examiners, technological

infrastructure, workload management, and administrative efficiency. Without a proportional strengthening of these institutional capacities, the ongoing increase in patent applications may generate an examination bottleneck that could affect the timeliness, consistency, and substantive quality of patent examination (Arman & Kahkeshan, 2024).

Under Article 57 of Law No. 13 of 2016 on Patents, the substantive examination must be concluded within a maximum period of 30 months, so this duration functions as a statutory time limit rather than an optimal processing period. Such delays generate substantial legal uncertainty for applicants (Zhang et al., 2020), because the unclear status of patents makes it difficult to plan business decisions and commercialization strategies. These uncertainties affect not only applicants, but also other market participants, who may be unable to determine whether their new products will infringe patents that have not yet been decided (Sulistianingsih et al., 2025). With respect to investment, this uncertainty directly lowers investor interest, particularly in research and development-oriented industries that rely heavily on strong and predictable patent protection (Liegsalz & Wagner, 2013). Studies further indicate that postponements in the patent granting process can impede technology diffusion and subsequent innovation (Hegde et al., 2021). This pattern motivates companies to delay key decisions or adopt a wait-and-see approach when uncertainty

is high, thereby slowing the pace of innovation (Cao et al., 2021). In addition, policy uncertainty more broadly has been shown to obstruct innovation across different sectors (William & Fengrong, 2022). A comparable situation where persistent delays in processing patent applications create legal uncertainty and constrain economic development has also been observed in other developing countries, such as Brazil, where the time required for patent grant is 10.8 years (Garcez & Moreira, 2017).

In addition to time limitations, the quality of substantive examination is also a central concern. Indonesia's small pool of patent examiners continues to be a major institutional constraint. As of January 2025, the Directorate General of Intellectual Property (DJKI) employed only 110 patent examiners, each of whom reviewed an average of 120–180 patent applications per year, while Indonesia received 15,027 patent applications in 2023. Such a workload creates substantial strain on examiners, especially because substantive examination involves not only legal evaluation but also specialized technical knowledge and thorough prior-art searches. The institutional shortfall is further evidenced in DJKI's Strategic Plan for 2025–2029, which calls for up to 545 additional patent examiner positions by 2029 to respond adequately to the rising volume of patent applications, alongside variations in technical expertise, making it difficult for DJKI to carry out in-depth assessments of complex,

multidisciplinary inventions (Righi & Simcoe, 2019). Insufficient examination time can undermine examiners' ability to identify and reject invalid applications (Al Asy'arie et al., 2024). Consequently, there is a significant risk that patents may be granted without adequate testing of novelty and inventive step, a malfunction of the patent system that exacerbates market competition (Encaoua & Madies, 2014). These low-quality patents are not only exposed to legal challenges (Roisah et al., 2022), but also may serve as triggers for future disputes, thereby weakening the integrity of the patent system as a whole (Kwon, 2021).

The presence of weak patents harms not only parties directly affected, but also imposes additional burdens on the entire law-enforcement framework, because low-quality patents are vulnerable to legal challenges and can initiate disputes later on (Kwon, 2021). Patent litigation itself is a costly and complex undertaking, often requiring extensive time and incurring high expenses due to its technical complexity (Lee, 2010). Patent cancellation disputes, which should be addressed at the administrative stage, are instead moved into the judicial realm, such as the Commercial Court. This extends the dispute resolution process, increases legal expenses, and further strains the Commercial Court, which also handles other commercial matters—resulting in inefficiencies that are harmful to the investment climate (Kim et al., 2025). Reforms aimed at improving patent quality through new

administrative procedures can substantially reduce litigation costs (Kesan & Ball, 2006; Vishnubhakat et al., 2016).

Relative to Indonesia, Malaysia reflects a more flexible institutional strategy for dealing with comparable challenges (OECD, 2015). As a developing country with a similar regional economic standing, Malaysia also needs to raise the quality and effectiveness of its patent system. Nevertheless, Malaysia has chosen an administrative model that pairs substantive examination with avenues for third-party review. Under Sections 29A and 30 of the Patents Act 1983, patent applications first receive a preliminary examination, followed by a substantive or modified substantive examination carried out by patent examiners, who evaluate compliance with the substantive criteria for patentability. In addition, Malaysia offers a procedure for third-party observations after publication of the patent application, enabling interested parties to submit potentially relevant information about an invention's patentability to the Patent Registration Office prior to grant. The official MyIPO process further includes post-grant opposition, under which any interested party may contest a granted patent on grounds such as non-patentability, lack of novelty, lack of inventive step, and prohibited subject matter. This multilayered approach allows patentability to be evaluated not only through administrative examination but also through external scrutiny by interested parties, which may enhance the quality

of patent grants and lower the likelihood of keeping patents that do not meet the substantive requirements for patentability (Atmaja et al., 2021). From an administrative standpoint, the same arrangements may also increase the efficiency of intellectual property management by permitting relevant prior art information and objections to be incorporated into both the examination stage and the post-grant review process, thereby improving the accuracy and dependability of patent determinations (Marco et al., 2019), and patents exhibit a heterogeneous distribution of quality (Higham et al., 2021). The quality and reliability of patent rights arising from substantive examination are closely tied to their commercial prospects: patents that deliver clear, valid, and enforceable legal protection are more likely to be treated as valuable intangible assets and used for licensing, investment, technology transfer, and commercialization. Moreover, Malaysia aims to expand the creation of intellectual property value through commercialization and through using intellectual property as an asset, while also improving the efficiency of intellectual property management including by launching a government-supported intellectual property guarantee pilot project to enhance access to commercialization financing (Budi, 2019). Taken together, these steps seek to strengthen the innovation ecosystem by ensuring that patents are granted effectively and also carry clear commercial value, a dimension that remains under development for Indonesia (Roisah, 2018).

