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THE INFRASTRUCTURE OF INNOVATION: ACCOUNTABILITY AND ACCESS IN CONTEMPORARY IP LAW



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Abstract

Intellectual property law once again stands at a constitutional crossroads. The traditional story of copyright, patents, trademarks, and trade secrets as incentive-generating private rights is being challenged by generative artificial intelligence, platform intermediation, standard-essential patents, biologic medicines, climate technology, data extraction, and the geopolitics of industrial policy. These developments not only raise additional facts for consideration under existing categories, but also reveal a broader policy question: intellectual property institutions are increasingly allocating access to the knowledge infrastructure on which speech, health care, scientific inquiry, competition, and technological sovereignty rest. This article proposes an interdisciplinary approach to contemporary intellectual property policy by synthesising legal doctrine with political economy, innovation theory, human rights, competition law, and information governance scholarship. The challenge here is not to choose between more versus less protection, but to craft accountable legal “*interfaces*” between proprietary regimes and systems of public access, transparency, licensing, and contestation. This book discusses five current policy disputes: authorship and invention in the era of artificial intelligence; transformative use and culture; patents, public health, and climate technology; platform regulation of branding and data; and trade secrets in algorithmic and biomedicine markets. This research draws on seminal cases, such as *Feist*, *Eldred*, *Campbell*, *Google v. Oracle*, *Thaler*, *Mayo*, *Myriad*, *Huawei v. ZTE*, *Novartis v. Union of India*, *Deckmyn*, and *Pelham*, as well as WTO case law. The paper proposes an alternative intellectual property policy model in which IP rights remain relevant but are subject to requirements of proportionality, evidence, public-option licenses, interoperability, procedural justice, and democracy.

Keywords – Generative Artificial Intelligence; Human Rights, Competition Law; Climate Technology; Trade Secrets; Interdisciplinary Approach; Intellectual Property Policy.

I. INTRODUCTION: THE NEW IP QUESTION

Modern IP law cannot be appropriately characterised as a technical body of law concerned with protecting innovations, creativity, signs, and secrets. Today, IP law is a legal discipline through which legal regimes define who is entitled to train computational models, reproduce cultural memory, repair interconnected devices, produce crucial medications, utilise climate technologies, and analyse the data and computer code that are integral to modern society. The legal terms do not change: originality, inventive step, fair use, exhaustion, likelihood of confusion, secrecy, compulsory licensing and infringement. But the goals of such legal instruments are now different.

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The justification of IP is instrumental. Copyright and patent law grant a limited monopoly to encourage the creation and dissemination of works and inventions.¹ Trade mark law reduces consumers' search costs and protects source identification for business purposes.² Trade secret law protects commercial morality and confidentiality without requiring public disclosure.³ Such explanations are still important but insufficient. IP rights today operate within rich technological systems in which the cost of copying is essentially zero, the cost of access is enormous, and the most valuable capital lies in data, standards, platforms, networks, compute power, and regulatory approval, not in any individual invention or work.

This paper offers three interrelated arguments. The first is that the classic incentive-versus-access debate is too one-dimensional: it focuses on IP as a calibrated price for information commodities. Still, it fails to consider the institutional context of knowledge production and circulation. The second argument is that the contemporary controversies regarding artificial intelligence, pharmaceuticals, climate technologies, platform regulation and cultural reuse demonstrate the same underlying problem; IP law is increasingly concerned with controlling access to knowledge infrastructure rather than information commodities alone. The third argument is that any contemporary IP policy needs to be pluralist and interface-driven. It needs to protect legitimate IP rights that support creativity, investment, and disclosure while simultaneously creating access, transparency, interoperability, and accountability at the interfaces between exclusion and public systems.

The paper proceeds in seven sections. Section I outlines the research gap. Section II develops the theoretical framework. Part III focuses on artificial intelligence and the human-oriented nature of authorship and inventorship. Part IV deals with transformative use, cultural engagement, and expression. Part V looks into patents in the areas of public health and climate change policy. Part VI investigates competition, standards, platforms, and data. Part VII outlines an accountability-based IP interface policy framework.

