

# Intellectual Property Management



## About this report

This is the fifth in a series of reports that will be published addressing selected topics following European Commission priorities. The aim is to reflect on the latest trends and developments and discuss the future of blockchain in Europe and globally.

This report has been produced by the EU Blockchain Observatory and Forum Experts Panel and team.

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### Note

While we have done our best to incorporate the comments and suggestions of our contributors where appropriate and feasible, all mistakes and omissions are the sole responsibility of the authors of this report.

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Intellectual property (IP) encompasses the legal rights arising from creative endeavours in industrial, scientific, literary, and artistic domains. Traditionally, it is categorised into two branches: industrial property and copyright. Intellectual property management is an intriguing subject to review.

This report presents requirements from different **stakeholder** perspectives (artists, musicians, researchers, etc.). The ways to **manage** differ from use case to use case, with or without **smart contracts and NFTs**. There are **legislations** to comply with and digitisation aspects to consider.

## Executive Summary

At a time when digital innovation is at the forefront of policy discussions, the management and protection of intellectual property (IP) has become a critical challenge for creators, businesses, and legal entities alike. This report by the EU Blockchain Observatory and Forum looks at the transformative potential of blockchain technology in revolutionising IP management. The technology promises to solve long-standing problems, such as proof of ownership, enforcement of rights, and distribution of royalties with efficiency and transparency.

Blockchain's decentralisation, immutability, and transparency provide a robust framework for the secure and accessible management of IP rights. By implementing smart contracts, blockchain facilitates automated transactions, including the payment of royalties. This automation not only lowers costs but also minimises the potential for disputes, creating a more efficient process for all parties involved.

Non-fungible tokens (NFTs) that use blockchain technology provide a unique mechanism for asserting ownership and linking rights declarations to digital assets. The uniqueness and indivisibility of NFTs make them an ideal tool for representing ownership of unique digital and real-world assets. In our report, we introduce emerging standards, such as EIP-2981, which aim to standardise NFT royalties and demonstrate the industry's efforts to create interoperable and fair compensation mechanisms for creators.

However, the integration of blockchain into IP management faces challenges. In this report, we identify and present key hurdles, such as the need for comprehensive legal frameworks that recognise and enforce blockchain transactions, the standardisation of different blockchain platforms to ensure interoperability, and the technical scalability required for widespread adoption.

Despite these challenges, the report is optimistic about the future of blockchain in IP management. It calls for a collaborative approach between policymakers, technologists, IP owners, and IP users to create an environment conducive to innovation while protecting creators' rights. The development of supportive regulatory frameworks, together with advances in blockchain technology will be crucial to realising the full potential of blockchain for the management of intellectual property.

In conclusion, the report highlights the significant opportunities that blockchain offers for improving the efficiency, transparency, and fairness of IP management. It encourages continued research, development, and cross-sector dialogue to overcome the existing challenges and fully exploit the benefits of these technologies.

# Chapter 1: Use Cases for Intellectual Property (IP)

There is a wide range of blockchain uses (patent management, trade secret management, IP rights and registries, evidence of use, traceability, certification trademarks, evidence of creation, IP enforcement, anti-counterfeiting, supply chain tracking, provenance authentication, and digital rights management). It should be noted that there are different sectors to include (art, music, research, etc.) in communities.

## 1.1 INDUSTRIAL PROPERTY RIGHTS

### 1.1.1 INDUSTRIAL PROPERTY RIGHTS AND THE ROLE OF BLOCKCHAIN

Blockchain might provide different added values for intellectual property management. These added values might be an open, trustless, tamperproof, and hack-resistant database for IP management. Another added value might be the automatic resolution of various disputes related to intellectual property in an automated way via smart contracts, which is predicted to be more efficient than the classical disputes through the legal system. Added value depends heavily on the IP use case.

**The subject of IP is on the blockchain:** In this case, blockchain contains the subject of IP, and IP management can provide all the previously mentioned added values, including automated IP-related dispute resolution or 'law' enforcement. One example is the CryptoPunks crypto collectibles, where the metadata is stored on the chain as well.

**The subject of IP is digital but not on the blockchain:** In this case, the IP is not controlled by the blockchain, so not all blockchain added values can be exploited. One example is digital art NFTs, where the digital art is usually on a different device, so it can be copied independently of the blockchain. There might be, however, good integration possibilities as well, like in online gaming or in the metaverse, where the subject of IP is either within a specific closed system (e.g. Nike Swoosh), or leveraged within an online game (e.g. PokemonGo), or in a virtual world (e.g. Decentraland or Second Life), so it might be fully integrated with blockchain-based digital assets, including property rights enforcement by smart contracts as well.

**The subject of IP is non-digital:** This might be the trickiest category. Here, blockchain can provide some added values like trustless, permissionless, open databases. However, enforcement of intellectual property rights is only possible with proper anti-counterfeiting measures (i.e. preserving the product authenticity itself), and ecosystem interaction and information sharing.

Blockchain technology can play a significant role in managing, licensing, enforcing, and remunerating intellectual property rights, encompassing patents, designs, trademarks, copyrights, and trade secrets. This role can be extensive, touching on various aspects, from the initial creation to the global distribution of intellectual property (IP). Blockchain can establish and validate intellectual property ownership by creating an unalterable record of when a specific design, creation, or invention was first conceived. This can be crucial in cases involving design, patents, and copyrights, where establishing the timing of design, invention, or creation is vital (**verification of ownership and timestamping**).

**Smart legal contracts** are self-executing agreements with contract terms encoded in software, that can automate various aspects of intellectual property management, including licensing and royalty payments. For example, a smart contract could automatically disburse royalties to a content creator each time their work is

used or sold. Through smart contracts, blockchain automates transactions, including licensing and royalty distributions, reducing administrative burdens, and enhancing efficiency (**delivery of automated contracts**).

**Non-Fungible Tokens (NFTs)** are digital certificates authenticating properties of an asset using blockchain technology. Recently, NFTs have garnered considerable interest.

**Phygital NFTs**<sup>1</sup> introduce a novel approach to intellectual property rights. Creators can tokenise their physical creations, safeguarding their work through blockchain authentication. This ensures **protection and recognition for creators**, fostering a new era of intellectual property management. Phygital NFTs empower creators to control and monetise their physical creations in the evolving digital landscape (**protection and recognition of creations**).

Blockchain can be used to trace the origin of products and materials, which is particularly important for safeguarding trademarks, plant varieties, geographical indicators, and trade secrets. Companies can use blockchain to authenticate product and/or prevent product counterfeiting and maintain the confidentiality of trade secrets across the entire supply chain (**supply chain tracking**).

Additionally, the application of blockchain in digital rights management (DRM) offers content creators robust protections and fair compensation. In the realm of digital assets like music, videos, and software, blockchain can be used to strengthen DRM systems (**enhanced digital rights management (DRM)**).

Furthermore, the technology streamlines licensing processes, offers transparent and auditable records, and aids in the efficient search for prior art. By timestamping inventions and innovations on the blockchain, inventors and patent examiners can quickly ascertain whether a particular concept has already been disclosed. This can help protect the copyrights of content creators and ensure they receive equitable compensation for their work (**patent prior art search**).<sup>2</sup>

Blockchain can bolster security measures to guard against intellectual property theft. Access controls and encryption can be integrated into blockchain solutions to ensure that only authorised individuals or entities can access and use intellectual property assets (**protection against intellectual property theft**).

Blockchain can streamline the process of licensing intellectual property by offering a transparent and auditable ledger of agreements. This can reduce disputes and guarantee that creators are justly compensated for the use of their work (**simplified licensing and royalty management**).

For global enterprises, blockchain provides formidable protection against IP theft and facilitates cross-border IP protection by offering a standardised and decentralised recording mechanism across different jurisdictions. The inherent transparency and trustworthiness of blockchain transactions foster confidence among all stakeholders, potentially reducing disputes and associated costs (**cross-border intellectual property protection**).

The transparency and immutability of blockchain records can foster trust among stakeholders involved in intellectual property ownership, transactions, and disputes. Parties can rely on the blockchain ledger to establish a credible history of IPR events. Streamlining intellectual property management on or integrating with blockchain platforms can lower administrative costs associated with filing, tracking, and enforcing

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<sup>1</sup> Cointelegraph: What are phygital NFTs and how they work ([Source](#))

<sup>2</sup> The same reasoning can be applied to any IPRs where processes for seniority claim are available (e.g., design and trademark, but this might also be the case for PV and GIs).

rights.<sup>3</sup> In our approach, we generally refer to a **blockchain-based system**. A blockchain-based system might not only contain a blockchain but additional centralised or decentralised components as well, like:

- blockchain for IP tokenisation.
- decentralised storage, like IPFS, for storing documents in a decentralised way;
- user interface elements. These might be centralised or decentralised (most typically, centralised);
- there might be several blockchains involved, like public and consortium ones;
- centralised components, like API services;
- interoperability solutions, like integrating two blockchains or a blockchain with centralised components;
- off-chain cryptographic components, like self-sovereign identity, verifiable credentials, or DID.

Blockchain technology shows great potential for improving the protection and management of industrial property rights; still, it is crucial to recognise that it is not a one-size-fits-all solution, and there are challenges, such as legal and regulatory issues, that need to be addressed. Implementing blockchain technology into intellectual property systems will require thorough strategic thinking, the establishment of open standards, and cooperation among various stakeholders, including governmental bodies, legal experts, and technology providers. Overall, blockchain's integration into IP management promises a more secure, transparent, and efficient framework, revolutionising how IP rights are managed and enforced worldwide.

### ***Use cases and requirements***

Numerous applications have already benefited from the specific properties of NFTs applied to physical, digital, and phygital assets, while others have been predicted but not thoroughly explored. A non-exhaustive list of such use cases consists of intellectual property, the trading of artworks and collectibles, gaming, ticketing, and academic certification.

Each NFT includes a unique identifier and metadata about the related asset. Minting an NFT refers to generating the cryptographic token used to represent a unique asset and recording it on a blockchain. Once minted, an NFT cannot be swapped or edited, making it ideal for establishing and tracking provenance, ownership, or the access rights of natively digital assets or tokenised physical goods. Smart contract programming facilitates and records transfers of NFTs between buyers and sellers.

Ownership of an NFT does not inherently grant IP rights to whatever digital or physical asset the token represents. According to legal scholar Rebecca Tushnet, 'From an IP perspective, NFTs do not change anything. If you did not have the rights to distribute a work before, you do not have them now. If the sale or memorialisation of an NFT involves reproducing and distributing a work that is under copyright, then copyright will cover those reproductions unless a limitation or exception like fair use applies.'<sup>4</sup>

NFTs themselves can be subject to IP protections, including copyright, design, patent, and trademark rights. As such, NFT purchasers should pay attention to what IP rights, if any, come part and parcel with the NFT.

On the basis of the identified use cases, an initial set of JPEG NFT requirements<sup>5</sup> have been identified and organised in the following main categories:

- Metadata descriptions
- Metadata embedding and referencing

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<sup>3</sup> It is essential to clarify that with an EBSI type of system, one proposes a piece of IPR ownership evidence registered on blockchain, but it still can be used offline or in any other type of environment.

<sup>4</sup> *Harvard Law Today*, 'Memes for sale? Making sense of NFTs' ([Source](#))



- Provenance, authenticity, and integrity
- Media asset registration format

From these requirement categories, it becomes apparent that many of the underlying needs overlap with those of JPEG Fake Media<sup>5</sup> introduced in the previous paragraph. Therefore, it is vitally important that the subsequent specifications are aligned with each other. Moreover, there is also an overlap in scope. Trustworthy knowledge about the authenticity of assets is crucial when transferring ownership. Contrariwise, in some cases blockchain technology can serve as one of the tools to establish trust related to the authenticity and provenance of the asset.<sup>6</sup>

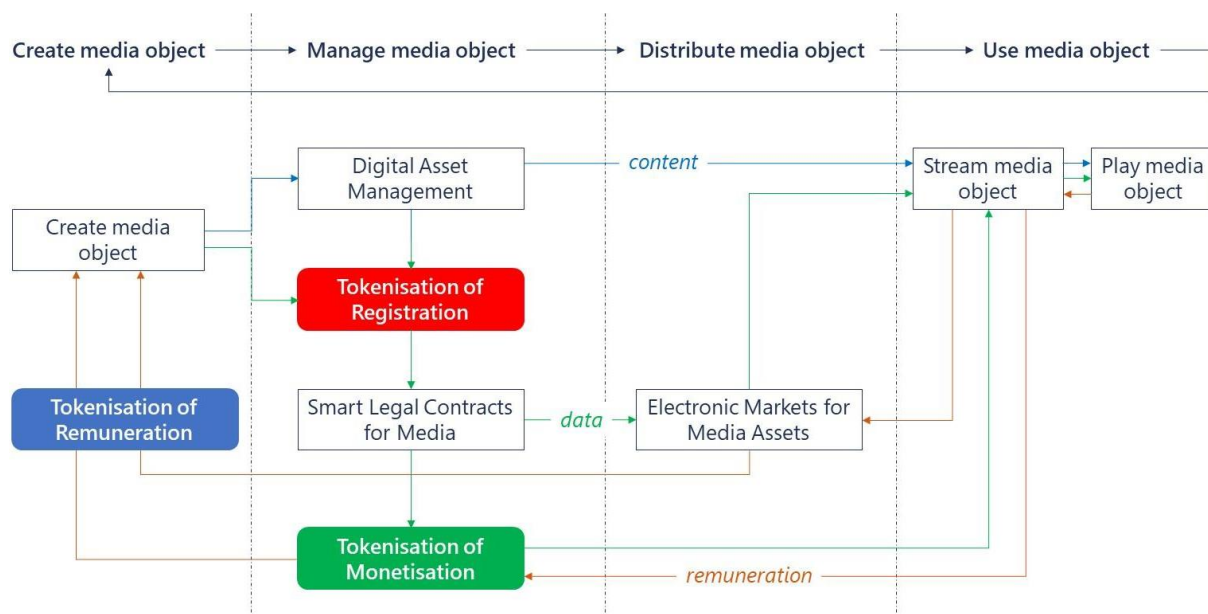


Figure 1: Tokenisation of media entitlements © Philippe Rixhon Associates

We distinguish between the tokenisation of **registration**, **monetisation**, and **remuneration**.