The most consequential step is the introduction of a post-grant opposition mechanism, which enables third parties to raise objections to already granted patents through a more streamlined administrative procedure (National Research Council, 2003). This mechanism functions as an essential corrective measure to address potential weaknesses in the initial substantive examination. By offering a relatively fast, lower-cost administrative venue, the system helps keep patent validity disputes from being taken straight to court, thereby easing the litigation workload and enhancing the system's overall efficiency (Roisah, 2015). Such mechanisms have demonstrated success in screening out low-quality patents and strengthening legal certainty (Liu, 2018). For instance, in the opposition system at the European Patent Office, the patent cancellation rate is about 41%, and patent-right restrictions arise in 30% of other cases, highlighting its effectiveness for post-grant quality control (Graham et al., 2002).

The presence of post-grant opposition also provides a strong institutional incentive for patent authorities to improve examination quality (Hayuningrum & Roisah, 2015). Patent examiners know that every patent that is granted may be subject to public re-examination, which encourages the use of stricter and more comprehensive examination standards. Over the long run, this mechanism helps increase public confidence in the patent system and has been

shown to encourage further innovation by promoting freedom to operate through the invalidation of unmeritorious patents (Gaessler et al., 2025). The invalidation of unmeritorious patents through the post-grant opposition process has been found to raise subsequent innovation by as much as 16% according to citation-based measures (Gaessler et al., 2025). This mechanism enables more efficient re-examination of patents than court litigation, while also generating useful information about prior art that may have been overlooked during the initial examination (Masur & Ouellette, 2023).

This comparison indicates that institutional capacity constraints do not always need to be handled by expanding the role of the courts. Indonesia can draw important lessons from Malaysia's strategy by strengthening administrative mechanisms as the first line of defense for patent quality an approach that has proven capable of producing substantial social welfare benefits by reducing the unnecessary social costs associated with low-quality patents (Schankerman & Schuett, 2022). Introducing a post-grant opposition system could substantially reduce litigation burdens (Kesan & Ball, 2006), functioning as an effective, accessible, and accurate alternative to court litigation regarding patent validity (Vishnubhakat et al., 2016). It would also improve the quality of patents in circulation (Graham et al., 2002; Liu, 2018), and ultimately reinforce legal certainty while supporting the national innovation environment by

enabling further innovation (Gaessler et al., 2025).

2. Dispute Resolution Mechanisms And Technical Expertise: Indonesia Vs. Singapore

The patent dispute resolution mechanism is a pivotal phase in law enforcement, because it is at this point that patent protection is effectively tested. In Indonesia, responsibility for resolving patent disputes is vested in the Commercial Court. While this court is established as a specialized forum for commercial matters, the technically driven character of patent disputes creates distinctive challenges for the judicial system. Patent litigation is inherently more complex and calls for a thorough grasp of the relevant science or technology (Lee, 2010).

A comparison of patent dispute resolution mechanisms between Indonesia and Singapore should be based on both the level of patent protection and the number of disputes handled within each jurisdiction. For Indonesia, the analysis should take into account the counts of granted standard patents and simple patents, as well as the number of disputes concerning each category that have been settled through litigation and alternative dispute resolution (ADR). Likewise, for Singapore, the analysis should separate granted standard patents from utility innovations, where applicable, and determine the volume of disputes resolved through court proceedings and ADR mechanisms. These data matter because the number of granted patents

offers an empirical indication of the likely scale of patent disputes and the workload confronting dispute-resolution institutions (Rifqi et al., 2023). Accordingly, the comparison between the two jurisdictions should assess not only the formal availability of litigation and ADR under their respective patent laws, but also how extensively these mechanisms are actually used in practice. The information should be reported for comparable time periods and drawn from dependable institutional sources, including the Directorate General of Intellectual Property (DJKI), Indonesian courts, the Intellectual Property Office of Singapore (IPOS), and the courts of Singapore.

The effectiveness of these dispute-resolution mechanisms should also be evaluated in light of the technical complexity inherent in patent disputes. Patent litigation typically involves adjudicating technically intricate matters, such as novelty, inventive step, prior art, claim construction, infringement, and the technical scope of the invention. Accordingly, access to appropriately qualified patent examiners, judges, experts, mediators, and other technical professionals is a key element of effective dispute resolution. To show how legal norms function in practice, a comparative table should be provided at the end of each subsection, outlining the relevant regulatory framework and how it is applied in Indonesia and Singapore. At a minimum, the table should compare the jurisdiction and procedures for patent litigation,

the availability and use of ADR, the handling of standard patents as well as simple/utility patents, the extent of technical expertise involvement, and the empirical implementation of these mechanisms. Such a comparison of norm implementation would allow the study to determine whether differences between Indonesia and Singapore stem solely from differences in statutory design or also from differences in institutional capacity, technical expertise, and the actual use of dispute-resolution mechanisms (Kurniawan et al., 2025).

Judges in Indonesia's Commercial Court generally have legal backgrounds rather than technical or scientific ones, which could create a potential institutional gap in the adjudication of patent disputes. This is particularly significant given that patent litigation requires judges to understand highly technical matters, including the interpretation of patent claims and descriptions of inventions, as well as prior art, inventive steps and the technological differences between the patented invention and the product or process in question (Roisah & Setiyono, 2019). While judges can rely on expert evidence and technical assistance, a lack of in-house technical expertise can complicate judicial assessment and increase reliance on the quality and presentation of expert testimony submitted by the parties. Consequently, disputes involving sophisticated technologies may predominantly be assessed through legal and procedural frameworks rather than through a

comprehensive understanding of the underlying technology (Roisah, 2017).

