

From Regulatory Lag to Regulatory Foresight: Reforming Legal Systems for Technological Disruption

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ABSTRACT

Fast changing of technology has produced a growing gap between law and technology, in which the legal control is running behind technology. Whereas law is retaliatory, the new technologies, including artificial intelligence, blockchain, biotechnology, and autonomous vehicles, develop in a proactive way and present complex challenges. They are intellectual property rights, privacy, liability, cross-border performance, and ethical uncertainty. Poor time lag in legislation, lack of technical expertise and jurisdictional issues worsen the situation. Possible solutions to such gaps include regulatory sandbox, technology foresight, sunset clauses, and micro-directives. Legal professionals need to be trained interdisciplinarily and interacted with experts on a constant basis. To control the multinational technological development there is the need to have global coordination. Active and adaptive systems are capable of defending rights and also facilitate innovation. Reactive to anticipatory governance should be altered in order to make sure that law is up-to-date with the societal and technological advancements.

Keywords: law-technology gap, artificial intelligence, blockchain, regulatory sandboxes, technology foresight, intellectual property, and others.

INTRODUCTION

Novelty is the backbone of the legal profession; it's what keeps a lawyer always active and working. There are thousands of precedents and yet hundreds more are made each year by superior courts to tackle human ability to innovate. As a society we not only innovate in ways of dodging the law but in doing all sorts of different transactions which have never been done in the manner or scale before in the history of mankind. Law exists to set boundaries between citizens of a state so that none can take more than their fair share and that one's liberty doesn't affect another's rights.

Humanity took millennia to progress from the invention of the wheel to the development of the basic automobile; however, it required only a century to advance from a petrol engine to a self-driving car. The rate of innovation in society has exponentially expanded in all fields of life. This challenge is faced by all sorts of professionals, factory workers who got replaced by the conveyor belt, surgeons who got replaced by lasers and copywriters who got replaced by the typewriter. Among these, one field has always stood upon human ingenuity and has been the centre of the political, economic and sociological evolution of society – the legal field.

Laws and policies develop over time. If one were to ask what came before the law or the crime, the answer would be the latter. The law in its traditional sense is reactive in nature¹; it requires a wrong to happen

¹Susan W. Brenner, 'Distributed Security: Moving Away from Reactive Law Enforcement' (2004) 9 International Journal of Communications Law and Policy.

before making it illegal. Innovation in technology is proactive; it continuously attempts to achieve novelty in everyday tasks.

In the UK courts are well adept at the use of evolving common law principles and have to face immense pressure in adjudicating in areas with no legislative guidance. Despite the continuous legislation on modern technology there still remains a gap which depends on various factors. We can try to delve deeper into those regulatory gaps by evaluating regulatory models, highlighting approaches to those gaps, and understanding the challenges and possible reforms for this problem.

The Law-Technology Gap

The Law-Technology gap is the growing delay in regulations compared to the usage of certain technologies. There is a growing divergence between the rate at which technology is coming to the market and the rate of regulations being passed to counter the wrong use of such technology².

This gap not only poses a jurisprudential question but affects policy-making, market growth and the rights of citizens. There are technologies which can potentially harm Intellectual Property rights such as Artificial Intelligence which can be used to re-create any type of art. Technologies such as facial recognition software can track down people, such data can be used to invade the privacy rights of individuals and threaten the security of a sovereign state. On the other hand, Biotechnology and other life-related research pose not only legal questions but seek to redefine our previous notions of life itself, the regulatory challenges keep on growing³.

One of the major causes of these gaps is caused by the overly cautious and secure legislation system. Legislative bodies operate in a slow, detail-oriented process in which there are lots of committee reviews, public consultations and judicial interpretation questions. Legislators are law experts, not technological experts, they need to employ expert opinion on each step of the process, this lack of expertise increases the delay in effective regulation, and can even lead to laws that don't address the core issues. Compared to this, technology just sees an inefficiency and human need and develops continuously and exponentially. It is decentralized and everyone contributes to its advancements.