A **registration** data exchange is a two-sided marketplace of trusted rights data. On one side, rights holders register entitlements (for a fee) and receive **registration** tokens. On the other side, rights users query entitlement information (for a fee) and receive trusted rights data.

**Registration** tokens are certificates.

The **monetisation** of entitlements can be semi-automated. Rights holders prepare smart legal contracts equivalent to licence templates. Then, rights holders and rights users negotiate on digital marketplaces and agree on custom licences. The **monetisation** can also be fully automated through tokenised smart legal contracts.

<sup>5</sup> IEEE.org, An introduction to the JPEG Fake Media Initiative ([Source](#))

<sup>6</sup> Batista, D., Kim, H., Lemieux, V.L., Stancic, H., Unnithan, C., 'Blockchains and Provenance: How a Technical System for Tracing Origins, Ownership and Authenticity Can Transform Social Trust'. In: Lemieux, V.L., Feng, C. (eds) *Building Decentralized Trust*, Springer, 2021, Cham. [https://doi.org/10.1007/978-3-030-54414-0\\_6](https://doi.org/10.1007/978-3-030-54414-0_6) ([Source](#))

**Monetisation** tokens are smart legal contracts.

Several rights holders can share the **remuneration** of entitlements. Shares of **remuneration** can be tokenised, issued on primary markets, and resold on secondary markets.

**Remuneration** tokens are securities.

## 1.1.2 TOKENISED VS NON-TOKENISED INTELLECTUAL PROPERTY REPRESENTATIONS

When discussing blockchain technology in relation to intellectual property (IP), the conversation often centres around how to manage and protect IP rights using blockchain's capabilities. Two primary methods emerge: tokenised and non-tokenised representations of IP. Each approach has its unique advantages and challenges, catering to different needs within the realm of IP management.

### Tokenised Intellectual Property Representations

Tokenisation refers to the process of converting rights to an asset into a digital token on the blockchain. These tokens can represent ownership or certain rights to intellectual property, such as patents, copyrights, trademarks, or even creative works like music and art.

The advantages of this representation include increased liquidity of intellectual property by enabling fractional ownership and easier transferability, transparency, and security ensuring the authenticity of ownership and integrity of the transaction history, and increased efficiency as well as accessibility through a simplified and accelerated process of buying, selling or licencing IP rights for a broader audience.

Still, there are a few challenges to this approach, such as **regulatory compliance** – mainly due to the complex regulatory environment surrounding IP rights and digital assets. **Market acceptance** is also a significant obstacle, in the sense that owning a piece of intellectual property through tokens is still a new concept. Finally, **accurate valuation** of intellectual property is complex, and tokenisation adds another layer of complexity to this process.

### Non-Tokenised Intellectual Property Representations

Non-tokenised blockchain applications for intellectual property involve using the blockchain to record and verify the creation, transfer, and ownership of IP rights without converting them into digital tokens. Blockchain can provide a tamper-proof record of the creation date and ownership history of an IP asset, therefore preventing fraud and unauthorised use. At the same time, automating the registration and renewal of IP rights through smart contracts can help streamline operations and support more efficient dispute resolution.

On the other hand, the integration of blockchain technology with existing IP registration systems and legal frameworks is both complex and time-consuming. As blockchain offers transparency, it may also expose sensitive information if it is not managed properly, especially in permissionless blockchains. Also, the volume of transactions that blockchain systems can handle (i.e. scalability) for global IP management varies.

Both tokenised and non-tokenised approaches offer the potential for innovation within the field of intellectual property management. The selection between the two depends on the specific requirements of the IP owners, the nature of the intellectual property, and the intended application (use case).

As blockchain technology evolves, we may see more nuanced applications that blend the benefits of both approaches.

### 1.1.3 AREAS OF IMPLEMENTATION – RELEVANT USE CASES

Industrial property rights encompass a category of intellectual property privileges aimed at protecting inventions, designs, and creative outputs linked to industrial and commercial endeavours. These rights are pivotal for stimulating inventiveness and defending the interests of individual innovators and enterprises.

The following table provides a few examples or common instances of industrial property rights:

*Table 1: Examples of industrial property rights*

Type of Industrial rights	What is being protected	Description	Relevant example
Patents	Innovations	Patents shield novel and useful innovations like machinery, processes, chemicals, and technological advancements. They grant the inventor exclusive rights to use, manufacture, and market the invention for a specified period, typically around 20 years, thus encouraging innovation and investment in research and development.	<p>Pharmaceutical companies often invest heavily in research and development to create new drugs. They secure patents for these drugs, giving them exclusive rights to manufacture and sell them for a certain period, allowing them to recoup their investments.</p> <p>Tech companies like Apple and Samsung patent their innovative technologies, such as smartphone designs and features, to get royalties from other companies which copy their inventions/ideas.</p>
Trademarks	Brand Identity	Trademarks protect brand names, logos, slogans, and symbols, enabling businesses to distinguish their offerings from those of competitors. They prevent others from using similar marks that might confuse consumers.	For example, the Coca-Cola logo and the Nike swoosh are trademarks that distinguish their products from those of their competitors.
Industrial designs	Product aesthetics	Industrial design rights safeguard the visual attributes of a product, including its form, colour, and embellishments. These rights deter unauthorised replication of the design, stimulating product diversity and ingenuity.	<p>Fashion designers use industrial design rights to protect unique clothing designs, preventing others from producing identical or substantially similar garments.</p> <p>Car manufacturers patent their vehicle designs to prevent unauthorised copying.</p>

Type of Industrial rights	What is being protected	Description	Relevant example
Trade secrets	Proprietary knowledge	Trade secrets shield valuable business information, procedures, formulations, and expertise that provide a competitive edge. Maintaining the confidentiality of these secrets is vital for preserving a competitive advantage.	The Coca-Cola Company keeps its famous soda recipe a trade secret, which is a form of industrial property right. This protects the formula from being duplicated by competitors.
Copyrights	Creative works	While typically associated with literary and artistic creations, copyrights can also extend to industrial and commercial content, such as software, architectural blueprints, and technical manuals. Copyrights protect the expression of ideas, encourage creativity, and protect the rights of creators.	<p>Musicians, authors, and filmmakers rely on copyrights to protect their creative works. For example, a songwriter's copyright ensures they are compensated when their songs are used in movies or advertisements.</p> <p>Software developers protect their code with copyrights to prevent unauthorised copying and distribution.</p>
Geographical indications	Regional product origin	Geographical indications (GIs) protect products originating from specific regions with established reputations, like Champagne or Parmigiano-Reggiano cheese. GIs prevent the use of these names for products made outside the designated area, preserving product quality and renown.	Certain products, like champagne and Parmigiano-Reggiano, are protected by trademarks based on their geographical origin.
Utility models	Incremental inventions	Utility models, often referred to as 'petty patents', protect minor and step-by-step enhancements to existing inventions. They provide a shorter and less expensive form of protection than regular patents, promoting ongoing innovation.	Mechanical inventions: in some countries, utility models protect minor improvements to existing products or processes that may not meet the inventive threshold for a full patent.

Type of Industrial rights	What is being protected	Description	Relevant example
Plant breeder rights	New plant varieties	These rights protect novel and distinct plant varieties developed through breeding or genetic modification. They encourage investment in agricultural research and the advancement of improved crops.	Agriculture: breeders of new plant varieties, such as new types of fruits or vegetables, can obtain plant patents to protect their investment in developing these new varieties.
Semiconductor topographies	Integrated circuits	Semiconductor topography rights protect the three-dimensional arrangement of integrated circuits. They stimulate innovation in the electronics sector by preventing unauthorised replication of chip layouts.	Electronics: companies that design integrated circuits, such as computer chips, can protect their layout designs from being copied by competitors.
Data exclusivity	Pharmaceuticals and biotechnologies	Data exclusivity rights protect data submitted by pharmaceutical and biotech firms during the regulatory approval process for new drugs or biologics.	Pharmaceutical and biotech companies, use this protection as it encourages investment in research and development by providing market exclusivity for a specified duration.

Overall, industrial property rights assume a pivotal role in promoting innovation, nurturing economic expansion, and protecting the intellectual and commercial assets of individuals and companies across diverse industries.

## 1.2 EU SUPPORT AND RELEVANT RESEARCH

**The European Commission is already supporting research and development around the use of blockchain techniques to address IPR challenges.**

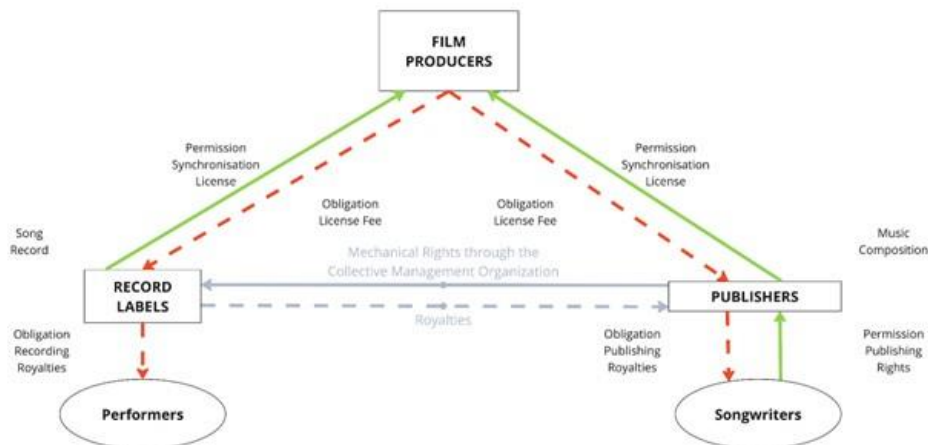
In order to deploy cross-border blockchain services across Europe as soon as possible, the [pre-commercial procurement](#) (PCP) of the European Blockchain Services Infrastructure (EBSI) is focusing on developing use cases – such as the management of intellectual property rights – that can be implemented relatively easily by using existing blockchain technology. As there are gaps in existing blockchain solutions to enable the delivery of demanding cross-border blockchain services (e.g. regarding full compliance with the EU legal framework, security, interoperability, robustness, and sustainability), the EBSI requires new, improved blockchain solutions. The PCP therefore focuses on the development and testing of a novel distributed ledger or blockchain solution that builds on the EU legal framework, particularly the GDPR Regulation, the eIDAS

Regulation, the NIS Directive,<sup>7</sup> and the copyright directives.<sup>8</sup> Such a public infrastructure will meet core requirements of scalability and throughput, interoperability with other systems, security, robustness, high sustainability/reduced environmental footprint, energy efficiency, and continuity of service.

Some notable examples of projects approved include the IOTA Stiftung Intellectual Property Rights Management in the creative industry<sup>9</sup> and Chromaway, which developed an IP marketplace powered by Relational Blockchain Nebula,<sup>10</sup> expected to work as a simple and transparent marketplace for storing, selling, and purchasing IP licences in the EU.

In the context of the EBSI pre-commercial procurement (EBSI PCP), the IOTA Foundation, in collaboration with the [Musika Peripherika project](#) and the EU Media Programme, has conceptualised and developed an intellectual property management use case.

The use case has focused on the automation of royalty payments derived from synchronisation contracts between holders of music rights and a film-producing company that wants to use the music work within a film. See below.



The process starts from a legal contract in written form and then turned into a set of smart contracts and NFTs that allow the automating of the royalty payment in a transparent and auditable manner. The use case leverages the [Smart Contract for Media MPEG-21 standard](#) and involves real stakeholders from the Musika Peripherika Project. The interaction of users with the system is performed through an **IPR marketplace** web application, where different stakeholders can participate and interact. Stakeholders, both juridical and natural persons, use decentralised identities following the EBSI standards and can get access to the marketplace through their credential (EUDI compatible) wallet.

The figure below shows the vision that has guided us in the proposal, analysis, and experimentation performed during the PCP concerning the IPR use case. Such a vision gravitates towards an IPR marketplace where different actors in the creative industries (music, film, ...) confluence towards collaboration on achieving a common purpose, the diffusion of work of art across different media. This is actually an ecosystem of actors that will cooperate and receive remunerations (royalties) for what they provide to others. For instance, a

<sup>7</sup> ENISA – NIS Directive ([Source](#))

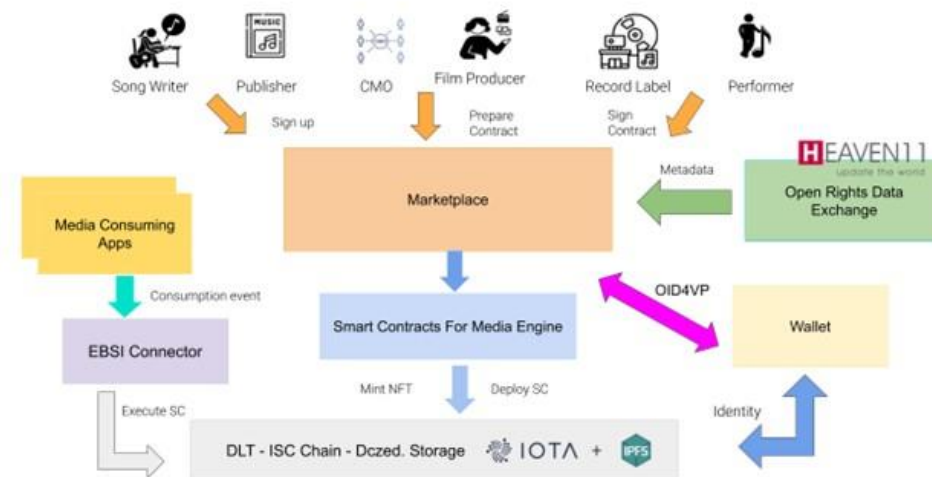
<sup>8</sup> EU Digital Strategy: Copyright Legislation ([Source](#))

<sup>9</sup> IOTA – EBSI Use Case ([Source](#))

<sup>10</sup> Chromaway Use Case ([Source](#))

songwriter must be remunerated by the song's publisher when her song composition is used upstream, for instance by a record label in a song recording.