This institutional limitation may also affect the consistency and predictability of patent adjudication. Where judges possess different levels of familiarity with complex technologies and technical evidence, similar patent disputes may potentially produce different assessments, particularly in relation to claim construction, novelty, inventive step, and infringement. Recent empirical research indicates that judicial decision making may vary considerably at the individual judge level, demonstrating the importance of judicial expertise and consistency in patent adjudication (Hoffmann et al., 2024). Therefore, strengthening technical capacity within the Commercial Court system through specialized judicial training, greater access to independent technical experts, and institutional mechanisms for consistent technical assessment is essential to ensure that patent disputes are resolved not merely according to procedural and legal considerations, but also on the basis of a rigorous understanding of the technological substance of the dispute.

This condition affects the consistency and predictability of decision-making. Research indicates that substantial differences in judicial outcomes may arise at the level of individual judges in patent validity disputes, even after accounting for other contextual factors (Hoffmann et al., 2024). Such unpredictable rulings heighten legal uncertainty for both patent holders and

alleged infringers. For firms particularly in high-technology sectors this uncertainty represents a major risk that can impede investment and strategic business decisions (Dejuan-Bitria & Mora-Sanguinetti, 2021; Janicke, 2005). This kind of “investment-killing” legal uncertainty calls for legal reform to promote investment in innovative fields (Roisah et al., 2023).

In Indonesia, expert involvement in patent trials remains largely ad hoc and has not been structurally incorporated. Experts are frequently introduced by the parties as witnesses, which means their role functions more as a form of evidence than as a neutral partner to the court. This arrangement makes it difficult for judges to access an objective and comprehensive technical understanding, even though patent litigation necessarily depends on a thorough grasp of the underlying science or technology (Lee, 2010). By contrast, studies suggest that embedding judicial expertise for example, through pilot programs in which expert judges manage patent cases can substantially increase patent-driven innovation (Kim et al., 2025). Reforms to the litigation process, such as simultaneous expert testimony or written expert reports, can improve trial accuracy (Gertner & Sanders, 2018), thereby reinforcing the case for a more structured and neutral model than an adversarial expert-witness system.

Singapore takes a different, more structured approach to resolving patent disputes, with a legal and institutional framework designed

to incorporate specialised intellectual property expertise into the adjudication process. This integration is supported by judicial specialisation and access to technical expertise in complex patent proceedings. Judges dealing with intellectual property disputes must assess technically complex issues such as claim construction, the scope of patent protection, novelty, inventive step, prior art and infringement. Having access to specialised judicial expertise can improve the quality and consistency of decisions, as judges who regularly handle intellectual property disputes are more familiar with the interaction between legal and technological considerations. In addition, technical assistance and expert evidence can be employed when disputes involve highly specialised scientific or technological issues. This is particularly important in patent litigation, where courts must understand not only the legal validity of a patent, but also the underlying scientific and technological principles of the invention (Lee, 2010). Consequently, Singapore's approach combines judicial specialisation with access to technical expertise, thereby reducing the risk of technically complex patent disputes being determined solely from a procedural or doctrinal perspective.

Singapore also actively promotes alternative dispute resolution (ADR) as a mechanism that complements litigation. IPOS offers parties participating in intellectual property proceedings, including patent disputes, a

voluntary mediation option that can be initiated at any point before IPOS issues its decision; once the parties select mediation, the IPOS proceedings are generally suspended so that the mediation can proceed. IPOS also facilitates mediation by providing financial incentives, enabling eligible parties to obtain funding of up to S\$8,000 or S\$12,000 to cover mediation-related costs. In addition, IPOS works with the WIPO Arbitration and Mediation Center, which supplies specialized mediators and an expert-determination mechanism for patent proceedings, including disputes involving patent claims, licensing rights, valuation, royalties, and damages. For patent and other intellectual property disputes that are already pending before Singapore courts, parties may likewise refer the matter to WIPO Mediation, and any settlement may be recorded as a court order, making the settlement directly enforceable.

These mechanisms show that Singapore's ADR framework is not simply an alternative to litigation, but is embedded within a wider institutional strategy for resolving technically complex IP disputes in a more flexible, confidential, and cost-effective way. However, the available official statistics do not offer a directly comparable annual breakdown of patent disputes resolved through ADR versus those resolved through patent litigation. IPOS does provide annual statistics on IP filings, registrations, and dispute-resolution activities, yet the published figures do not consistently separate patent

disputes into ADR and court litigation categories. Accordingly, the lack of a comparable numerical dataset should be treated as a limitation in its own right, rather than being used to present an unsupported ratio between ADR and litigation. By integrating technical expertise, judges in Singapore can render decisions that are more grounded in technological substance while preserving legal consistency. The central purpose of litigation is to reach the correct outcome and deliver justice to the parties, which is especially pertinent when the process includes expert testimony (Gertner & Sanders, 2018). This stands in contrast to systems that depend on generalist judges, where insufficient technical understanding may produce judgments that emphasize procedural matters more heavily and therefore lead to substantial variation in judicial decisions (Hoffmann et al., 2024).

Beyond the courts, Singapore also actively promotes the resolution of patent disputes through alternative mechanisms, such as mediation and arbitration. These mechanisms provide flexibility, speed, and confidentiality, which are frequently preferred by industry participants over traditional litigation. Arbitration or mediation offers many benefits over conventional litigation, including low costs, very short dispute-resolution timelines, and predictability particularly in high-tech business disputes (Elfakharani et al., 2019). The availability of alternative dispute-resolution options enables intellectual property disputes to be resolved efficiently (De, 2012).

The combination of technical expertise integrated into the judicial system and access to multiple alternative dispute-resolution channels yields a framework that is highly responsive to the needs of the business sector in Singapore. A well-designed ADR system will better serve the interests of the parties and produce tailored solutions for their complex disputes (Lemley, 2015). An efficient system with strong intellectual property protection is a key driver of an innovation economy and helps attract foreign investment (Yan, 2024). Therefore, Singapore's holistic approach not only strengthens patent enforcement, but also sustains the national innovation and investment environment.

