

Taxing Digital Intellectual Property: Legal Examination of Virtual and Real World Problems

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Intellectual Property has been a classic and time-tested pillar of economic growth, an innovation engine, and a generator for creativity, and technological advancement. However, the 21st century marks the dawn of the Fourth Industrial Revolution, one where the physical, digital, and biological worlds come together.

This technological revolution, fuelled by breakthroughs in AI, blockchain, and decentralized economies, has spawned revolutionary shifts in the production, monetization, and taxation of intellectual property.

In 2025 and beyond, traditional IPR thinking will be disrupted by the advent of a new generation of intangible assets in the form of inventions created by AI and holographic trademarks, virtual property, and non-fungible tokens. Not only do they disrupt the ownership legal regimes, but also exert pressure on the old tax systems built during the industrial age. While these intangible assets become the centre of the global economy, the existing tax systems lack the capability to manage the complexities of the digital era.

We examine in this paper the challenges posed in the taxing intellectual property regime in India and the possible solutions. As the internet and metaverse grow, there is an urgent need to reexamine Indian taxation laws in taxing intangible property like taxation in IPR.

Keywords: Digital Taxation, Taxation and IPR, Digital Intellectual Property, Intellectual Property, India, IPR

Taxation of intellectual property is not merely a legal issue; it is one of global economic importance. Governments depend on tax revenues raised from IP transactions to finance core public services, but the pace of technological innovation has accelerated so much that it has outpaced the capacity of tax authorities to control and collect tax on new IP types effectively. Meanwhile, corporations are exploiting the global digital economy, using IPR to shift their tax burden through sophisticated IP structuring and profit-shifting mechanisms. Such activities, legal as they may be, reveal the broad holes in existing tax systems and call for a revolutionized strategy towards taxing intellectual property.

As we approach the digital era, there has never been a greater call to rethink the taxation of intellectual property. Digital marketplaces, AI, and distributed economies are forcing new thinking from traditional tax models and eroding the foundations tax law is based on. Governments must stay ahead of

technological advancements, such as blockchain, to drive further transparency and reduction of intellectual property activity tax compliance. Governments must, in turn, establish global frameworks that harmonize IP taxation, reducing the scope for tax evasion and stimulating innovation and economic growth.

Traditional parameters will no longer bound intellectual property in the future.¹ The lines between tangible and intangible, human and machine, physical and virtual will increasingly blur, and the tax regimes of the past will have to evolve to keep pace with the realities of the digital age.

Over and above that, changes in technology move at such high speed that is leaving governments back in implementing viable reforms.² On the international front, efforts at the OECD for example, there have been BEPS initiatives, but they do not exhaustively bring to the front all the singular problems that emanate from emergent technologies and digital assets.³ Unless concerted efforts to modernise IP, and tax policies are made, countries will miss out on

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substantial tax revenues, and emerging industries will be burdened by uncertain tax environments that hamper their development.⁴

Intellectual Property in AI and Automation

AI-Generated IP: Ownership, Value and Taxation

Artificial intelligence, or AI, has heralded a whole new dramatic turn in the world of intellectual property.⁵ Traditionally, it is easy to recognize who created the work: it was either a creator or an artist. But nowadays, as more and more AI models generate art like *DALL-E*, music like *AIVA BLURS*, patents, and even literature, the old understanding of authorship and ownership has been turned on its head.⁶ In this new sphere of automation, the creator could be a machine rather than a human raising the most difficult questions about ownership, valuation, and taxation of AI-generated IP.

For example, AI art. In 2018, an AI-produced portrait¹ titled *Edmond de Belamy* by the Paris-based collective sold for £432,500 at Christie's. The artwork was generated by the workings of a machine learning algorithm, which was trained on portraits spanning centuries of art history. Such an event instantly brought forth radical questions: *who owns this creation? The artists who trained the AI? The creators of the algorithm? Or perhaps, should ownership lie with the machine itself, as it is the true "creator"? If the machine can produce valuable works on its own, then should it be taxed, or should the human party behind the algorithm be liable?*

Traditional tax laws depend on clear definitions of ownership, and with AI-generated IP, these definitions are fuzzy. Value and tax liabilities to be imposed on AI-generated creations are several complex issues. If a machine is recognized as the creator, should tax liabilities be assessed based on the commercial success of its work? Or should liabilities be continued over human creators at the hands of tax authorities to consider AI merely as an adjunct of their thought or a subsidiary tool?

At least, its solution lies with the Tax Self-Assessment System for AI IP. Here, AI systems may automatically determine the market in real-time and value their creativity. The AI would report the tax liability, which would then be verified and processed through a blockchain-backed algorithm.⁷ Blockchain ensures that tax assessments are transparent, accurate, and immutable. Hence, there is no human intervention in the tax computation process, making it efficient and reliable.