These interactions between actors require metadata about the different concerned IP entities, and that's the role of the Open Rights Data Exchange.



Additionally, as we are dealing with an ecosystem of actors, these actors must possess a decentralised digital identity that allows them to interact without complex onboarding processes. There is also the need for a **trust framework** among actors, and for that purpose the *EBSI Trust Framework* has been used due to its flexibility. In other words, only trusted issuers and fully verified individuals must be able to get access to the IPR marketplace to draw up contracts. Then, these parties, attested through credentials issued by accredited issuers, through an EUDI wallet, can get access to the marketplace via OID4VP flows. This setup was prototyped and experimented with during the PCP successfully.

The main aim of the marketplace is the seamless preparation, acceptance, and deployment of contracts between the actors in the ecosystem. And for increasing **transparency, traceability, and auditability**, the marketplace uses the smart contracts technology. But far from creating something bespoke or ad-hoc to solve this problem, our proposal is based on a standard for smart contracts for media, ISO MPEG-21 (Part 23). Using this standard, contracts can be represented ontologically i.e. with full, shared, and agreed semantics across the industry. Moreover, typical text clauses usually found in contracts currently signed by industry stakeholders can be represented using ontologies defined by the referred standard with the possibility of extension through linked data vocabularies.

Furthermore, through an automatic translation process, the smart contract code to be executed within an IOTA smart contract chain can be generated. And, last but not least, through tokenisation, not only IP entities, but also the statements (deontic expressions) within a real-life contract can be represented on-chain and their metadata can be permanently available through a decentralised storage, such as IPFS. For instance, an obligation to pay a royalty.

The final aim is that events happening in the ecosystem, for instance, a song played on the radio, or a media consuming application playing a song, can trigger the execution of a smart contract for media that inexorably will honour all the contract clauses that were initially agreed by actors through the IPR marketplace. This will lead ultimately to the maximisation of transparency and trust.

[TRACE4EU](#), is a project co-funded by Digital Europe aiming to create an umbrella architecture based on existing EBSI services to support traceability applications. TRACE4EU evaluates application scenarios that are relevant to citizens, businesses, and governments, such as secure e-commerce and business-to-business transactions related to copyright-protected material. The traceability of digital rights will depend on decentralised party and content identifiers and verifiable authorship and ownership credentials. Furthermore, the pilot will be aligned with the EU Digital Wallet and related qualified trust services.

The **OnePass**<sup>11</sup> project is a partnership of digital wallet providers, EBSI nodes, research, and other national institutions working together to initiate the deployment of the EBSI small and medium-sized enterprises (SME) financing use case. This project aims to create a trusted business acceleration framework to foster cross-border SME financing, leveraging existing (and future) infrastructures provided by the EBSI. This framework will better and more efficiently connect the sources of financing from leading countries in investment and capital with sources of talent and high-growth projects located around Europe, relying on verifiable credentials (VCs) issued by issuers or similar entities.

The **EBSI-ELSA**<sup>12</sup> is a pilot project, deployed by the EUIPO, aiming to enable IP authenticity management synchronisation between all parties involved in the supply chain: EU intellectual property offices, governments, customs authorities, manufacturers, transport and logistics operators, intermediaries, and retailers. The EBSI-ELSA project worked with the Netherlands customs authorities, transport and logistics operators Jet Air Services and KLM Cargo, and brand owners Mercedes-Benz Tech Motion and Harman International, to address the pressing issue of counterfeiting in supply-chain management.

Following attempts to build a centralised [global repertoire database](#) and a centralised [international music registry](#), the European Commission and WIPO is now considering decentralised solutions based on distributed ledger technologies.

In *An intellectual property action plan to support the EU's recovery and resilience*,<sup>13</sup> the Commission announces that it will further work with stakeholders to promote the quality of copyright data and achieve a well-functioning 'copyright infrastructure' – the set of rules, technologies, and institutions that frame data management practices in the creative industries – to improve authoritative and updated information on rights holders, terms and conditions, and licensing opportunities.

In *Developing the Copyright Infrastructure*,<sup>14</sup> the stocktaking of work and progress under the Finnish Presidency, the authors noted that there are many international standardisation organisations (ISOs) and industry-specific identifiers for works and rightsholders, however, they lack interoperability in a broader context. This results in high transaction costs for the industry and lost revenue for rights holders. Investing in the copyright data infrastructure, encompassing standardised metadata entries in connection with digital copies of works and where relevant, registrations with collective management organisations (CMOs), can/would improve the efficiency of licensing, and allow automated processes for the distribution of revenue streams.

In the study on *Copyright and New Technologies*,<sup>15</sup> published by the Commission in March 2022, the authors argue that a well-functioning copyright infrastructure would require opening and integrating the rights data framework – a set of rules and technologies – to:

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<sup>11</sup>EBSI ([Source](#))

<sup>12</sup> EUIPO – Blockathon ([Source](#))

<sup>13</sup> [Source](#)

<sup>14</sup> [Source](#)

<sup>15</sup> EU Study on copyright and new technologies ([Source](#))



- Support releasing much more of the digital potential of Europe's creative sectors and contribute to the development of a single market for data.
- Address interoperability issues and make rights management simpler, more accurate, faster, and more affordable for all stakeholders on the content value network.
- Provide trustworthy rights information which can then be relied upon for rights licensing and rights enforcement, as well as for fair, appropriate, proportionate, and transparent rights remuneration.
- Restore a level playing field between major actors and the European small and medium-sized creative enterprises through an inclusive approach catering to the interests of any rightsholder, stakeholder, incumbent, or new intermediary.

Opening and integrating the rights data framework is necessarily a multi-country project because:

- This development cannot be achieved by one or a few players but covers a multitude of different rights holders of different sizes and their representatives, as well as rights users of both commercial and non-commercial nature in 27 jurisdictions.
- A successful development requires cooperation between holders and users of copyright data, intellectual property offices, copyright registrations, recordation of transfers, legal deposits, and standardisation bodies across the Union.

**In Autumn 2022, the governments of Estonia and Finland set up a task force to pursue the work on the copyright infrastructure. The task force identified a preliminary series of use cases that could benefit from blockchain solutions.**

**News publishers** – European press articles are consolidated on American online platforms and used to train generative AI in China. What are the necessary interoperable content identifiers for articles, texts, pictures, titles, and graphics and the standard datasets for consent, terms, and conditions to facilitate the enforcement of rights related to Articles 4 (Text and data mining)<sup>16</sup> and 15 (Protection of press publications)<sup>17</sup> of the EU directives on copyright? What about the identification of assets that have been created/modified by AI? Or the transparent information about the applied 'AI training and generation recipes' for a specific generated content? Or consent/no consent registrations? Or the possibility of knowing if AI x,y has been trained on 'my' content? Need for intervention: high, urgency of intervention: high.

**Videogames** – A videogame is a complex construct of graphics, sound, characters, content, programming (goals and objectives, rules and instructions, interaction, conflict, competition, challenge, opposition, outcomes, and feedback), and more. Most of these individual items are produced by different individual contributors. How can the graph of components be represented to facilitate the management of related rights across creative sectors and jurisdictions? Need for intervention: high, urgency of intervention: high.

**The Metaverse** – With the highly dynamic and interactive metaverse everybody is a co-creator. The distinction between authors and users becomes fuzzy. One needs to cater to the registration of collaborative rights. Avatars can be digital twins. Who owns them? Who can do what with them? Need for intervention: high, urgency of intervention: high.

<sup>16</sup> DIRECTIVE (EU) 2019/790 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 April 2019 on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and 2001/29/EC ([Source](#))

<sup>17</sup> Ibid.

**Educational content** – The value of a licence for one teacher to use once one document to teach one class might be close to €5.00, but the cost of a licence, even with good IT support, will not be less than €20.00. How can the author of the document be fairly, appropriately, proportionally, and transparently remunerated in a timely fashion through a sustainable licensing process that prevents the emergence of black boxes and the use of inaccurate flat rate levies? Need for intervention: medium, urgency of intervention: medium.

**Music and film** – Swedish and Portuguese songwriters create a song in Germany. The song is performed by Croatian and Slovenian musicians in a Spanish recording studio. The recording is used by filmmakers in Italy. The film is broadcast – among others – in Greece. All of this happens within 2 months. The Swedish, Portuguese, Croatian, and Slovenian music makers are not members of any management organisation in Greece. How can they be fairly, appropriately, proportionally, and transparently remunerated in a timely fashion? How will Article 17 of the EU directive on copyright be practically implemented for everyone? Need for intervention: medium, urgency of intervention: medium.

It should be noted that EUIPO has set up Agorateka, a public registry in the EU for legal offers on music TV, and films: <https://euipo.europa.eu/ohimportal/en/web/observatory/agorateka>.

**Out-of-commerce works** are millions of works that are still protected by copyright but end up being considered out-of-commerce, such as literary works, audio-visual works, phonograms, photographs, and unique works of art. Providing access to this rich European cultural heritage relies on swift and affordable rights clearance and licensing process. Need for intervention: medium, urgency of intervention: medium. EUIPO already has an ‘out-of-commerce’ database in place: <https://euipo.europa.eu/out-of-commerce/#/>

## 1.3 IPR ENFORCEMENT

### 1.3.1 INTRODUCTION

The digital age has ushered in a plethora of opportunities and challenges for the management and enforcement of intellectual property (IP) rights. The ease of reproducing and disseminating digital and/or physical assets across borders has posed significant challenges to traditional IP values, particularly their scarcity and territorial nature. Indeed, digital assets, due to their nature, are infinitely reproducible. These characteristics challenge the very essence of IP rights, which are rooted in the concepts of exclusivity and territoriality. At the same time, the operation of digital platforms has not only contributed to the piracy of purely digital content, but also allowed counterfeiters to effectively distribute their products (in its 2020 Status Report on IPR infringement, EUIPO has already reported that up to 6.8% of EU imports, or EUR 121 billion per year, are fake goods. The report is available [here](#).<sup>18</sup>

In a more recent [report](#)<sup>19</sup>, EUIPO has also reached some alarming conclusions about the negative impact of counterfeit products in key economic sectors within the EU.

The rapid dissemination of digital and physical content across borders further complicates the enforcement of these rights and calls for a multitude of international, regional, and national legal regimes in application. The explosion of Web1.0 and Web2.0 saw a surge in the sharing and distribution of digital content, often bypassing traditional IP enforcement mechanisms and pushing for the implementation of effective technological arrangements that would protect the interests of rights holders (on the traditional discussions on DRM within

<sup>18</sup> Accessed: 08.03.2024.

<sup>19</sup> Accessed: 08.03.2024

Web1.0 and Web2.0 environments. See among many others, Burk, D. L., 'Legal and technical standards in digital rights management technology'. *Fordham Law Review*, 74(2), (2005) pp. 537-57.

### 1.3.2 POTENTIAL BLOCKCHAIN SOLUTIONS FOR IP RIGHTS ENFORCEMENT

NFTs, which are by their very nature unique cryptographic tokens, can be linked to the authorship and ownership<sup>20</sup> of a digital or physical asset, seem tailor-made for IP rights enforcement. These tokens can represent third-party rights, typically acquired through licences. The embedded smart contract logic in NFTs can ensure that licence terms are executed as intended by the contracting parties. For instance, in the music industry, artists can issue NFTs representing limited edition tracks or albums (for an overview of the music NFT market see Thomas, L. '[Complete Guide to the NFT Music Ecosystem](#)', *NFT Now*<sup>21</sup>, (2022). These NFTs can have embedded smart contracts that dictate terms of access, usage, and redistribution, ensuring that artists receive royalties for secondary sales or transfers.

But blockchain applications can also support IP rights enforcement actions beyond purely digital spaces. Academic literature has consistently been exploring the potential deployment of blockchain-based applications in supply chains to mitigate counterfeiting (see, for example, Ma, J., Lin, S.-Y., Chen, X., Sun, H.-M., Chen, Y.-C. & Wang, H., 'A Blockchain-Based Application System for Product Anti-Counterfeiting', *IEEE Access*, 8, 2020, pp.77642-77652. DOI: 10.1109/ACCESS.2020.2972026). Most importantly, blockchain technology is being used by EUIPO as part of the EBSI-ELSA initiative to combat product counterfeiting. This approach involves the use of blockchain to authenticate brand owners' credentials, oversee the lifecycle of digital twins for products, and securely record product shipment histories. At its core, the solution proposes the creation of digital certificates for each product, serving as a verifiable mark of authenticity. These certificates are linked to their physical counterparts through secure identifiers, allowing for easy verification of the product's genuineness. Additionally, every product is assigned a digital twin on the blockchain, a comprehensive digital replica that contains detailed information about its origin, manufacturing, and ownership history. The system facilitates a transparent tracking of a product's journey across the supply chain, offering a transparent and tamper-proof method to ensure the integrity of the product from the manufacturer to the end consumer. By making these records publicly accessible, the EUIPO's blockchain solution empowers consumers, companies, and regulators to independently verify product authenticity, thus creating a trusted ecosystem that significantly hampers the proliferation of counterfeit goods (for more details about the EBSI-ELSA initiative visit <https://www.euipo.europa.eu/en/observatory/enforcement/blockathon>).

