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# 

# Abstract

[not included in this draft]

# **1. Introduction**

Blockchain technology has been hailed as a revolutionary technology that will change the music industry, especially in regards to aiding musicians gain more autonomy and faster royalty payments.[[1]](#footnote-1) A plethora of projects are attempting to utilize blockchain to turn these perceived benefits into a reality.[[2]](#footnote-2) However, there are many challenges that must be overcome before the music industry will adopt blockchain technology.[[3]](#footnote-3)

In our first report, *A Preliminary Review of Blockchain in the Music Industry*, we reviewed why the first wave of disruption from file sharing in the music industry did not lead to musicians having greater autonomy, the major stakeholders and issues in the music industry, blockchain projects and pioneers in the music industry, blockchain use cases and challenges up ahead for blockchain projects and pioneers to overcome.[[4]](#footnote-4)

In this report, we attempted to tackle some of the issues we identified in our first report. Specifically, issues identified regarding artist attribution and autonomy, accuracy and speed of royalty payments, the complex web of the music industry, and the international legal frameworks governing copyright in musical works.[[5]](#footnote-5)

In tackling these issues, we determined that focusing on automating music licensing would be the best approach because if we can automate music licensing, we can also tackle all the issues discussed above.

Furthermore, if we could determine approaches to automating music licensing via new technologies such as blockchain and smart contracts, we could provide an incentive for stakeholders in the music industry to utilize blockchain because an automated music license would comport blockchain with existing copyright frameworks and industry standards.

Additionally, by focusing on automating music licensing, we believe that we can provide a literature review that synthesizes the academic and gray literature (which is heavily present in the blockchain literature) on blockchain and other emerging technologies interaction with existing legal frameworks and the structure of the music industry.

This report, for brevity’s sake, and for easing the stress on the authors, has been divided into two parts. Part one (this report) will provide a synthesis of academic and gray literature in this area, a discussion of the United States of America and European Union (EU) legal frameworks that are pertinent to music licensing, different types of copyright licensing schemes, issues with music licensing in the music industry, and a short description of the applicable technologies for automating music licensing or that we thought were important.

Part two will provide a discussion on the terms of service and copyright policies of certain decentralized, distributed, and stewardship streaming platforms, the methods and discussion of our Ricardian music license on the OpenLaw platform, a guide for practitioners, and a short conclusion.

# **2. Literature Review and Synthesis**

## 2.1. Background

We conducted a literature review to identify prior research covering multiple disciplines in the blockchain literature that were specific to legal frameworks and the music industry. The blockchain literature in this area is spread among multiple disciplines in the academic and gray[[6]](#footnote-6) literature, thus we felt it was imperative to synthesize the literature to provide clarity on the current state of automated music licensing approaches. Additionally, music licensing is a topic that requires extensive background knowledge in legal frameworks and the music industry, even before considering the technological approaches to automating music licensing, and this need for extensive background knowledge influenced our research methodology.

## 2.2. Research Questions

In researching this topic, our research was framed by the following questions:

1. What are the transactional costs of music licensing?
2. What are the perceived benefits of automating music licensing via smart contracts?
3. What are the legal and technical implications of automating music licensing?
4. How are current how are current streaming and multimedia content (Decentralized) handling licensing?
5. What are the current barriers to automating music licensing?
6. What are the gaps in knowledge or know-how for automating music licensing?
7. What web protocols exist, if any, for licensing intellectual property?
8. What are the licensing models available for musical works?
9. What are the legal boundaries affecting music licensing in an international context
10. Can we conceptualize an automated music licensing framework(s)?
11. What are the consideration in translating legal language into programming language
12. What is the state of literature in this area?
13. Should rights under copyright, if tokenized on a blockchain, be tokenized as fungible or non-fungible tokens?

## 2.3. Our Addition to the Field

Our contribution to the field is three-fold. First, we shall synthesize s literature from multiple disciplines covering existing legal frameworks and automation approaches applicable to music licensing, and the intersections thereto. Second, we shall discuss the licensing schemes available on decentralized, distributed and stewardship streaming and content platforms. Third, we shall aid industry members and professionals by developing a frame of reference for automated music licensing by developing a blockchain-interactive Ricardian music license on the OpenLaw platform.

## 2.4. Structure of our Report

We structured our report based on our needs but incorporated certain features of Horst Treiblmaier’s blockchain case study structure into our report.[[7]](#footnote-7) Specifically, the Introduction, Research Methodology, and Discussion sections were added to our report to better conform with established practice.[[8]](#footnote-8)

## 2.5. Research Methodology

We utilized qualitative research methods in our research because we needed to explore the academic and gray literature, and the growth of blockchain and other emerging technologies applicability to the music industry.[[9]](#footnote-9)

For our literature review, we conducted a scoping review to get a better understanding of the extant of academic and gray literature in this area, and to see where we should focus our research in automated music licensing.[[10]](#footnote-10)

**Search**

We conducted an exploratory search of academic and gray literature related to our research topic.

The primary keywords we used to search for literature are summarized below:

* blockchain
* music
* industry
* smart contract
* intellectual property
* multimedia
* copyright
* law
* prototype
* proof of concept
* streaming
* business
* automate
* data
* decentralized
* metadata
* contract
* dispute
* issue
* electronic
* signature
* transaction
* record
* licensing
* metadata
* music file
* music business

We selected the terms above to narrow our results to literature directly related to our research topic.

The research databases we utilized for conducting our search were:

* ResearchGate,
* Social Science Research Network (SSRN),
* Google Scholar,
* ProQuest, and
* Semantic Scholar.

**Screening**

We searched for papers relevant to our research topic and our research questions.

Our criteria for selecting literature based on 1) their relevance to specifically music licensing, and 2) whether the analysis covered a broad range of subtopics of a relevant topic. Considering the extent to which our selected literature expounded on subtopics, we have discussed the literature in greater length than generally seen in literature reviews.

We decided that to get a better overview of the research topic, we needed to utilize research from multiple disciplines such as law, music, and computer science.

Utilizing our keywords in our searches, we would scan the abstract and titles of papers to see if they initially fit our criteria. If the paper seemed to fit our criteria, we would read the papers to verify that they had met the criteria.

We did not include any papers that met our exclusion criteria:

* The full text was unavailable;
* The source became unavailable before we finished this draft;
* The paper did not discuss a perspective with enough depth or particularity; and
* There was an issue identifying the author of the article.

We categorized the papers we found into the following categories:

* Music Business Perspective
* Legal Perspective
* Automation Perspective
* Value Web Perspective

The categories are summarized in the table below and are used as subsection headings for this section.

|  |  |
| --- | --- |
| **Perspective** | **Subareas** |
| Legal Perspective | Contract Law |
| Intellectual Property Law |
| Electronic Signatures |
| Evidentiary Quality |
| Music Business Perspective | Supply Chain |
| Transformation Benefits and Drawbacks |
| Automation Perspective | Smart Contracts |
| Metadata |
| Semantic Web |
| Ricardian Contract |
| Value Web Perspective | Music Industry Value Web |

Other than the perspectives above, we also included a short subsection on relevant identifier standards used in the music industry to provide further background on the research topic.

**Review Results**

We gathered approximately 50 papers in total (as of September 26, 2019), and selected 40 papers.

We included most of the papers we gathered for two reasons. First, most of the papers we gathered fit our criteria, and we did not intend to exclude any paper based on their legal, economic, business, or technical perspective. Second, we wanted to show the broadness and diversity of literature in this area to better synthesize the academic and gray literature.

## 2.6. Music Business Perspective

### 2.6.1. Blockchain Impacts and Policy Concerns

Ignacio De Leon and Ravi Gupta in *The Impact of Digital Innovation and Blockchain on the Music Industry* analyzed the potential impacts and policy concerns of applying blockchain in the music industry.[[11]](#footnote-11) De Leon and Gupta identified eight (8) discrete impacts blockchain could have on the music industry, summarized in the list below:

1. “flexible pricing and revenue optimization;
2. speedier payments;
3. superior valuation;
4. transparency and negotiating power;
5. piracy;
6. sharing revenue;
7. news business models (fans, micropayments); and
8. reordering of the music industry.”[[12]](#footnote-12)

For our research purposes, we decided to focus on De Leon and Gupta’s discussion of impacts (1), (4), (6), and (8).[[13]](#footnote-13)

De Leon and Gupta’s analysis of impact (1) led to them concluding that blockchain can optimize revenue and enable flexible pricing by 1) having consumers pay for specific songs, rather than a Collective Management Organization’s (CMO) entire catalogue, and 2) dynamic pricing of musical works based on usage, popularity, and other real-time metrics (can embed in a smart contract).[[14]](#footnote-14)

De Leon and Gupta’s analysis of impact (4) led to them concluding that blockchain can lead to greater transparency for stakeholders but is unlikely to lead to musicians and consumers becoming better negotiators solely based on more transparency.[[15]](#footnote-15)

De Leon and Gupta’s analysis of impact (6) led to them concluding that musicians would not receive a substantially greater share of the music industry revenue because intermediaries provide vital services such as monitoring intellectual property infringement and developing and promoting sound recordings. [[16]](#footnote-16)

De Leon and Gupta’s analysis of impact (8) led them to conclude that new business models would develop that empower consumers to promote musicians in exchange for micropayments.[[17]](#footnote-17)

De Leon and Gupta discussed that blockchain could lead to new business models in the music industry that empower consumers to promote musicians in exchange for micropayments.[[18]](#footnote-18)

Despite these impacts, De Leon and Gupta do not expect blockchain to cause a decentralized transformation of the music industry because it makes more economic sense to rely on large consolidation to share risk among stakeholders, but they do believe that blockchain could reorder the industry supply chain like file sharing platforms did in the late 1990s and early 2000s.[[19]](#footnote-19)

De Leon and Gupta then transitioned to discuss policy issues that may arise from blockchain use cases in the music industry.

De Leon and Gupta identified four policy issues regarding smart contracts, intellectual property, incumbency and monopolies, and governance structures.[[20]](#footnote-20)

Since our research topic is on automated legal applications in music licensing, we decided to focus on De Leon and Gupta’s analysis of smart contracts, intellectual property, and incumbency and monopolies policy issues.[[21]](#footnote-21)

De Leon and Gupta’s analysis of the smart contract policy issue led them to conclude that there is a need for clarifying how smart contracts comport with traditional legal frameworks and principles before stakeholders utilize smart contracts in the music industry.[[22]](#footnote-22) Despite these concerns, De Leon and Gupta believe that smart contracts will eventually lead to greater compensation prospects for musicians.[[23]](#footnote-23)

De Leon and Gupta’s analysis of the copyright law policy issue regarding assignment and piracy led them to conclude that musicians could self-certify their ownership of musical works, but that this is not a cure-all because the self-certifying musicians may not actually own the copyright to the work.[[24]](#footnote-24) However, De Leon and Gupta do believe there are benefits for musicians unaware of copyright law, especially small time musicians, because generally registering the musical work on or with the blockchain is coupled with monetization of the musical work.[[25]](#footnote-25)

De Leon and Gupta’s analysis of the incumbency and monopolies policy issue led them to conclude that incumbents are unlikely to be replaced because they can acquire blockchain start ups to harness their innovations, and incumbents are likely to repurpose themselves through innovations.[[26]](#footnote-26)

De Leon and Gupta’s analysis of the governance structures policy issue led them to conclude that blockchain may lead to policy changes in the governance structure of the law and society overall.[[27]](#footnote-27) In the music industry, blockchain may help modernize PROs consent decrees with the Department of Justice (DOJ).[[28]](#footnote-28)

### 2.6.2. Blockchain Supply Chain

Camila Sitonio and Alberto Nucciarelli in *The Impact of Blockchain on the Music Industry*, continued De Leon and Gupta’s analysis of blockchain’s impact on the music industry by analyzing blockchain’s impact on the recorded music supply chain.[[29]](#footnote-29) In particular, Sitonio and Nucciarelli see blockchain having the potential to affect the recorded music supply chain by removing intermediaries, ending monopolization of distribution channels, inhibiting information asymmetry among stakeholders, and speeding up royalty payments.[[30]](#footnote-30)

Sitonio and Nucciarelli examined three recorded music supply chains: 1) recorded music supply chain before digital media (“traditional supply chain”), 2) recorded music supply chain after digital media (“digital supply chain”), and 3) recorded music supply chain with blockchain technology (“blockchain supply chain”).[[31]](#footnote-31)

Sitonio and Nucciarelli, in analyzing the recorded music supply chain before digital media, discussed how the supply chain was vertically integrated to eventually produce physical goods or promotional items for the end consumer.[[32]](#footnote-32)

Record labels were the primary intermediary and retained “approximately thirty-percent (30%) [of the value, larger than any other actor] in the recorded music supply chain before the era of digital media.”[[33]](#footnote-33) Record labels were responsible for financing and resourcing musicians needed to record their music, and collecting “royalty payments for artists, thus leading to information asymmetry among artists, distributors, and consumers.”[[34]](#footnote-34) This led to “extreme information asymmetry among artists, intermediates, and final consumers.”[[35]](#footnote-35)