For instance, when an AI develops a software product that is sold to a company, the AI system can look up the market and determine its value, consider licensing and sales trends, and compute the tax amount automatically. With blockchain technology, the transaction is documented securely; hence, fraud would be impossible, and the tax authorities would have an audit trail.

As AI systems like *DeepArt* can create pieces of visual art and sell them for considerable sums of money, a system must exist that can tax these works fairly, transparently, and in an efficient way. The UK tax system can be made more capable of handling this new class of IP by utilizing a self-assessment model that takes into account the market conditions and automates the filing of tax.

This self-assessment system will challenge the concepts of IP ownership and taxation in existence.⁸ In this framework, by harnessing the power of AI and blockchain, creators-including humans as well as machines-will be taxed fairly with respect to the value generated in the market.

The Invisible Assets: Synthetic Data and Patents

There is this new intellectual property called synthetic data that further complicates the models of traditional taxation. Synthetic data is AI-generated data used for model training or simulation of real-world scenarios.⁹ Such data cannot be touched or seen and, most importantly, it is infinitely replicable, yet its value cannot be evaluated, and in several sectors such as healthcare, finance, and autonomous vehicles, this data plays a crucial role.¹⁰

In autonomous driving, synthetic data serves to train AI systems on how to drive under different driving conditions. Such datasets, which are produced by simulating millions of hours of driving, form fundamental training material for AI systems: self-driving cars will then be able to recognize pedestrians, other vehicles, and road signs. It is not derived from any actual event but has been synthetically derived through algorithms and simulations. In that sense, it is invaluable for driving technological progress forward.

However, taxing artificial data is pretty tough because, unlike a patent or a trademark, *it can't be owned*. It may be reproduced without limit and is used in dozens of industries. But it hardly ever gets consumed or destroyed during its use; therefore, taxing is difficult because its value will vary with utility for AI models and their application.

Such issues could be addressed through a Proposed Tax Framework by considering synthetic data as a form of digital resource whose value depends on its utility in specific applications, such as training AI or powering commercial applications.¹¹ Just as intellectual property laws differentiate between tangible and intangible assets, a dynamic taxation model for synthetic data would recognise its unique characteristics. For example, a dataset applied in critical sectors such as health care may be taxed at a different rate than a dataset used in gaming or entertainment.

The value of the synthetic data will be based on its quality, rarity, and relevance to the particular industry being considered.¹² It is also worth noting that data analytics and AI-driven tools should be utilized in tracking the synthetic data, so taxes are charged at the commercial levels. A better example will include a synthetic dataset used in establishing a medical treatment breakthrough being accorded a much higher tax level than the latter, whose utilization has been described as not impactful.¹³

It may also be that the taxation model can be based on usage-based taxes. The model would make synthetic data from high revenue-generating industries such as pharmaceuticals and be taxed at a higher rate as compared to its less commercially viable uses. As such, this would ensure the level of synthetic data contribution toward the economic creation of value will be taxed under this model.

In the UK, a tax based on the societal and commercial impact synthetic data produces for the use of AI tools for health diagnostics might be implemented. A company creating synthetic data for such applications might report on use in AI training and then subject itself to some form of self-assessment that ensures the tax is reflective of the broader value the data helps generate.

Challenges and Opportunities in the Synthetic Data Taxation

One of the major difficulties in taxing AI-generated IP and synthetic data lies in the lack of legal precedents. Tax authorities are constantly having to play catch-up with AI, which is fast-evolving, and try to come up with policies that fit new technologies that were not foreseen when traditional IP laws had been established.

Of course, in doing so, there lies a threat and an opportunity: the integration of AI and artificial data may just help create new, entirely exclusive IP laws

along with tax infrastructures that befit the better needs of digital and automated economics. Tax officials will be well on their way to creating fully transparent, fair, and smooth systems for levying taxes based on digital assets using blockchain-aided automated self-assessments.

An example would be if smart contracts and blockchain technology automatically make tax payments for IP creators and owners while complying with the tax laws applied. Additionally, a tax regime that dynamically reacts to the synthetic data value will promote more innovative use of AI as it increases responsible use and development.¹⁴

An exponential rise in AI-generated IP and synthetic data brings with it a new era of intellectual property, and it needs new approaches toward ownership, valuation, and taxation.¹⁵ Traditional tax systems, which have been built around human creators and tangible assets, need to adjust to this change by integrating blockchain and self-assessment models.