**Finally, parallel imports**, also known as grey market goods, are another area where the deployment of blockchain-based solutions might provide added value. Parallel imports involve legally purchasing products in one country and then importing into and selling them in another country without the permission of the intellectual property owner. This practice often undermines local distributors, affects pricing strategies, and can lead to a loss of revenue for IP owners, even though the goods themselves are genuine. NFTs can provide a detailed history of a product's journey from manufacture to sale. By tokenising physical goods, manufacturers can create a transparent and immutable record on the blockchain that tracks every transaction and transfer of ownership. This level of detail can help identify when goods are diverted from their intended market, thereby highlighting instances of parallel importing. Furthermore, NFTs can be programmed with smart contracts that enforce geofencing, where the token (and thus the physical good it represents) is only valid or accessible in

<sup>20</sup> NFTs offer a robust mechanism for proving the ownership and authorship of digital assets by leveraging the inherent properties of blockchain technology, such as immutability, transparency, and decentralisation. They enable a verifiable link between the creator and the asset, providing proof of originality and ownership history. However, it's important to recognise the limitations and understand that while NFTs authenticate ownership within the blockchain, the digital replication of the content itself remains a separate issue.

<sup>21</sup> Accessed: 25.09.2023

certain regions. This could prevent goods intended for one market from being sold in another, addressing the issue of parallel imports directly by embedding market restrictions into the product's digital representation.

### 1.3.3 NFTS IN ROYALTY RIGHTS ENFORCEMENT

One of the most prominent use cases of NFTs in IP rights enforcement is in the realm of royalty rights. Traditionally, artists and creators have relied on collective management organisations to manage and distribute their royalties. However, these entities have often been criticised for mismanagement and unfair distribution practices (see, for example, the findings of Band, J. and Butler, B., 'Some Cautionary Tales About Collective Licensing', *Michigan State International Law Review*, 21(3), 2013, pp. 689-728), while, according to recital 6 of Directive 2014/26/EU on collective management of copyright and related rights and multi-territorial licensing of rights in musical works for online use in the internal market, the need to improve the functioning of collective management organisations is also an established goal of the EU legislator). NFTs offer a decentralised alternative. By embedding royalty distribution logic in smart legal contracts, artists can ensure they receive their fair share of revenues directly, limiting their exposure to intermediaries (while artists might, up to a certain extent, need some form of intermediation to access blockchain applications, their overall dependency, especially regarding managing their content, could be limited). This has been evident in various creative industries (see the overview by Tunc, M.M., Cavusoglu, H. and Zheng, E., '[Resale Royalty in NFT Marketplaces: Implications for Creators and Platforms](#)',<sup>22</sup> SSRN, 2022, where the deployment of NFTs for the management of royalties has been embraced (for an overview of NFT royalty standards practices see Moreaux, A.C. and Mitrea, M.P., 'Royalty-Friendly Digital Asset Exchanges on Blockchains', *IEEEAccess*, Volume 11, 2023, pp. 56235-56247; for an assessment of NFT royalty schemes within the framework of EU law see Garbers-von Boehm, K., Haag, H., and Gruber, K., '[Intellectual Property Rights and Distributed Ledger Technology with a focus on art NFTs and tokenized art](#)', European Parliament, 2022, pp. 39-40.<sup>23</sup>

### 1.3.4 NFTS, SMART LEGAL CONTRACTS, AND DIGITAL RIGHTS MANAGEMENT

Beyond royalties, NFTs and smart legal contracts have the potential to revolutionise digital rights management (DRM). Instead of relying on proprietary and centrally controlled DRM solutions, creators can use open-source and decentralised smart legal contracts to define access and usage rights for their content (for an early analysis of the potential of blockchains and blockchain-based applications in rights management and a comparison with traditional DRM schemes see Finck, M. and Moscon, V., 'Copyright Law on Blockchains: Between New Forms of Rights Administration and Digital Rights Management 2.0', *IIC*, 50, 2019, pp. 77-108 and for a more recent outlook that also considers the developments in the NFT space see Ferro, E., Saltarella, M., Rotondi, D., Giovanelli, M., Corrias, G., Moncada, R., Cavallaro, A., Favenza, A., '[Digital assets rights management through smart legal contracts and smart contracts. Blockchain: Research and Applications](#)', 4(3), 2023, pp.1-10.<sup>24</sup> While smart legal contracts can define the conditions upon which certain operations over protected works can be executed, NFTs can serve as the major component for user authorisation. Such authorisation will unlock the designated usages and signify that the conditions to execute certain actions have been met, since an NFT can uniquely associate a user with certain rights over a protected asset. Such arrangements have already been proposed and they display a potential for deployment across various creative industries (there are even relevant patent registrations, see, for example, Long, J. and Liu, M.C., 'Non-fungible token (NFT) based digital rights management in a decentralised data delivery network', US Patent No. 11075891, 2021).

<sup>22</sup> Accessed 25.09.2023

<sup>23</sup> Accessed 25.09.2023

<sup>24</sup> Accessed 26.09.2023

### 1.3.5 CHALLENGES IN DEPLOYING BLOCKCHAIN SOLUTIONS IN IP RIGHTS ENFORCEMENT

Despite the potential benefits, there are also significant challenges in using NFTs for IP rights enforcement. The territorial and fragmented nature of IP rights can lead to conflicts over competing exclusive rights (copyright, trademarks, designs etc.) and licences. Additionally, the tokenisation of rights via NFTs and the automation of licensing and rights management schemes might be based on unstable foundations, since blockchains, despite all their qualities, might still contain inaccurate information regarding licensing and rights management. This poses risks for both creators and consumers. It is, therefore, imperative that the deployment of NFTs and smart legal contracts in IP rights management, licencing, enforcement, and remuneration must be accompanied by additional governance and guarantee mechanisms, beyond the technological infrastructures, which will secure the integrity of the information that forms the basis upon which NFTs and smart legal contracts operate. The need for governance in blockchain solutions, particularly for intellectual property (IP) enforcement, is not just a topic of academic debate (for an in-depth analysis of the potential and challenges associated with implementing blockchain-based solutions in IP enforcement see Bodó, B., Gervais, D. and Quintais, J.P., 'Blockchain and smart contracts: the missing link in copyright licensing?', *International Journal of Law and Information Technology*, 26(4), 2018, pp.311–336); it's becoming a reality. The EUIPO is at the forefront of this shift, actively adopting blockchain-based solutions through the integration of blockchain components in its traditional [TMview and DesignView databases](#)<sup>25</sup> and the preparation of the [EBSI-ELSA infrastructure](#).<sup>26</sup> By integrating these technologies into its institutional framework, EUIPO not only provides crucial governance guidance but also ensures robust safeguards for the ecosystem.

Furthermore, the deterministic logic of smart legal contracts, which operates on 'If, then' principles, may not always align with the complexities of IP law enforcement. For instance, the CJEU decision in the Nintendo case (C- 355/12, ECLI:EU: C:2014:25) highlighted the nuances in the enforcement of IP rights. The Court ruled that while protection against circumvention of technological measures is valid when such measures aim to prevent acts that fall within the realm of the exclusive rights of the rightsholder and are not authorised by the latter, such protection must always respect the principle of proportionality and should not lead to an overstretch of IP enforcement. This highlights the challenges in automating IP rights enforcement through NFTs and smart contracts, especially if one considers that the assessment of whether a particular action constitutes circumvention of legitimate technological protective measures or legitimate and lawful use of a protected work is heavily context-based and cannot be performed in advance.

Finally, the ever-lasting debate on the current state of decentralisation of blockchain-based ecosystems might put pressure on the potential of NFTs and smart legal contracts as IP enforcement tools. While NFTs and smart legal contracts can retain a sufficient degree of decentralisation, the NFT market has displayed signs of power concentration and dependency on certain key platforms. The attitudes of such key players are now influencing the potential use cases of NFT and smart legal contracts for IP rights management. It has already been reported, for example, that revenue losses pushed major NFT marketplaces to stop enforcing the collection of NFT-based royalties (see, for example, Akers T., 'Opensea NFT marketplace ending resale royalties' policy', *The Art Newspaper*, [online] 23/8/2023. Available at: <https://www.theartnewspaper.com/2023/08/23/opensea-nft-marketplace-ending-resale-royalties-policy> [Accessed 25.09.2023], Lutz S., 'Opensea to Make Creator Royalties Optional for NFT Trades'. *Decrypt*, [online] 18/8/2023. Available at: <https://decrypt.co/152878/opensea-make-creator-royalties-optional-nft-trades> [Accessed 25.09.2023]).

<sup>25</sup> Accessed: 08.03.2024

<sup>26</sup> Accessed: 08.03.2024

NFTs and smart legal contracts offer promising solutions to the challenges faced in IP rights enforcement in the digital age. However, their deployment is not without limitations. As the technology evolves and matures, it will be crucial to address these challenges to harness the full potential of NFTs in supporting the management of IP rights.

## Chapter 2: Impact of NFTs on IPR

The current applications of NFTs focus on digital art, where each piece is mapped with a token. Alternatively, the NFT is the art (or has the URL that leads to the art with the NFT creator as the author). NFTs can also be used to link to physical art and become a certificate of authenticity and ownership. This chapter presents perspectives on NFTs as new copyright issues arise. It considers the use of NFTs and some best practices.

### 2.1 CURRENT NFTS APPLICATIONS COPYRIGHT

NFTs are undeniably a disruptive business model. They aim to introduce a new ethos in the relationship between creatives and users of digital artworks (Fortnow, M. and Terry, Q., *The NFT Handbook: How to Create, Sell and Buy Non-fungible Tokens*, John Wiley & Sons Incorporated, New Jersey, 2021, pp. 47-57). This relationship is currently centred around major online intermediaries and is characterised by the access model. In a nutshell, via a combination of technological, legal, and market choices, creators and individual internet users are not currently allowed to exert substantial control over digital assets. On the contrary, digital assets are controlled by powerful centralised intermediaries that seemingly provide unlimited access to them. This arrangement comes with several advantages (for a very positive appraisal of the access model, see Rifkin, J. '2', in *The age of access: How the shift from ownership to access is Transforming Modern Life*, Penguin Business Library, London, 2002). For example, it provides a rather rigorous rights management regime that should provide intellectual property holders with security as regards the exploitation of their IP portfolios. In addition, individual users enjoy a high level of convenience, as they do not have to worry about the storage, availability, functionality, and accessibility of the digital assets, since all these activities are undertaken by the platform. On the other hand, the current digital asset arrangement, by which creators and users effectively give up control of their assets to centralised intermediaries, comes with important drawbacks (see the criticism of Perzanowski, A. and Schultz, J. *The end of ownership: Personal property in the Digital Economy*, MIT Press, Cambridge, Mass, 2018). As regards creators, the most apparent drawback is the well-documented value gap, namely the fact that intermediaries seem to be reaping the benefits of their content without adequately remunerating them, something that even prompted a major overhaul of the EU digital platforms regime under Art. 17 of the DSM Directive (see on the value gap Frosio, G., 'Reforming Intermediary Liability in the Platform Economy: A European Digital Single Market Strategy', *Northwestern University Law Review Online*, 112(251), 2017a, doi:10.31235/osf.io/w7fxv, and on the impact of Art. 17 of the DSM Directive, Rosati, E., (2021) 'The DSM directive Two Years on: Do things ever get easier?', *IIC - International Review of Intellectual Property and Competition Law*, 52(9), 2021, pp. 1139–1142. doi:10.1007/s40319-021-01082-6). Centralised intermediaries have obtained a disproportionately high influence over the entire operation of digital activities. In addition, the dependence of users on centralised intermediaries leaves them exposed to misuse (such as data misuse and privacy violations, censorship and content control, unilateral changes to terms and conditions, etc.) on the end of intermediaries, as users are restricted to a tentative access right for digital assets that can be taken away at any moment (see, for example, the significant uproar caused by the recent decision by Sony to cease support for the Funimation streaming platform and integrate it into Crunchyroll. This move led to users losing access to content they had purchased under the assurance it would be available 'forever' without restrictions. This unilateral action by Sony has negatively impacted users, stripping them of control over content they paid for with the expectation of perpetual access. For a more detailed account of this incident, see Harding, S., 'Sony is erasing digital libraries that were supposed to be accessible "forever"', *Ars Technica*,

2024. Available at: <https://arstechnica.com/culture/2024/02/funimation-dvds-included-forever-available-digital-copies-forever-ends-april-2/?comments=1&comments-page=1> [Accessed: 08.03.2024]).

To assess the relationship between EU copyright law and the NFT landscape, it is imperative to cognitively map the existing business models. Such mapping will reveal the network of legal relationships that unfold between the different stakeholders of the ecosystem and, based on this network, identify the potential for disputes and consequently the applicable jurisdictional rules.

There are two distinct NFT business models: on the one hand, there is the business model that supports the storage of both the NFT certificates and the underlying asset on the blockchain. 'CryptoPunks' (<https://www.larvalabs.com/cryptopunks>, accessed 18 September 2023) is an interesting example of this business model. The CryptoPunks project created digital images of individualised characters and associated them with NFT tokens. Each NFT token of CryptoPunks not only consists of a smart contract that dictates the rights of the acquirer of the NFT, but also contains within it the underlying digital asset. In other words, in the case of CryptoPunks, the NFT and the underlying digital asset constitute an undivided entity, which is stored on the blockchain (See Larva Labs, 'On-chain CryptoPunks', <https://www.larvalabs.com/blog/2021-8-18-18-0/on-chain-cryptopunks>, accessed 18 September 2023). The uniqueness of the business model of CryptoPunks becomes even clearer when one looks at the token standard they use for their smart contracts: instead of the typical ERC-721, CryptoPunks have developed their own *sui generis* token standard that came before the ERC-721. Beyond CryptoPunks, other projects have also displayed a preference for full 'on-chain' storage of both the NFT certificate and the underlying digital art asset (see for example, <https://gnars.com/on-chain-nfts-and-why-theyre-better/>, accessed 18 September 2023).