II. RESEARCH GAP AND METHODOLOGY

While many studies about IP start with this dichotomy, whether there needs to be more rights to promote investments or there have to be limits and exceptions for access purposes, the dichotomy is very helpful. Still, it is not enough to explain the reasons behind the need for exclusivity in some areas and sharing in others. This is especially true when intellectual property interacts with artificial intelligence, the drug supply chain, clean technologies, online platforms, and standards organisations. In these areas, the exclusive rights system does not reward the innovator after the innovation. Rather, it is the system that constructs the platform for other future actors to learn and speak.

Thus, the research gap is both theoretical and institutional. Theoretically, IP policy needs a fuller theory of knowledge governance. Economics is important, but innovation studies highlight that

¹ William M Landes and Richard A Posner, *The Economic Structure of Intellectual Property Law* (Harvard University Press 2003) 11–36; William M Landes and Richard A Posner, 'An Economic Analysis of Copyright Law' (1989) 18 *Journal of Legal Studies* 325.

² William M Landes and Richard A Posner, 'Trademark Law: An Economic Perspective' (1987) 30 *Journal of Law and Economics* 265.

³ Lionel Bently, Brad Sherman, Dev Gangjee and Phillip Johnson, *Intellectual Property Law* (6th edn, OUP 2022) 1191–1244.

knowledge production is collaborative and cumulative; political economy demonstrates how legal rights entrench market power; human rights emphasise access to science, culture and health; and competition law focuses on the private ordering of markets through standards, licenses and platforms.⁴ Institutionally, courts and legislatures require better tools than vague balancing tests. They require doctrinal filters, licensing defaults, transparency obligations and evidentiary rules that distinguish socially productive exclusivity from enclosure.

The methodology combines doctrinal analysis with an interdisciplinary approach. This means studying key case law and treaties relating to copyright, patents, trade-marks, trade secrets, competition and international intellectual property from the perspective of current policy conflicts. However, it does not argue that any particular theoretical tradition can resolve every dispute in intellectual property law. It claims less than that. The point is that the core legal debates all involve the same institutional problem. Namely, how should the law manage the boundary between exclusive control and public access in social infrastructure for knowledge?

III. THEORETICAL FRAMEWORK: FROM PROPERTY TO KNOWLEDGE INFRASTRUCTURE

There are four dominant theories of IP law. The first is utilitarian incentive theory, which asks whether the anticipated social benefits of increased creativity and invention outweigh the social costs of exclusion. This philosophy finds expression in the US Constitution through the advancement of science and useful arts.⁵ Labour or desert theory holds that creators and inventors have some right to the results of their intellectual work. Thirdly, personality theory, especially as applied to moral rights and artistic integrity. Finally, there is a democratic or cultural theory, whereby copyright law and other laws become the condition of participation in public culture.⁶

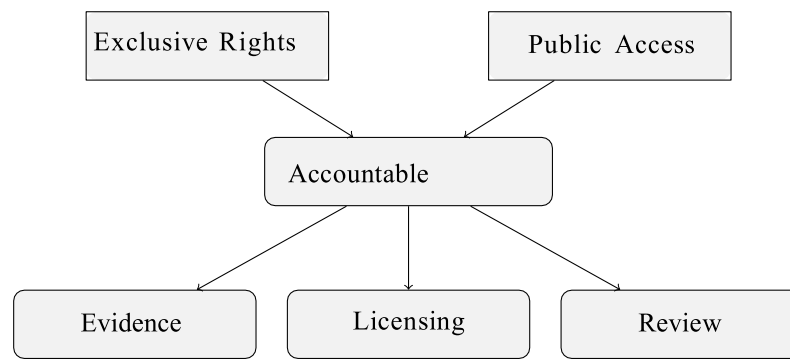
Each theory casts light on some areas of IP law and obscures others. Incentive theory fails when innovation is cumulative, publicly funded, or produced by communities rather than firms. Labour theory will provide justification for protection, but not an explanation of the term, scope and exceptions. Personality theory protects authorship, but has little to say about industrial patenting. Democratic theory explains cultural appropriation, but understates the funding necessary for risky research. The question is not which theory to choose, but how to institutionalise the theories.