The Metaverse and Virtual IPR

Taxing the Metaverse

The Metaverse is no longer a futuristic concept but has already emerged as a blossoming virtual ecosystem where people meet, buy and sell virtual real estate, and exchange unique digital assets such as non-fungible tokens. Virtual worlds like *Decentraland*, *Sandbox*, and *Somnium Space*, which rely on blockchain technology, are changing the economic activities within these virtual spaces, thereby making the difference between virtual and physical economies unclear.¹⁶ This fast-moving virtual economy poses grave questions regarding tax authorities' taxing virtual assets and, by and large, continues to expand as these digital economies grow. As a matter of fact, in India, this is an already discussed question and has started answering the questions regarding the full tax implications of virtual assets.

In Decentraland, sales of virtual real estate have not been slight: in some cases, land plots go for millions of dollars. An instance of that was the acquisition of a piece of virtual land in Decentraland in 2022 at the price of \$2.4 million. Another example comes from Sandbox; transactions involving NFTs represent frequent deals when selling virtual real estate. Here, the six figures USD is no rare achievement in such a deal. As such transactions do

not fit in with the format of the traditional tax regimes, authorities have a huge concern regarding taxing how such transactions should be done. “*Should such transactions attract capital gains tax or be considered a mode of property transaction?*”

In India, the Union Budget for 2025 has proposed imposing a 30% tax on the income gained from virtual digital assets. Such assets include cryptocurrencies, NFTs, and others. The virtual estate, however, is still a blurry concept and is yet to receive a clear definition when it comes to treatment; so far, people are struggling with the issues concerning how such virtual transactions can be taxed. On top of these issues, their decentralized nature leaves transactions unmonitored by conventional regulatory regimes at borders. With little regulation governing such cross-border transactions, current tax enforcement becomes impossible.

Recently, one possibility for this new frontier of real estate was Decentralized Autonomous Organisations (DAOs). DAOs are blockchain-based entities that allow for community governance through smart contracts. For virtual assets, DAOs can be self-regulating bodies within virtual worlds, collecting taxes and providing transparent, immutable records of transactions. Tax authorities can collaborate with such DAOs to ensure that tax liabilities are met and tracked with accuracy, which would otherwise be a challenge of decentralized governance in virtual economies.

The most notable virtual economies and taxing of virtual assets report of PwC is that the tax policies must be updated to represent the digital transformations in the jurisdictions. According to PwC, virtual assets, including virtual real estate and NFTs, are increasingly speculative investment products and should be treated as other financial assets from the taxation perspective. However, the nature of such assets, particularly, their decentralised and cross-border nature; gives rise to challenges in enforcing taxes. PwC is of the view that jurisdictions need to have well-defined, harmonized tax legislation that will help simplify virtual asset transactions to ease tax compliance for both the asset holders and the tax authority.

Holographic Trademarks and Virtual Copyrights

The branding landscape is evolving as the Metaverse continues to expand. Holographic trademarks and virtual copyrights are becoming new significant areas of intellectual property in these digital worlds. In 2025, holographic trademarks are

increasingly used by brands to represent their brand logos and symbols in virtual environments. These trademarks exist only within the Metaverse, representing a major shift from traditional, physical branding strategies. Popular brands like Nike and Gucci have already started utilizing these digital assets and are selling virtual sneakers and handbags in Fortnite and Roblox, for instance. The rise of these non-physical assets brings upon fundamental questions as to how these should be taxed.¹⁷

In India, the government has been updating its IP laws that reflect the digital age. The use of holographic trademarks in virtual spaces is a new frontier in India. Currently, the Copyright Act of 1957 is the main statute for IP law, but it does not address the intricacies of virtual assets. The question is: *how can a trademark be taxed if it has no physical counterpart? Should brands be taxed on the sale of virtual goods in the same way as they are taxed on the sale of tangible products?* The challenge is in how traditional tax frameworks apply to virtual goods, which exist only in digital form and hold value in virtual economies.

Virtual copyrights are also becoming more significant in the Metaverse. Users frequently create virtual assets-artwork, music, clothing, and designs that are often protected by copyright laws. Virtual content creators on platforms like *Second Life* or *Roblox* are generating significant income through the sale of their creations. However, the existing copyright law designed for physical works should be adjusted according to the reality of the virtual world and more so in India, since the Copyright Act, under existing discussions to better respond to the emerging challenges, leaves much in the mist about how virtual copyrights can be recognised and taxed.

As mentioned, the PwC report indicates that digital copyrights, especially those that are connected to virtual works, need to be taxed in a manner that is similar to how traditional copyrights are taxed. However, it notes that virtual assets such as holographic trademarks and digital arts, just like intangible assets like intangible intellectual property, should be taxed depending on their virtual utility and value in the market.

Proposal: Decentralized IP Taxation in Virtual Economies

DAOs could be an alternative way that address the virtual assets and IP taxation complexities in the future by handling taxation matters on virtual goods.