On the other hand, the NFTs of other providers, such as, for example, the Bored Ape Yacht Club (<https://boredapeyachtclub.com/#/>, accessed September 18, 2023), follow a different path. They mostly use the ERC-721 token standard and what is stored on the blockchain are their smart contracts. The underlying digital art asset, due to storage limitations and efficiency considerations, is not included in the smart contract and is not stored on the blockchain. It is usually stored on a decentralised storage platform, most commonly one that follows IPFS architecture (alternatively, a digital web space controlled by the creator would also make a plausible storage option for the digital art). To secure the bond between the smart contract that is stored on the blockchain, and the underlying asset that is stored outside the blockchain on an IPFS server, the providers of such NFTs associate the smart contract with an IPFS link. By virtue of this association, they try to emulate the situation where both the smart contract and the underlying asset would be stored on the blockchain.

The current market environment of NFTs does not end here. In the analysis of NFT business models, one must factor in the existence of digital marketplaces. These are digital platforms where NFTs are placed for display and 'auctioning' by their providers. Some of the most popular such platforms are [OpenSea](#),<sup>27</sup> [X2Y2](#),<sup>28</sup> [Immutable X](https://market.immutable.com/) (<https://market.immutable.com/>, accessed 18 September 2023), [Axie Marketplace](#),<sup>29</sup> [Magic Eden](#),<sup>30</sup> [Nifty Gateway](#),<sup>31</sup> [Origin Protocol](#),<sup>32</sup> [Super Rare](#),<sup>33</sup> and [Rarible](#).<sup>34</sup> It is important to note that these platforms do not create NFTs, nor do they store them. They merely display the NFTs in order to attract the attention of those who are interested in acquiring them ([Nifty Gateway](#)<sup>35</sup> being a unique case, where the platform also offers custody services on user NFTs apart from listing them and making them available for transactions) and they facilitate exchanges between NFT creators/providers and interested stakeholders. They

<sup>27</sup> Accessed 18 September 2023

<sup>28</sup> Accessed 18 September 2023

<sup>29</sup> Accessed 18 September 2023

<sup>30</sup> Accessed 18 September 2023

<sup>31</sup> Accessed 18 September 2023

<sup>32</sup> Accessed 18 September 2023

<sup>33</sup> Accessed 18 September 2023

<sup>34</sup> Accessed 18 September 2023

<sup>35</sup> Accessed 18 September 2023

operate on their terms and conditions, and they are independently and separately related to NFT creators/providers and blockchain users interested in acquiring NFTs. They usually also operate on traditional Web 2.0 protocols and not on the blockchain.

One could, therefore, say that current NFT business models usually depend on a network of contractual relationships that develop between three major stakeholders: the creators/providers of NFTs, the digital marketplaces where NFTs are being displayed and offered to the general public, and, finally, the end-users that are interested in acquiring NFTs, either to enjoy their utility or to further trade them, usually on a peer to peer-basis. The creation of NFT ecosystems and marketplaces incentivises several interferences with protected digital artworks that might trigger the exclusive rights bestowed upon creators under copyright law. The details of this interaction between NFTs and copyright belong to the next section.

## 2.2 COPYRIGHT PERSPECTIVE ON NFTS

**Non-fungible tokens could facilitate copyright management, licensing, enforcement, and remuneration. The Joint Photographic Experts Group (JPEG) at the International Organization for Standardization (ISO) reported on their exploration in July 2023.**

### *Scope and Approach*

Several digital assets that NFTs point to are either in existing JPEG formats or can be represented in current and emerging formats under development by the JPEG Committee. However, various provenance and security concerns have been raised about NFTs. To better understand requirements for media formats, the JPEG Committee launched the JPEG NFT exploration. The scope was defined as ‘the creation of effective specifications that support a wide range of applications relying on NFTs applied to media assets. The standard shall be secure and eco-friendly, allowing for an interoperable ecosystem relying on trustworthy NFTs within a single application or across applications.’ The committee strives to engage stakeholders from diverse backgrounds, including technical, legal, artistic, and end-user, to establish use cases and requirements. The final ‘Use Cases and Requirements for JPEG NFT’ document was released in July 2023.<sup>36</sup>

## 2.3 NFT CONSIDERATIONS

The process by virtue of which NFTs become available to wider digital audiences includes several technical steps and components that interfere with the exclusive rights of the copyright holder. In fact, as long as the technical activities involved in the creation and marketing of NFTs triggers one of the rights of the copyright holder, the relevant activity can only be undertaken with the authorisation of the latter. In that sense, the relationship between NFTs and copyright is defined by the set of rights bestowed upon the copyright holder as soon as copyright over the digital artwork is established.

While there is no legislative definition of what constitutes a protected work under EU copyright law, the CJEU has developed its own standard through its case law. In *Infopaq* (Case C-5/08, ECLI:EU:C:2009:465) the CJEU had to decide whether a text that consisted of only 11 words can be protected under copyright law. By jointly examining the provisions of Articles 1(3) of Directive 91/250, 3(1) of Directive 96/9 and 6 of Directive 2006/116, the Court concluded that under secondary EU law intellectual works are protected by copyright only if they are original in the sense that they are their author’s intellectual creation (see Case C-5/08, ECLI:EU: C:2009:465, par. 35). What constitutes an author’s ‘own intellectual creation’ was further explored in the joint *Football Association Premier League and Others* (Joined Cases C-403/08 and C-429/08, ECLI:EU: C:2011:631), where

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<sup>36</sup> JPEG.org ([Source](#))



the court concluded *a contrario* (see Joined Cases C-403/08 and C-429/08, ECLI:EU: C:2011:631, par. 98) that the author can express their creative abilities in the production of the work by making free and creative choices during the creation process. Finally, it needs to be stressed that the media used in the production of a work does not necessarily deprive the author of the ability to make creative choices and, therefore, from copyright protection. This was made explicitly clear in Painer (C-145/10, ECLI:EU: C:2011:798), where the Court was presented with the argument that a person's photo portrait does not merit copyright protection because the scope of the protection conferred on such a photograph was restricted, or even non-existent, because of the minor degree of formative freedom allowed by such photographs. The Court rejected this line of thinking, by insisting that even when technical tools like photographic equipment are being deployed, the photographer can still make critical creative choices, by choosing, for example, the background, the subject's pose, and the lighting (see case C-145/10, ECLI:EU: C:2011:798, par. 91). The Court further explained that when taking a portrait photograph, the author can choose the framing, the angle of view and the atmosphere created. Finally, when selecting the snapshot, the photographer may choose from a variety of developing techniques the one he wishes to adopt or, where appropriate, use computer software.

In that sense, NFTs will frequently be (related to) digital assets that are protected by copyright. It needs to be remembered, of course, that NFTs are dual artefacts that consist of an immutable blockchain-based certificate that contains critical metadata as regards the creation, association, and location of a digital piece of artwork and an underlying digital artwork asset that is uniquely related to the blockchain certificate (for this dual nature of NFTs, see Giannopoulou, A. et al., 'The rise of non-fungible tokens (NFTs) and the role of copyright law – part I', *Kluwer Copyright Blog*, 2021. Available at: <https://copyrightblog.kluweriplaw.com/2021/04/14/the-rise-of-non-fungible-tokens-nfts-and-the-role-of-copyright-law-part-i/> (accessed: 16 September 2023)). Copyright protection will usually attach itself to the underlying digital artwork, while the NFT certificate will not necessarily be protected under copyright (see in more detail Guadamuz, A., 'Copyfraud and copyright infringement in NFTs', *TechnoLlama*, 2022. Available at: <https://www.technollama.co.uk/copyrfraud-and-copyright-infringement-in-nfts> (accessed: 16 September 2023)).

Exactly because the underlying digital artwork will usually be protected under copyright law (since it will usually be easy to establish, as per the relevant CJEU case law, as the author has displayed creative choices when creating the digital artwork), the different processes that lead up to the creation of the final NFT product will most likely entail actions that fall within the scope of the exclusive rights of the author.

EU copyright law provides copyright holders three exclusive economic exploitation rights: the right of reproduction (Art. 2, Directive 2001/29), the right of distribution (Art. 4, Directive 2001/29) and the right of communication to the public (Art. 3, Directive 2001/29). Each of them refers to different stages of the exploitation process of a work and can, therefore, influence different stages of the life cycle of an NFT.

The right of reproduction refers to the authority to produce copies of a protected work. It ensures that only the author can decide issues such as how many copies of their work are going to be produced, what type of copies (e.g. digital, or physical), etc. When one looks at the typical life cycle of an NFT, it does not appear impossible for the right of reproduction to obtain significant relevance. Indeed, during the most typical mode of minting an NFT, users usually obtain access to a rather straightforward interface that, in most cases (and irrespective of whether the underlying digital artwork will be stored 'on-chain' or 'off-chain'), requires them to upload their work on a platform (or directly on a blockchain network) to kick start the minting process. By uploading the work, a new copy is being created and, therefore, the right of reproduction is being triggered (see in this vein, Garbers von Boehm, Haag, and Gruber, *Intellectual Property Rights and Distributed Ledger Technology*, 2022, pp. 34-36, sections 3.1.2.1.1. to 3.1.2.2. [https://www.europarl.europa.eu/thinktank/en/document/IPOL\\_STU\(2022\)737709](https://www.europarl.europa.eu/thinktank/en/document/IPOL_STU(2022)737709) (accessed 18 September 2023)). None of the exceptions listed in Art. 5 would apply in the most typical NFT minting scenarios, which automatically means that if the minting process entails the creation of copies of the original work, such actions

can only be undertaken if authorised by the copyright holder. It goes without saying that if other stages of the life cycle of an NFT entail the creation of copies (as is, for example, the case when NFTs are being deposited on IPFS servers or even stored on-chain), then the right of the reproduction will again be triggered and only the authorisation of the copyright holder can legitimise the interference with their work.

The right of distribution ensures that the power to decide whether a protected work will be made available in the market rests exclusively with the copyright holder. On the face of it, the right of distribution should have immense importance for the NFT market. After all, the basic premise of NFTs is that average users can 'buy' NFTs, 'own' them, and 'resell' them on a peer-to-peer basis. In the physical world, peer-to-peer secondary sales of protected works are possible because of the exhaustion of the distribution rights of the author (see Art. 4(2), Directive 2001/29). In the realm of purely digital artworks, the idea that digital assets can be 'owned' and transferred by sales contracts runs counter to existing CJEU case law. Indeed, secondary EU law is not particularly forthcoming towards the idea that digital assets can be associated with proprietary interests, and are susceptible, therefore, to transfers between peers via the means of sales contracts. In particular, while in *UsedSoft* (case C-128/11, ECLI:EU: C:2012:407, paras 73-88) the CJEU decided that the digital transfer of software without any intermediation of a physical storage device can display the functional characteristics of a sales contract, especially if the software is provided for an unlimited time, something that even justifies the exhaustion of the copyright that the seller holds on the transferred software, it denied such an interpretation for other digital assets such as digital artwork. Indeed, in *Tom Kabinet* (case C-263/18, ECLI:EU:C:2019:1111, paras 53-72), a case revolving around a company that claimed that it could allow the creation of a secondary peer-to-peer market for digital books, the Court judged that sales contracts are, under existing secondary EU law, only conceivable on digital assets carried by a tangible medium, while pure digital assets fall squarely within a service-on-demand model. The consequences of the approach taken by the Court in *Tom Kabinet* are important (for a detailed assessment, see Mezei, P., *Copyright exhaustion: Law and policy in the United States and the European Union*, Cambridge University Press, Cambridge, United Kingdom, 2022, pp. 144-166): if there cannot be distribution of digital assets via sales contracts and no exhaustion of the right of distribution, there cannot be any proprietary rights assigned to them, as sales contracts presuppose the existence of a proprietary right that is being transferred from the buyer to the seller. Simply put, the CJEU decision in *Tom Kabinet* means that NFT transactions will not be regulated by the distribution right of the copyright holder (see Mezei, P. et al., 'The rise of non-fungible tokens (NFTs) and the role of copyright law – part II', Kluwer Copyright Blog, 2021. Available at: <https://copyrightblog.kluweriplaw.com/2021/04/22/the-rise-of-non-fungible-tokens-nfts-and-the-role-of-copyright-law-part-ii/> (accessed: 18 September 2023), Geiregat, S., *Supplying and reselling digital content: Digital exhaustion in EU copyright and neighbouring rights law*, Edward Elgar Publishing, Cheltenham, UK, 2022, pp. 55-75), but would rather fall under the right of communication to the public.

The right of communication to the public refers to the economic exploitation of protected works via mass communication channels. Typical examples of such business models are hyperlinking and streaming. The right of communication to the public might, to a certain extent, be relevant for the NFT market. Indeed, no matter whether stored on-chain or off-chain, NFTs are typically made available to mass audiences either by virtue of the hyperlink included in their metadata or by virtue of their placement in NFT marketplaces. If the underlying digital artworks have not been made available before, their placing on the blockchain and/or a typical off chain marketplace will most likely constitute an act of communication to the public. If, on the other hand, the digital artwork has been available prior to the minting or the placing on chain and/or an NFT marketplace, then existing CJEU case law will define the circumstances under which such activities might fall under the right of communication to the public (see, for example, C-466/12, *Svensson and Others*, ECLI:EU: C:2014:76, C-348/13, *BestWater International*, ECLI:EU: C:2014:2315, C-160/15, *GS Media*, ECLI:EU: C:2016:644, C-265/16, *VCAST*, ECLI:EU: C:2017:913).