According to the proposed framework, IP law represents governance of knowledge infrastructures. A knowledge infrastructure is a legal and technological framework that facilitates future creation, invention, verification, repair, expression, and competition. Such examples include scientific databases, training corpora, technical standards, software interfaces, research tools, chemical compounds, plant varieties, semiconductors, and cultural archives. In the event that IP law is being applied to these kinds of infrastructures, apart from assessing the legitimacy of the claimed rights, IP law must be concerned about the type of dependence created through the claimed rights.

⁴ See generally Suzanne Scotchmer, *Innovation and Incentives* (MIT Press 2004); Amy Kapczynski, 'The Access to Knowledge Mobilization and the New Politics of Intellectual Property' (2008) 117 Yale Law Journal 804; Rochelle Cooper Dreyfuss and Susy Frankel (eds), *The Oxford Handbook of Intellectual Property Law* (OUP 2018).

⁵ US Constitution Art I, s 8, cl 8.

⁶ Justin Hughes, 'The Philosophy of Intellectual Property' (1988) 77 Georgetown Law Journal 287; Margaret Jane Radin, 'Property and Personhood' (1982) 34 Stanford Law Review 957; Neil Weinstock Netanel, *Copyright's Paradox* (OUP 2008).



Such framing transforms the policy issue. Rather than posing the normative question of whether IP is good or bad, it poses whether the particular right, within the context of the particular market and technology environment, is tied to mechanisms that justify exclusion. Such mechanisms include disclosure, scope proportionality, exception fairness, license non-discrimination, contestability, transparency, and public-interest safeguards. Absent such mechanisms, IP ceases to serve as a limited incentive and becomes a private law of infrastructure control.

IV. AI, AUTHORSHIP AND INVENTORSHIP

Artificial intelligence has reignited long-standing questions about creativity and innovation. While the first issue concerns the capacity of AI to produce outputs similar to works and innovations protected by law, the second concerns whether IP law should allow non-human creation to constitute authorship or inventorship, and, if it does not, how IP law will allocate rights in human-AI creations. Modern authorities have generally upheld the human-centric nature of IP law. In the United Kingdom, the Supreme Court ruled in *Thaler v Comptroller-General of Patents, Designs and Trade Marks* that inventorship under the Patents Act 1977 requires natural persons, and that ownership of the DABUS machine did not confer entitlement to file patent applications with the machine listed as inventor.⁷ On the other hand, in the United States, the Copyright Office has opined that copyright protects human authorship and that materials produced solely by AI are unregistrable, while human selection, arrangement, and modification of such materials may be copyrightable if they constitute sufficient creativity.⁸

These theories comport with the earlier originality doctrine. In *Feist*, the US Supreme Court denied protection for mere labour and demanded a modicum of creativity.⁹ Similarly, in Europe, originality has been characterised as the author's intellectual creation.¹⁰

Human-centred approaches are attractive but insufficient. They avoid premature declaration of machine authorship, but leave many difficult questions about training, source material, bargaining power, and market replacement. AI developers can argue that massive training represents legal text and data mining, fair use, or transient reproductions. Copyright holders can argue that training involves taking expressive value and competing with licensed markets. Human users can create hybrid works in which their contributions are inseparable from the outputs of AI models. Courts will

⁷ *Thaler v Comptroller-General of Patents, Designs and Trade Marks* [2023] UKSC 49.

⁸ United States Copyright Office, *Copyright and Artificial Intelligence, Part 2: Copyrightability* (January 2025) 2–4.

⁹ *Feist Publications Inc v Rural Telephone Service Co Inc* 499 US 340 (1991).

¹⁰ *Infopaq International A/S v Danske Dagblades Forening* (C-5/08) EU:C:2009:465.

have to decide whether doctrines governing search engines, thumbnails, and software interfaces can extend to foundation models.

A better policy approach is not to give machines legal personhood. This would misunderstand the justificatory foundation of IP and would risk granting rights without accountability. Nor would it be wise to ban all unlicensed computation of protected works. This would excessively protect incumbents and prevent necessary research, criticism, access, and innovation. A better approach would be an interface theory with four components.