In the United Kingdom we can take an example of the rapid spread of generative AI has complicated the norms of copyright laws in the creative arts industry. There's a question of whether the content generated by an automated system is an intellectual property or not and what are its possible ramifications⁴. Then since Generative AI works on data provided by other creative artists including copyright works, what would be the possible safeguards for those copyright holders, there's a gap in their protection as well⁵. UK's opt-out model for content creators in response to Generative AI hasn't proven to be of much use⁶.

² Gary E Marchant, "The Growing Gap between Emerging Technologies and the Law" in Gary E Marchant, Braden R Allenby and Joseph R Herkert.

³ Helen Lawton Smith, "Regulating Science and Technology: The Case of the UK Biotechnology Industry" (2005) 27(1) Law & Policy 189.

⁴ Ryan Abbott, "Artificial Intelligence, Big Data and Intellectual Property: Protecting Computer Generated Works in the United Kingdom" in Tanya Aplin, Research Handbook on Intellectual Property and Digital Technologies (Edward Elgar Publishing 2020) 322.

⁵ M Abdulhalim Singay, AI Revolution on Trial: Protection of Intellectual Property Rights against Generative Artificial Intelligence in the USA and UK (PhD thesis, Central European University).

⁶ Tamlin Magee, 'Can You Opt Out of GenAI?' (Raconteur, 29 April 2025)
<https://www.raconteur.net/technology/can-we-opt-out-of-genai> accessed 5 May 2025.

Approaches to Technological Regulation

The gap between regulation and technology is not static, various methods have been developed to mitigate this gap and hamper its growth. One of the effective methods is “regulatory sandboxes” in which new technologies are given time to be tested in regulatory limits. In the UK such an attempt was made by the Financial Conduct Authority which produced great results by nurturing new business entrants in a safe isolated environment providing a chance for entrepreneurs and safety to consumers⁷.

If we look at the current regulatory approaches in different jurisdictions, the European Union tends to adopt precautionary and principle-based regulations⁸. The US regulatory philosophy prioritizes national security over individual privacy⁹. The UK’s approach is a mix of precautionary strategies such as the AI Safety Institute¹⁰ and promoting innovation such as the Digital Markets Competition and Consumers Act¹¹.

Another way to approach this matter is elaborated as “technology foresight”. This method involves a systematic attempt at predicting future technological advances. In traditional forecasting, expert insights are sought to determine and anticipate regulatory frameworks, while technology foresight engages a broad spectrum of stakeholders to make informed policy decisions. Technology foresight attempts to shift regulatory and policing approaches from reactive to proactive. The problem of inflexible and restricted regulations is solved by flexible and long-lasting legislation.¹²

Challenges in Regulating Technology

There is an established distrust of automatic technology among humans. When automated elevators were launched in the market they were scary to the consumers who were accustomed to manual movement of the elevator. Before this invention in the 1900s, elevators were manoeuvred manually. It took a lot of convincing and time for the general populace to adapt to the automated elevators¹³. Humans have an internalized bias against automation, which can cause stagnation in the adoption of new technologies¹⁴.

Despite the efforts made by legislators, policymakers, regulators and emerging regulatory tools we still have some hurdles in closing the gap between technology and its regulation¹⁵. One cause is the ethical

⁷ Anna Butor-Keler and Michał Polasik, ‘The Role of Regulatory Sandboxes in the Development of Innovations on the Financial Services Market: The Case of the United Kingdom’ (2020) 19(4) *Ekonomia I. Prawo. Economics and Law* 621.

⁸ Regulation (EU) 2016/679 of the European Parliament, and of the Council. Dated: 27 April 2016 (General Data Protection Regulation) [2016] OJ L119/1.

⁹ Leah B Movius and Nathalia Krup, ‘US and EU Privacy Policy: Comparison of Regulatory Approaches’ (2009) *International Journal of Communication* 19.

¹⁰ Department for Science, Innovation and Technology, ‘UK to Establish World’s First AI Safety Institute’ (Gov.uk, November 2023) <https://www.gov.uk/government/publications/ai-safety-institute-overview/introducing-the-ai-safety-institute> accessed 5 May 2025.