## 2.4 A CONCEPTUAL FRAMEWORK FOR AN IPR MARKETPLACE

A conceptual framework is 'a structure or theoretical framework that is used to organise and understand complex ideas, concepts, or theories within a particular field of study or discipline. It provides a way to systematically categorise and analyse information, helping researchers, scholars, or professionals to make sense of their subject matter.'<sup>37</sup> A conceptual framework typically includes **concepts** (key ideas, variables, or elements that are central to the topic or research question), **relationships** (connections and interactions between these concepts), **assumptions** (the underlying beliefs and theoretical principles that guide the framework), **definitions** (clear and precise definitions of the concepts to ensure a common understanding) and finally, **context** (the broader context in which the framework is applied, including relevant theories, literature, research, etc.).

**Context:** The context for the conceptual framework of an IPR marketplace integrates blockchain technology's potential with the evolving dynamics of intellectual property management. It considers the shift towards digital assets and the need for innovative solutions to manage, protect, and monetise IP in a global digital economy. The framework is informed by research in digital economics, blockchain innovations, and the legal landscape of IP rights, emphasising the importance of adaptability in legal frameworks to accommodate new technologies. This approach reflects a broader trend of leveraging decentralised technologies to foster transparency, efficiency, and security in digital transactions, aligning with ongoing discussions about the future of IP management.

**Concepts:** The key components of the conceptual framework for the establishment of a blockchain-based IPR marketplace, include:

**Blockchain technology:** the underlying decentralised ledger technology that securely records and verifies transactions.

**Intellectual property (IP):** includes patents, copyrights, trademarks, and other forms of intellectual property that can be bought, sold, or licensed.

**Marketplace:** refers to the platform or ecosystem where IP rights are bought, sold, licensed, or traded.

**Marketplace participants:** entities involved, such as creators, inventors, buyers, sellers, and regulators.

**Smart contracts:** self-executing contracts with code that automatically enforces terms and conditions of IPR transactions.

**Tokens/cryptocurrency:** digital assets used for payments, representing ownership or licensing of IPR.

**Legal framework:** the set of laws and regulations governing IP rights, including intellectual property protection and dispute resolution.

**Definitions:** We must provide some key definitions for the establishment of an IPR marketplace and its operation:

**Digital assets registration:** i.e. using blockchain technology for immutable record-keeping of IPRs, to ensure that all digital assets and their associated IPRs are uniquely identified and recorded on the blockchain. The process for the registration would require that creators upload their work to the

<sup>37</sup> Jabareen, Yosef. (2009). Building a Conceptual Framework: Philosophy, Definitions, and Procedure. Int. J. Qual. Methods. 8. 10.1177/160940690900800406. ([Source](#))

platform, which then generates a unique digital fingerprint (hash) and records it on the blockchain, establishing undeniable proof of authorship as well as time of registration.

**Smart contracts:** i.e. enforcing automated agreements, such as licensing terms and royalty payments, without the need for traditional licensing systems. When a transaction occurs, the smart contract automatically executes the agreed-upon terms, distributing payments and updating ownership records accordingly.

**Decentralised platform:** i.e. facilitating direct and transparent marketplaces where creators and consumers can interact without intermediaries. The platform operates on a peer-to-peer network, allowing users to browse, license, or purchase IPRs directly from the rightful owners.

**Standardisation and interoperability:** i.e. implementing standards for digital assets and smart contracts to ensure that digital assets and smart contracts interact seamlessly across different blockchain platforms and marketplaces. This can be done through the adoption of common standards and protocols for digital asset representation, smart contract formats, and metadata to enable cross-platform transactions and interoperability.

**Legal and regulatory compliance:** i.e. incorporating mechanisms to promote compliance with international IP laws and regulations and ensure that transactions within the marketplaces are legally binding and compliant. The process includes the integration of legal frameworks into smart contracts and platform policies, along with tools for rights management and enforcement that align with international standards.

**User verification and privacy:** i.e. establishing trust in the marketplace by verifying the identity of participants while protecting their privacy. This can be done through the implementation of secure digital identity verification methods that balance transparency in transactions with the need for confidentiality and data protection.

**Marketplace governance:** i.e. maintaining the integrity and fairness of marketplaces through clear governance structures and dispute-resolution mechanisms. This can be done through the establishment of community-driven governance models, including oversight bodies and transparent processes for addressing disputes and enforcing marketplace rules.

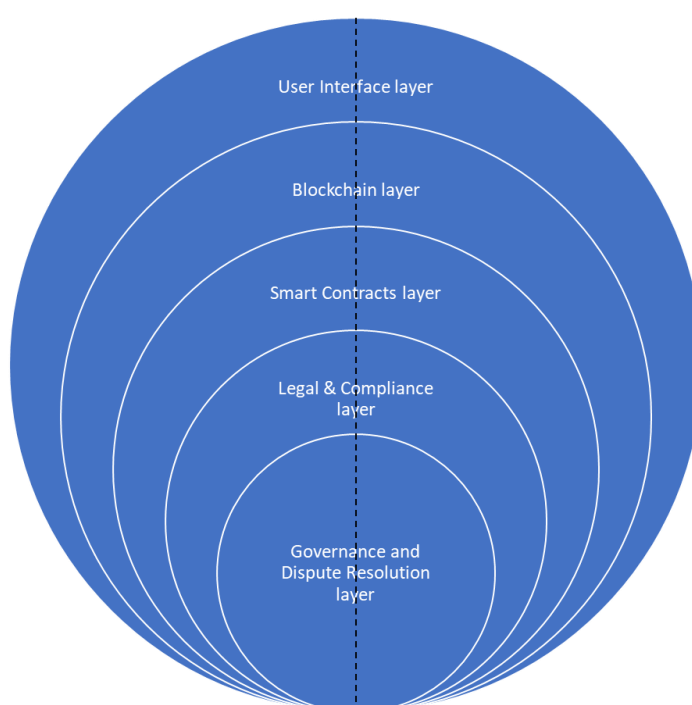
**Assumptions:** We envision that a conceptual framework for an IPR marketplace should integrate blockchain technology to ensure transparency, security, and efficiency. Such a framework should combine technical advances with legal and regulatory considerations, aiming to create a secure, efficient, and user-friendly environment for trading and managing IPRs. For this reason, we assume:

1. **Blockchain as a reliable infrastructure:** meaning that we consider blockchain's capabilities for secure, transparent, and efficient transaction and data management are suitable for IPR transactions.
2. **Adaptability of legal frameworks:** implying that we consider that existing and future legal and regulatory frameworks can adapt to accommodate and enforce digital transactions and rights management conducted on blockchain platforms. For example, the EU obligation for a smart contract to be legal, i.e., amendable, revocable, and human-readable, can be respected through hybrid (on-chain/off-chain) storage of information.
3. **Market efficiency through decentralisation:** suggesting that removing intermediaries through a decentralised platform could lead to increased market efficiency, reduced costs, and enhanced accessibility for participants.

4. **Standardisation facilitates interoperability:** indicating that the development and adoption of standards for digital assets and smart contracts could ensure interoperability among different blockchain systems and legal jurisdictions, enhancing the marketplace's usability and reach.
5. **Privacy and verification balance:** assuming that it is possible to ensure user privacy while implementing robust identity verification processes, maintaining trust and security within the marketplace.
6. **Willingness of market adoption:** suggesting that we expect creators, IP owners, and users to be willing and ready to transition to blockchain-based platforms for managing and trading IPRs, recognising the benefits over traditional systems.

**Relationships:** The following graph illustrates the conceptual framework for an intellectual property rights (IPR) marketplace, showing the interaction between different layers:

*Graph 1 – Conceptual Framework of an IPR Marketplace*



The user interface layer is the entry point for users to interact with the marketplace, including registration, asset uploads, and transaction initiation.

The blockchain layer records transactions, ownership, and asset registration, serving as the backbone of the marketplace for transparency and security.

The smart contract layer automates agreement enforcement and royalty distributions based on predefined rules encoded in smart contracts.

The legal & compliance layer ensures activities within the marketplace comply with international laws and IP regulations.

The governance & dispute resolution layer provides the structure for marketplace governance, including mechanisms for resolving disputes and enforcing marketplace rules.

The above visualisation captures the flow and dependencies across different components of the marketplace, highlighting the importance of each layer in facilitating secure, transparent, and efficient transactions within the IPR ecosystem.

### 2.4.1 Real Life Example of IPR Marketplace<sup>38</sup>

ChromaWay is currently developing the Relational Blockchain Nebula (RBN) IP Marketplace as part of Phase 2 of the EBSI pre-commercial procurement programme. The RBN IP marketplace is expected to operate as a simple and transparent marketplace for storing, selling, and purchasing IP licences in the EU. By combining the strengths of blockchain with a tiered governance model, this solution can help standardise and automate how IP is exchanged. The application is designed with a two-tiered architecture that includes administrators (managers of the system) and end users (buyers and sellers of IP).

As expected, there are many stakeholders involved in the system designed to handle IP transactions for the EU. Stakeholders include government agencies, law firms, and consumer protection groups. Decentralisation is introduced into the solution by granting administrative duties to multiple stakeholders who reach consensus to perform the needed administrative functions. These include:

- KYC checks on users who wish to access the application.
- Verifying the content of licensing agreements and ensuring they are handled correctly by all parties involved.
- Reviewing and resolving disputes between users.
- Discontinuing licence agreements between legal entities.
- Granting licence agreements between legal entities.

By distributing these key functions across various entities as opposed to granting central authority to one party, the system remains transparent and fair for all participants.

Users fall into two broad categories: licence owners and licencees. Licence owners represent inventors or companies that hold an IP and wish to sell licences for the use of that IP by third parties. Licence owners can:

- enter requests to register their IPs in the system;
- create sales offers for their IPs in the marketplace;
- raise disputes pertaining to license agreements.

Licensees can:

- create purchase offers for IPs listed in the marketplace;
- raise disputes pertaining to licence agreements.

Licensing agreements are prepared in the form of smart contracts, making things easier for the IP exchange process. In the RBN marketplace, each contract contains full terms and conditions — making the process more accessible and unambiguous for both parties. It also boosts efficiency by turning the marketplace itself into a secure repository for the EU's IP data.

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<sup>38</sup> Medium.com: Chromaway streamlines intellectual property in the EU ([Source](#))

Smart contracts also offer the advantage of automatic execution; on the licence owner's side, the performance is a grant of rights, while on the licensee's side the smart contract enters into force after the transfer of financial compensation and possible royalties. All information regarding completed transactions will be automatically written to the blockchain, creating a permanent record of the legal agreement and financial exchange between the parties.

### Overcoming challenges

**The IP system is too fragmented, with procedures that are complex and costly:** The RBN marketplace has the potential to replace the current patchwork of systems with a single interface that automates and streamlines the procedure by which IP is bought and sold.

**Many companies, in particular SMEs, do not make full use of the opportunities offered by IP protection:** Making a fully digitised system facilitates SMEs participation on a level playing field. Once the entity has been onboarded to the system, they can participate in the same way as large businesses and corporations. Agreements are recorded and enforced automatically, removing the need for expensive and time-consuming legal and administrative costs for small businesses.

**Tools to facilitate access to IP for both licence owners and licensees are insufficiently developed:** The creation and development of the marketplace directly addresses this problem by delivering a single interface that facilitates access for both licensors and licensees.

**Despite continued efforts to turn the tide, counterfeiting and piracy of both goods and trade secrets is still prevalent:** By using a diverse but trusted set of administrative level nodes, the system can be guarded against malicious actors attempting to gain access to valuable IP. Since the data underlying the contracts is stored on a blockchain, it remains secure against threats posed by hacking.

**There is lack of 'fair play' on the global level due to a lack of global norms and standards regarding IP protection:** The first step to establishing global norms is demonstrating a solution that is superior to currently available options. By delivering a functional and streamlined platform, the EU can set an example for others to follow.

## Chapter 3: Standards

This chapter presents works that show standardisation processes taken by technology providers and market participants. For example, CWS/9 has proposed recommendations.

(see [https://www.wipo.int/meetings/en/details.jsp?meeting\\_id=64368](https://www.wipo.int/meetings/en/details.jsp?meeting_id=64368) ).

### 3.1 EIP-2981 NFT ROYALTY STANDARD

Royalty and different royalty models of NFT systems are extremely important, especially if the NFT relates to the intellectual property rights of certain physical or digital assets. The reason for the importance is that the different royalty models represent the different possible business models behind tokenised intellectual property applications. They provide the possibility of distributing the sell price among different actors, most typically between the buyer and content creators. EIP-2981 is an Ethereum/solidity standard, providing a standardised way for distributing royalty to the content originator, like to the original artist [ERC-2981]. It describes a single actor/single split of revenues model; in this sense it can be regarded as the simplest form of standardised NFT royalty models.

Blockchain systems and platforms experienced a Cambrian explosion in the last couple of years. It resulted in several different, sometimes competing platforms and approaches. For this reason, it is important to define some official or de facto standards to help individuals and enterprises deal with simplified interfaces and user experiences. One such attempt is the Ethereum Improvement Proposals (EIP) that try to manage modifications and extensions of the platforms in a well-structured process-oriented way [EIP]. EIP is strongly Ethereum oriented, there is however a subset of the improvement proposal, called Ethereum Request for Comment (ERC), which focuses on smart contract standards and the application layer of the blockchain [M. Marcobello, 2022]. ERC standards usually describe smart contract standard interfaces, without specifying the underlying functionalities in detail. The definition itself is usually based on solidity, therefore these standards can be directly applied to other blockchain platforms having solidity as a smart contract programming language, like Binance Smart Chain or Polygon. Token standards are usually defined as ERCs, the most common are:

- ERC-20, describing the basic fungible token
- ERC-721, describing basic NFT token
- ERC-1155, a hybrid token combining fungible and non-fungible token properties

Because these ERC standards define interface functionality of different digital assets, usually there is an attempt to extend them to non-solidly supported platforms as well, providing broader standardised usage. As an example, even R3 Corda, which is very different from Ethereum both in working mechanism and in smart contract programming, has fungible and non-fungible tokens that are partly influenced by the corresponding ERC standards.