Singapore's experience indicates that incorporating technical expertise is not simply an added benefit, but a necessary component of modern patent enforcement that enhances the quality of decisions, strengthens legal certainty, and fosters innovation and investment. This perspective is exemplified by the High Court's decision in *Lee Tat Cheng v Maka GPS Technologies Pte Ltd* [2017] SGHC 48, which involved a dispute over patent infringement and validity in which the Court explicitly underscored the significance of expert evidence in addressing technically complex patent matters. The Court explained that experts help the judiciary to understand the meaning of technical terms and phrases in patent specifications, the scope of patent claims, the disclosure of prior art, the practical operation of the claimed invention, and

the technical differences between the patented invention and the allegedly infringing devices. The Court also stressed that expert evidence allows the judge to assess patent claims from the perspective of the “person skilled in the art,” while the final determination of legal questions remains the Court’s responsibility. The case thus illustrates a functional framework for integrating technical input into adjudication: technical experts supply the scientific and technological basis required for decision-making, whereas judges retain sole responsibility for applying the relevant legal standards. This separation is especially important in evaluating claim construction, novelty, inventive step, and infringement, where an accurate grasp of the underlying technology is vital to the legal conclusion. Accordingly, Singapore’s experience suggests that the systematic incorporation of technical expertise into patent adjudication can lower the likelihood that decisions rest solely on abstract legal reasoning, and can support greater consistency, accuracy, and legal certainty when resolving technologically complex patent disputes (Kim et al., 2025; Loon, 2023; Yan, 2024). For Indonesia, putting in place a structured technical support mechanism for patent judges modeled on the specialist judges and technical assistants structure in Singapore is a critical strategic measure to improve both the accuracy and the efficiency of handling patent disputes (Gertner & Sanders, 2018; Lee, 2010). The availability of effective alternative dispute resolution channels

has also been shown to be crucial for high-technology industries, providing the speed and predictability of resolution that businesses and investors urgently require (Elfakharani et al., 2019).

3. Maturity Of The Legal Framework And Judicial Specialization: Indonesia Vs. Germany

Germany is widely considered to have one of the most mature patent enforcement systems in the world. This maturity is reflected in an institutional design that prioritises specialisation. Unlike Indonesia, which concentrates patent disputes in one type of court, Germany has a clear and functional division of authority.

A notable feature of the German system is its bifurcated patent litigation, whereby infringement and revocation claims are handled separately. This dual-track system has been in place since the early days of German patent law. Infringement suits are handled by district courts with extensive experience in commercial cases, while the Federal Patent Court has exclusive jurisdiction over invalidation suits. This separation of powers enables each court to specialise in the areas within its expertise, with the district courts handling commercial aspects and the Federal Patent Court reviewing the technical validity of patents.

The Federal Patent Court has a unique composition of judges, combining legal and technical expertise within one panel. Technical judges have scientific and engineering

backgrounds, enabling them to thoroughly assess novelty, inventive step and sufficiency of disclosure. This collaboration ensures that patent validity is tested comprehensively with a strong technical understanding a crucial aspect, given that patent litigation inherently requires an in-depth knowledge of the underlying science or technology. This specialisation contributes to the largest caseload in Europe (Cremers et al., 2016) and aims to ensure higher-quality, more in-depth decisions, which in turn increase legal certainty and predictability for industry players. Predictability is a key factor in business planning and legal risk management for industry players. The knowledge that patent disputes will be handled by a truly competent forum boosts confidence in the legal system.

Despite inherent weaknesses in Germany's bifurcated patent litigation system such as the possibility that preliminary injunctions may be issued for infringements before the Federal Patent Court has definitively ruled on the patent's validity empirical practice indicates that strict oversight mechanisms and high standards of caution have been effective in reducing these adverse effects. Infringement cases before the district courts use a stringent evidentiary threshold for injunctions, which ensures that only patents with strong *prima facie* validity can stop rivals' commercial activities, thereby preventing exploitation of the system by weak patent holders (Cremers et al., 2016). European litigation data further shows that Germany, the jurisdiction with

the largest patent caseload on the continent, has preserved a balance between the speed of infringement enforcement and the thoroughness of validity review, with the patent cancellation rate remaining consistently proportionate due to specialization (Hoffmann et al., 2024). This model not only safeguards original innovators, but also deters temporary monopolies that undermine market competition, demonstrating that bifurcation is not a structural defect but an adaptive feature governed with institutional precision (Lee, 2010).

The caliber of patent validity decisions in Germany continues to constitute a major competitive advantage of this bifurcation system, reinforced by the composition of the Federal Patent Court panel, which combines legal judges with technical judges drawn from scientific and engineering backgrounds. These technical judges can carry out deep analyses of patent requirements such as novelty, inventive step, and sufficiency of disclosure, assessments that frequently call for specific knowledge of the most recent technological developments, leading to decisions that are more grounded and less reliant on partisan expert testimony (Gertner & Sanders, 2018; Lee, 2010). A comparative study of European litigation indicates that Germany's much higher case volume than that of the UK, France, or the Netherlands does not undermine decision quality; rather, it broadens judges' experience and supports predictable precedents for industry (Cremers et al., 2016). This incorporation of technical expertise differs from

generalist approaches, where discrepancies between judges often stem from technical misunderstandings rather than from differences in case facts, thereby strengthening overall legal certainty (Hoffmann et al., 2024; Oytana & Chappe, 2018).