This system would see self-governing bodies represented through DAOs for virtual worlds that would enable user and IP ownership participation in matters of management as well as the collection of taxes. This may be able to solve the issue of taxing assets in a decentralised, cross-border environment with the most transparent and efficient mechanism for ensuring tax compliance.

This way, DAOs could be created that can collect taxes automatically from virtual transactions. For example, selling virtual real estate, digital goods or even licensing of intellectual property. Blockchain technology can be used so that DAOs can create a record of immutability which would help show the collection of taxes transparently and accurately. Such a model can be extremely helpful in the case of countries like India wherein the digital economy is booming, and the government authorities are looking forward to efficiently dealing with the tax implications of such virtual economies.¹⁸

The PwC report further strengthens this argument by stating that the application of DAOs in virtual asset taxation may help overcome the challenges of decentralization. According to the report, DAOs may allow participants in virtual worlds to self-regulate tax compliance, thereby reducing the burden on traditional tax authorities and increasing tax transparency. The report also advises governments to explore the possibility of cross-border cooperation to ensure harmonization of tax laws across virtual worlds.

DAOs and Blockchain

The rise of DAOs, or Decentralized Autonomous Organizations, has completely changed the various dimensions of governance and ownership in the context of Intellectual Property (IP). Self-governing entities operating on blockchain technology, powered by smart contracts, form a decentralized model of decision-making and resource management. These decentralized autonomous collectives open new avenues for holding and managing IP assets, pushing traditional legal frameworks and tax authorities to rethink the entire world. While ownership of IP has been moving toward a decentralized model, questions about how the government can collect taxes from it have become even more distributed.

DAOs and the Evolution of IP Ownership

In the traditional setting, IP ownership belongs to a legal entity such as a corporation, an individual, or a

government body. They own patents, trademarks, copyrights, and trade secrets, with the power to license, sell, or use the IP for royalties or other forms of income. The model has been disrupted by DAOs. Such organizations allow for the collective ownership of IP assets where decisions about their monetization and management are decided through community voting, all based on smart contracts on the blockchain.

A DAO cannot be said to be limited to a geographical boundary or centralized governance. The IP ownership in a DAO is thus decentralized. Any decision related to the licensing of a patent, sale of a trademark, and distribution of royalty from a copyright can be decided collectively by token holders. Pseudonymous users distributed across the jurisdictions are represented in a vote on the destiny of the IP, challenging concepts of ownership and governance.¹⁹

For instance, *PleasrDAO*, the most prominent DAO, has acquired valuable IP assets like Edward Snowden's NFT and the Wu-Tang Clan's album "*Once Upon a Time in Shaolin*." Under this model, the DAO holds the assets and members have a fractional ownership along with decision-making power over how these are used, put on display, or resold. This form of ownership brings with it new complications as far as ascertaining the legal owner, and most importantly, who owns the tax burden regarding income coming from such an asset.

Taxation Challenges in a Decentralized Landscape

The decentralized nature of DAOs would challenge the existing tax framework, as existing tax structures depend on a single, centralized identifiable owner of the assets. Here, ownership of IP in a DAO is divided among the whole global network; often, it is difficult to identify which particular entity has managed or is to report its tax liabilities. This technology of blockchains powering the DAOs presents members with some degree of anonymity or pseudonymity, hence it is hard for any tax authority to trace the inflow of the income and apply enforcement on people.

The most serious problem of DAOs is the jurisdiction problem. Traditionally, tax obligations for income related to IP rights depend on the country where the IP owner resides, or the transaction takes place. DAOs are also cross-border because their members are in different countries. Thus, it is worth asking which jurisdiction has the right to charge taxes on income earned from *the sale of IP rights owned by a DAO*.

For example, if a DAO licenses software to a company in the United States and pays the licensed developers based in Europe, Asia, and North America, how do tax authorities determine the country that would collect and tax the income. More importantly, taxes may be paid in some cryptocurrencies, thus further clouding the process of identifying taxable events, to say nothing of enforcing the law.

Anonymous Participation and Crypto Payments

Another significant challenge for tax authorities is that there is anonymity or pseudonymity regarding the members of a DAO. Using blockchain, participants can anonymously interact with the DAO or pseudonymously using only the wallet addresses. When smart contracts automate royalty payments or profits from licensing IP, these might end up being in cryptocurrencies such as Bitcoin or Ethereum. Since these are automated and anonymous transactions, the tax authorities will find it very difficult to track the income flows and identify those responsible for reporting income.²⁰

In the case of DAOs managing high-value IP assets like patents or trademarks, the money earned from licensing or sales may be substantial, but there would be no single central entity and little record of ownership to draw on in an attempt to enforce tax compliance.