However, the value retained by record labels dramatically fell in the recorded music supply chain after digital media.[[36]](#footnote-36) In the the recorded music supply chain after digital media, Sitonio and Nucciarelli discussed how record labels lost their substantial influence to a new actor, the Aggregator.[[37]](#footnote-37) Aggregators were a new actor in the supply chain that collected usage information about how and where people are streaming music, listening to digital radio, and downloading digital music files.[[38]](#footnote-38) With the introduction of digital media, musicians could distribute their music physically in the traditional supply chain, or digitally through the digital supply chain.[[39]](#footnote-39) Especially for smaller musicians, they could now record their music anywhere and digitally distribute their music online through Aggregators without first needing to sign with a record label.[[40]](#footnote-40)

Aggregators led to the Record Labels losing their losing their monopolistic control over the supply chain because transaction costs shifted music distribution to digital media rather than physical goods.[[41]](#footnote-41) However, the value captured by Aggregators and the Record Label’ monopolistic loss of control over distribution did not lead to greater value capture for Artists, and rather reinforced the “information asymmetry in the industry.”[[42]](#footnote-42) Stunningly, Record Labels still retain about fifty percent of the value in the digital supply chain.[[43]](#footnote-43)

Especially regarding the flow and totality of royalty payments, musicians are receiving fewer royalty payments from the Aggregators’ business models, and for smaller musicians, “royalties are commonly unpaid.”[[44]](#footnote-44)

Thus, some believe the blockchain supply chain will make up for the lack of value added for Artists by eliminating intermediaries inhibiting direct interactions between musicians and consumers.[[45]](#footnote-45) The blockchain supply chain is expected to allow musicians to directly publish their music on a blockchain, then have their music reached by consumers on blockchain-based platforms, “reducing transactional costs, allowing artists to access data generated by the transactions, and creating a more efficient system for royalty payments.”[[46]](#footnote-46)

However, Sitonio and Nucciarelli the rise of the blockchain supply chain to be inhibited because for major artists under contract with record labels, choosing to self-publish may raise contractual lability or cause them to violate their contractual relationship.[[47]](#footnote-47) Alternatively, intermediaries may not be completely eliminated from the supply chain, rather, the role of intermediaries such as record labels may change to usage information collectors and providers of technical, marketing and sales support for musicians, while the blockchain would handle royalty payments and information transparency.[[48]](#footnote-48)

Sitonio and Nucciarelli believe blockchain can solve two of the main issues they identified in the music industry: (1) “the lack of access to transactional information,” and (2) “the inefficiencies associated to royalty payments.”[[49]](#footnote-49) Sitonio and Nucciarelli identified four blockchain use cases in the music industry:

* record keeping;
* smart contracts;
* data analysis and business model innovation; and
* revenue management.[[50]](#footnote-50)

### 2.6.3. Challenges and Opportunities for Blockchain Platforms

Alexandra Cecilie Gjøl Torbensen and Raffaele Ciriello continued De Leon and Gupta[[51]](#footnote-51) and Sitonio and Nucciarelli’s[[52]](#footnote-52) analysis of blockchain’s impact on the music industry by investigating how the music industry can create value with blockchain technology in *Tuning into Blockchain: Challenges and Opportunities of Blockchain-based Music Platforms*.[[53]](#footnote-53)

For our research topic, we focused specifically on Torbensen and Ciriello’s analysis of challenges and opportunities of blockchain-based music platforms.[[54]](#footnote-54)

Torbensen and Ciriello identified two categories of blockchain use cases:

1. Musician-centered music supply chain; and
2. Process Optimization.[[55]](#footnote-55)

Torbensen and Ciriello identified four blockchain use cases that fall under the two above categories:

* “ticket sales,
* cryptocurrency enabled music platforms,
* blockchain powered streaming startups, and
* providing an infrastructure for decentralized music business.”[[56]](#footnote-56)

In Torbensen and Ciriello’s analysis, the first category of blockchain use cases is unlikely to take root because even though this is the most musician-friendly outcome, most musicians are not interested in deal “with the work that comes after the recording of the music.”[[57]](#footnote-57)

Torbensen and Ciriello then discussed three specific areas under process optimization where blockchain could aid the music industry.[[58]](#footnote-58) The first area Torbensen and Ciriello envision blockchain aiding the music industry is providing a common resource for metadata through smart contracts.[[59]](#footnote-59)

However, a major issue Torbensen and Ciriello believe may arise is obtaining metadata from “different organizations in different databases, [and] integrating all these datasets into one platform.”[[60]](#footnote-60) Such a strategy would be extremely costly for a blockchain-based music platform, and thus Torbensen and Ciriello mention that some blockchain-based music startup are instead aiming towards “creating interfaces to aggregate metadata and make the complex licensing structures more transparent via smart contracts.”[[61]](#footnote-61)

The second area Torbensen and Ciriello envision blockchain optimizing processes is automated royalty payments.[[62]](#footnote-62) Through smart contracts and relevant metadata, Torbensen and Ciriello believe “payout processes could simply be automated via smart contracts with transparent business logic.”[[63]](#footnote-63)

The third area Torbensen and Ciriello see ripe for process optimization by blockchain-based music startups is achieving in transparency in licensing structures.[[64]](#footnote-64) However, Torbensen and Ciriello, based on their interviews, found that there was an apprehensive mindset from industry members about transparency in licensing structures because they want their contractual agreements to remain confidential from competitors .[[65]](#footnote-65)

Additionally, we also focused on Torbensen and Ciriello’s discussion of matching the interests of stakeholders in the music industry and the need to align incentives embedded in the blockchain.[[66]](#footnote-66)

Torbensen and Ciriello’s analysis identified a major disconnect among music industry stakeholders because stakeholders all want “a better way to handle metadata and licenses,” but there is a mismatch of incentives for stakeholders.[[67]](#footnote-67) For example, Torbensen and Ciriello mention that labels and publishers have a disincentive to make their deals with musicians public, and thus, Torbensen and Ciriello suggest a private blockchain solution, but then will this private blockchain solution meet the goals of labels and publishers? For a blockchain-based music platform to succeed, Torbensen and Ciriello believe it will need to align incentives for all stakeholders that will lead to data sharing and effective governance.[[68]](#footnote-68) In conclusion, Torbensen and Ciriello do not believe that current blockchains “[have the] appropriate incentives at the music industry level.”[[69]](#footnote-69) To reach the appropriate level of incentives, Torbensen and Ciriello see a need to embed these incentives in blockchain because music industry stakeholders are worried about “mak[ing] the risky first step towards an integrated solution without knowing whether others will follow.”[[70]](#footnote-70) To get stakeholders to make the first step, the incentives for a blockchain-based music platform needs to be aligned towards an integrated solution for all stakeholders.[[71]](#footnote-71)

Juri Mattila continues in the same vein as the preceding authors in *The Blockchain Phenomenon – The Disruptive Potential of Distributed Consensus Architectures* by discussing one of the first blockchain-based music platforms, UJO Music.[[72]](#footnote-72) UJO Music was one of the first blockchain-based music platforms to issue royalty payments to musicians on the Ethereum blockchain to address the long-standing issue of artists collecting royalties not in a matter of days or months—but often years.[[73]](#footnote-73) Ian Dunham in *Music Information: The Need for a Central Music Licensing Database* emphasized that blockchain may provide the appropriate infrastructure to develop a centralized music licensing database, although “more work must go into parsing the details of its operation, including who would organize it, the exact details of protocol, and how all parties can cooperate in order to achieve a higher efficiency.”[[74]](#footnote-74) These problems are not overcome by international standards such as the International Standard Recording Code (ISRC) and the International Standard Musical Work Code (ISWC).[[75]](#footnote-75) These questions are particularly important now while the global music industry is noticeably turning to streaming services, with the existence of the abovementioned Aggregators in Sitonio and Nucciarelli’s work.[[76]](#footnote-76) An additional point of contention are intermediaries in royalty distribution such as CMOs, who usually charge a substantial fee for their distribution services.[[77]](#footnote-77)

## 2.7. Legal Perspective

### 2.7.1. Electronic Signatures and Evidence

Sadia Sharmin, in her thesis *Music Copyright Management on Blockchain: Is it legally viable?*, investigated whether blockchain can mitigate issues in the music industry, and the challenges of managing copyright on a blockchain.[[78]](#footnote-78) For our research topic and for the sake of brevity, we excluded Sharmin’s discussion of blockchain use cases for copyright management because Bodo et al. and Finck and Moscon discuss that perspective in greater detail.

Sharmin’s research questions for her thesis were :

1. “What is the legal frame work of music copyright and how blockchain technology is relevant to this field?
2. What are the problems of today’s copyright system in the music industry and can blockchain help to alleviate the problems?
3. How Could blockchain-based technologies be used in the music copyright management?
4. What legal aspects need to be considered?
5. What are the risks and challenges of using block[]chain technology based applications in the music copyright management?”[[79]](#footnote-79)

Sharmin’s motivation for her thesis was tackling the inefficiency in the music industry, the lack of transparency and remuneration for musicians in the supply chain, as exemplified in *Wixen Music Publishing, inc v Spotify USA inc*, and the possibility for blockchain to remedy these issues subject to new blockchain-specific legislation.[[80]](#footnote-80)

Sharmin chose a qualitative method for her thesis to provide clarity in this uncertain area and selected primary and secondary sources from a combination of national and international legislation, journal articles, reports, official websites of international and national organizations, statutes and case law.[[81]](#footnote-81)

Sharmin discussed recent government intellectual property agency efforts to understand how blockchain technology can comport existing copyright frameworks.[[82]](#footnote-82) For example, Sharmin noted that both the European Union Intellectual Property Office (EUIPO) and the United States Patent and Trademark Office (USPTO) have hosted events to elicit responses from individuals and organizations involved in blockchain and copyright management on the basics of blockchain and how it can comport with intellectual property law.[[83]](#footnote-83) Additionally, the U.S. Department of Commerce’s Internet Policy Task Force held a meeting to discuss the future of blockchain and copyright management with individuals and groups spanning multiple industries, including Ascribe and dotBlockchain (who were both invited).[[84]](#footnote-84)

Sharmin focused her analysis on how blockchain can conform with the following existing legal frameworks: 1) electronic signatures, 2) evidentiary admissibility, and 3) contract law.[[85]](#footnote-85) First, Sharmin questioned whether electronic signatures and timestamps recorded on the blockchain are valid signatures under existing European Union electronic signatures law.[[86]](#footnote-86) From Sharmin’s analysis of how blockchain data could be interpreted under the current EU legislation for electronic signatures regulatory framework (910/2014/EU), electronic signatures and time stamps on a blockchain may be valid, but may require an expert to qualify the electronic signatures and time stamps as evidence in a court of law.[[87]](#footnote-87)

Second, in Sharmin’s analysis of whether blockchain data would qualify as admissible evidence in a judicial proceeding, Sharmin ascertained that blockchain could qualify as admissible evidence in most jurisdictions as long as an expert can “explain[] the fundamentals of the technology and assert[] its trustworthiness.”[[88]](#footnote-88)

Lastly, Sharmin discussed general issues associated with smart contracts such as when a smart contract is considered a traditional legal contract and how do traditional contract principles apply to smart contracts .[[89]](#footnote-89)

### 2.7.2. Contract Law

Mark Giancaspro in *Is a ‘smart contract’ really a smart idea? Insights from a legal perspective* analyzed contractual issues and uncertainties that may arise with the advent of smart contracts under Australian, French, American and English law.[[90]](#footnote-90)

Giancaspro discussed the following contract law principles in his comparative analysis:

* “Capacity,
* Mistake,
* Formation (Offer and Acceptance),
* Legal intent in follow-on contracts,
* Certainty of Terms,
* ,
* Interpreting smart contract code; and
* Remedial issues”[[91]](#footnote-91)

Contractual capacity and mistake are contractual issues that concern the real-world identity of parties on a blockchain.[[92]](#footnote-92) On the blockchain, users are identified by a public address[[93]](#footnote-93), a long hexadecimal string of alphanumeric characters, that is disconnected from any real-world identifiers such as a name or physical address.[[94]](#footnote-94) For example, all public addresses on the Ethereum blockchain are identified by a forty-two (42) alphanumeric character combination that starts with “0x.”[[95]](#footnote-95)

“Contractual capacity refers to a party’s ability to enter into a contract.”[[96]](#footnote-96) Giancaspro analyzed contractual capacity in the context of minors entering into contracts.[[97]](#footnote-97) Under Australian, English, American and French law, a minor (a person under the age of majority) generally does not have contractual capacity to enter into a contract.[[98]](#footnote-98) Australian, English and American law provide for limited exceptions to the general rule (e.g., a contract for necessaries such as a car or furniture), and in those circumstances, the contract is voidable, i.e., the minor may elect to terminate the contract, at the minor’s discretion.[[99]](#footnote-99) Given that public addresses on a blockchain are not linked to real -world personal identifiers, a party may inadvertently enter into a contract with a minor via smart contract.[[100]](#footnote-100) Thus, a pre-screening procedure may be needed to deter minors from entering into contracts via smart contracts.[[101]](#footnote-101)

The application of Mistake to smart contracts faces the same issue as contractual capacity.[[102]](#footnote-102) Mistake is a legal defense to contract formation, wherein a party may void a contract because a party was mistaken about the identity of the counterparty or the terms of the contract.[[103]](#footnote-103)

In Giancaspro’s analysis, Mistake can easily occur with smart contracts because smart contracts are susceptible to identity theft.[[104]](#footnote-104) For example, in the case of identity theft, a hacker can steal another person’s private key[[105]](#footnote-105), thereby obtaining the person's public key, and then using the public key to facilitate fraudulent transactions as if it was the proper account holder.[[106]](#footnote-106) Under this scenario, the account holder may allege Mistake to void any contracts entered into with counterparties via smart contracts. Unfortunately, this scenario exemplifies the possible lack of trust and predictability counterparties may have assumed would be associated with smart contracts.