The maturity of the German patent system is further reinforced by its deep integration into the European regional patent framework, including the new Unified Patent Court, where the principle of national bifurcation is recalibrated for supranational harmonization while preserving local efficiency. As the hub for European patent litigation, Germany manages thousands of cases each year, positioning it as a benchmark for other jurisdictions seeking to handle transnational complexity without lowering national standards (Cremers et al., 2016). This framework shows that domestic specialization can work in synergy with international integration: the Federal Patent Court functions as a credible gatekeeper of validity, shaping the interpretation of patent law across the European Union and even worldwide (Lee, 2010). Germany is therefore not only an effective practitioner but also a substantial driver of the development of international patent norms, through active engagement in WIPO and EPO, which strengthens its standing as a point of reference for developing countries aiming to reform their systems (Kim et al., 2025).

Compared with Indonesia, the patent judicial system which remains centered on the Commercial Court—reveals a pronounced

structural lag, as generalist judges handle a wide range of commercial matters with no patent-specific differentiation, producing inconsistent rulings and heavy dependence on external expert testimony that is frequently biased (Gertner & Sanders, 2018; Lee, 2010). Because there is no specialized forum for patent validity, infringement and revocation actions are often combined, which leads to prolonged delays and less comprehensive decisions, unlike the efficiency of Germany's bifurcation model, which clearly delineates competencies. In Indonesia, the shortage of technically trained judges intensifies these difficulties, since limited familiarity with technology results in substantial variation in how inventive step or infringement is assessed, ultimately eroding investor confidence in intellectual property as an asset (Cremers et al., 2016; Oytana & Chappe, 2018). This pattern produces an unpredictable legal environment, discouraging domestic innovation and impeding inward foreign direct investment flows, whereas Germany illustrates that specialization is an essential condition for a sustainable innovation economy (Kim et al., 2025).

Germany's experience suggests that, despite the difficulty of implementing the principles of bifurcation and specialization for resource-constrained countries such as Indonesia, their gradual adoption can serve as a catalyst for essential reforms. These reforms should begin with training technical judges and creating a specialized validity panel within the

Commercial Court (Lee, 2010). In addition, such changes will not only enhance the accuracy of decisions but also reinforce Indonesia's integration into the ASEAN and global patent ecosystems, in a way that parallels how Germany built on its position in Europe (Cremers et al., 2016). Accordingly, shifting to a specialization model would move Indonesia's patent system from a reactive to a proactive stance, promoting high-technology investment and knowledge-based economic growth. This is consistent with the direct correlation between judicial efficiency and innovation output observed in advanced jurisdictions (Gertner & Sanders, 2018; Kim et al., 2025). Implementing this approach can also mitigate regulatory uncertainty and policy changes that often disorient business actors in Indonesia, as has been seen across multiple legal areas (Rizky & Rahayu, 2025). Moreover, improving the quality and consistency of patent decisions through judicial specialization aligns with broader legal reform efforts in other sectors, such as the management of import classification disputes, which likewise demand specialized expertise to prevent biased decisions.

A comparison with Germany shows that the effectiveness of patent enforcement depends largely on institutional design and the degree of specialization. Integrating technical expertise with judicial specialization not only helps produce a more uniform and standardized judicial intellectual property regime, as illustrated by the creation of specialized IP courts in China (Zou & Zhu, 2024),

but also is directly associated with higher levels of innovation (Kim et al., 2025) and more predictable judicial outcomes (Hu et al., 2020). While complete implementation of the German model may not be feasible in the short term, its core principles judicial specialization and the integration of technical expertise can serve as valuable benchmarks for patent system reform in Indonesia. A strong and effective patent protection system in a country, particularly in a developing country, has been shown to increase foreign direct investment inflows and support sustainable economic growth (Pratomo & Hastiadi, 2017). Accordingly, reinforcing these principles is crucial for Indonesia to enhance innovation competitiveness and attract investment. This strategy will also support the resolution of patent litigation disputes that currently continue to face difficulties related to efficiency and fairness, and it will further strengthen Indonesia's technological innovation ecosystem (Syamhadi et al., 2023). In addition, optimizing intellectual property protection policies in the digital era is especially important for addressing challenges such as piracy and copyright infringement, which remain widespread in Indonesia (Saputra, 2025a). Rapid advances in digital technology require more adaptive intellectual property rights policies and stronger law enforcement, consistent with the objective of promoting technology and achieving technological independence in Indonesia (Purwaningsih & Ariyanti, 2021; Saputra, 2025b).

4. Patent Legal Certainty And Its Implications For The Investment And Innovation Climate

The link between patent activity, investment, and economic growth can be demonstrated using comparative empirical indicators from Indonesia and Singapore. Patent applications serve as a key proxy for innovation activity, whereas investment and GDP growth capture wider aspects of the economic context in which intellectual property is developed and brought to market. In 2024, Indonesia reported economic growth of roughly 5.0%, and net foreign direct investment (FDI) inflows were about 1.7% of GDP. By contrast, Singapore recorded GDP growth of 4.4% and much larger net FDI inflows of approximately 24.7% of GDP. These observed differences indicate that the economic impact of an effective patent system cannot be determined purely by the volume of patent applications; instead, the significance of patent protection depends on how far patented technologies are converted into commercially valuable assets through investment, technology transfer, licensing, and innovation. Therefore, patent activity should be treated as a component of a wider innovation ecosystem, in which the quality of intellectual property protection works in tandem with investment capability and economic development.

The comparison also suggests that stronger patent institutions can help create an environment favorable to investment by lowering uncertainty about the ownership and

enforceability of technological assets. However, the available macroeconomic data, on their own, do not establish a direct causal link between patent activity and economic growth. Instead, they reveal the broader setting within which patent protection functions. Accordingly, the crucial difference between Indonesia and Singapore is not simply the volume of patent applications, but the institutional capability to transform intellectual property rights into commercially usable and legally secure assets. In this regard, legal certainty should be understood as a process linking patent protection to investment and commercialization, rather than as an independent, repeatedly asserted end result. A more efficient system for patent examination and enforcement can enhance confidence in patent rights, which in turn supports licensing, investment, technology transfer, and commercialization, and ultimately sustains innovation-driven economic activity.