The ERC-2981 is a token standard that can extend both non-fungible (ERC-721) and hybrid tokens (ERC-1155) with standardised royalty payment functionality. The royalty standard is extremely important in the NFT use-case, because before standardisation each NFT marketplace handled royalty in a different way. ERC-2981 is a minimalistic implementation of the royalty distribution functionality however each marketplace can handle the royalty distribution in a uniform way. The standard provides one function having input parameters: the NFT token id and the sales price. The function simply returns two outputs: the address of the beneficiary of the royalty fee, and the amount to be paid (Figure 1). The whole functionality practically defines for a certain



token ID the proportion of the sales price that must be paid to the beneficiary, who is typically the content creator (Figure 1).

```

interface IERC2981 is IERC165 {

    function royaltyInfo(

        uint256 _tokenId,

        uint256 _salePrice

    ) external view returns (

        address receiver,

        uint256 royaltyAmount

    );

}

```

**Figure 1. ERC2981 specification [ERC2981]**

It might be surprising that the royalty standard is defined by a simple query interface. It is important to note however that this interface must provide a common standardised royalty structure for many different marketplaces or token sale mechanisms. Here are some examples [ERC-2981]:

- Totally centralised NFT marketplaces with classical fiat-based payment for selling NFTs. It is important to note that in this scenario the system is not trustless. The smart contract provides only information on royalty payments. It depends on the marketplace if it is actually paid or not.
- Centralised NFT marketplaces with centralised crypto payment. Like the previous example, this is again a trusted setup, without decentralised guarantee for the royalty payment.
- Decentralised NFT marketplaces with smart contract integrated payment.
- Primary NFT sales with smart contract integrated payment.

In most use cases, ERC-2981 is not implemented in a fully trustless manner. It is usually the responsibility of the marketplace to transfer the correct amount of money or crypto to the beneficiary. There are examples however of fully decentralised royalty implementations as well, like combining the token standard with the transferFrom function of the NFT token. The challenge is here, however, to distinguish between transfer functionalities for purchase from other transfer functionalities, like transferring tokens from one wallet to another one in backup-recovery scenarios. The ERC-2981 token standard does not define the exact implementation of the token, so multiple implementation strategies might be followed:

- Uniform percentual royalty: there is a certain percentage of the sale price that is paid to the NFT creator.

Uniform constant royalty: there is a constant amount of money or crypto that is paid to the NFT creator.

- Varied royalty: the amount of royalty fee can depend on the token ID as well. For example, different types of tiers can be defined on the basis of token ID. A 'free' token type might not pay a royalty at all, a 'cheap' token type might have a small amount of royalty, and a 'normal' token type can have a full amount.
- Fully flexible royalty token: although it is not widely used, theoretically, there is a way to change everything dynamically and algorithmically. Examples might range from changing variable royalty fee in each blockchain block to reconfiguring the content creator address dynamically.

The fact that an ERC standard provides only an interface to use but does not provide the exact underlying functionality might cause problems in smart contract security by introducing possible vulnerabilities in the smart contract implementation. For this reason, there are de facto standard libraries as well that implement a given standard in a reliable and secure way. The most famous secure solidity implementation library is OpenZeppelin. The ERC-2981 implementation of OpenZeppelin simply stores a structure for each token ID containing the content creator address and the percentual proportion of the royalty fee [OpenZeppelin].

One of the disadvantages of the ERC-2981 standard is that it realises a one-layer payment model, considering one artist or content creator who gets the royalty fee. Although this is the basic scenario of royalty payments in a very classical sense, there is sometimes the requirement to realise more complex payment use-cases. Examples might range from paying multiple artists or content creators proportionally, or creating middlemen in the payment process, like paying for resellers or virtual 'galleries'. To capture these extended requirements, new token standards are being introduced, like ERC-4920 and ERC-721C [XP.network, 2022]. The ERC-4920 is still a proposal but extends the royalty payment logic with many exciting use-cases. Examples are splitting the royalty fee into several sub-accounts, more support for on-chain payment logic, and creating hierarchical royalty trees. ERC-721C contains a lot of practical NFT extensions not limited solely to royalty payments. Examples are upgrades, timelocks, improved reward mechanisms, and logic for staking possibilities [Limit Break, 2023].

The future of the NFT royalty market is certainly yet to be seen. We can already conclude however that NFT will play an important role in the digitisation of intellectual properties and royalty payment will be considered.

## 3.2 ISO/DIS 24138 INFORMATION AND DOCUMENTATION – INTERNATIONAL STANDARD CONTENT CODE

**ISO/TC 46/SC 9, Information and Documentation, Identification and Description prepared the draft international standard on the international standard content code.**

'While ISO/TC 46/SC 9, Information and Documentation, Identification and Description, has established a variety of specific identifier standards, a content-dependent identifier for digital assets in all content formats has not yet been agreed.

Digital content is dynamic, always in motion, and acted upon globally by a variety of entities with different interests and requirements. Digital content continuously re-encodes, resizes, and re-compresses, changing its data as it travels through a complex network of actors and systems.

The International Standard Content Code (ISCC) is an identifier for numerous types of digital assets. An ISCC-CODE is generated from the digital content itself. It is the result of processing the digital content using a variety of algorithms including hash algorithms. The generated ISCC-CODE supports data integrity verification and

preserves an estimate of the data, digital content, and metadata similarity. However, ISCC has different functionality from content recognition systems.

The ISCC supports the association of higher-level identifiers (like work and product identifiers) with the digitally encoded manifestations of content. The ISCC does not specify a system for managing authoritative metadata. Other content identifier standards can use ISCC to support the discoverability of their identifiers and metadata based on digital content.

Organisations, individuals, and machines may generate ISCCs for numerous kinds of digital assets and use them for the identification and management of those assets.

ISCCs are neither manually nor automatically assigned to digital media assets. Instead, ISCCs are derived from media assets according to the procedures described in the ISO document <https://www.iso.org/standard/77899.html>. Unrelated parties can independently derive the same ISCC from a given media asset.

ISCCs exclusively reference media assets without any implication about ownership. As such, ISCCs are not managed authoritatively by any institution or entity.

The ISCC enables interoperability between different actors and systems using digital assets and supports scenarios that require content deduplication, database synchronisation and indexing, integrity verification, timestamping, versioning, data provenance, similarity clustering, anomaly detection, usage tracking, allocation of royalties, fact-checking, and general digital asset management use-cases.<sup>39</sup>

### 3.3 WIPO RECOMMENDATIONS (CWS/9)

The World Intellectual Property Organization (WIPO) is the global forum for intellectual property policy, services, information, and cooperation. The Committee on WIPO Standards (CWS) created Task No 59 to prepare a proposal for a new WIPO standard applying blockchain technology to IP ecosystems and established the Blockchain Task Force in 2018. The WIPO Blockchain Task Force proposes to develop reference models for using blockchain technology in the IP field, including guiding principles, common practice, and use of terminology. In this regard, the WIPO white paper on blockchain technologies and IP ecosystems (WIPO, 2022) explored potential applications and opportunities provided by blockchain and other decentralised ledger technologies (DLT) in the IP ecosystems and identified a set of potential blockchain-enabled IP management use cases, such as IP licensing, anti-counterfeiting, IP rights enforcement, certification mark, evidence of trademark usage, IP rights transfer/assignment, self-sovereign identity and global identifiers in IP community.

Original creative works receive protection automatically without the necessity for registration or formal requirements. Nevertheless, in certain cases, rightsholders may opt to voluntarily register their works in copyright registries to substantiate authorship and/or ownership, document the date of creation to validate protection and simplify the management and economic use of their copyright.

WIPO highlights that blockchain and other DLTs offer opportunities to automate processes and systems used by collective management organisations (CMOs), improving information accessibility for potential users and providing market operators with the opportunity to purchase, sell, and license intellectual property rights (IPRs), all within a meticulously tracked ledger system. This accessibility can also be enhanced through the integration of NFTs in IP management. By using DLT solutions, various user types gain access to digital content while

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<sup>39</sup> ISO.org ([Source](#))

identifying the involved parties throughout the process, from creation to public accessibility. Furthermore, smart legal contract solutions enable new methods for negotiating licences, whether individually or collectively through CMOs or other entities. Additionally, smart legal contracts can streamline the calculation of royalties collected from users and their distribution among different rights holders.

WIPO considers the IP ecosystem consists of a network of diverse stakeholders, including creators, inventors, enterprises, organisations, IP offices, and enforcement authorities. These entities engage in collaborative and competitive interactions within the IP environment, using resources to generate, protect, manage, and/or commercialise intellectual assets. These interactions can be structured into an IP value chain consisting of four phases - which can benefit from the support of decentralised ledgers and related technologies – which are the generation, protection, management, and commercialisation of an asset.

During the generation phase, decentralised ledger applications can assist in validating the date and ownership of preparatory documentation related to IP assets. This verification process helps establish the groundwork for filing patents, utility models, or other industrial property rights applications.

During the protection phase, permissioned blockchain solutions enable a managed ledger, facilitating append-only transactions and the sharing of immutable IP data. Blockchain technology can also furnish tamper-proof evidence throughout the application's lifecycle, spanning examination, opposition, and cancellation stages.

During the management and commercialisation phases, integrating blockchain solutions into the administration of IP registries could streamline various management activities, enhancing the value of IP rights portfolios. Initially, registered rights could be autonomously managed by their owners or their representatives, leading to increased efficiency. Additionally, IP rights holders might employ smart legal contracts for licensing and assigning registered IP rights. Tokenisation can further aid in securitising IP assets or using them as collateral.

WIPO recommends participants in IP ecosystems consider several factors when making decisions regarding IP management and DLT:

- (a) Whether to transition to blockchain and other DLT-based solutions along with other frontier technologies as part of their digital transformation.
- (b) Identifying applications that bring added value to existing solutions.
- (c) Determining the most suitable type of blockchain or DLT.

These considerations stem from a lack of interoperability across three key perspectives: technical standards, blockchain governance, and regulatory frameworks. Additionally, collaboration and capacity building are crucial for IP offices and other stakeholders as they integrate DLT into IP ecosystems.

**WIPO recommendations on technical standards** – As regards WIPO recommendations on technical standards, the work of the CWS Blockchain Taskforce could involve developing a new WIPO standard to support potential applications of blockchain technologies within IP ecosystems. It is beneficial for participation in such a forum to encompass not only primary representatives from Member States and IP offices but also observers from other international organisations, the private sector, and various stakeholder groups, particularly those actively involved in blockchain projects. Ensuring synchronisation and alignment of all efforts is crucial to facilitating the adoption of technology and preventing fragmentation, thereby promoting cohesive collaboration.

**WIPO recommendations on blockchain governance** - On blockchain governance, WIPO recommends carefully balancing the interests of all stakeholders involved. These stakeholders encompass founders, network nodes, blockchain users, application developers, and regulatory authorities. The blockchain network founders should prioritise establishing network governance that allows all stakeholders to voice their opinions and safeguard their interests. Before launching blockchain solutions, the governance structure should be clearly defined and agreed upon during the specification and design phases, taking into consideration existing governance processes within the relevant IP ecosystem. Nevertheless, the governance framework should remain adaptable to accommodate technical advancements within the system or address emerging stakeholder needs.

Moreover, given that stakeholders in blockchain-enabled IP ecosystems often span different countries and regions, it is imperative to consider multi-jurisdictional regulations during the design phase to prevent regulatory violations.

Examining the governance structures of existing blockchain consortia and ongoing projects within the IP domain can provide valuable insights into common practices. These insights can help in developing reference models and guiding principles of the establishment of effective governance frameworks.

**WIPO recommendations on regulatory frameworks** - Considerable legal uncertainty surrounds various aspects of blockchain-enabled IP ecosystems, raising questions about the full adaptation of legal systems to this innovation. Despite the entity administering a blockchain network possibly residing within a single Member State, stakeholders often hail from diverse jurisdictions. This scenario is especially prevalent in IP ecosystems, where many participants operate at international level. Such concerns merit careful consideration when evaluating the viability of implementing a blockchain solution and conducting a thorough legal risk assessment.

Competent authorities encounter three primary challenges when fulfilling fundamental legal and regulatory functions, contingent upon the nature of the blockchain. These challenges encompass identifying liability, establishing the relevant laws governing blockchain activities, and executing regulatory oversight or enforcing regulations.

## Chapter 4: Considerations on the appliance

While blockchain can have different applications for IP management, there are considerations arising from its use. For instance, interoperability can be an issue as different platforms exist, and the resources may be saved on-chain or off-chain.

### 4.1 GOVERNANCE

In *An intellectual property action plan to support the EU's recovery and resilience*,<sup>40</sup> the Commission defines the 'copyright infrastructure' as the set of rules, technologies and institutions that **frame** data management practices in the creative industries to improve authoritative and updated information on rightsholders, terms and conditions, and licensing opportunities.