Tax Authorities Response

In the face of DAOs and decentralized IP ownership, tax authorities will have to be innovative to ensure compliance. Some solutions are already being developed:

(i) **Blockchain-Based Tax Reporting:** Utilizing the same technology that backs DAOs-blockchain-lets tax authorities add more transparency to reporting. Through smart contracts, tax-compliant rules can be embedded for DAOs to automatically withhold taxes or even report transactions with tax authorities.²¹ For example, if the software is licensed by a DAO, the smart contract can be written to automatically subtract tax from the payment before transferring royalties to the members. This will ensure compliance at the point of transaction rather than relying on an individual's self-reporting of income.

(ii) **International Cooperation and Global Standards:** DAOs are the new global venture. Countries would have to consult each other when

creating international guidelines for IP taxes in decentralized conditions.²² Like with the OECD BEPS framework related to tax evasion by multinational enterprises, there are requirements for common standards on tax rules for such decentralized organizations at the global level. By making clear rules that describe jurisdiction and transfer pricing, governments can withhold tax base erosion and ensure just taxation of the income generated by DAOs.²³

(iii) **Cryptocurrency and Token Taxation:**

Many DAOs distribute income through cryptocurrencies or tokens, which fluctuate in value and may not fit neatly into existing tax categories. For this purpose, the United States has already started providing clear guidelines regarding taxation on cryptocurrencies and has been considering them as property for tax purposes. Therefore, it will be important to extend these guidelines towards token-based income from DAOs to address tax compliance in decentralized economies.

Some countries like France have imposed a DST that takes taxes from cross-border operating digital platforms. It is the right model to use in the case of a DAO because such organizations have their income source as a digital IP transaction and must pay for their generated income according to where it was spent.

A Model for the Future at Singapore?

Singapore and similar countries have begun experimenting with tax incentives for the development of R&D and IPs. The Productivity and Innovation Credit Scheme by Singapore provides significant tax deductions on the registration of IPs and R&D activities with the goal of positioning Singapore as an IP creation hub. Such a visionary tax policy might be suitable for DAOs: tax incentives might be a motivation for innovation and, at the same time, ensure proper taxing of the income generated from IPs.²⁴

For example, the government of Singapore offers a 200% tax deduction on the very *first \$100,000 on IP protection spending*. Similarly, an incentive applied to DAOs that manage their IP would facilitate decentralized collectives to abide by local tax compliances through a deduction or tax credit for paying IP-related taxes.²⁵

DAOs are raising the stakes in intellectual property ownership and taxation. DAOs revolutionize

collective ownership and management of IP assets but have direct competition with traditional, centralized models of ownership and governance structures for tax authorities. To ensure compliance, tax authorities must adapt by developing blockchain-based reporting mechanisms, global tax standards, and cryptocurrency taxation rules. As DAOs grow in prominence, it will be important to solve the complexity of taxing decentralized IP ownership in order to maintain a fair and effective tax system in the digital age.²⁶

Global Harmonisation

As digital economies are reshaping global markets, there is an increasing need for harmonized IPR taxation. In the wake of multinational tech companies using intangible assets across borders, a global solution is in order. The OECD's BEPS framework has been effective in addressing traditional corporate tax avoidance but is not quite able to keep pace with the digital-first economy. The limitations in dealing with complex digital IP transactions of BEPS reveal the necessity of a Global Digital Tax Alliance (GDTA).²⁷

It was the BEPS initiative that could address the most crucial issues. Profit shifting remains one of those issues, yet mechanisms to govern digital IP taxation are still to be established. Digital platforms, NFTs, and AI-generated content give tax authorities an unprecedented challenge: these intangible assets defy traditional boundaries of physical presence and jurisdiction. Digital economies allow companies to generate profits worldwide while transferring revenues to low-tax jurisdictions, thus creating a significant tax gap for many countries.

A GDTA would be the international governing body to be created for the purpose of filling these gaps by directing the standard framework of taxing digital IP. Differing from the OECD's conventional approach, the GDTA would concentrate on intangible properties like software, data, and digital content. The main task of the coordinated tax policy by the GDTA would be the fair allocation of revenue across jurisdictions and ward off profit erosion and base shifting- practices unfavourable to tech giants.²⁸

The Need for GDTA

The GDTA is a radical departure from the currently applicable tax frameworks that are uniquely placed to take on the challenges of the digital economy. While fragmented national tax policies, for instance, DSTs

have been applied to domestic transactions, the GDTA looks to harmonize the standards on taxation across the globe to present a uniform tax structure for intangible digital assets like data, software, and digital content.²⁹

This means that the GDTA has one of its major differences by focusing on the economic presence and not the physical headquarters to tax multinational corporations to ensure they pay taxes on real user bases and economic activities in cross-border borders. Issues on profit shifting that involve tech giants taking advantage of low-tax jurisdictions even though they generate significant revenues worldwide would be solved under the GDTA.