To begin with, copyrightability must be grounded in human control over creativity. When a human uses an AI system as a tool, copyright protection can apply to original selections, arrangements, prompts that show creative control, editing, composing, or integrating. Merely providing a generic prompt would not be enough. Secondly, training use cases need to be evaluated through a transparent combination of exceptions, licensing, and market-based evidence. Non-expressive computational analyses for research purposes may justify exceptions; commercial substitutional training purposes may need licensing or compensation. Thirdly, provenance and documentation matter. Registration schemes and litigation require sufficient documentation to identify human contribution without mandating publication of a confidential model architecture. Finally, any remedies proposed must be proportionate. If compensation is available for the harm done, an injunction to prevent future production of the entire model would be excessive in situations where the model comprises millions of inputs.

Patent law encounters a related but different problem. In cases where AI systems are used to discover molecules, materials, or engineering solutions, the inventor should be the human who conceived the inventive idea or made a contribution to the technical solution. In the situation where there is no identifiable human inventor, the public policy issue is whether patent law should encourage the use of inventive systems. There are good grounds for concern. The patent system rewards inventors with strong exclusion rights in return for a humanly understandable technical disclosure. If AI-generated inventions are patented in the absence of any human inventive contribution or humanly understandable technical disclosure, the patent system rewards ownership of computational capability rather than invention. This will further reinforce the concentration of companies that have access to both data and computing capabilities.

Indeed, the presence of AI shows that there is a need to distinguish between three different matters which have been treated as one and the same in the past: whether the product or invention is present, whether a human claimant is responsible for the creation of something which fits within the scope of IP, and whether the policy dictates exclusivity for the product created. The answer to the first question can be positive, while the other two can be negative.

V. TRANSFORMATIVE USE, CULTURE AND THE LIMITS OF PERMISSION

Copyright policy is generally regarded as a contract between creators and citizens. The contract fails when permission is needed for regular communication across cultures. Modern creativity is inherently intertextual; sampling, quotation, remixing, parody, fandom, memes, documentary citation, software reuse, and computer-aided montage all require previous works. A permission-based copyright system would be unnecessarily costly and undemocratic.

US case law, including the famous case of *Campbell v Acuff-Rose Music*, treats the transformative nature of the second work as crucial for its treatment as fair use – whether the second work offers something new, having further purpose or different character.¹¹ In its recent decision, *Google LLC v. Oracle America, Inc.*, the court held that using declared code for Android is fair use.¹² Neither decision fits the market substitution model, which acknowledges certain uses of protected works as inputs for creating a new work, achieving interoperability, or providing a public benefit.

The European legal system addresses the question using special exemptions and a fundamental rights approach. According to the *Deckmyn* case, parody is a work that involves a previous work and differs from it sufficiently to express humour or mockery, while maintaining a fair balance between the author's rights and freedom of speech.¹³ In the case of *Pelham*, the Court considered phonogram sampling to be a possible infringement when a sample is recognisably taken, but also considered quotation and other exceptions in light of the fundamental rights.¹⁴ The ongoing European discussion about pastiche proves that cultural reuse cannot be regulated with strict categories.

The issue with regard to contemporary policies is the absence or strategic nonexistence of the market for permission. An independent filmmaker, critic, research scholar or individual creator may fail to locate the rights holder or to pay transaction costs. On the other hand, the existence of general exceptions may hurt the creators in cases where the second use is substitute and commercial in nature. A defensible policy must therefore distinguish transformative dependency from avoidable appropriation.

Debate	Maximalist Risk	Minimalist Risk	Interface Response
AI Training	Control over reading and analysis.	Uncompensated substitution.	Text and data exceptions plus market sensitive licensing.
Cultural Remix	Permission veto over speech	Erosion of creative markets	Transformative use analysis and proportional remedies.
Medicine	Monopoly pricing of essentials.	Underinvestment in trials	Patentability filters, compulsory licensing and pooled procurement.

¹¹ *Campbell v Acuff-Rose Music Inc* 510 US 569 (1994).

¹² *Google LLC v Oracle America Inc* 593 US 1 (2021).