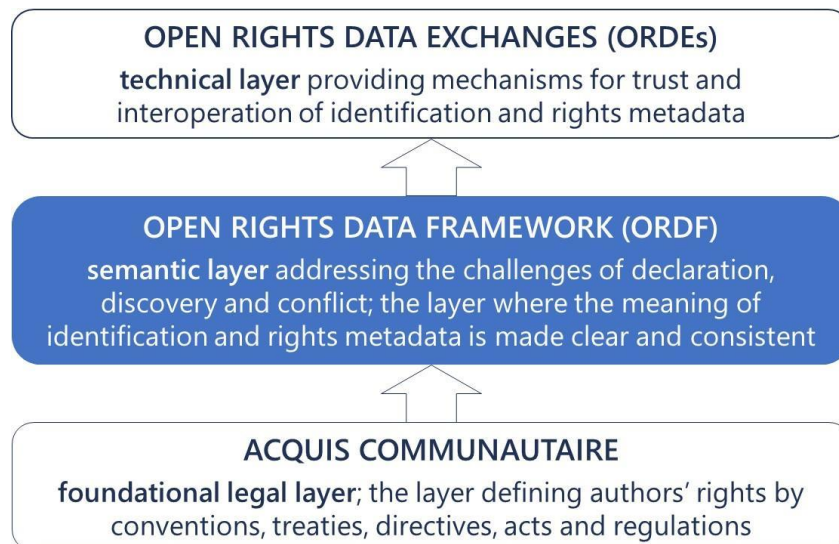


Figure 2: A semantic layer to govern technical infrastructures © Philippe Rixhon Associates

A successful data **framework** is minimally prescriptive but maximally inclusive. It supports many different solutions, past, present, and future. It enables numerous ways in which individuals and organisations can cooperate in creating, enriching, governing, and distributing trusted information. A well-governed data framework helps to streamline current processes and trigger innovative businesses. It is of potential benefit to everybody in the ecosystem.

**In Autumn 2022, the governments of Estonia and Finland set up a task force to work on the copyright infrastructure and its governance. The task force identified the first components of such governance.**

**A set of rules** – The semantic layer brings data together. Its building blocks are identifiers, credentials, and schemas (the formats in which metadata is captured). There are many types of these in use, standard and proprietary. The Open Rights Data Framework (ORDF) will be designed to combine all of them. On the basis

<sup>40</sup> European Parliament resolution of 11 November 2021 on an intellectual property action plan to support the EU's recovery and resilience ([Source](#))

of some of the best work done in metadata standards in the last 25 years, the ORDF will set up an innovative data architecture able to integrate rights and content data of any kind or complexity.

**A set of technologies** – The Copyright Infrastructure Task Force promotes the advances of technology programmes supporting the interoperability, searchability, and trustworthiness of rights management information. These cutting-edge technologies are the base of the Digital Decade comprehensive framework: blockchain, digital wallet, digital twins, high-performance computing, and 5G.

**A set of institutions** – Building a pervasive and inclusive ORDF at European and then global level requires cooperation and coordination between standards organisations, existing repositories, rightsholders, and rights users. The Copyright Infrastructure Task Force will not publish standards itself but coordinate requirements and resources to foster the creation and evolution of standards within standards organisations.

Supported by its four advisory boards –

- *Standardisation*, consisting of experts from standardisation bodies,
- *Repositories*, consisting of experts from organisations maintaining large repositories,
- *Rights holding*, consisting of experts from rightsholder associations, and
- *Rights usage*, consisting of experts from rights user associations,

The Copyright Infrastructure Task Force intends to assure the governance of the ORDF and liaise with the [European Data Innovation Board](#).

Another example of use of blockchain, is that of IP Australia on trademarks. [Smart Trade Mark](#) is an initiative launched by the Australian government, which is working on trials with industry and government partners for modernising trademarks, enabling brands to better protect themselves against misuse and counterfeit.

Smart Trade Mark operates on a platform that allows trademark owners to connect digitally to the government register to prove they are the authentic owner of a brand. It uses blockchain technology and APIs to connect information about the trademark, such as who the owner is and where it has been used digitally. This enables the trademark owner to control the use of their mark/s and prove a product's origin. Importantly, Smart Trade Mark is an open platform with the potential to enable a lot of different applications.

## 4.2 SECURITY

While blockchains present significant opportunities for IP management, they are at the same time quite complex systems, providing different kinds of security guarantees, like

- **Centralised trust:** for example, most people simply trust that the wallet application they choose use will not leak their private key.
- **Economic guarantees:** Most consensus algorithms, like proof of stake, are based on economic security, which is heavily dependent on market behaviour, like supply and demand.
- **Cryptographic guarantees:** Some elements of the systems are secure in a cryptographic sense, for example, keys and digital signatures.

Some of the challenges to be considered with regards to security include:

- Legal recognition, i.e. the legal status of blockchain entries as proof of IP ownership or transactions is not universally recognised, varying by jurisdiction.
- Standardisation, i.e. the lack of standardisation across different blockchains can complicate the integration of systems and recognition of IP rights across platforms.

- Scalability and environmental concerns, i.e. the energy consumption of certain blockchain implementations (e.g. those using proof of work consensus mechanisms) and scalability issues are also concerns that need to be addressed.

One of the key features of blockchain is its immutability, meaning that once data is recorded on the blockchain, it cannot be easily altered or deleted. While this can enhance the security of IP records, it also means that if there is an error or if fraudulent information is recorded, it becomes extremely difficult to correct or remove it. This can be exploited by malicious actors to permanently register false claims to IP (**Immutability**). Many IP management systems on blockchain rely on smart contracts to automate various IP-related processes. Smart contracts are self-executing contracts with the terms of the agreement directly written into code. Their vulnerability to bugs can be exploited, while flaws in smart contract code can lead to unauthorised access, loss of IP, or other security issues (**Smart contract vulnerabilities**). It is important to highlight though, that the legal obligations of amenability and revocability of smart contracts (decentralised governance, audit, and verification) lead to architectures that address them.

In blockchain-based IP systems, individuals or organisations are typically given private keys to manage their IP assets. The security of these private keys is crucial. If a private key is compromised or lost, it can lead to unauthorised access to and manipulation of IP assets. Ensuring the secure storage and management of private keys is a significant security challenge (**private key management**).

Scalability is a concern for many blockchain networks. As the number of IP assets recorded on a blockchain grows, so does the size of the blockchain ledger. This can make it difficult for participants to validate and store the entire blockchain, potentially leading to centralisation and security risks as only a few parties or nodes may have access to the full ledger (**scalability**).

While blockchain transactions are pseudonymous and not tied to real-world identities, the transparent and immutable nature of the blockchain can still raise privacy concerns. If someone can link a blockchain address to a real-world identity, it could reveal sensitive information about IP ownership and transactions. There is also the possibility to manage IP with verifiable credentials; there are limited transferable verifiable credential models as well. Such systems have different (off-chain) privacy guarantees; however, they are usually more centralised, i.e. the issuers usually have all the counterparty risks (**privacy concerns**).

In a public blockchain, if a single entity or a coalition of entities controls more than 51% of the network's computing power, they can potentially manipulate the blockchain. This could lead to fraudulent changes in IP ownership records or other malicious activities (**51% attacks**).

Finally, the legal framework surrounding IP rights is complex and varies from one jurisdiction to another. Implementing blockchain for IP management must align with existing legal standards and regulations. Ensuring legal compliance while maintaining security can be a challenge. At the same time, it is also an opportunity: if public organisations can provide digital credentials, in the future, brands will be able to collect all IPR proofs in a single wallet and link them to whatever product/art is produced for all interested parties to confirm the IPR validity (**legal challenges/compliance across networks and borders**).

In conclusion, blockchain technology has the potential to revolutionise IP management, offering enhanced security, efficiency, and transparency. However, widespread adoption requires addressing legal, technical, and environmental challenges.

## 4.3 SCALABILITY



Blockchain technology has become a promising solution for intellectual property (IP) management, addressing issues such as proof of ownership, rights distribution, and counterfeiting. However, scalability remains a significant challenge for its widespread adoption in this field.

The most important challenges concern:

- **Transaction throughput:** Blockchain networks, especially public ones like Bitcoin and Ethereum, have limitations on the number of transactions they can process per second. This limitation is often referred to as 'transaction throughput'. In the context of IP management, there may be a need to record a significant number of IP-related transactions, such as patent filings, trademark registrations, or copyright claims. If the blockchain network cannot handle a high transaction throughput, it can result in delays and congestion.
- **Block size and confirmation times:** Blockchain networks operate by grouping transactions into blocks and adding them to the blockchain. The size of these blocks and the time it takes to confirm transactions can impact scalability. Smaller block sizes can limit the number of transactions that can be processed in each block, while longer confirmation times can lead to delays in registering and verifying IP-related data.
- **Storage and data size:** Storing IP-related information, such as patent documents, trademark images, or copyrighted content, on a blockchain can be resource-intensive. As more data is added to the blockchain, the size of the blockchain's ledger grows, which can increase storage requirements and slow down data retrieval and validation processes.
- **Cost of transactions:** Many blockchain networks require users to pay transaction fees to prioritise their transactions. High transaction fees can deter users from registering or managing their IP on the blockchain, especially small inventors or creators with limited budgets.
- **Network congestion:** During periods of high demand or network congestion, transaction fees can skyrocket, and the processing time for transactions can increase significantly. This unpredictability can make IP management on a blockchain less reliable for users who need timely and cost-effective services.
- **Smart contract execution:** IP management often involves the use of smart contracts on blockchain platforms. Executing complex smart contracts that involve IP rights, royalties, and licensing agreements can be computationally intensive, potentially slowing down the network and affecting scalability.
- **Governance and consensus mechanisms:** Decisions about the rules and governance of a blockchain network can impact its scalability. Changes to the consensus mechanism or network upgrades may be required to improve scalability, but these changes often require a high degree of agreement among network participants.

To address these scalability challenges, blockchain developers and organisations are exploring various options, including Layer 2 scaling solutions (e.g. sidechains and state channels), consensus algorithm upgrades, and the use of hybrid blockchain systems that combine the benefits of public and private blockchains. In more detail:

- **Layer 2 solutions:** Technologies like state channels, sidechains, and rollups can significantly increase transaction throughput and reduce costs by processing transactions off the main chain while still ensuring security and decentralisation.
- **Off-chain data storage:** Using decentralised storage solutions (e.g. IPFS, Filecoin) for storing IP-related documents and only recording the hash of these documents on the blockchain can ensure data integrity while overcoming the blockchain's storage limitations.
- **Sharding:** This technique divides the blockchain network into smaller, manageable pieces (shards) that can process transactions in parallel, significantly increasing the network's overall capacity.

- **Cross-chain bridges:** These can facilitate interoperability between different blockchain systems, allowing for the seamless transfer and management of IP rights across multiple blockchains.
- **Customised blockchains:** Developing blockchains tailored specifically for IP management with customised governance models and optimised for high transaction throughput can address specific needs of the IP sector.
- **Merkle trees:** Merkle trees play a crucial role in enhancing blockchain scalability, particularly addressing the challenges of block size and confirmation times. They offer a compact, efficient way to verify the contents of large data sets, such as the transactions within a blockchain block, without needing to check each piece of data individually. This is particularly useful in the context of IP related data, where transactions might include the registration, transfer, or licensing of IP rights.

To address scalability while ensuring security, privacy, and compliance with IP laws, continuous technological advancements and collaboration between tech developers, IP owners, and regulatory bodies are essential. Pilot projects and consortia in the IP domain are exploring blockchain's potential, which could lead to standardised practices and more scalable solutions. Blockchain's role in IP management is still evolving, and scalability solutions are crucial for its long-term success in this area. As blockchain technology matures, we can expect more innovative solutions to emerge, making it increasingly viable for complex and high-volume areas like IP management.

## Conclusions

One of the key insights one can gain from this report is the transformative potential that blockchain applications can have for the management of intellectual property rights. Blockchain virtues, i.e. decentralisation, immutability, and transparency, present significant opportunities for enhancing IP management. The automation of transactions, including royalty payments through smart contracts, reduces costs, minimises disputes, and creates a more efficient process for all parties involved. The use of NFTs offers a novel mechanism for claiming ownership and linking rights to digital assets, which, although challenging to the traditional IP enforcement mechanisms, it also offers a unique way for creators to protect and monetise their works.

The development of standards such as EIP-2981 for NFT royalties and ISO/DIS 24138 for content coding is crucial for ensuring interoperability among different blockchain platforms. These standards aim to create fair compensation mechanisms and ensure seamless integration of blockchain technology into the broader IP management ecosystem.

Blockchain is expected to have a significant role in enhancing the efficiency, transparency, and fairness of IP management, although ongoing research, development, and dialogue across sectors to address the existing challenges and harness the benefits of blockchain and NFTs is deemed necessary. Besides making existing systems and use-cases more efficient, tokenised IP management promises to become a platform for further innovations. Examples for disruptive further innovations might be the usage of tokenised IP as a building block in DEFI (decentralised finance), REFI (regenerative finance) or decentralised science protocols.

Despite the opportunities, integrating blockchain into IP management is not without challenges. The need for comprehensive legal frameworks that use blockchain transactions, the establishment of interoperability among blockchain platforms, and the scalability required for widespread adoption are significant hurdles. A collaborative approach involving policymakers, technologists, IP owners, and users is essential to overcome these challenges.

The European Commission's support for blockchain applications in IP management, as demonstrated by initiatives like the European Blockchain Services Infrastructure (EBSI), signifies the EU's commitment to leveraging technology for enhancing IP rights enforcement and management. The successful integration of blockchain into the EU's IP framework will require not only technological innovation but also the adaptation of legal and regulatory environments to accommodate new models of IP creation, distribution, and monetisation.

Finally, while blockchain presents several opportunities for improving IP management, realising its full potential requires a balanced approach that addresses the technological, legal, and regulatory challenges. The collaborative efforts of all stakeholders will be essential in shaping an IP management landscape that is both innovative and protective of creators' rights in the digital age.

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