¹¹ Digital Markets, Competition and Consumers Act 2024

¹² Ian Miles, ‘The Development of Technology Foresight: A Review’ (2010) 77(9) *Technological Forecasting and Social Change* 1448.

¹³ Mowrey Elevator, ‘The Extinction of Elevator Operators’ (15 September 2016) <https://www.mowreyelevator.com/industry-updates/extinction-elevator-operators/> accessed 7 May 2025.

¹⁴ Michael A. Bishop and J. D. Trout, “Epistemology and the Psychology of Human Judgment” (Oxford University Press 2005).

¹⁵ Jelle K. Hopster and Matthijs M. Maas, “The Technology Triad: Disruptive AI, Regulatory Gaps and Value Change” (2024) 4(4) *AI and Ethics* 1051.

ambiguity of emerging technologies. Generative AI raises questions about ownership, transparency, privacy and accountability that the previous mechanisms cannot address. A few of those questions can be:

- Who will be liable for a violation by generative AI? The end user, manufacturer or the running company? If one is responsible, what are the burdens born by others?
- What are the methods and means to ensure AI is community-friendly and free from bias to keep the end user free from harm? What will be the regulations to govern the ethical standpoint of AI-generated content?
- Who will be the ultimate beneficiary of AI-generated intellectual property? The source of AI's algorithm? The end user? Or the manufacturer?¹⁶

These kinds of questions require a new approach towards legal doctrines to solve them.

Another question is regarding jurisdiction, laws are regulated within a particular territorial jurisdiction but technology is now surpassing boundaries and is almost always multinational in nature. In the example of self-driving cars the choice of legislators while creating regulations for the companies can halt or hasten the technological progress as multiple regulations in different jurisdictions will never sit well with the manufacturers¹⁷. In the case of cross-border digital evidence discovery for a multinational company, there are many issues as jurisdictions such as Switzerland may prohibit foreign courts from extracting the data of Swiss nationals, but a multinational working in the USA and Switzerland with a subpoena from a US court for a Swiss national's personal data will have to take a decision¹⁸.

A fundamental challenge in continuously regulating the continuously novel technology is the lack of resources. The capacity of governmental institutions, judiciary and regulatory bodies is limited and often lacks the expertise to learn the possible ramifications of particular provisions of law for a particular kind of technology such as blockchain or personalized medical prescriptions. Regulatory institutions may also face political, media, and economic restraints as well. This can lead to short-term inadequate regulations which cannot timely address the mischief at hand¹⁹.

Furthermore, social media has become an essential part of our daily lives, there is hardly anyone left who is not affected by the deeply rooted impact of social media in our lives. This has given birth to a concept of cyberspace known as the metaverse. As cyberspace and its value in our lives grow, so does the value of elements available inside cyberspace. A famous example is "Non-Fungible Tokens" (NFTs). This concept along with blockchain technology gives rise to many problems for the legislators such as decentralized currency, digital identity and many new questions about cross-border property rights, intellectual property rights and evaluation of digital assets. A simple application of regulations from the physical property to the digital property is not possible, only proactive legislation can deal with such future threats to the judicial system.

¹⁶ One such question was dealt by the court in *Thaler v Comptroller-General of Patents, Designs and Trade Marks* [2023] UKSC 49

¹⁷ Jason B. Jensen, "Self-Driving but Not Self-Regulating: The Development of a Legal Framework to Promote the Safety of Autonomous Vehicles" (2018) 57 *Washburn Law Journal* 579.

¹⁸ Christoph Zeunert and Daniel Rosenthal, "Cross-Border Discovery: Practical Considerations and Solutions for Multinationals" (2011) 12 *Sedona Conference Journal* 145.

¹⁹Chen Zhong, "Building a Legal Framework for the Metaverse: Digital Identity, NFT Property Rights, and Global Legal Structures" (2025) 1(1) *Digital Society & Virtual Governance* 52.