Legal certainty is a fundamental pillar of any patent protection system. It serves as a vital instrument that encourages innovation and attracts investment. Without clarity regarding the validity, scope and enforcement of patent rights, the system loses its ability to protect intellectual assets. In Indonesia, legal certainty in patents still faces serious challenges due to administrative and judicial weaknesses. These lead to inconsistent decisions and an over-reliance on external expert testimony, which is often biased (Gertner & Sanders, 2018). The length of the examination process, uncertainty regarding the

quality of patents granted and a lack of technical judges who understand technology in depth lead to significant variations in the assessment of inventive steps or infringement (Oytana & Chappe, 2018). Consequently, patents often cannot be used to their full potential as investment guarantees or as a basis for technology-based business development, which undermines investor confidence in intellectual property as an asset (Lee, 2010).

This uncertainty directly affects the behavior of domestic innovators. Many inventors and start-up firms encounter a strategic choice: either file patents that may prove ineffective or prohibitively costly to enforce, or instead keep their inventions as trade secrets. When patent protection is viewed as unreliable, the motivation to pursue long-term, research-driven innovation declines; this, in turn, obstructs economic transformation toward a knowledge-based economy (Kim et al., 2025). Moreover, this uncertain legal landscape generates regulatory uncertainty and frequent policy shifts that often bewilder business actors (Rizky & Rahayu, 2025). As a result, Indonesia's technological innovation ecosystem is harmed, and patent litigation disputes become more difficult to resolve (Syamhadi et al., 2023).

From the standpoint of foreign investors, patent legal certainty is among the key factors used to identify investment locations. Jurisdictions with weak or uneven patent systems are generally viewed as carrying substantial legal risk, which

obstructs the inflow of foreign direct investment (Pratomo & Hastiadi, 2017). In the setting of global competition, this situation leaves Indonesia at a disadvantage relative to other countries in the region that can provide more credible patent protection, an example being China's achievement in establishing a specialized IP court to support an effective and standardized IPR regime. The experiences of other nations indicate that reinforcing administrative processes and incorporating technical expertise can meaningfully enhance perceptions of legal certainty.

Germany, as a leading jurisdiction for managing global patent disputes, maintains that patent legal certainty can be secured through a high degree of judicial specialization and a well-defined allocation of authority. Its bifurcated framework, which separates infringement courts from validity courts, offers basic clarity regarding the respective functions (Cremers et al., 2016). This arrangement enables businesses to conduct more reliable assessments of legal risk when making decisions and has positioned Germany as a benchmark for other jurisdictions seeking to manage transnational complexity while preserving high national standards (Hoffmann et al., 2024). While complete implementation of the German model may not be feasible in the short run, its core principles judicial specialization and the incorporation of technical expertise can still provide important guidance for reforming the patent system in Indonesia.

Therefore, strengthening patent legal certainty should be understood as an economic development strategy in Indonesia, rather than simply a legal reform agenda. A credible patent system will promote high-quality investment inflows, bolster the research and development ecosystem, and enhance the competitiveness of national industries, consistent with the objective of advancing technology and achieving technological independence in Indonesia (Purwaningsih & Ariyanti, 2021). In the absence of sufficient legal certainty, patents become less attractive as an innovation policy tool, particularly when confronted with digital-era challenges such as copyright infringement (Saputra, 2025a). Patent law enforcement reform in Indonesia must be oriented toward establishing legal certainty that is both measurable and sustainable, by improving the quality of administrative examinations, incorporating technical expertise into dispute resolution, and creating a more specialized patent judiciary. These measures are essential to ensure that the patent legal framework can effectively support innovation and draw investment, while also responding to the problems of regulatory uncertainty and frequent policy shifts (Rizky & Rahayu, 2025).

From the viewpoint of foreign investors, legal certainty in relation to patents is a core criterion for identifying global investment destinations. Jurisdictions with weak or inconsistent patent regimes are viewed as inherently carrying high legal risks, which in turn

directly constrains the inflow of foreign direct investment (Pratomo & Hastiadi, 2017). Against the backdrop of intensifying global competition, this situation puts Indonesia at a relative disadvantage to other regional jurisdictions that can provide more credible patent protection, as illustrated by China's achievement in establishing a dedicated intellectual property court. This sense of risk is not only a hypothetical issue; it is a practical factor that shapes investors' strategic choices about where to allocate their capital and technology, with the goal of ensuring safe returns on investment and the fair enforcement of rights (Guan, 2023). As essential legal instruments, patents are designed to encourage innovation and investment in research and development, thereby making them important for economic growth (Ningrum & Faslah, 2025).

Insufficient legal certainty within the patent regime can trigger a range of substantial economic disincentives. Foreign investors, particularly those in high-tech and capital-intensive sectors, depend strongly on robust protection of their intellectual property to secure exclusivity and profitability. In the absence of such protection, the threat of piracy, imitation, or unauthorized exploitation of inventions becomes excessive, deterring investment and impeding technology transfer (Butticè et al., 2020). This outcome not only lowers potential foreign direct investment, but also obstructs the transfer of essential technology needed to strengthen domestic innovation capabilities, thereby slowing

the shift of the economy toward a knowledge-based foundation. Studies indicate that intellectual property rights are a key determinant of higher economic growth (Viglioni et al., 2023). By contrast, the experience of developing countries in Southeast Asia suggests that enhancing administrative mechanisms can substantially improve perceptions of legal certainty, even when economic and technological capacities have not yet fully matched those of developed countries. Malaysia, for instance, has carried out a detailed assessment of its intellectual property system to bolster the country's innovation performance (OECD, 2015). Such steps, in turn, establish a more credible environment for investors. As a result, investors can be confident that patents processed through the system have received adequate validation, which provides a stronger basis for investment and for business development decisions.