The major problem that arises from Mistake is the want of legal enforceability since mistake is a defense to contract formation.[[107]](#footnote-107)

Formation, Certainty of Terms, and Contractual Interpretation are issues that concern the smart contract source code.[[108]](#footnote-108)

Formation is the offer and acceptance elements that are required for the creation of a valid contract.[[109]](#footnote-109) “Under Australian and English law, an offer is characterised by a party’s indication of willingness to be bound by the terms of a promise he or she has made to another party, with the latter being provided with the opportunity to elect between acceptance and rejection of the proposal.”[[110]](#footnote-110) An offer via smart contract is relatively easy to discern when compared with traditional contracting because the smart contract source code is stored and accessible on the blockchain, and the terms of the smart contract bind the user deploying the smart contract.[[111]](#footnote-111)

In Giancaspro’s analysis, the major issue with Formation in a smart contract context is acceptance because of the instantaneous nature of blockchain technology.[[112]](#footnote-112)

In this area, the “postal acceptance rule”[[113]](#footnote-113) may decide when acceptance has occurred.[[114]](#footnote-114) The postal acceptance rule applies when there is an expected time lapse between the offer and acceptance, and that acceptance may occur when the acceptance is dispatched or upon receipt of acceptance.[[115]](#footnote-115) Concerning the postal acceptance rule and public-key infrastructure (PKI), Giancaspro proposed three ways acceptance could be effectuated in a purchase of goods situation:

1. ”once the party seeking to purchase the goods transmits their offer,
2. once it is received and authenticated through consensus of network users, or
3. once it is coded and added to the [b]lockchain.”[[116]](#footnote-116)

Follow-on intent is the issue that most impacts the intent of the counterparty. Giancaspro describe a follow-on as a scenario that occurs when parties “voluntarily enter[] into a smart contract (the primary contract) [, and] that contract can itself enter the parties into an additional contract (the secondary contract).”[[117]](#footnote-117) Giancaspro identified two issues with follow-on smart contracts: “(1) can an intention to create legal relations be established in this circumstance, and (2) can a smart contract or related electronic agents or ‘bots’ autonomously enter parties into legally enforceable follow-on contracts?”[[118]](#footnote-118)

For our purposes, we shall focus on the first issue.

For our research topic, we focused only on Giancaspro’s analysis of the first follow-on intent issue.

Intent is a major aspect of each jurisdiction’s contract law, with Australia, English and American law (common law nations)[[119]](#footnote-119) determining intent based on the objective circumstances of the parties, while French law tests intent based on the subjective circumstances[[120]](#footnote-120) of the parties.[[121]](#footnote-121)

Regardless of jurisdiction, Giancaspro concluded that follow-on intent is unlikely to be found under these circumstances because it is unlikely that the parties would have had a chance to consider the effects of additional smart contracts, or acquiesced to additional smart contracts.[[122]](#footnote-122)

Certainty of Terms and Contractual Interpretation are two concepts in contract law about how the terms of contract should be interpreted.

Certainty of Terms concerns whether the essential terms of the contract were particularly described in terms of “inherent clarity and completeness.”[[123]](#footnote-123) Contractual interpretation concerns giving meaning to the terms and purpose of the contract, and is generally a matter for the courts,.[[124]](#footnote-124)

In Giancaspro’s analysis, Certainty of Terms is an issue with smart contracts because of whether the smart contract source code provides reasonable certainty to the essential terms of the contract.[[125]](#footnote-125) As Giancaspro discusses, in the process of developing a smart contract, “terms drafted in natural language by the parties must then be coded into programming language in order to generate the actual smart contract comprising the agreement of the parties.”[[126]](#footnote-126)

Furthermore, the natural language drafts of the agreement may not be legally relevant in analyzing whether the smart contract itself is reasonably certain because of the parol evidence rule.[[127]](#footnote-127)

Giancaspro identified two additional issues that may arise with Certainty of Terms: 1) how would a smart contract interpret normative terms in a contract such as “reasonableness,” and 2) when interpretation is necessary such as a violation of the “duty of ‘good faith and fair dealing.’”[[128]](#footnote-128)

In Giancaspro’s analysis, Contractual Interpretation is an issue with smart contracts because smart contract source code is difficult for most programmers to understand, and more so for anyone is not trained as a programmer. [[129]](#footnote-129) Interpreting smart contract source code will likely require expert witnesses, and maybe even references to past natural language drafts, if not prohibited by the parol evidence rule.[[130]](#footnote-130) Additionally, there are certain terms that cannot easily be translated into smart contract source code, such as terms that are in subjective language. [[131]](#footnote-131)

Lastly, Giancaspro analyzed contractual interpretation of smart contracts dependent on data oracles, i.e., external data feeds. [[132]](#footnote-132) Giancaspro considered a hypothetical scenario where

an insurance smart contract oracle created to indemnify “created to indemnify a homeowner against inclement weather” that is dependent on data oracles for “information relating to rainfall, temperature or other factors from a meteorological agency’s website in order to determine if the policy is activated” may “commit errors or even fail altogether” if the data oracles “malfunction or become inactive.”[[133]](#footnote-133)

Giancaspro suggested a possible legal remedy for smart contracts connected to data oracles that malfunction is the doctrine of frustration.[[134]](#footnote-134)

Remedial Issues concern the technical mishaps that occur with smart contracts.[[135]](#footnote-135)

Remedial Issues concern the contractual remedies available to the parties if a dispute arises because of a technical malfunction of the smart contract.[[136]](#footnote-136)

When smart contracts are deployed to a blockchain, they are extremely difficult to update,[[137]](#footnote-137) and once a smart contract has executed, the effects are nearly irreversible.[[138]](#footnote-138)

There have been many cases of smart contracts malfunctioning on the Ethereum blockchain, either by coding errors (developer-side) or hacks, that have led to millions of dollars worth of ether (ETH) and tokens stuck in a smart contract or sent to the wrong public address.[[139]](#footnote-139)

This is a major reason why smart contracts are at a high risk for disputes concerning liability for technical errors.[[140]](#footnote-140) Giancaspro identified two remedial issues with smart contracts: 1) the reformation[[141]](#footnote-141) and, 2) injunctive relief[[142]](#footnote-142).[[143]](#footnote-143) Giancaspro determined that reformation is likely unavailable because once a smart contract is deployed on the blockchain, it is extremely difficult to update because of the blockchain’s inherent immutability.[[144]](#footnote-144) Giancaspro determined that injunctive relief is also likely to be unavailable because smart contracts are “autonomous and self-executing.”[[145]](#footnote-145) Once a smart contract is deployed on a blockchain, it cannot be stopped simply by sending cease and desist notifications, nor even when a party provides an injunctive relief order to the counterparty.[[146]](#footnote-146)

### 2.7.3. Copyright Law

#### 2.7.3.1. Licensing

Balazs Bodo, Daniel Gervais and Joao Pedro Quintais in *Blockchain and smart contracts: the missing link in copyright licensing?* investigated how a blockchain-based copyright licensing regime would comport with existing copyright frameworks.[[147]](#footnote-147) Bodo et al.’s initially focused on the inherent attributes of blockchain they believe would be compatible with copyright licensing:

-“distributed ledgers;

tokenization and digital scarcity;

smart contracts and decentralization.”[[148]](#footnote-148)

In Bodo et al.’s analysis of distributed ledgers, they concluded that because distributed ledgers is a general-purpose technology, it can correspond to the fundamentals of copyright law through many different implementations.[[149]](#footnote-149) In Bodo et al.’s analysis of tokenization and digital scarcity, Bodo et al. remarked about the interesting ability to turn any kind of information into a token, i.e., tokeniz[ed/ation], on a blockchain, with four applicable tokenizations in the copyright domain:

1) “a protected work,”

2) “a record of rights management information for protected content,”

3) “terms of use of protected content,” and

4) “remuneration of a work” (e.g., Musicoin).[[150]](#footnote-150)

Bodo et al. believe tokens and blockchain’s elimination of the double spending problem present a possible avenue for reintroducing scarcity into copyrighted works.[[151]](#footnote-151)

In Bodo et al.’s analysis of smart contracts, they concluded that smart contracts can automate transactions (transactions that can easily be described by if-then loops) such as revenue payments, lower transaction costs, and even standardize licensing terms across different uses and jurisdictions.[[152]](#footnote-152) However, Bodo et al. cautioned using smart contracts because of the uncertainty of how smart contracts conform with contract law.[[153]](#footnote-153)

Specifically, contract law issues regarding: 1) identification of the parties; 2) remedies for breach of contract; 3) jurisdictional conflicts; and 4) how does dispute resolution work.[[154]](#footnote-154)

Bodo et al. then examined one of the most profound powers of the blockchain, its ability to disintermediate and decentralize industries through trustless transactions.[[155]](#footnote-155)

Bodo et al. see blockchain’s ability to disintermediate possibly upsetting intermediaries at every level: “(i) publishers and music labels, (ii) CMOs, and (iii) online platforms, including those that host user-uploaded content.”[[156]](#footnote-156) However, Bodo et al. do not envision blockchain completely decentralizing (removal of all intermediaries) the music industry, rather, they see a trend towards decentralizing by upsetting the power of incumbents through new stakeholders .[[157]](#footnote-157) Furthermore, Bodo et al. do not imagine complete disintermediation because “current intermediaries control critical assets for disintermediation, such as the type of comprehensive RMI datasets for musical works and sound recordings held by CMOs."[[158]](#footnote-158) Moreover, Bodo et al. even see the possibility of CMOs utilizing blockchain themselves to further entrench their status in the value chain through a private blockchain (read-only).[[159]](#footnote-159)

Bodo et al. identified four copyright domains where blockchain implementations are promising and challenging:

1. Private ordering,
2. Copyright registries,
3. Right Management Information, and
4. Fair remuneration.[[160]](#footnote-160)

First, in Bodo et al.’s analysis of private ordering, their major concerns were fragmentation and licensing coordination.[[161]](#footnote-161)

Fragmentation refers to the ability for an author to separately, and divisibly, transfer or license any rights granted under copyright law to a third party.[[162]](#footnote-162) Fragmentation issues would impact blockchain’s applicability as a licensing tool for an international copyright regime because “there is no such thing as international copyright right[s].”[[163]](#footnote-163) Rather, a blockchain-based licensing framework would have to be based on international treaties, such as the Berne Convention and World Intellectual Property Organization (WIPO) treaties.[[164]](#footnote-164) However, Bodo et al. determined that this would also lead to fragmentation issues.[[165]](#footnote-165)

For example, the Berne Convention would provide copyright protection for a work made in a member nation in all other 175 member nations (total 176 nations), but only under each member nation’s domestic copyright laws.[[166]](#footnote-166) This could lead to fragmentation issues because it is possible for an author to obtain 176 different rights under copyright, of which each right under copyright may be separately, and divisibly, transferred or licensed to a third party (i.e., fragmentation).[[167]](#footnote-167)

The issue of fragmentation also extends to copyright exhaustion because copyright exhaustion is based on each nation’s domestic copyright laws.[[168]](#footnote-168) Copyright exhaustion can be categorized into three different schemes:

1. National;
2. Regional; or
3. International.[[169]](#footnote-169)

In a national exhaustion scheme, the authorized sale of a work within a nation exhausts the rights holders' right to control further disposition of the work within that nation.[[170]](#footnote-170) In a regional exhaustion scheme, the authorized sale of a work within a region exhausts the rights holder's right to control further disposition of the work within that region, as is the case in the EU.[[171]](#footnote-171) In an international exhaustion scheme, the rights holder's right to control further disposition of the work is exhausted when an authorized sale of the work occurs in any market in the world, as is the case in the USA.[[172]](#footnote-172)

Bodo et. al. analogized rights fragmentation to the common law concept of title, i.e., “the legal link between a person who owns property and the property itself,” as a possible means of understanding how each right fragment may be exploited and possibly licensed to third parties.[[173]](#footnote-173)

In understanding rights fragmentation and transferring rights through smart contracts, Bodo et al.’s major concern was the issue of smart contract conformance under existing law, especially regarding the need for a “written instrument” to effectuate transfer of copyright under certain nation’s domestic copyright law.[[174]](#footnote-174)

Licensing coordination refers to the complexity of coordinating between on- and off-chain transactions for copyright licensing.[[175]](#footnote-175) Licensing coordination leads to three major issues: 1) off-chain transactions; 2) inconsistent domestic laws; 3) desynchronization.