¹³ *Johan Deckmyn and Vrijheidsfonds VZW v Helena Vandersteen and Others* (C-201/13) EU:C:2014:2132.

¹⁴ *Pelham GmbH v Ralf Hutter and Florian Schneider-Esleben* (C-476/17) EU:C:2019:624.

Standards	Hold-up through injunctions	Uncompensated standard use	FRAND duties and competition oversight.
Trade Secrets	Secrecy over public impact systems.	Forced disclosure of legitimate know-how	Protected audits and regulatory access.

The table illustrates a larger truth. Intellectual property disputes of the modern age do not usually have clear pro-rights or anti-rights positions. Rather, they need institutional architecture. And for transformative uses, it should contain open-textured fairness considerations, safe harbour provisions for quotations and criticisms, effective exceptions for parodies and pastiches, and remedies that avoid market destruction without censorship. Courts should be cautious of using any and all licensing opportunities as proof against the user. When the right holder can create a market through the exercise of control, the market-harm consideration becomes circular.

VI. PATENTS, PUBLIC HEALTH AND CLIMATE TECHNOLOGY

Patent law captures best the notion of an incentive deal struck. This legal instrument confers upon the innovator an exclusive entitlement in exchange for making an innovation that is novel, useful, and inventive. Nonetheless, patents are also the intellectual property regime most relevant to issues of distributional justice. In particular, when the object in question is a lifesaving drug, diagnostic tool or technology for renewable energy, the consequences of exclusivity may be drastic.

In terms of doctrinal response, courts have policed patentable subject matter and inventive contribution. *Mayo Collaborative Services v. Prometheus Laboratories* is an instance in which the United States Supreme Court declared invalid claims that amounted to a monopoly over the natural law and its use through well-known processes.¹⁵ In another case of *Association for Molecular Pathology v Myriad Genetics*, the isolation of naturally occurring DNA was considered not patentable, but cDNA could be patentable.¹⁶ On the Indian front, the decision in *Novartis AG v Union of India* concerned the interpretation of section 3(d) of the Patents Act, which did not allow evergreening unless there was an enhancement in the therapeutic efficacy of the substance in a new form.¹⁷ While the contexts may differ, all three cases reflect a concern that patent law may encourage the discovery, use, or extension of existing inventions as if they were true inventions.

There is one more aspect of international law. TRIPS requires certain minimum standards, while allowing certain flexibilities, such as compulsory licenses.¹⁸ The Doha Declaration states that TRIPS should be interpreted in a way that favours the right of WTO member countries to protect public health and ensure access to medicines.¹⁹ The global pandemic showed the problem with translating

¹⁵ *Mayo Collaborative Services LLC v Prometheus Laboratories Inc* 566 US 66 (2012).

¹⁶ *Association for Molecular Pathology v Myriad Genetics Inc* 569 US 576 (2013).

¹⁷ *Novartis AG v Union of India* MANU/SC/0281/2013.

¹⁸ Agreement on Trade-Related Aspects of Intellectual Property Rights (adopted 15 April 1994, entered into force 1 January 1995) 1869 UNTS 299, arts 27, 30, 31.

¹⁹ WTO, *Declaration on the TRIPS Agreement and Public Health* (14 November 2001) WT/MIN(01)/DEC/2, para 4.

formal flexibilities into production and technology-transfer capabilities. Patents alone will not produce vaccines, but patents, trade secrets, data, and know-how may influence this process.

The same problem applies to climate technology. Fast dissemination of climate-friendly technologies is essential for the planet, but companies are seeking patents for batteries, carbon capture, green hydrogen, grid management, seeds, and adaptation technologies. An extreme approach of abolishing such rights can discourage the development of certain areas. A completely proprietary approach will slow down dissemination for the countries most affected by climate change. In terms of policy, the issue should be approached through differentiated access. Technologies developed using public money must have some access requirements. Technologies critical for mitigation and adaptation must be potential candidates for patent pools, public options, sharing through procurement and licensing on concessional terms for poor and developing countries. Competitive authorities should scrutinise aggregation efforts that enable the building of blocking positions in climate-critical industries.