Singapore goes further by explicitly tying patent legal certainty to the quality of its adjudication and enforcement processes. Patent litigation procedures in Singapore including invalidation and revocation processes, as well as the possibility of damages or court orders show a structured system for managing patent disputes (Low, 2018). By embedding deep technical expertise into the judicial system, patent disputes can be resolved quickly, substantively, and with decisions grounded in accurate technical understanding, underscoring the value of expertise in specialized courts (Miller & Curry,

2009). The clarity and consistency of rulings produced through this process foster a legal environment that is not only friendly to innovation but also especially appealing to global technology companies. Predictability in court outcomes benefits firms when making business decisions involving patents (Janicke, 2005).

Compared with these conditions, Indonesia's situation highlights the structural obstacles that continue to undermine the national patent system. Even though there is a sufficient regulatory framework to protect intellectual property rights, its implementation in the technology sector faces substantial challenges (Syarif & Pratiwi, 2025). Insufficient institutional capacity, a shortage of technical judges who understand the complexities of technology, and inconsistent judicial decisions produce an environment in which patent legal certainty is more illusion than reality (Gertner & Sanders, 2018; Oytana & Chappe, 2018). Problems such as delays and excessive costs in construction litigation in Indonesia, which can be likened to patent disputes, indicate the need for comprehensive system reform (Azizan et al., 2024). These circumstances, in fundamental terms, constrain Indonesia's ability to attract high-quality investment and to promote sustainable innovation (Rao et al., 2024).

Therefore, strengthening patent legal certainty should be viewed as a strategic necessity for Indonesia's economic development, extending beyond a mere legal reform agenda. A

credible patent regime will not only draw in high-quality investment flows, but also reinforce the research and development ecosystem and improve the overall competitiveness of the national industry (Cheng & Zhao, 2025; Purwaningsih & Ariyanti, 2021). In the absence of sufficient legal certainty, patents become less attractive as an effective instrument for innovation policy (Syafrida, 2019). Legal certainty, policy consistency, and clear regulations are crucial determinants for investors (Wole et al., 2021). Accordingly, comprehensive reforms should involve raising the quality of administrative examinations, incorporating technical expertise into dispute resolution, and establishing a more specialized patent judiciary, so that the patent legal framework can effectively support innovation and investment in this knowledge-based economy. It is also essential to increase stakeholders' awareness and understanding of the importance of intellectual property rights protection, including among academics and legal practitioners, to promote more effective and adaptive policy implementation amid digital challenges (Laksmi, 2024; Saputra, 2025).

Germany illustrates that patent legal certainty can be achieved through a high degree of judicial specialization and a clear allocation of authority. The bifurcation system, despite being complex because it separates the infringement and patent revocation processes (Cremers et al., 2014), clarifies the respective functions of infringement courts and validity courts. German

courts are the jurisdiction with the highest number of patent cases in Europe, and even worldwide (Cremers et al., 2016; Lamping & Rademacher, 2023). This points to an active and dependable enforcement system that enables sound business decision-making. For industry participants, this arrangement makes it possible to conduct more accurate assessments of legal risk when making business decisions.

This comparison shows that legal certainty in patent matters depends not only on the content of the law, but also on institutional design and the quality of implementation. Regulation that is well crafted will still provide only illusory protection if it is not supported by effective institutions. By contrast, suitable institutional reforms can substantially enhance the effectiveness of the patent system even under the same legal framework. Research indicates that judges with specialized expertise in patent adjudication can raise patent-driven innovation by 5.2% to 6.2% (Kim et al., 2025), highlighting the value of judicial specialization.

In the Indonesian context, strengthening patent legal certainty should be understood as an economic development strategy, rather than simply a legal reform agenda. A credible patent system not only promotes quality investment flows (Kumar et al., 2018; Liu, 2016; Pratomo & Hastiadi, 2017; Stepanov, 2020), but also reinforces the research and development ecosystem and enhances the competitiveness of national industries. Without legal certainty,

patents lose their usefulness as an effective innovation policy tool (Syafriada, 2019). Therefore, patent law enforcement reform in Indonesia must be aimed at producing legal certainty that is both measurable and sustainable, as a strategic prerequisite for national economic growth. Patent legal certainty serves as a core foundation that allows inventors and companies to make long-term investment decisions with confidence, supports quality investment flows, and strengthens the research and development ecosystem (Cheng & Zhao, 2025; Purwaningsih & Ariyanti, 2021). Research indicates that the quality of governance, including the rule of law, is positively associated with innovation performance (Rodríguez-Pose & Di Cataldo, 2015). In contrast, an uncertain environment—marked by delays and inconsistencies in judicial decisions—will obstruct innovation and technology transfer, thereby lowering Indonesia's appeal as an investment destination (Rao et al., 2024). The quality of intellectual property rights protection strongly affects innovation and economic growth, particularly in developing countries (Hudson & Minea, 2013). Credible patent enforcement is essential because patent policy reforms have a measurable effect on innovation (Helmert & Love, 2024).