First, off-chain transactions may lead to certain issues arising, such as conflict resolution and information asymmetry between the blockchain and traditional institutions.[[176]](#footnote-176) Bodo et al. suggested that a possible solution to the off-chain coordination issues would be to have the “author retain all of their copyright rights,” with non-exclusive licenses preferred for mass uses while exclusive licenses are used sparingly or when best appropriate through the blockchain (“author ownership solution”).[[177]](#footnote-177) However, this solution does not avoid all potential conflicts, such as a conflict between a non-exclusive licensee and an exclusive licensee in a given territory.[[178]](#footnote-178) An alternative solution Bodo et al. suggested is for authors to transfer some of their rights to a third party, such as a CMO, but conflicts may still arise “within a given territory … or among territories... Thus, the need for some form of coordination emerges” (“CMO transfer solution”).[[179]](#footnote-179)

Importantly, Bodo et al. noted an unaddressed issue, whether an author who owns all the titles in their work may be able to internationally exploit markets and formats.[[180]](#footnote-180) In the CMO transfer solution, global coordination would still be an issue internationally.[[181]](#footnote-181) Furthermore, antitrust and other unfair competition law concerns may arise.[[182]](#footnote-182)

Second, inconsistent domestic laws raise concerns when a smart contract contains restrictions that conflict with the domestic law of a user’s territory, which may see a court “impose an appropriate remedy, such as allowing circumvention of DRM or the reduction of any payment due.”[[183]](#footnote-183)

Third, desynchronization issues may arise between on-chain smart contracts and off-chain traditional contracts.[[184]](#footnote-184) Desynchronization occurs when off-chain transactions are not recorded on-chain.[[185]](#footnote-185) This is unfortunately an issue that cannot be resolved through blockchain alone, and thus will need heightened off-chain coordination.[[186]](#footnote-186)

Second, in Bodo et al.’s analysis of copyright registries, their major concerns were the types of distributed ledgers registries and conformance with international copyright registration frameworks.[[187]](#footnote-187) Bodo et al. define copyright registries as “the range of DLT applications that create a registration of information regarding works,” which may be voluntary or mandatory.[[188]](#footnote-188)

Bodo et al. describe two types of copyright registries (hereafter “DLT based registries”): 1) passive and 2) active.[[189]](#footnote-189) Passive DLT based registries are “used to record RMI information as a time-stamped entry into a public ledger that anyone can consult. Given that such information is only useful if it is authoritative, RMI is most likely to be maintained by trusted intermediaries (such as CMOs).”[[190]](#footnote-190) In active DLT based registries, “rights are tokenized, rights holders are account holders, so DLTs not just record, but facilitate the transactions of rights.”[[191]](#footnote-191)

In determining conformance with international copyright registration frameworks, Bodo et al. further analyzed active DLT based registries conformance with the Berne Convention.[[192]](#footnote-192)

Bodo et al. assumed that if active DLT based registries are scalable and reach critical mass, eventually “exploitation of works (at least of a certain type, such as sound recordings) in the digital realm [would be] dependent on registration in a digital ledger.[[193]](#footnote-193) In this system, works can be easily licensed, uses and remuneration tracked, and enforced by an accompanying smart contract(s).[[194]](#footnote-194) This ledger would eventually become the de facto means for exploiting a work, raising legal concerns about “whether such a registry would constitute a prohibited formality under international law.”[[195]](#footnote-195)

“Article 5(2) of the Berne Convention prohibits formalities that affect the ‘enjoyment’ or ‘exercise’ of protected rights in relation to non-domestic works.”[[196]](#footnote-196) Formalities include “registration, recordal of transfers of ownership, notice requirements, and deposit.”[[197]](#footnote-197) Enjoyment of rights “relates to author’s rights coming into existence and being recognized absent any formality. In essence, the prohibition rules out constitutive and maintenance formalities in respect of works of non-domestic origin, as well as those that function as ‘conditions to sue for infringement’. Conversely, certain declaratory formalities are allowed.”[[198]](#footnote-198) In Bodo et al.’s opinion, voluntary registration of works on DLT based registries should not violate the Berne Convention because “[o]nly copyright-specific, government imposed formalities are prohibited.”[[199]](#footnote-199)

Third, in Bodo et al.’s analysis, blockchain can provide benefits for rights management information through cooperation, but the issue of unverified data needs to be addressed.[[200]](#footnote-200) Bodo et al. believe blockchain’s main benefit for rights management information is blockchain’s ability to encourage cooperation among multiple stakeholders, such as “songwriters, performers, publishers and record companies,” who may own certain rights to a musical work.[[201]](#footnote-201) However, one major issue Bodo et al. noted is the blockchain’s inherent inability (based on current technology) for pre-filtering works before adding such works to the blockchain.[[202]](#footnote-202) Even though blockchain may safeguard against data tampering, it cannot guard against inaccurate or unverified data.[[203]](#footnote-203) This issue raises the need for a dispute resolution measure[[204]](#footnote-204) to handle conflicting claims to a musical work.[[205]](#footnote-205)

Fourth, in Bodo et al.’s analysis, they see blockchain serving three types of roles for fair remuneration: 1) enabling payments, 2) opening up “statutory or compulsory licenses and collective rights management schemes to smart contract licensing,” and 3) providing greater transparency for authors and performers.[[206]](#footnote-206)

Bodo et al. see blockchain’s role in enabling payments to have a de minimis effect on the “status quo in copyright law” because it merely adds a new method payment.[[207]](#footnote-207)

Bodo et al. see blockchain’s role in opening up compulsory licensing as the most relevant.[[208]](#footnote-208) Such an application may help reduce or eliminate the traditional reasons that led to the creation of the compulsory licensing scheme. [[209]](#footnote-209) In particular, the transaction costs associated with licensing copyrighted works.[[210]](#footnote-210) Transaction costs become prohibitively high when a work has “a relatively small value, but ha[s] a relatively large number of users and right holders.”[[211]](#footnote-211) Transaction costs include:

* “identifying and matching rights holders and users,
* the high costs of monitoring use,
* the costs of enforcement, and
* the complexities of setting the price and negotiating the terms of use.”[[212]](#footnote-212)

“Collective management has been successful because it offers substantial economies of scale, making collectively managed licenses preferable to individual licensing.”[[213]](#footnote-213)

Bodo et al. propose that blockchain may lower individual licensing transactions costs to nearly the same as collective licensing by: 1) reducing the transaction costs associated with finding a rights holder through a publicly available, blockchain-based RMI registry (which make up the bulk of transaction costs), and 2) automating individual licensing through smart contracts based on publicly available usage information (through digital content intermediaries and digital fingerprinting technologies).[[214]](#footnote-214) Additionally, Bodo et al. also considered the potential for automated licensing via smart contracts to create new global licensing standards, based on the early success of Creative Commons licenses.[[215]](#footnote-215) If possible, it may cause an economic shift in the industry, “making collective rights management and compulsory licensing comparatively costlier.”[[216]](#footnote-216)

Bodo et al. see blockchain’s role in providing transparency to help minimize information asymmetry between creators and other stakeholders.[[217]](#footnote-217) Bodo et al. discussed that the ties between the music industry oligarchy (three major record labels) and online streaming platforms (e.g., Spotify), is causing creators to feel that they have no platform to discuss their issues nor the chance to share in the spoils of their success.[[218]](#footnote-218) Ultimately, Bodo et al. determined that blockchain’s role here will be to shed light on the industry and “on a situation that many see as both unfair and unsustainable.”[[219]](#footnote-219)

#### 2.7.3.2. Rights Management

Finck & Moscon further elaborated on Bodo et al.’s analysis of blockchain and copyright licensing in *Copyright Law on Blockchains: Between New Forms of Rights Administration and Digital Rights Management 2.0* by investigating possible blockchain applications in copyright law for digital rights administration and management (DRM).[[220]](#footnote-220)

Finck and Moscon first provide some background on how technology is shaping protection and circumvention measures around copyright law before analyzing blockchain-based DRM applications.[[221]](#footnote-221)

Finck and Moscon’s research motivation was to investigate possible blockchain-based DRM applications for enforcing copyright law in a more efficient and balanced manner than current DRM systems.[[222]](#footnote-222)

Finck and Moscon frame their investigation of DRM’s impact through the lens of international copyright treaties.[[223]](#footnote-223)

Finck and Moscon begin their analysis of DRM systems by providing 1) a short summary of DRM systems, 2) how DRM systems have impacted public and private ordering, and 3) how international copyright treaties have impacted DRM systems.[[224]](#footnote-224)

First, in general, a DRM system is a code-based enforcement mechanism of the rights of a copyright holder in a copyrighted work.[[225]](#footnote-225) DRM systems started to gain prominence in response to the increased digitization of copyrighted materials and the advent of computers.[[226]](#footnote-226) DRM is generally comprised of technological protection measures (TPM) and rights management information (RMI).[[227]](#footnote-227) “TPMs include hardware and software to protect the rules and identify the content, the user’s IT system and the user him/herself.”[[228]](#footnote-228) “RMI is information that identifies content protected by copyright or neighboring rights, the rights owners in such content and the terms and conditions of use associated with it.”[[229]](#footnote-229) DRMs may also include rights expression languages[[230]](#footnote-230) (REL).[[231]](#footnote-231)

DRM systems are generally incompatible with other DRM systems.[[232]](#footnote-232) The lack of interoperability among DRM systems has likely arisen from a lack of standardization for DRM architecture and the unwillingness of companies to license their technology.[[233]](#footnote-233)

Furthermore, interoperability is unlikely to arise because it is more advantageous for proprietary DRM systems to be incompatible for two reasons: 1) developing a monopoly or niche in the market surrounding the DRM; and 2) the diversity of digital content needing to be protected, in conjunction with different levels of protection needed for each type of content.[[234]](#footnote-234) However, Finck and Moscon discussed that a possible benefit from the lack of interoperability is to restrict copyright owners’ control over their content regarding legitimate access and uses by users.[[235]](#footnote-235)

Second, DRM plays a role in public ordering[[236]](#footnote-236) by enforcing existing copyright frameworks, and a role in private ordering[[237]](#footnote-237) by protecting the rights of private sector entities and individuals.[[238]](#footnote-238) Though, DRM’s use in private ordering sometimes contravenes existing copyright frameworks by going beyond the protections guaranteed therein, and even protecting works ineligible for copyright protection.[[239]](#footnote-239) DRM’s misuse is in private ordering is very prevalent in *mass-contract* situations, where the terms offered by the licensor to the licensee are often drafted in favor of the licensor while overly restrictive to the licensee because the parties cannot directly negotiate with each other.[[240]](#footnote-240)

An example Finck and Moscon mention is the usage of DRM for private ordering in the academic publishing sector has ran afoul of the intentions of copyright law by restricting access (restricting the number of copies or prints) and use (copying file).

Finck and Moscon provide an example of this situation in the academic publishing sector, where DRM has led to restricted access (restricting the number of copies or prints) and use (copying the research paper) of research papers by users.[[241]](#footnote-241) This type of activity, as poignantly mentioned by Finck and Moscon, tests the strength of the first sale doctrine[[242]](#footnote-242) in copyright law, and highlights the need for copyright law to catch up with digitization.[[243]](#footnote-243)

Third, Finck and Moscon discussed how international copyright treaties have led to a rise in private ordering.[[244]](#footnote-244) In formally adopting the World Intellectual Property Organization (WIPO) Copyright Treaty (WCT) at the national level, The United States of America (USA) passed the Digital Millennium Copyright Act (DMCA), and the European Union (EU) passed the InfoSoc Directive.[[245]](#footnote-245) The WCT imposed obligations for adequate legal protections and remedies against circumvention of TPMs and removal or alteration of RMI.[[246]](#footnote-246) Both the USA and EU legislation exceeded the WCT’s requirements and effectively extended the “protection of technical measures even beyond the boundaries of exclusive rights.”[[247]](#footnote-247) Thus, both legislations allowed private ordering-based contracts and technical measures to exceed the bounds of copyright law by restricting copyright-permitted uses such as fair use through TPMs.[[248]](#footnote-248) These acts have essentially shifted “copyright from public to private ordering enabled by both contracts and technological measures.”[[249]](#footnote-249)

Additionally, this raises the possibility of rightsholders using DRM to influence the market (i.e., a use beyond protecting the rights of the copyright holder) via a “strategic barrier to entry in

addition to a contract and the rules protecting the technology that facilitate its use, to

erect strategic barriers even in secondary markets.”[[250]](#footnote-250)

After introducing background information on DRM, Finck and Moscon transitioned to discuss blockchain and smart contract use cases in the copyright domain, and if they can provide an alternative to the current DRM systems.[[251]](#footnote-251)

Finck and Moscon identified three main drivers for blockchain use cases in the copyright domain:

1. blockchain’s potential capacity to precisely identify a digital asset,
2. blockchain’s potential to “foster transparent and disintermediated transactions,” and
3. blockchain’s potential to be developed as a DRM system.[[252]](#footnote-252)

Since Bodo et al. discussed the first two drivers in greater detail in their paper, for our purposes, we shall only discuss Finck and Moscon’s analysis of the second and third main driver.