The multidisciplinary lesson is that innovation is not just a personal affair; it is integral to public financing, science, regulatory approval, clinical trials, production capacity, and procurement. Accordingly, patent policy needs to be evidence-based. If exclusivity is needed to spur investment, then it must be secure. If, on the other hand, exclusivity serves primarily to protect incremental modification, defensive thicket or publicly financed inventions, the law must reduce the scope and improve access terms.

VII. COMPETITION, STANDARDS, PLATFORMS AND DATA

IP rights in the modern era often work within a private governance regime. Standard-setting organisations, app stores, online markets, cloud services, and content platforms can control the economic value of IP rights. That is why the interplay of IP and competition law has become crucial. The use of standard-essential patents (SEPs) reveals this issue. Once a patented technology is adopted as part of a standard, those who use that standard become locked in. The patentee has the right to demand royalty payments under threat of an injunction, and, at the same time, implementers can refuse to pay until the very end due to hold-out behaviour. In *Huawei v ZTE*, the CJEU has developed the rules governing SEP injunction negotiations where the patentee has committed to licensing on FRAND terms.²⁰ This decision is important not only for telecom but for any other industry where patents affect access to standards.

The same problem arises with software interfaces. In *Google v Oracle*, the US Supreme Court acknowledged the value of reimplementation for programmers and platform innovation.²¹ The broader point is that some technical works serve as pathways rather than as expressive goals. Too much control over interfaces can limit interoperability and lock users into an ecosystem. This does not mean that all software copying is legitimate. It means that copyright analysis must take into account the functional nature of the work reproduced.

Trademarks and platforms are areas of modern conflict. Trade mark laws provide consumer protection from confusion and protect goodwill, but platforms regulate search results, sponsored keywords, recommendations, and counterfeit detection. The emphasis on confusion in the legal

²⁰ *Huawei Technologies Co Ltd v ZTE Corp* (C-170/13) EU:C:2015:477.

²¹ *Google LLC v Oracle America Inc* 593 US 1 (2021).

system must now be supplemented with an emphasis on platform motivations. A marketplace may have an incentive not to enforce against counterfeits to preserve transaction volume, or to enforce against complaints to avoid liability. Small merchants can be removed automatically without any consideration. Consumer deception could arise not solely through the use of a brand mark, but also through ranking, labelling, badge fulfilment, and advertising structure. Consequently, IP law must make sure that trade mark protection is combined with procedural fairness and the right of appeal. The use of trade secrets is becoming even more pervasive. Companies rely on trade secrets in respect of algorithms, data sets, production processes, biotech knowledge and even platform regulation systems. There are legitimate cases for keeping things secret, where disclosure would be harmful to value and could facilitate unfair competition. However, secrecy becomes controversial when it interferes with regulators, the persons concerned, or the courts' ability to test systems used to determine people's rights, health status, access to credit, employment opportunities, or safety. Here, the solution is not publishing everything indiscriminately; it is controlled access through confidential regulatory oversight, inspections, protective orders, data rooms, and audits. Trade secret protection should safeguard competitive value without creating a zone of no evidence for technologies that affect the public interest.

Data is the connective tissue among these issues. While copyright does not apply to facts themselves, as Feist established, database protections, contractual agreements, technical protection mechanisms, trade secrets, and platform policies can establish exclusivity over data. Exclusivity can support investment in curating and securing data, but it can also limit research and competition. Modern IP law thus needs to transcend these formal categories. The real question is whether legal and technical exclusivities over information assets are justifiable in terms of verifiability, portability, repair, and research.

VIII. INTERNATIONAL IP, DEVELOPMENT AND LEGAL PLURALISM

International IP law is frequently described as a process of harmonisation. However, what really happens is a contested agreement between trade, development, cultural policy and technical capability. While TRIPS sets out some minimum standards, differences between states can be found in exceptions, patentability criteria, compulsory licensing, moral rights, database protection, and enforcement focus. Such differentiation should not be regarded simply as an impediment to efficiency. It may be a case of legitimate policy experimentation.