The GDTA would use AI and blockchain technologies to create automated tax compliance systems.³⁰ Such systems would track real-time global IP transactions and, hence, accurately allocate taxes based on user location, avoiding revenue leakage.³¹ Automation can bring about a level of transparency and efficiency that cannot be matched by the existing tax frameworks because it reduces manual intervention and creates a secure, tamper-proof record of transactions.

Unlike the existing BEPS framework that looks at loopholes already in place and curbs them, the GDTA looks at an institutional approach by proposing uniform policies, thereby opening avenues for international cooperation. This property chimes in that tax competition among countries does not collapse into a race to the bottom, where tax havens begin to undermine national tax bases.

The GDTA is distinct with real-time enforcement, international cooperation, and the efficiency of using technology to face the intricacies of the digital economy while always keeping an eye on long-term tax equity and sustainability.³² For this reason, this aggressive framework prevents tax evasion and encourages equitable taxing across jurisdictions, and each country can reap its benefits concerning digital economic activities.

Taxing Global IP Revenue Systems through Digital Cooperation

As the world economies continue to further go digital, the real challenge in efficiently taxing the revenue streams of intellectual properties lies in this. The generation of revenues in the forms of software, digital content, and e-commerce is phenomenally so large in amounts that it transcends borders, and the

full benefits of these transactions mostly elude national tax authorities. A practical solution for fair and consistent taxation across jurisdictions exists through digital cooperation by way of a GDTA.

AI-driven tax assessment systems for IP would be a cornerstone of this cooperation. Such systems automatically track royalties, licensing fees, and digital services through real-time transactions. Tax authorities would thereby analyse global IP revenue flows with unprecedented accuracy, by allocating tax liabilities according to user location or economic presence rather than outdated models based on physical headquarters. This approach ensures that countries with large user bases or economic activities benefit from tax revenues generated within their borders.³³

Another kind of smart contract embedded in electronic IP transactions can further automate at the source any withholding of tax at the generating point of the revenue. Since taxes would automatically be collected based on source transparency, it saves administrative burdens besides minimizing the possible scope for evading taxes with the transparent dealings of smart contracts based on specific tax rules laid down beforehand.

Moreover, secure blockchain networks will help in cross-border collaboration. Thus, the global IP transactions shall be reported and exchanged between the countries in real-time so that the digital services can be taxed justly and uniformly. At the same time, it minimizes the double taxation risks resulting from the unilaterally enforced Digital Services Taxes.

Further, the AI algorithms may distribute tax revenues fairly and equitably based upon usage, data generated, or economic value created due to specific regions. This would mean that developing countries and developed economies would get their legitimate share of revenues within digital services. For instance, if a multinational tech company produces enormous revenue through user data in developing markets, the countries can tax the economy directly.

An approach led by GDTA would settle disputes through enhanced global transparency and facilitate harmonized tax policies. Such an approach would remove the fragmented national tax regimes found in France and India and decrease the potential for profit shifting to low-tax jurisdictions.³⁴ The countries would thus avoid losses through base erosion while having a sustainable tax system for the digital age through the taxation of global IP revenue streams via digital cooperation.

The future of IP taxation is collaborative and, to an extent, technologically driven. Digital cooperation of this nature, underpinned by AI and blockchain, would thus create an efficient, transparent, and, above all, fair system for taxing global streams of revenues under IP. This will help recoup revenues lost in jurisdictions, but it will also correctly primarily ensure that benefits from the digital economy are received by all the concerned jurisdictions participating in such a system.

IP Commercialisation in the Decentralized World

The future of intellectual property commercialization is fast changing because the digital world is shifting into a decentralized web where transactions are being carried out without the intermediation of traditional entities.³⁵ This decentralized economy, based on blockchain and peer-to-peer networks, presents unprecedented opportunities for innovation, but it poses challenging issues for regulators, particularly in taxation. When IP is monetized in a decentralized and often anonymous environment, tracking and taxing IP royalties and licensing fees becomes more and more difficult for tax authorities.³⁶

The digital economy is a borderless one, and as such, the conventional restrictions of geographies and jurisdictional oversight are no longer relevant in the same way.³⁷ Digital assets like patents, trademarks, and copyrights are bought, sold, and licensed ever more commonly in decentralized markets without necessarily being related to any jurisdiction. This creates tax compliance gaps because tax authorities find it impossible to track the revenues generated by the above assets when such transactions are traceable only to a geographical location that is impossible to determine.³⁸

For example, it can be a patent sold as a non-fungible token on a decentralized platform or digital streaming royalties that are paid utilizing smart contracts on a blockchain. The cross-border character of such transactions could be established without a centralized tax reporting body to be attached to. That decentralized nature is a double-edged sword of sorts: whereas flexibility and anonymity suit businesses so well, enforcement of IP taxation becomes a challenging problem across borders. In this borderless economy, multinational corporations, as well as individual creators, have new revenue streams, and national tax administrations face enormous obstacles in enforcing the rules and recovering taxes fairly.