In Finck and Moscon’s analysis, the second driver can provide much needed transparency and cost savings by automating transactions via smart contracts.[[253]](#footnote-253) With the advent of smart contracts, Finck and Moscon see micropayments becoming economically viable because smart contracts can execute payments for smaller fees than previous payment methods while automatically splitting payments among multiple parties.[[254]](#footnote-254) Thus, this model lets musicians engage in direct peer-to-peer (p2p) transactions with consumers, and control the pricing and licensing terms of their works.[[255]](#footnote-255) However, these blockchain-based models are unlikely to lead to a truly decentralized music industry, rather, these blockchain-based models and associated stakeholders will replace current industry incumbents, and take their place as new intermediaries.[[256]](#footnote-256)

This outcome is more likely when taking into account that it would be impractical to expect most musicians to learn the legal, marketing, and coding tools to make effective smart contracts.[[257]](#footnote-257) Finck and Moscon suggest that for the “direct-to-fan” model to flourish, there is a need for “user-friendly form[s] of smart contract management, which do[] not require the user to personally code the smart contract.”[[258]](#footnote-258)

Relevant to our research topic, Finck and Moscon discuss how smart contracts may lead to standardization of licensing terms and conditions for multi-jurisdictional uses of copyrighted works.[[259]](#footnote-259) Standardized smart contract will provide “transparency and reduce barriers to using contracts for transactions,” and even customizable licenses.[[260]](#footnote-260)

In Finck and Moscon’s analysis of the third main driver, blockchain has the potential to disrupt DRM systems.[[261]](#footnote-261) In this use case, smart contracts (with embedded contractual elements) would automate and standardize transactions “in relation to blockchain-based tokenized elements.”[[262]](#footnote-262) The smart contract would “self-enforce copyright agreements such as licenses, and provide information about rights in copyrighted materials.”[[263]](#footnote-263) Additionally, the smart contracts could be used to automate access to digital assets.[[264]](#footnote-264)

Additionally, blockchain’s characteristics of immutability and replication make it appealing as a cyber security measure in comparison with traditional DRM systems which “rely on single points of failure, are expensive, can be overcome by a single hacker and interfere negatively with

consumer expectations.”[[265]](#footnote-265) Finck and Moscon also highlight that automated licensing via smart contracts can offer rightsholders “greater security and stronger protections against possible attackers including copyright infringers that seek to access the digital asset.”[[266]](#footnote-266)

An interesting note mentioned by Finck and Moscon is the difference between automated licensing and traditional DRM systems regarding DRM systems specific focus on “control of access and use of digital subject matter.”[[267]](#footnote-267) In automated licensing via smart contracts, user rights can be encoded in access-control smart contracts, thereby giving users more rights than in traditional DRM systems.[[268]](#footnote-268) Finck and Moscon expect the DRM system to coordinate with a trusted timeserver (alternatively, a separate chain or distributed storage could be used) and “compare the time with the contract terms coded on the blockchain and take away access once the user’s license has expired.”[[269]](#footnote-269)

However, even though smart contracts can provide more user-friendly benefits, “smart contracts do not necessarily encode legally permitted copyright uses.”[[270]](#footnote-270)

An additional use case Finck and Moscon considered was blockchain as a public copyright registry.[[271]](#footnote-271) Finck and Moscon believe that blockchain could help reconcile issues regarding trust with RMI databases. RMI databases are plagued by faulty or non-existent data and lack of sharing relevant data, and lack of interoperability.[[272]](#footnote-272) Furthermore, for the parties that rely on RMI such as CMOs, it is very tough getting clean data and reconciling data sources.[[273]](#footnote-273) As Finck and Moscon mentioned earlier, this may also come from groups with an interest in a natural monopoly on data.[[274]](#footnote-274)

Additionally, and very important note regarding storing files on the blockchain, Finck and Moscon mention that the blockchain would only be sued for automating transactions (rights and permissions) via smart contracts, rather than storing the digital asset itself.[[275]](#footnote-275)

Finck and Moscon identified five structural challenges of blockchain systems.[[276]](#footnote-276) The first structural challenge that needs to be addressed is that the volatility of cryptocurrencies make them unappealing as a method for royalty payments.[[277]](#footnote-277) The second structural challenge that needs to be addressed is whether a blockchain-based copyright management system can generate enough network effects, i.e., it needs to be used by many copyright owners and copyrighted works to be successful.[[278]](#footnote-278) The third structural issue is on-chain and off-chain coordination of copyrighted works (“off-chain double spending problem”).[[279]](#footnote-279) This off-chain double spending problem can arise because since blockchain cannot control off-chain actions, a person could *double spend* their copyright by transferring their rights on-chain, and then again transferring their rights off-chain.[[280]](#footnote-280) The fourth structural issue is the use of blockchain for copyright infringement.[[281]](#footnote-281) It is possible for copyright infringers to submit infringing content to a blockchain at the base layer[[282]](#footnote-282), and then have the infringing content replicated among peers on the blockchain network.[[283]](#footnote-283) The fifth structural issue is inaccurate data being stored on the blockchain, i.e., the *garbage-in garbage-out* problem.[[284]](#footnote-284) The *garbage-in garbage-out* problem is an issue for copyrighted information because there is nearly no way of authenticating that such information is accurate when it is registered on the blockchain.[[285]](#footnote-285)

Finck and Moscon assessed from their investigation that blockchain in the copyright domain raises concerns about private ordering and code-is-law paradigm, but can enable innovation in the industry for a fairer copyright regime.[[286]](#footnote-286)

Blockchain could be used as a “means of private ordering to the detriment of legally-protected public policy goals such as access to knowledge.”[[287]](#footnote-287) Thus, and as fervently acknowledged by Finck and Moscon, that we should be on the look out for how blockchain is being utilized.[[288]](#footnote-288)

Finck and Moscon discussed how blockchain enforces the “code-is-law” paradigm in two ways.[[289]](#footnote-289) “First, the protocols of distributed ledgers enforce their creators’ normative choices,” and second, smart contracts self-enforce and execute compliance with “ a pre-determined rule-set.”[[290]](#footnote-290) From there, Finck and Moscon discussed that at the end of the day, technological infrastructure is driven by private interests and without appropriate legislation, will “disregard users’ interests.”[[291]](#footnote-291)

Thus, this has led to suggestions outlined by Finck and Moscon to pass new legislation that by default, make certain uses mandatory and irrevocable by contract and technology, or even making new technology with “fair use by design.”[[292]](#footnote-292) This is very much needed because a major differences between code and law is the *ex ante* fashion of code, such that “save for the technologically skilled, those exposed to it have no option other than compliance.”[[293]](#footnote-293)

Lastly, Finck and Moscon espouse that blockchain may “enable a more disintermediated and fair era of copyright management.”[[294]](#footnote-294) The innovative ecosystem of pioneers in this intersection are trying to develop tools to push decentralization into the copyright domain that empowers musicians.[[295]](#footnote-295) Though, user-friendly tools still need to be made, there is progress being made to make it easier for musicians to code smart contracts that comply with applicable law.

#### 2.7.3.3. General

Birgit Clark and R. Burstall in *Crypto-Pie in the Sky? How Blockchain Technology is Impacting Intellectual Property Law* described a typology of blockchain applications in the intellectual property (IP) sector (copyright, trademarks, patents, and trade secrets.[[296]](#footnote-296)

For our research topic, we shall discuss Clark and Burstall’s typology of blockchain applications in copyright, namely, smart IP rights and registries, evidence of creatorship, and smart contracts and IP.[[297]](#footnote-297)

In Clark and Burstall’s discussion of smart IP rights and registries, they see such registries recording the whole lifecycle of IP rights, thereby making IP transactions and audits seamless.[[298]](#footnote-298)

In Clark and Burstall’s discussion of evidence of creatorship, Clark and Burstall contemplate digital certificates implemented in conjunction with blockchain to record creatorship in an unregistered creative work, and how this may be used as “evidence of their conception, use, qualification requirements and whether the right is still in the period of protection.”[[299]](#footnote-299) In particular, this can provide a major benefit for music licensing because creators can exhibit both their statement of creatorship and engage in individual licensing.[[300]](#footnote-300)

In Clark and Burstall’s discussion smart contracts and IP, Clark and Burstall consider the two divergent views on smart contracts, and how smart contracts can impact IP licensing agreements.[[301]](#footnote-301) Clark and Burstall first begin their discussion on smart contracts by on the two divergent views of smart contracts:

1. Replacement of legal agreements and practitioners with self-enforcing code; and
2. Supplement to legal agreements and practitioners with self-enforcing code.[[302]](#footnote-302)

Clark and Burstall believe the first view is overly simplistic because it “does not reflect real-life human and business interaction, where contractual disputes often cent[er] on the quality of contractual performance.”[[303]](#footnote-303) Furthermore, and discussed in more detail by Giancaspro[[304]](#footnote-304), smart contracts work well for easily computable and objective terms (such as a small dispute or micropayments), but should not be solely relied upon in situations “where there is [a] need for a subjective judgment and evidence of facts.”[[305]](#footnote-305) Rather, Clark and Burstall believe the second view is more appropriate because it conceptualizes “smart contracts as computerised transaction protocols that execute contract terms … without human involvement once the underlying binding contract has been coded.”[[306]](#footnote-306)

Clark and Burstall then discuss how smart contracts can impact IP licensing.[[307]](#footnote-307) Clark and Burstall contemplate that smart contracts “could be used to establish and enforce IP agreements, such as licences, and allow the transmission of payments in real time to IP owners,” with such smart contracts including “rights management information, such as ownership, use permissions and payment terms.”[[308]](#footnote-308) Though, Clark and Burstall think it is too early “to determine whether smart contracts are the future of digital rights management,” they do envision smart contracts “redefin[ing] how creators are remunerated—often instantly via micropayments—by acting as a platform for creators and distributors of IP.”[[309]](#footnote-309) Clark and Burstall then transitioned to discuss global standards and concerns surrounding smart contracts.[[310]](#footnote-310) Clark and Burstall noted that there are global standards being developed for self-executing contracts, and hope these standards can lead to a “more reliable definition of [smart contracts].”[[311]](#footnote-311) Lastly, Clark and Burstall discussed concerns that may arise with the increased usage of smart contracts, such as:

* whether smart contracts can “accurately execute more complex contractual terms or legal concepts, such as public domain and multi-territorial licensing information”;
* how “consumer protection laws and public interest considerations” will shape the “concept of smart contracts”; and
* the availability of reliable and safe data oracles.[[312]](#footnote-312)

## 2.8. Automation Perspective

### 2.8.1. Smart Contract Automation Approach

#### 2.8.1.1. Smart Contract Technical Issues

Alharby Maher and Aad van Moorsel in *Blockchain Based Smart Contracts: A Systematic Mapping Study* conducteda systematic mapping study of twenty-four (24) studies related to smart contracts in multiple domains to “identify current research topics and open challenges for future studies in smart contract research.”[[313]](#footnote-313) Maher and van Moorsel study focused on three research questions:

1. “What are the current research topics on smart contracts?”;
2. “What are the current smart contract applications?”; and
3. “What are the research gaps that need to be addressed in future studies?”[[314]](#footnote-314)

Maher and van Moorsel categorized the issues into four categories:

1. codifying issues,
2. security issues,
3. privacy issues, and
4. performance issues.[[315]](#footnote-315)

For our research question, we discussed all four categories because these issues can affect any automated licensing approach that utilizes smart contracts.[[316]](#footnote-316)

Maher and Van Moorsel identified the following as codifying issues:

* *Difficulty of writing smart contracts,*
* *Inability to modify or terminate smart contracts,*
* *Lack of support to identify under-optimized smart contracts, and*
* *Complexity of programming languages*.[[317]](#footnote-317)

The first issue, *difficulty of writing smart contracts*, primarily affects whether developers can develop a smart contract that executes as intended.[[318]](#footnote-318) If a smart contract is difficult to write, even for those well-versed in smart contract development, the likelihood of errors and mishaps is high.

Maher and Van Moorsel identified three potential solutions to this issue:

* Semi-automate the creation of smart contracts by “translat[ing] [] human-readable contract representations to smart contract rules”
* creating smart contract guidelines for developers; and
* “formal verification techniques to detect unintended behaviours of smart contracts.”[[319]](#footnote-319)

The second issue*, inability to modify or terminate smart contracts*, concerns the immutability of data stored on a blockchain.[[320]](#footnote-320) Once a smart contract is deployed on the blockchain, its terms, i.e., the source code, cannot be modified or terminated without a massive undertaking such as a hard fork.[[321]](#footnote-321)

Maher and Van Moorsel identified the creation of standards for modifying or terminating smart contracts taken from traditional contract law as a potential solution to this issue.[[322]](#footnote-322)

The third issue, *lack of support to identify under-optimized smart contracts,* concerns under-optimized smart contracts, which are smart contracts “that contains unnecessary or expensive operations,” (e.g., paying more in Gas fees on the Ethereum blockchain/ in the Ethereum Virtual Machine than necessary ).[[323]](#footnote-323)

Maher and Van Moorsel identified that programming optimization patterns and tools thereto could be a potential solution to this issue.[[324]](#footnote-324)

The fourth issue, *complexity of programming languages*, concerns the type of programming language utilized for writing smart contracts.[[325]](#footnote-325) Maher and van Moorsel discussed the difference between procedural- and logic-based programming languages.[[326]](#footnote-326) In procedural-based programming languages such as Solidity (smart contract language for Ethereum Virtual Machine), programmers must specify *what* and *how* things should be done because code is executed in steps.[[327]](#footnote-327) “This makes the task of writing smart contracts in those languages cumbersome and error prone.”[[328]](#footnote-328) Contrastingly, in logic-based programming languages, programmers need not specify the sequence of steps in the code.[[329]](#footnote-329) “However, algorithms for logic-based languages are expensive and inefficient.”[[330]](#footnote-330)

Maher and van Moorsel identified the following as privacy issues:

* *Lack of transactional privacy*
* *Lack of data feeds privacy*.[[331]](#footnote-331)

*Lack of transactional privacy* is an issue for smart contracts because all data is publicly accessible on a blockchain. This may deter the adoption of smart contracts in financial transactions and transactions involving confidential or private information.