The problem with the IP regime from the developmental perspective is not that protection may have a negative effect. Rather, the issue is that a standard approach to protection could impose an unequal burden on nations at various stages of technological advancement. A pharmaceutical patent would be felt differently in a country capable of producing these products domestically and a country having to rely on importing them. Copyright term extension could be advantageous to a large catalogue more than to the creator himself. Plant variety protection may have different implications for farmers in agrarian societies. Border regulations that place too much emphasis on enforcement may hamper the legitimate trade of generic drugs.

Human rights law further reinforces this point. The right of participation in cultural activities and enjoyment of the benefits of scientific development must be balanced against the protection of the

moral and material interests of the author.²² The two do not amount to the same thing as copyright and patent protection, respectively. The protection of the author's interests is important, but human rights law does not entrench all statutory monopolies. A balance needs to be struck that ensures both participation and protection.

Legal pluralism is thus not a failing of IP policy. It is an aspect of legitimacy. States need to be left with flexibility to set their own limits on exceptions for education, disability access, library uses, scientific research, public health, and technology education. Global institutions need to promote transparency and cooperation, but not make complete enforcement the sole yardstick of compliance. An ideal IP system is neither the most powerful nor the most restrictive, but the one best suited to its society.

IX. REMEDIES, PROCEDURE AND THE INSTITUTIONAL DESIGN OF IP

While substantive issues concerning intellectual property tend to receive more consideration than procedural matters, the manner of enforcement can dictate the true balance of the overall process. A restrictive right enforced through automatic injunctions, statutory damages, and border and platform seizures can be much more severe than an expansive right enforced through proportional measures. On the other hand, what seems like a powerful right can be rather powerless if its enforcement is costly, delayed or unattainable for individual creators. Procedure must then be regarded as an inherent part of the right in contemporary IP law.

First is the matter of injunctive relief. The property language leads to the simplistic idea that infringement generally entails the remedy of exclusion. This simplistic notion fails in the case of complex products and public interest settings. In the US, *eBay Inc. v. MercExchange LLC* ruled against a mandatory grant of a permanent injunction in patent infringement suits and established that the traditional equity test should be applied.²³ The ruling is noteworthy because it acknowledges that a patent may be a component of a larger system and that monetary compensation can provide relief to the patent holder without placing an excessive burden on users and the public. A similar approach should apply in copyright cases involving minute portions of large technical systems, SEP cases, health-related technologies and big-corpora-trained AIs.

The second is automated enforcement. Copyright and trademark claims are increasingly being settled on platforms before ever getting to court. Notice-and-takedown approaches could help avoid clear instances of infringement but also delete legitimate speech, comments, parody, repair instructions, and small-business listings. The public-law approach is required even where enforcement appears to be private. Users need proper notice and explanation of the removal and counter-notice processes, and of human review when removal affects a business or expression. The penalty for repeated abuse should apply not only to users who infringe but also to those who make complaints.

The third topic is proof. With respect to cases involving AI, pharmaceuticals, platforms and trade secrets, it may well be true that the evidence involved is both technical and unbalanced. The judicial process must accommodate expert access, confidentiality agreements, model documentation,

²² International Covenant on Economic, Social and Cultural Rights (adopted 16 December 1966, entered into force 3 January 1976) 993 UNTS 3, art 15.

²³ *eBay Inc v MercExchange LLC* 547 US 388 (2006).

sampling, log-keeping, and source code reviews. In the absence of such measures, the case favours the side that holds the evidence. Procedural reform is, therefore, not a management concern but rather an enabling factor for proper decision-making.

Fourth, there are remedies in respect of public institutions. Universities, libraries, archives, public laboratories, and health authorities frequently operate on the borderline between protected works and open access. What is needed is a legal regime that reduces concerns about catastrophic liability arising from good-faith action in research, preservation, education, and emergency distribution. Safe harbour provisions, damages caps, and public-interest defences preserve incentives while ensuring that enforcement does not chill socially valuable institutional behaviour.

Finally, remedies must consider the issue of cumulative creation. In cases where there is an infringing component in a transformative use, a complicated machine, or any socially beneficial technology, destruction and injunction could be wasteful of the further potential. Courts should opt for more specific orders, royalties, acknowledgements, correction labels, data deletion, filtering, or compensatory damage if the solution does not interfere with legitimate further use. The variety of remedies is consistent with the article's larger thesis, according to which IP is justified not only by rights but also by the legality of its exercise.