IP-as-a-Service (IPaaS)

IP-as-a-Service, or IPaaS, presents a promising approach toward these issues. This would entail the licensable and commercialised IP sitting on cloud-based platforms, which track and automatically tax every transaction either by geospatial location or jurisdictional agreements. The basic idea behind IPaaS would be an automated global marketplace for the transaction of IP, all driven by smart contracts that could automatically manage licensing, distribution, and most importantly, instant taxation.

At the practical level, with an IP asset like a patent licensed through an IPaaS platform, for instance, the algorithms on the platform would compute the applicable taxes immediately concerning where the IP asset is used, who the licensees are, and which jurisdictions apply. Because of the geo-location data, the IPaaS model would work to assign tax liability to the proper authorities against the economic activity harnessed by the tied IP asset.

- (i) **Real-time tax compliance:** The chances for tax evasion or revenue leakage are very few since there is real-time realization of taxes during the transaction.
- (ii) **Transparency and auditability:** All IP transactions would be recorded on blockchain networks, thus there would be transparency and tamper-proof and audit-ability records of revenue streams which would be auditable for tax authorities.
- (iii) **Reduced administrative cost:** With IP rights holders not having to penetrate or understand intricate tax codes relevant to different jurisdictions, their administrative task is also reduced.³⁹

Such an IPaaS system, therefore, will transform global IP taxation, making the process more efficient, transparent, and resistant to fraud. Simultaneously, it allows countries the opportunity to gain revenues from taxation, even when decentralized, and anonymous transactions do not reach the coffers.⁴⁰

Digital Tax Residency

As decentralized and decentralized technologies become commonplace, the typical definition of tax residency is shifting. In a decentralized world in which companies and individuals are conducting business across virtual platforms rather than physical jurisdictions, it may make sense to introduce the concept of digital tax residency for IP holders. This would permit individuals and businesses to determine their virtual tax jurisdiction based on the physical

location where their digital assets generate revenue rather than physical location.

The digital artist or the software developer would come up with an intellectual property that renders revenue across several platforms, countries, and markets. In this scenario, digital tax residence will be declared by the IP holders based on the economic activity of their digital assets, like downloads of their software or sales of their digital art. This then represents a more dynamic and flexible system that can better respond to the reality of the digital economy.⁴¹

Environmental Impact of IP and Green Tax

Green technology and intellectual property (IP) based on green innovation have altered the global governance approach in handling green challenges by changing how industries and governments act toward confronting challenges from environmental causes.⁴² Green taxes have the capacity to define how cleantech innovations occur and come into prominence within such green growth fields as renewable energy, carbon sequestration, and artificial intelligence. Governments can adopt two main steps: taxing the environmental impact of IP creation and offering tax incentives linked to sustainability to promote the development of green technologies.⁴³

Taxing the Environmental Footprint of IP Development

One of the areas that needs to be looked into is the environmental price of developing some forms of intellectual property, especially in the technology industry. As there is greater technological innovation, there is more energy consumption that comes along with it. For instance, AI models consume quite a bit of computation power, and this creates a gigantic carbon footprint. Creating gargantuan AI models such as OpenAI's GPT-3 has been estimated to yield 552 metric tons of CO₂, the equivalent of driving 125 cars per year.

To offset this effect, some nations, including Sweden, have imposed high carbon taxes of around \$137 per ton of CO₂ to incentivize industries to minimize their carbon footprint.⁴⁴ Such taxes have helped decrease greenhouse gas emissions by 25% in Sweden as the economy has expanded more than 60% from 1990 to 2017.⁴⁵ Implementing similar carbon-based taxes on the environmental footprint of IP innovation, especially in energy-intensive areas such

as AI, may promote the use of cleaner technologies and carbon-neutral computing.

Green IP Tax Credits: Encouraging Sustainable Innovation

Governments should also promote corporations to seek out green innovations through the provision of tax credits for those companies which create IP driving environmental sustainability. Such credits must be directed toward industries which utilize renewable energy, energy-efficient innovations, carbon abatement, as well as reduction technologies.⁴⁶

In the United States, the Energy Investment Tax Credit (ITC) offers a 30% tax credit to businesses investing in renewable energy projects. Since its launch in 2006, this policy has greatly increased solar energy installations, leading to a 52% average annual growth in the solar sector.⁴⁷ Likewise, the European Union's "Horizon Europe" program invests close to €95 billion (2021-2027) in financing green innovation, directly supporting businesses that create patents or technologies aimed at environmental sustainability.