Lack of data feeds privacy is an issue because smart contracts that rely on external data need to “send[] a request to the party that provides those feeds.” Because data stored on blockchains are publicly accessible, “th[ese] request[s] [are] exposed to the public …”[[332]](#footnote-332)

Maher and van Moorsel identified lack of trustworthy data oracles as a security issue.[[333]](#footnote-333) Lack of trustworthy data oracles is an issue for smart contracts that rely on external data because “there is no guarantee that the information provided by an external source is trustworthy.”[[334]](#footnote-334)

Maher and van Moorsel identified sequential execution of smart contracts as a performance issue.[[335]](#footnote-335) Sequential execution is a performance issue because most blockchains do not have the scalability capacity (i.e., low transactions-per-speed TPS) to process a high volume of transactions executed via smart contracts.[[336]](#footnote-336) Thus, the more smart contracts that are executed, the slower it will take for the transactions executed via smart contract to be processed and added to the blockchain.[[337]](#footnote-337) Additionally, a high volume of transactions will lead to network fees (i.e., miner’s fees) rising, thereby making each transaction more costly.[[338]](#footnote-338)

#### 2.8.1.2. Smart Contract Proof of Concept

The first smart contract automation approach was Ujo Music, in partnership with Imogen Heap, releasing Imogen Heap’s *Tiny Human*, the first digital music file that worked in conjunction with a smart contract on the Ethereum blockchain.[[339]](#footnote-339) This release showed the promise of blockchain for automating music licensing because you could interact with the music file through a smart contract, and the web application showed transparency because it displayed the following information to prospective purchasers:

* credits (the team behind the song),
* stems (individual segments of the song) can be individually purchased,
* lyrics were provided with the song, the
* inspiration for the song was provided, and
* licensing information (policies, distributions, and transactions) was provided.[[340]](#footnote-340)

This first example has led to the rise of more and more approaches to automating music licensing via smart contracts and provided an example for the proof of concept discussed in the next research paper.

Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen in their thesis, *The Music Industry on Blockchain Technology*, developed a proof of concept (PoC) demonstrating “music copyright registration and licensing through smart contracts on the Ethereum blockchain” as a potential solution for the lack of transparency and excessive middlemen.[[341]](#footnote-341)

Engebretsen and Haugen were motivated to produce their PoC because they wanted to show that blockchain has real-world applications, and could resolve issues musicians face “regarding transparency, efficiency and fairness.”[[342]](#footnote-342) Engebretsen and Haugen’s two goals for the PoC were:

1. “[i]dentify the core problems in the music industry and understand how blockchain technology can be utilized to resolve the issues”; and
2. “[d]emonstrate that musicians and other industry players can benefit from transparent blockchain based decentralized applications.”[[343]](#footnote-343)

Engebretsen and Haugen’s research question for their thesis was “[h]ow can blockchain technology be utilized in order to solve problems related to transparency, efficiency, and fairness along the music industry value chain?”[[344]](#footnote-344) Engebretsen and Haugen’s research methods for the thesis were to analyze the relationships between stakeholders in the music industry to determine core problems, and then applying their PoC to remedy these core problems.[[345]](#footnote-345)

For our research topic, we only discussed Chapters 3 – 7 of Engebretsen and Haugen’s thesis because the background information contained in Chapter 2 is discussed in another section.[[346]](#footnote-346)

Concerning relevant properties of distributed and decentralized networks, Engebretsen and Haugen discuss the three axes of centralization: 1) architectural, 2) political; and 3) logical, and highlighted three advantages of these networks: 1) security; 2) immutability; and 3) transparency.[[347]](#footnote-347)

In Chapter 3, Engebretsen and Haugen discuss the design of their PoC, and why they chose the Ethereum blockchain as the underlying infrastructure for their PoC.[[348]](#footnote-348) Engebretsen and Haugen’s goal for the PoC was to implement a “copyright database and music licensing dApp” that appealed to both copyright holders and licensees.[[349]](#footnote-349)

Engebretsen and Haugen chose the Ethereum blockchain for their DApp because the Ethereum blockchain has built-in security measures that mitigate against distributed denial of service (DDoS) attacks, the Ethereum blockchain’s transparency characteristic makes it a viable option for a global rights database, the use of ERC-721 tokens, i.e., Non-Fungible Tokens (NFTs), to represent copyright on the blockchain, and blockchain’s immutability ensures that any data collected through the DApp will not be altered in the future.[[350]](#footnote-350)

Additionally, Engebretsen and Haugen chose the Ethereum blockchain because Ethereum has a strong community and strong leadership supporting the development of the blockchain.[[351]](#footnote-351)

Engebretsen and Haugen’s DApp focused on three essential use cases:

1. “Registering a musical work;
2. Creating license contracts; and
3. Searching for musical works and purchase licenses from a database.”[[352]](#footnote-352)

Engebretsen and Haugen defined a musical work as an object with the following attributes:

* “title”,
* “type of work (song, recording, composition, lyrics, etc.)”,
* “description”,
* “time of registration”,
* “list of all [contributors] and their respective share of ownersh[i]p”, and
* “a file embodying the work itself.”[[353]](#footnote-353)

Engebretsen and Haugen determined that the only two attributes that need to be stored on the Ethereum blockchain were the file (specifically the hash of the musical work file) and the list of contributors because the file identifies the musical work, and the list of contributors identifies the royalty splits.[[354]](#footnote-354) By storing only these two attributes, , Engebretsen and Haugen determined that this would help reduce Gas fees[[355]](#footnote-355) , since storing data on the Ethereum blockchain is expensive .[[356]](#footnote-356)

In Engebretsen and Haugen’s technical implementation of their DApp, they discuss the technical design choices and some critical code structures.[[357]](#footnote-357)

Engebretsen and Haugen describe their technical implementation of their DApp, which includes the back-end logic written in a collection of smart contracts, and the front-end user interface written in Angular.[[358]](#footnote-358)

Engebretsen and Haugen organized their back-end logic into the following smart contracts:

* “contract WorkBase”,
* “contract ERC721”,
* “contract TokenOwnership is WorkBase, ERC721”,
* “contract LicenseBase is TokenOwnership”, and
* “contract LicensePurchase is LicenseBase.”[[359]](#footnote-359)

Engebretsen and Haugen described the core contracts of their DApp: 1) WorkBase, 2) TokenOwnership, 3) LicenseBase, and 4) LicensePurchase while leaving the other contracts to be understood based on in-line comments in the contracts.[[360]](#footnote-360)

For our research topic, we focused on the back-end of the DApp rather than the front-end because the back-end describes how music licenses can be converted into a smart contract.[[361]](#footnote-361)

The WorkBase contract defines the core data of the DApp:

* the musical work as a struct data type,
* an array to act as a master database for the musical works,
* a function to register a work and determine the contributors and their payment splits,
* certain mappings, including a mapping “of whether a work has been approved or not,”[[362]](#footnote-362) and
* a function issuing copyright tokens to contributors as proof of registration.[[363]](#footnote-363)

Engebretsen and Haugen defined the copyright tokens to be distributed based on the splits determined by the contributors with one token representing ten percent (10%) ownership of a work’s overall copyright, thus only ten tokens are issued.[[364]](#footnote-364) Engebretsen and Haugen chose to only issue ten (10) tokens to optimize the smart contract because Gas fees have a linear positive relationship with the number of tokens issued.[[365]](#footnote-365)

The TokenOwnership contract defines:

* an array where all tokens are stored,
* a mapping to keep track of which tokens are owned by which addresses,
* a function to transfer tokens from one address to another, i.e., to assign copyrights from a holder to another person,
* token standard by inheriting the ERC-721 standard.[[366]](#footnote-366)

The LicenseBase smart contract provides the code for creating and storing license profiles that can be “purchased through [the] web application.”[[367]](#footnote-367) Specifically, the LicenseBase smart contract defines the:

* a struct of license profiles,
* a mapping of license profiles to addresses,
* an array to act as a master database for the license profiles, and
* a function to register a license and add it to the array.[[368]](#footnote-368)

The LicensePurchase smart contract provides “defines the function used when buying a specific license for a work” and a function used when contributors want to withdraw their entitled royalties.[[369]](#footnote-369)

Additionally, Engebretsen and Haugen discussed that the LicensePurchase smart contract can hold ETH as part of transactions, and that a mapping is included so that the ETH stored in the smart contract, i.e., paid royalties, will be mapped onto the token ID, i.e., the contributors addresses.[[370]](#footnote-370) This mapping scheme was chosen to save on gas costs and to optimize the smart contracts.[[371]](#footnote-371)

The withdrawFromWorkId() function determines which tokens, i.e., copyrights to a work, the sender owns (through msg.sender), “calculates the aggregated token balance sum, [and sends the sum] from the smart contract account to the account of msg.sender.”[[372]](#footnote-372)

In the web application, Engebretsen and Haugen specifically mention the blockchain services needed to connect the web application to the smart contracts.[[373]](#footnote-373)

Engebretsen and Haugen included two blockchain services in their Angular application to handle blockchain-related services: 1) “web3.service.ts,” and 2) “ethereum.service.ts.”[[374]](#footnote-374)

The web3.service.ts service is “mainly for establishing a Web3.js provider [to] connect [the] Angular application to the running blockchain. That is the service where MetaMask is set as the current Web3 provider.”[[375]](#footnote-375) “The ethereum.service.ts service provides the components with access to the functionality of the deployed smart contract.”[[376]](#footnote-376)

Engebretsen and Haugen then summarized the results of their PoC.[[377]](#footnote-377) Engebretsen and Haugen determined that in applying blockchain to the music industry, blockchain could provide more transparency within the ecosystem and optimize the industry's currently inefficient money flow.[[378]](#footnote-378) Engebretsen and Haugen’s PoC successfully implemented these four components:

* “an open [and] transparent” registered works and licenses database,
* representing copyright as erc721 tokens,
* “[u]sers can create and purchase licenses for single musical works
* “[m]usicians get real-time information about generated license royalties.”[[379]](#footnote-379)

Two unresolved problems Engebretsen and Haugen’s PoC could not address were: 1) an international standard for regulating licensing, and 2) “[s]ingle license contracts that involve several musical works.”[[380]](#footnote-380)

A major accomplishment we ascertained from Engebretsen and Haugen’s PoC (which they also acknowledged) was creating a Graphical User Interface (GUI) that made it less apparent to the user that they were interacting with smart contracts and the technicalities of a blockchain.[[381]](#footnote-381)

A specific feature of Engebretsen and Haugen’s web application that we thought was very supportive of automated licensing was providing contributors the option to offer synchronization and public performance licenses by default, and the option for contributors create their own license as a license profile.[[382]](#footnote-382)

In creating our Ricardian Tokenized Music License on the OpenLaw platform, we believe our license could be used in conjunction with Engebretsen and Haugen’s Rights Done Right DApp and web application in the *create work* section by including our license as a license profile or adding it directly as a smart contract in the DApp back-end.[[383]](#footnote-383)

After developing their PoC, Engebretsen and Haugen considered the challenges of blockchain, whether the music industry is ready for blockchain, blockchain as an economic transaction system, blockchain’s immutability characteristic, centralized v. distributed storage, and web applications.[[384]](#footnote-384)

Because the challenges associated with smart contracts was mentioned earlier by Maher and van Moorsel[[385]](#footnote-385), we only discussed challenges Maher and van Moorsel did not address in their paper.[[386]](#footnote-386)

A major challenge for Engebretsen and Haugen’s PoC were the Gas fees associated with registering a musical work on their DApp.[[387]](#footnote-387) Engebretsen and Haugen estimated that the cost of registering a work to the DApp was approximately $0.10 - $0.60, an amount that may be trivial to an independent musician, but is a significant amount to a major publisher because of the large number of works that they need to register.[[388]](#footnote-388)

Engebretsen and Haugen discussed that the most popular Ethereum programming language, Solidity, has major limitations because of its relative immaturity compared to other mature languages such as Java or .NET, and certain technical limitations that Engebretsen and Haugen had to make up for on the front-end.[[389]](#footnote-389)

Engebretsen and Haugen do not believe the music industry is ready to transition to trustless DApps because the major intermediaries, CMOs and record labels, do not have the incentive to radically change their business models, especially to a new platform that they do not control.[[390]](#footnote-390) Engebretsen and Hauge expect a slow transition from legacy systems to blockchain-backed systems in the music industry.[[391]](#footnote-391)

Then regarding the necessity of blockchain to solve issues in the music industry, Engebretsen and Haugen believe blockchain can disrupt the oligarchy in control of the music industry, but is not necessary for solving the lack of information and standards in the music industry because a centralized solution can be developed to address this issue.[[392]](#footnote-392)

Engebretsen and Haugen discussed that they believe cryptocurrencies currently are not a “sound basis for financial transaction” system because of their extreme volatility relative to fiat currencies, and that the current financial system revolves around government-issued fiat currencies.[[393]](#footnote-393)

In their DApp, Engebretsen and Haugen priced the licenses in ETH because ETH is a static value, but because ETH is volatile with the fiat currencies, the price of a license will constantly fluctuate.[[394]](#footnote-394) A possible workaround suggested by Engebretsen and Haugen is to price the licenses in USD instead through the aid of a data oracle, albeit with further research needed on whether “oracles weaken[] blockchain’s core decentralization objectives.”[[395]](#footnote-395)

Engebretsen and Haugen discussed the advantages and disadvantages of blockchain’s immutability.[[396]](#footnote-396) Immutability “provides data integrity as no stored records on the blockchain can be altered,” but this also provides disadvantages if musicians want to make changes to the registered work, or the inability to patch a smart contract if a vulnerability is found.[[397]](#footnote-397)

Engebretsen and Haugen discussed the advantages and disadvantages of centralized versus distributed storage.[[398]](#footnote-398) Engebretsen and Haugen discussed that centralized storage’s major advantage is its “easy configurability and integration with any application.”[[399]](#footnote-399) However, a disadvantage of centralized storage is that such data centers are a single point of failure, and users have to trust a third party to keep their data safe and not share their data with third parties.[[400]](#footnote-400) In a distributed peer-to-peer storage, data is stored “across a network [of] nodes, making them more secure, possibly faster, cheaper and censorship resistant. Distributed storage systems leverage the enormous amounts of unused storage space located on the user's hard drive[s] around the world.”[[401]](#footnote-401) Many of the distributed storage solutions are in development so Engebretsen and Haugen instead chose to use Google’s Firebase, which does lead to more centralization than wanted, but they still believe their DApp is decentralized enough.[[402]](#footnote-402)

In answering their research question, Engebretsen and Haugen concluded that blockchain could apply to solve problems in the music industry related to “transparency, efficiency, standards, and inaccessible copyright information.”[[403]](#footnote-403) However, Engebretsen and Haugen’s research also revealed limitations of blockchain such as scalability and processing time, and the lack of maturity in tools and community which hinder DApp development.[[404]](#footnote-404)

Two areas for further research Engebretsen and Haugen mentioned were investigating the legal and governance issues involved with creating a music licensing DApp.[[405]](#footnote-405)

### 2.8.2. Metadata Automation Approach

Bill Rosenblatt, in collaboration with Digimarc Corporation (Digimarc), proposed the use of audio watermarks in conjunction with blockchain technology to track musical works in *Watermarking Technology and Blockchains in the Music Industry*.[[406]](#footnote-406)

Rosenblatt and Digimarc identified the common issue with music licensing, notably that there are two copyrights, one in the musical composition and another in the sound recording, and the difficulty of tying sound recordings to specific musical compositions. [page 8].