Practical efforts to build legal certainty include improving the quality of administrative examinations at the Directorate General of Intellectual Property and incorporating technical expertise into dispute resolution. Enhancing the

quality of patent examination, reflected in both speed and depth of analysis, is vital to ensure that granted patents are high quality and rest on a solid legal basis, since low-quality patents can impede innovation and result in costly disputes (Squicciarini et al., 2013). Studies further show that insufficient examination time can lead to low-quality patents (Prabandari et al., 2020), and there are strategies that can be adopted to improve the quality of published patents (Waspiah et al., 2022). Moreover, patent disputes are highly technical legal matters that demand a thorough understanding of the innovation at issue. Incorporating independent and capable technical experts into the litigation process can improve the precision of decisions (Gertner & Sanders, 2018; Oytana & Chappe, 2018) and support timely, efficient decision-making (Kim et al., 2012).

Developing a more specialized patent judiciary is essential for promoting consistency and predictability in judicial decisions. Creating specialized patent courts or divisions, staffed by judges with deep expertise in intellectual property and technology, has been found to enhance both the efficiency and quality of case management. Without such specialized knowledge, the likelihood of inconsistent and unpredictable rulings will continue, particularly given observable differences across individual judges in their proclivity to invalidate patents (Hoffmann et al., 2024). Evidence of similar inconsistencies in decision-making across European jurisdictions confirms that this is a genuine issue (Cremers et

al., 2016), and that judges' differing experiences can yield divergent outcomes (Lemley et al., 2014). A specialized judicial framework can also bring greater clarity to roles in dispute resolution, as illustrated by Germany's bifurcated system (Cremers et al., 2014). Alongside these reforms, greater stakeholder awareness and understanding of the value of IPR protection will strengthen the patent system's role as a basis for innovation-driven economic growth in Indonesia (Laksmi, 2024; Saputra, 2025b). Nevertheless, achieving litigation dispute resolution that is both efficient and fair remains challenging in Indonesia, especially in cases with technical complexities such as patents (Syamhadi et al., 2023). To respond to violations of digital intellectual property rights in Indonesia, more stringent policy reform and enforcement of the law are required (Saputra, 2025b).

D. CONCLUSION

A comparative study of patent enforcement systems in Indonesia, Malaysia, Singapore, and Germany indicates that the central challenge in Indonesia is not the lack of a legal framework, but the constrained capacity of institutional and judicial implementation. Even though Indonesia has patent legislation that is normatively aligned with international standards, the effectiveness of patent protection remains constrained by weak implementing institutions and by an enforcement design that has not yet adapted to the complexity of contemporary technology. First, the limited

institutional capacity of the Directorate General of Intellectual Property has direct consequences for the quality and efficiency of patent examination. The protracted examination process, together with the likelihood of low-quality patents, generates legal uncertainty from the outset of protection. This uncertainty harms patent applicants and also relocates the task of correcting deficiencies in patent quality to the litigation stage, a pattern that is systematically inefficient. Second, at the judicial level, the absence of specialization and structured technical expertise means that the Commercial Court is less than optimal for resolving patent disputes. Such disputes are not only legal matters, but also technological ones that call for deep technical understanding. Without the incorporation of technical expertise, court rulings may become inconsistent and difficult to predict, thereby undermining the role of patents as instruments for legal certainty.

Third, Indonesia's mechanism for resolving patent disputes continues to depend on slow and expensive litigation. Because there are no post-grant administrative routes to challenge the validity of patents, the courts end up serving as the primary forum for technical disagreements that ought to be addressed earlier through filtering. As a result, disputes take longer to resolve and the costs of enforcing rights rise for both patent holders and third parties. A comparison with Malaysia indicates that even developing countries can enhance the quality and

efficiency of their patent systems through carefully targeted administrative reforms. Singapore further shows that incorporating technical expertise into the adjudication process is necessary for credible patent enforcement. At the same time, Germany offers a useful example of how judicial specialization and well-developed institutional design can deliver high legal certainty and produce decisions of strong quality. The results of this study confirm that the low level of legal certainty for patents in Indonesia reflects a structural problem with a direct effect on the investment and innovation environment. Without substantial institutional and judicial reform, patents will have difficulty serving as a strategic tool for knowledge-based economic development. Accordingly, patent enforcement should be embedded as an essential component of national innovation policy, rather than treated only as a technical matter within intellectual property law.

Drawing on comparative analysis and research findings, this article puts forward several strategic policy recommendations aimed at strengthening patent enforcement in Indonesia. To begin with, reforming the Directorate General of Intellectual Property should be treated as the foremost priority. This improvement should encompass raising the budget, enhancing the examiner-to-application ratio, and recruiting and training patent examiners with advanced technological expertise. Without a high-quality substantive examination, judicial-level reforms will not produce an optimal effect. Second, Indonesia

should implement an administrative opposition mechanism following the granting of patents at the Directorate General of Intellectual Property level. Such a mechanism would function as a quicker and more efficient means of screening patent quality than litigation in court. By establishing this administrative route, the workload on the Commercial Court can be reduced, and the overall quality of patents circulating within the system can be substantially enhanced.

Third, concrete measures toward patent court specialization are required. Policy alternatives may include creating a dedicated patent court or forming a highly specialized patent division within the Commercial Court. This specialization is necessary to ensure that patent disputes are decided by judges with relevant experience and an ongoing focus on this area. Fourth, the incorporation of technical expertise into the adjudication process must be implemented in a continuous, structured fashion. The approach of appointing independent technical assistants attached to patent courts should be considered as a substitute for the ad hoc method used to date. With reliable and consistent technical support, judges can render more accurate determinations on the merits while maintaining their judicial independence. Fifth, the capabilities of judges and law enforcement officials must be continuously strengthened through targeted training in patent law and global technological developments. This training should

be grounded not only in theory, but also in best practices drawn from jurisdictions that are well established in patent enforcement.

ACKNOWLEDGMENTS

This research was financially supported by the Competitive Scheme: National Collaborative Professor Acceleration Research under the Internal Research Grant of Universitas Islam Riau. We would like to express our sincere gratitude for the financial support that made this study possible.

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