Proposal for Reforms

It is clear that the foremost step towards accepting technological regulation is allowing the concept of constant and persistent innovation to prevail. If the judges, lawyers, and regulators will stay concerned and fearful about their jobs they will not only fall behind in societal progress but may also inevitably become the cause of such stagnation as being the ones responsible for societal growth.

To address these issues regulatory systems should be more adaptive and flexible to the upcoming technological innovations. With the adoption of regulatory sandboxes, there should be “sunset clauses” in tech-related legislation. Such clauses can help the government or a governmental institution to do a periodic review and update regarding the law. This will make sure that strict regulations don’t come in the way of innovation. These experimental laws are easier and quicker to pass and make sure that no innovation touches the market unregulated, therefore ensuring consumer safety.

Legislators must develop a method to always have experts on deck or develop interdisciplinary skills. Law students and legal professionals would need to work on multiple skills and acquire interdisciplinary knowledge. Law-tech experts can handle all the intricate challenges of AI regulation without having to face a setback due to hastened legislation. There should be bodies which deal with the rights of manufacturers and consumers directly without having to wait for the long-term outcome of a regulatory law.

Law schools, judicial academies and other nurseries for training future lawmakers should have a versatile adoption of modern technological challenges faced by the regulators. Furthermore, increased transparency and public engagement in tech law-making processes can foster democratic legitimacy and public trust, which are often eroded by opaque and hasty regulations.

Dealing technological advances with technology is one way to counter the exponential growth in technological innovation. The regulatory bodies can issue micro-directives which target specific guidelines in the face of a particular technology. Such directives can be quickly updated and adjusted according to the technological upgrade. Broad, detailed regulations often take more time and resources to enact, the same resources are wasted and regulations are made obsolete when a new technology emerges. This approach not only facilitates compliance for innovators but also allows regulators to address potential risks proactively²⁰.

CONCLUSION

The rapid advancement of technology continues to outshine the pace at which legal frameworks are developed, creating an apparent and material law-technology gap. This challenge creates significant problems for regulatory institutions, policymakers and law practitioners who have to deal with novel ethical, legal and jurisprudential dilemmas. Technologies such as artificial intelligence, blockchain, and biotechnology often present regulatory hurdles that existing legal concepts are ill-equipped to resolve. These include questions concerning liability, ownership, cross-border enforcement, and the protection of fundamental rights such as privacy and property. The traditional reactive model for regulatory mechanisms, where laws are drafted in response to malicious usage of technology, cannot keep up with the proactive and ever-developing nature of technology.

To end this gap, legal systems must develop certain farsighted, flexible and interdisciplinary approaches such as “regulatory sandboxes”, “sunset clauses” or “micro-directives”. These frameworks allow for controlled experimentation with new technologies within a monitored and limited environment, ensuring

²⁰ Anthony J. Casey and Anthony Niblett, “Self-Driving Laws” (2016) 66(4) University of Toronto Law Journal 429.

innovation with consumer protection and regulatory insight. Incorporating experts and stakeholders in regulatory frameworks can not only help anticipate future developments but also enact laws which are free from innovatory uncertainty and inclusive.

In addition to institutional innovation, there is a pressing need for structural reforms in the way legal professionals are trained. Law schools, judicial academies, and governmental institutions should incorporate technology-related courses. They should promote interdisciplinary learning, equipping future lawyers and judges with the tools to understand and regulate complex technological dilemmas. Regulatory agencies should maintain in-house technological expertise or work in close coordination with technical professionals to reduce the chances of over-legislation or redundant legislation.

Technological advance is not limited to one jurisdiction; lawmakers should coordinate globally to address cross-border issues. This would prevent the stagnation felt by manufacturers in technological innovation on a commercial scale. The public and stakeholders must participate in such regulatory decisions.

Overall regulatory lag is not inevitable and can be dealt with. The problem has been materialized and legal experts are already planning on battling this. Innovation in technology should be brought to law schools and educational practices so we can have professionals well adept at combating the law-technology gap. Bridging the law-technology gap requires a paradigm shift from reactive, static and rigid legislative practices to proactive anticipatory practices.

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