In proposing this solution, Rosenblatt and Digimarc identified the following issues in the music industry that have led to the need for tracking musical works:

* there are two separate copyrights in the musical composition and the sound recording and the difficulty of tying sound recordings to specific musical compositions,
* the lack of a uniform “source for mapping recordings to their underlying compositions”, and
* standard identifiers[[407]](#footnote-407) in the music industry are “neither ubiquitous nor comprehensive enough to enable automated identification of music without errors, gaps, or ambiguities.”[[408]](#footnote-408)

These issues led Rosenblatt and Digimarc to consider the need for unique identifiers for tracking musical compositions and sound recordings.[[409]](#footnote-409)

In creating unique identifiers, Rosenblatt and Digimarc analyzed four methods to bind identifiers to digital audio files that could curb the above issues: 1) header metadata; 2) hashes; 3) acoustic fingerprints; and 4) digital watermarks.[[410]](#footnote-410) In analyzing the four methods, Rosenblatt and Digimarc concluded that the digital watermark the best method for binding identifiers (can also talk about the other identifiers).[[411]](#footnote-411) Rosenblatt and Digimarc examined the binding identifiers based on the following criteria:

* “*Robustness*: the identifier remains associated with the file even after the file has been transformed in various ways, such as transcoding, downsampling, excerpting, pitch-shifting, re-equalizing, and digital-analog-digital conversion”;
* “*Data Flexibility*: the same audio data can exist in multiple files with different identifiers”;
* “*Identifier Reliability*: the identifier can reliably identify the recording in the file for rights and royalty management purposes”; and
* “*Security*: the identifier is difficult to remove or change without altering or marring the content.”[[412]](#footnote-412)

Rosenblatt and Digimarc determined that header metadata provided data flexibility and identifier reliability because they are easy to insert into a file, even multiple headers, and can contain multiple types of values, but lacked in robustness and security because it is “trivially easy to change or remove header metadata without affecting the content,” and may not survive when the file is transformed.[[413]](#footnote-413)

Rosenblatt and Digimarc determined that hashes provided identifier reliability since hashes are generally unique for an individual file, but lacked in robustness, security, and data flexibility because “they do not give the copyright owner or distributor any flexibility or control over identifiers,” and the hash can easily change if just a single bit of audio data is modified, such as by changing the file format.[[414]](#footnote-414)

Rosenblatt and Digimarc determined that acoustic fingerprints[[415]](#footnote-415) provided robustness and security because like “standard hashes, fingerprints are inherent in the data, so they can’t be removed or separated from it. But unlike standard hashes, it’s difficult (if not impossible) to alter a file’s fingerprint without perceptibly marring its sound to a listener.”[[416]](#footnote-416) However, acoustic fingerprints lacked in data flexibility and identifier reliability because “fingerprinting is not very good at differentiating between certain versions of a given music track that might need to be distinguished for rights and royalty management purposes,” and “it is impossible to assign different identifiers to different files containing the same recording.”[[417]](#footnote-417)

Rosenblatt and Digimarc determined that digital watermarks[[418]](#footnote-418) exceled in each category because “[a] well-designed watermarking scheme is robust to transformations …, can be used to associate any data desired …, can allow a level of certainty comparable to header metadata, ” and “can’t be altered without seriously disrupting the audio itself.”[[419]](#footnote-419) The one disadvantage of watermarks is that they need to be inserted into legacy audio content.

Rosenblatt and Digimarc also considered the application of blockchain technology with digital watermarks.[[420]](#footnote-420)

Concerning storing digital music files on a blockchain, Rosenblatt and Digimarc concluded that digital music files should not be stored on a blockchain because blockchains currently are not efficient enough to store files and transaction information.[[421]](#footnote-421) Rather, the more appropriate use would be to store transaction information associated with digital music files on the blockchain, though with a loss of security.[[422]](#footnote-422) To remedy the loss of security, Rosenblatt and Digimarc recommended creating links between transactions and digital music files, whereby a unique identifier stored in the transaction references or matches an identifier in a digital music file.[[423]](#footnote-423) Rosenblatt and Digimarc identified two secure methods for linkage: 1) encryption and 2) digital watermarks.[[424]](#footnote-424) Rosenblatt and Digimarc assessed that encryption was a suitable method, but would be too complex and cumbersome for the user or service provider because the whole file (digital music and metadata) must be encrypted together, and if the user or service provider wants to process or convert the file’s format, they will “have to use a special application that will decrypt the file, do the conversion, and preserve the integrity of the metadata.”[[425]](#footnote-425) In comparison with digital watermarks, Rosenblatt and Digimarc assessed that digital watermarks are easier to deal with for users or service providers because they can process or convert the file’s format without any intermediary step nor without damaging the watermark’s integrity.[[426]](#footnote-426)

Rosenblatt and Digimarc then discussed possible embedded identifier and blockchain examples in the music industry for licensing, found music[[427]](#footnote-427) and royalty payments.[[428]](#footnote-428)

Rosenblatt and Digimarc provided an example of how Core Rights could use digital watermarking and blockchain for their venue licensing marketplace.[[429]](#footnote-429) Core Rights could embed digital watermarks in its digital music files to identify them as Core Rights files for its venue licensing marketplace, and store transactions on the blockchain that include information about the licensee, ISRC, and underlying composition and/or sound recording.[[430]](#footnote-430) Alternatively, this information can be stored in the digital watermark.[[431]](#footnote-431) A player application can then be used to read the digital watermark and record acceptance of the license on Core Rights blockchain, or alternatively, the digital watermark can be used for auditing purposes by tracing the digital watermark to transactions on the blockchain.[[432]](#footnote-432)

Rosenblatt and Digimarc provided an example of how producers could use embedded identifiers and blockchain for found music.[[433]](#footnote-433) For found music in remixes, “producer[s] could use an app that reads the watermark in a [digital] music file, deposits a licensing transaction on a blockchain, and then [the blockchain or the smart-contract will or the transaction will] provide[-s] stems (individual tracks) to the producer for remixing.”[[434]](#footnote-434) Once the producer has created remixes based on the individual stems, the producer will “submit the remix through the app to the service provider,” which will give the remix its own unique digital watermark and associating the remix’s digital watermark with the digital watermarks associated with the stems.[[435]](#footnote-435) This will allow the service provider to easily process rights and royalty management for anyone who wants to use the remix, as well as the owner(s) of the stems.[[436]](#footnote-436)

Rosenblatt and Digimarc provided an example of how embedded identifiers and blockchain could be used for royalty payments.[[437]](#footnote-437) For royalty payments, digital watermarks could be used for interactive streaming services because each time a music file is played, a transaction can be recorded on the blockchain with the applicable royalties due to rights holders.[[438]](#footnote-438) These transactions can be traced to the digital watermark in the digital music file because the identifiers used would be the same, thereby allowing rights holders to access transaction information from extracting identifiers “without any need to contact the [digital music service providers (DSPs)] directly.”[[439]](#footnote-439) Lastly, Rosenblatt and Digimarc found this royalty scheme applicable with dotBlockchain Media’s (dotBlockchain)[[440]](#footnote-440) architecture and Open Music Initiative’s vision.[[441]](#footnote-441)

Benji Rogers approach for dotBlockchain is to create an open-source technology for a file format (ending in “.bc”) which will contain metadata referencing blockchain transactions, ownership information, and licensing information in addition to the digital music file.[[442]](#footnote-442) dotBlockchain is being developed to be interoperable with any blockchain (i.e., blockchain agnostic) and existing music rights databases.[[443]](#footnote-443) dotBlockchain’s founders believe the file format’s interoperability will depend on a Minimum Viable Data (MVD) standard.[[444]](#footnote-444) The MVD standard’s approach is to require the least amount of essential information needed to discern a musical recording and associated rights holders from another musical recording.[[445]](#footnote-445) With this model, musicians can easily upload their musical works and associated information, with changes tracked by a blockchain.[[446]](#footnote-446) Additional information can also be provided for commercial uses and then tailored to external databases.[[447]](#footnote-447)

Another initiative worth mentioning is the Open Music Initiative, described as “a non-profit initiative … creating an open-source protocol for the uniform identification of music rights holders and creators.”[[448]](#footnote-448) The aim of the initiative is to facilitate platform interoperability. Presence of patrons such as Berklee and MIT Connection Science gives hope that the approach taken may produce noticeable results, amid the myriad of solutions present in the digital music industry.[[449]](#footnote-449)

### 2.8.3. Semantic Web Automation Approach

Primavera De Filippi, Greg McMullen, Trent McConaghy, Constance Choi, Simon de la Rouvière, Juan Benet, and Diana J. Stern, in *How Blockchains Can Support, Complement, or Supplement Intellectual Property*, discussed the benefits of blockchain for intellectual property (patents, trademarks, copyright, trade secrets), with a particular discussion of copyright.[[450]](#footnote-450)

For our research topic, we focused on Filippi et al.’s discussion of how automated licensing can remove the complexity associated with finding the licensing terms of a copyrighted work.[[451]](#footnote-451) Automated licensing, with the aid of a public registry for works, can help potential licensees, find an appropriate license and the acceptable methods of payment.[[452]](#footnote-452) By making it easier for potential licensees to find appropriate licenses, more people should be encouraged to follow the legal routes for using a copyrighted work.[[453]](#footnote-453)

In addition, we shall also discuss COALA-IP’s development of an intellectual property licensing protocol that combines the semantic web with blockchain.[[454]](#footnote-454)

The two major goals of the licensing protocol are to develop a minimum viable data set for IP licensing (JSON-LD, RDF schemas) and a free and open messaging protocol for licensing transactions (ILP, IDPL, LCC).[[455]](#footnote-455)

COALA-IP’s licensing protocol is built on four building blocks:

* Linked Content Coalition (LCC) framework,
* Linked Data (LD),
* InterPlanetary Linked Data (IPLD), and
* InterLedger Protocol (ILP).[[456]](#footnote-456)

The LCC framework is meant to unify data standards for IP works through a Rights Reference Model (RRM) and Entity Model (EM).[[457]](#footnote-457) LCC RRM is meant to provide a “formal framework of representing intellectual property rights,” and is built on top of LCC EM.[[458]](#footnote-458) LCC EM is a meta-model for identifying entities who are IP rightsholders, and is the base model for LCC RRM.[[459]](#footnote-459)

Linked Data is a design approach to connect machine-readable, interlinked resources across the semantic web, i.e., the web of data, through the use of Semantic Web technologies such as Uniform Resource Identifiers (URIs) and Resource Description Framework (RDF).[[460]](#footnote-460)

“RDF's core data structure is a graph-based model that uses sets of triplets [(subject, predicate, and object)] to construct graph subsets.”[[461]](#footnote-461) COALA-IP employs JSON-LD to link JSON object’s “properties to a corresponding RDF schema through the concept of a context.”[[462]](#footnote-462) COALA-IP uses JSON-LD in conjunction with schemas from Schema.org, “a collaborative initiative with the mission to create, maintain and promote schemata for structured data on the internet.”[[463]](#footnote-463)

IPLD is “an attempt to put Linked Data on distributed ledgers by using hashes as content-addressed links, a technique referred to as "Merkle Links."[[464]](#footnote-464) Merkle Links provide “the ability to cryptographically check the data referred to by a link.”[[465]](#footnote-465) Through IPLD, IP data stored on different blockchains can reference the existence of related IP data on other blockchains.[[466]](#footnote-466)

ILP is an open source protocol being developed in a W3C Community Group “for sending payments across different ledgers” over the web.[[467]](#footnote-467) COALA-IP may use ILP to conduct IP licensing transactions on multiple blockchains.[[468]](#footnote-468)