Sustainability-Linked Tax Incentives for IP Holders

A more focused strategy for tax incentives linked to sustainability would spur innovation in green intellectual property (IP) by incentivizing firms that specialize in clean technologies. Such incentives would encourage industries to emphasize renewable energy, carbon capture, and energy-efficient technology, thus speeding up the world's shift to a low-carbon economy.

Governments can offer greater tax credits to companies patenting clean energy technologies, including wind, solar, and geothermal. According to the International Energy Agency (IEA), renewable energy produced 29% of electricity in 2022, and the sector has a huge growth potential. Governments can do more to foster this by stimulating development. In the United States, for instance, the Energy Investment Tax Credit (ITC) played an important role in encouraging the growth of solar installations, illustrating the impact of policy-led incentives to encourage the uptake of green technology.⁴⁸

Likewise, carbon capture and storage (CCS) technologies are at the heart of the battle against climate change. CCS will provide 20% of the overall cut in carbon emissions required to achieve net zero

by 2050, the IEA estimates. Governments providing tax credits to companies developing CCS technologies can accelerate their deployment, *as Norway's over \$3 billion investment* in CCS projects illustrates. This would stimulate innovation and enable the scaling of decarbonization-critical technologies.

In the technological industry, more is needed to minimize the green footprint of AI technology and data centres. Eco-friendly data centres and energy-conserving AI applications can be applied to slow the increase in these technologies' energy demands. Accenture, in one study, estimated that adopting energy-efficient cloud computing would reduce emissions globally by 59 million tons of CO₂ annually, equivalent to removing 22 million cars from the road. Governments providing tax credits to create such innovations would make a big dent in emissions from the tech sector, one of the fastest-growing consumers of energy.⁴⁹

The circular economy, focusing on waste reduction and reuse of resources, can also benefit from certain tax allowances. The German case of the Renewable Energy Sources Act is a good example since it encouraged energy-efficient production behaviour, and since then, the country has reduced its greenhouse gas emissions by 40% since 1990. Such countries can also motivate industries to apply environmentally friendly practices that stress resource conservation and waste minimization by offering them equal tax deductions.

These tax incentives tied to sustainability not only drive innovation in key sectors but also serve to solve top-priority environmental issues. Governments worldwide will need to make these kinds of incentives a policy to incentivize firms to invest in greener, cleaner technology. Providing economic incentives for producing sustainable IP would put green innovation on an even playing field, promote global climate objectives, and drive economic development. Sustainability-based tax incentives would in the long term allow industries to shift towards a low-carbon economy for the common good of the environment and society at large.

Conclusion

The nexus of taxation and intellectual property (IP) is a key intersection between innovation and compliance. With IP becoming more and more decoupled from physical borders and deeply rooted in

the digital economy, taxing IP in a fair and consistent manner has become a daunting task. IP assets are no longer geographically bounded, rendering conventional tax structures insufficient. This requires a strong, globally aligned effort to develop policies that respond to the nuances of intangible, digitally native assets while ensuring a balanced and equitable framework for taxation. Balancing the encouragement of innovation-led economic growth with tax justice is one of the most significant challenges facing governments.

Innovation is essential to economic competitiveness, but unregulated or uneven taxation has the potential to dampen that momentum. With the implementation of pioneering technologies such as AI, blockchain, and smart contracts, policymakers can simplify compliance, increase transparency, and reduce tax evasion.

These technologies deliver the infrastructure on which a fairer, more efficient tax administration can keep abreast of digital developments. While IPRs continue to be embedded in the intangible economy and shifting economies toward digital platforms, future-proofing IP taxation is a priority. Tax regulations by 2025 and onwards must catch up with digitalization, embracing the technologies that facilitate fairness and cooperation at transborder levels. Further, cross-government international collaboration will be central in crafting homogenous and implementable tax norms reflecting the trends of the digital-first economy as tech-powered innovations restructure the nature of intellectual property.

In conclusion, the future of IP taxation rests in the art of trying to balance innovation and tax compliance with fairness. The governments need to adopt innovative strategies in conjunction with the latest technology and international collaboration and establish an adaptive yet equitable framework. Through the evolution of tax policy for the digital age, we can help ensure that intellectual property continues to drive economic growth while upholding the values of tax justice in the global economy. Such a harmonized framework will be vital to defining the future of IP taxation in an open, digital-first world.

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