X. A POLICY FRAMEWORK FOR ACCOUNTABLE IP INTERFACES

The above analysis suggests a sensible way forward. The aim is not to dissolve IP exclusions into open access, but to ensure that where exclusivity governs knowledge infrastructure, it is held accountable. Six principles for reform could apply.

First, exclusivity in IP law needs to be evidence-driven. Legislatures need to require sector-specific evidence before extending the term, remedy or subject matter of exclusions. Courts need to avoid assuming that greater exclusivity necessarily leads to greater creation or innovation. The incentive function of IP varies in music, software, pharmaceuticals, fashion, databases, standards, and machine learning. The policy should address these differences.

Second, the law should safeguard human creativity and technological innovation without deifying individual authorship and inventorship. While authorship and inventorship need to stay human, ownership principles should acknowledge collaborative and organisational creation. Works and innovations created with the help of AI should receive legal protection only insofar as human involvement meets the necessary threshold. The registry should include truthful disclosure of significant AI involvement when the assertion is relevant. The registry should make disclosure mandatory on any material AI assistance used for making the claim.

Third, exceptions and limitations should be treated as part of the structure of IP, not merely as defences to be reluctantly invoked. "Fair use," "fair dealing," "quotation," "parody," "research exceptions," "text and data mining," "education", and "disability exceptions and repair" determine the proper scope of the right. They should be precise enough to inform regular users and flexible enough to adapt to new technology.

Fourth, licensing is the infrastructure for licensing. FRAND commitments, patent pools, collective licensing, public-option licenses, open standards, and compulsory licenses are not extraneous interventions in IP. There are ways to ensure that exclusivity can be consistent with cumulative innovation and the public interest. Public funding should presumptively come with access provisions

when the knowledge created is fundamental to health, resilience to climate change, or core research infrastructure.

Finally, remedies must be proportional. The remedy of an injunction is strong and occasionally necessary, but may be disproportionate in cases where the right relates to only a minor part of a highly complex product, technical standard, machine learning model trained on large datasets, or medication needed for public health. The issues of substitutive harm, public interest, good-faith bargaining, proportionality, and monetary compensation should be taken into account by the court. Sixth, procedures should be established to facilitate review despite secrecy. Trade secrets, confidential submissions to regulatory authorities, and proprietary software algorithms should not prevent legitimate review. This applies particularly to matters related to artificial intelligence, biotechnologies, environmental sciences, and platform regulation.

These principles do not require any global code to implement them. They can guide legislation, judicial interpretation, treaty flexibility, institutional licensing practices, and procurement agreements. The common denominator of all these principles is the humility of institutions, because the production of knowledge involves both individual initiative and public circumstances.

XI. CONCLUSION

The most important contemporary controversies in intellectual property law are not side-issues related to emerging technologies. Rather, they relate to the constitutional place of intellectual property in knowledge societies. Artificial intelligence challenges the very humanity of the author and inventor. Transformative use challenges copyright's ability to fit within cultural discourse. Patents in health and climate policy challenge the justification of exclusivity in relation to survival and global stability. Standards, platforms, data and trade secrets challenge the compatibility of private control over infrastructure with competition and accountability.

This paper has made a case for an entirely new policy approach: accountable interfaces of intellectual property. Such an approach recognises that exclusive rights are potentially valuable means of creativity, investment and disclosure, but insists on tying them to public-oriented processes whenever they apply to knowledge resources that others rely on. The policy program is neither maximalist nor minimalist. It is about building an intellectual property regime that is evidence-based, human-centred, competitive, development-oriented and institutionalised in terms of access.

What will shape IP policy in the future is less the rhetoric around property vs openness but more the construction of legal interfaces between these realms. The development of a mature intellectual property regime entails rewarding merit, maintaining freedom of culture and science, encouraging follow-up innovation, and keeping the knowledge infrastructures contestable. It is how we get out of the stalemate between incentives and exclusivity.