### 2.8.4. Ricardian Contract Automation Approach

Usman W. Chohan in *What Is a Ricardian Contract?*, discussed how recent technological innovations have made Ricardian Contracts viable and considered their wider implementations and uses given their benefits.[[469]](#footnote-469) Chohan defines a Ricardian contract as a “method of expressing, encoding, and executing a contractual document through software, which means that it represents the recording of documents as contractually lawful, and then securely linking them to other ambits/systems, such as of accounting, for the contract to serve as an issuance of value.”[[470]](#footnote-470) Ricardian contracts have three primary advantages: “[1] robust, [2] transparent, and [3] efficient.”[[471]](#footnote-471) Ricardian contracts are robust because they utilize cryptographic hashes.[[472]](#footnote-472) Ricardian contracts are transparent because the legal prose is human-readable.[[473]](#footnote-473) Ricardian contracts are efficient because the markup language extracts essential information as machine-readable tags.[[474]](#footnote-474) Chohan describes the advantages of Ricardian contracts from a legal perspective and a computing perspective.[[475]](#footnote-475)

From a legal perspective, the markup language “leads to reduced transaction costs, faster dispute resolution, better contract enforcement and enhanced transparency.”[[476]](#footnote-476) From a computing perspective, “the software design pattern [] digitizes documents … without losing any of the richness of the contracting tradition.”[[477]](#footnote-477)

An additional benefit for both perspectives is that cryptographic hash functions mitigate against fraud because there is a cryptographic hash function that refers to the agreement, and the parties both sign the agreement with a cryptographic signature (similar to signing a transaction with a private key in a cryptocurrency transaction).[[478]](#footnote-478)

Chohan describes the four components of a Ricardian contract as follows:

* “a contract is offered by an issuer to contract holders”;
* “[i]t is held for a valuable right by holders and managed by the issuer”;
* “[i]t is easily readable on paper and by programs”; and
* “[i]t is digitally signed, carrying the keys and server information, and is allied with a unique, secure identifier.”[[479]](#footnote-479)

Chohan describes the characteristics of a Ricardian contract as follows:

* “dislocalization of parties across time and domain,”;
* cryptographic hashes to bind the parties for “legal and accounting aspects”;
* each subsequent transaction references the hash of the Ricardian contract;
* “operations of [] transactions and the issuance of the contract are cleanly separated”; and
* agreements may be done in counterparts and/or in smaller sub-agreements that are combined to form one single agreement.[[480]](#footnote-480)

Chohan reflects that the concept of Ricardian contracts is similar to the concept of smart contracts.[[481]](#footnote-481) However, Chohan discusses that the difference between Ricardian contracts and smart contracts is that “smart contracts [relate] to the automated execution of already agreed contracts, while Ricardian contracts represent a design pattern that captures the intent of agreeing parties.”[[482]](#footnote-482) Thus, this difference leads to the realization that “Ricardian contracts are a vehicle for [implementing] smart contracts.”[[483]](#footnote-483)

## 2.9. Value Web Perspective

### 2.9.1. Music Industry Value Web

Derek Sellin and Timo Seppälä in *Digital Music Industry – Background Synthesis* synthesized the current state of the music industry with the factors that have led to a lack of transparency and complexity in the industry.[[484]](#footnote-484)

Sellin and Seppälä frame their synthesis from the viewpoint of musicians, a central stakeholder that is concerned with inadequate royalty rates and a lack of transparency from streaming services as streaming services have finally raised revenue for the digital music industry for the first time since the 1990s.[[485]](#footnote-485) The ire over royalties is very apparent for musicians, especially for composers because musicians do not receive royalties until the end of the following year, or even later.[[486]](#footnote-486)

Other than delayed payment, there is also the issue of *black box royalties*, royalties held by entities on behalf of an unidentified rightsholder, that are “distributed arbitrarily, according to the market share of known rights holders.”[[487]](#footnote-487)

Sellin and Seppälä articulated a non-exhaustive list of reasons why black boxes may occur:

* “the inability to identify rights holders despite payments made for the use of their compositions;
* “the lengthy time required for filing domestic and ultimately international copyrights, often begun only when a recording is actually released”;
* “multiple claims for the same rights exceeding 100% of ownership, resulting in indefinite disputes”;
* “international collaborations with less than all creators asserting their rights”;
* “international legal inconsistencies regarding what type of performances result in payments (most visible in the fact that radio play does not generate royalties for recording artists in the United States)”; and
* “the slow and often manual processes to report usage and clear payments under international reciprocal agreements.”[[488]](#footnote-488)

Sellin and Seppälä discussed that the issues described above cannot be remedied by technology yet, but applying better record keeping and rights data sharing methods with real-time consumption data among stakeholders would greatly improve the speed and completeness of royalty payments to musicians.[[489]](#footnote-489)

Sellin and Seppälä outlined the music industry in a layered approach to weave through the industry’s complexity.[[490]](#footnote-490) Sellin and Seppälä divided the music industry into three layers:

1. Ownership Data (Layer 1),
2. Consumption Data (Layer 2), and
3. Payment Systems (Layer 3).[[491]](#footnote-491)

Sellin and Seppälä describe the current state of the music industry in Layer 1.[[492]](#footnote-492) Sellin and Seppälä further delineated the scope of Layer 1 into three sublayers:

* Future Music,
* All Formats, and
* Royalty Rates.[[493]](#footnote-493)

Future Music covers the creation of new music and systems built for new music.[[494]](#footnote-494) All Formats covers underlying ownership, consumption and payment issues for physical and digital formats.[[495]](#footnote-495) Royalty Rates covers solutions that increase the efficiency of royalty payments and enable direct licensing schemes.[[496]](#footnote-496)

Sellin and Seppälä also discussed sources of complexity in the music industry.[[497]](#footnote-497) A major source of complexity in the music industry is the constant reaction to technological innovations, and correcting for perceived market abuses.[[498]](#footnote-498) The reaction to technological innovations and perceived market abuses led to the rise of Collective Management Organizations (CMOs), and subsequent legislation and regulation to protect copyright holders.[[499]](#footnote-499) The complexity is evident in the United States, and even more so when considering the global music.[[500]](#footnote-500)

In describing the global music industry value web, Sellin and Seppälä created a generalized model describing two (2) copyrights (musical composition and sound recording), three (3) licenses (performance, mechanical, sound recording/neighboring rights), and their functional roles.[[501]](#footnote-501) Sellin and Seppälä discussed the general functions of each copyright in its lifecycle from creation-to-consumption.[[502]](#footnote-502)

In the Musical Composition[[503]](#footnote-503) Copyright section of the value web, Sellin and Seppälä described the functions as follows:

1. Songwriters create and copyright original musical works;
2. Songwriters assign the copyright in the original musical work to Publishers;
3. Publishers promote the use of Songwriters’ musical works in exchange for fifty percent (50%) of licensing revenue;
4. Rights Societies (aka CMOs) track and estimate public performances of Songwriter’s musical works to collect and distribute royalties to Songwriters and Publishers.[[504]](#footnote-504)

In the Sound Recording Copyright section of the value web, Sellin and Seppälä described the functions as follows:

1. Recording Artists (including performer and producers) create a recording of a performance of a musical work, generally on behalf of a record label, in exchange for royalties on sales;
2. Labels fund the recording of a performance of a musical work, promote and distribute the sound recording through sales channels, and pay sound recording royalties to Recording Artists and composition royalties to CMOs; and
3. Distributor/Aggregator distributes sound recordings through physical and/or digital distribution channels on the behalf of Labels.[[505]](#footnote-505)

In the Consumption section of the value web, Sellin and Seppälä described the functions as follows:

1. Performance Use of a musical composition requires a license from a Songwriter (or Publisher or CMO) where music is broadcasted or consumed in a public forum;
2. Mechanical Use of a musical composition requires a license from a Songwriter (or Publisher or CMO) when a music recording is available for purchase; and
3. Sound Recording/Neighboring Rights requires a license whenever a sound recording is used for commercial purposes. Neighboring Rights are rights distinct from the Songwriter of the musical work, and generally also requires a license.[[506]](#footnote-506)

Sellin and Seppälä shortly discussed the payment flows from the end user to rightsholders in the music industry.[[507]](#footnote-507) Citing to Berklee College of Music’s Rethink Music project, Sellin and Seppälä mentioned eight (8) unique scenarios for payment flows in the United States, each with “its own delays, its own information & reporting standards, and its own commissions.”[[508]](#footnote-508)

Additional factors that amplify the complexity of the value web are:

* poor metadata identifier and transmission standards;
* incompatible rights databases among stakeholders;
* “error-prone and labor-intensive human processes”; and
* the numerous relationships between musical compositions and sound recordings (multiple parties involved).[[509]](#footnote-509)

Sellin and Seppälä then identified the following inefficiencies in the current infrastructure that contribute to black boxes and slow royalty payments:

* database replication: stakeholders do not share one common database for rights data, thus stakeholders must replicate the same rights data in each of their private databases;
* manual matching: CMOs needing to identify relevant foreign CMO to collect royalties from, and manually synchronize their databases;
* identification codes: multiple standards that may or may not be applicable to identify a musician; and
* metadata: commercial databases for mapping artists to works does not exist, commercial databases are “voluntary, incomplete and centralized by a single commercial entity,” and the metadata in the music file can be modified at a later time.[[510]](#footnote-510)

Sellin and Seppälä summarized the features the music industry lacks as the following:

* “[e]fficient processes for sharing comprehensive rights data”;
* “[s]ystematic adherence to rich metadata standards”;
* “[s]calable systems for the growing pace of digital music releases and detailed per-stream reporting”; and
* “[w]illingness to share rights and reporting data openly with others in the industry.”[[511]](#footnote-511)

Lastly, Sellin and Seppälä recommend that any proffered solution to the issues in the music industry meet the four following requirements:

1. “[i]t must be proven to be more efficient than the current system, or else payments to creators will, by necessity, decrease”;
2. “[i]t must be scalable to handle the demands of both the pace of digital music releases and the growth of global per-stream consumption data”;
3. “[i]t must embrace common standards, enabling interoperability and selective sharing of data”; and
4. “[i]t must recognize the reality of a fundamental lack of trust within the industry, or the resistance by many to reveal data, even that which simply represents factual “musical historical events.”[[512]](#footnote-512)

## 2.10. Relevant Standards

DDEX, formed in 2006 as “Digital Data Exchange,” is a consortium of media-related companies developing digital supply chain standards for use among music industry stakeholders.[[513]](#footnote-513) In 2008, DDEX developed and released its digital supply chain standard, a standardized extensible markup language (XML) format for transmitting information between parties (generally business-to-business).[[514]](#footnote-514) DDEX’s supply chain standard has been adopted all across the music industry (“digital retailers, digital distributors and aggregators, record companies, music rights societies and various technical service providers”), with “more than 3,500 implementation licences [] issued.”[[515]](#footnote-515) DDEX’s supply chain standards generic enough so that it can be adapted to other digital supply chains.[[516]](#footnote-516) DDEX offers an implementation license that allows the implementation of the DDEX supply chain standards via an application programming interface (API).[[517]](#footnote-517) DDEX implements its standards similar to W3C, such that anyone may become a contributor to the standards by joining as a member, but differs from W3C in that its standards are not publicly available.[[518]](#footnote-518)

The Common Works Registration (CWR) standard is a supply chain standard developed by performance rights organizations and music publishers, and maintained by the International Confederation of Societies of Authors and Composers (CISAC).[[519]](#footnote-519) The CWR is a standard format, that provides the necessary data required for registering and revising works with performance rights organizations or mechanical rights organizations.[[520]](#footnote-520) Additionally, the standard allows for tracking and facilitating the transfer of musical works “between publishers and societies.”[[521]](#footnote-521)

CISAC also maintains the International Standard Work Code (ISWC) for musical works in ISO 15707.[[522]](#footnote-522) ISWC is the international standard for identifying a musical work.[[523]](#footnote-523) The minimum descriptive metadata required for an ISWC is:

* “the title of the work,
* all composers, authors and arrangers of the work identified by their IPI numbers and role codes,
* the work classification code (from the CIS standards list), [and]
* in the case of 'versions', for example arrangements, identification of the work from which the version was made.”[[524]](#footnote-524)

The International Standard Recording Code (ISRC) is an international standard for identifying sound and music video recordings.[[525]](#footnote-525) The ISRC is comprised of the following elements, in the following order:

* “Country Code”,
* “Registrant Code”,
* “Year of Reference”, and
* “Designation Code.”[[526]](#footnote-526)

“The Country Code identifies the country of residence of the registrant.”[[527]](#footnote-527) “The Registrant Code identifies the entity assigning the Designation Code in an ISRC.”[[528]](#footnote-528) “The Year of Reference Element identifies the year in which the ISRC is allocated to the recording.”[[529]](#footnote-529) “The Designation Code consists of five digits assigned by the Registrant.”[[530]](#footnote-530)

The International Standard Name Identifier (ISNI) is an international standard for public identification of contributors to creative works.[[531]](#footnote-531) A creative seeking an ISNI will have to contact an ISNI Registration Agency to obtain an ISNI from the ISNI International Agency.[[532]](#footnote-532)

# **3. Legal Primer**

In discussing the background on our research topic, we also decided to include a legal primer on the major legal frameworks applicable to music licensing. The legal primer will provide basic background information on:

* International copyright frameworks;
* USA legal frameworks; and
* EU legal frameworks.

This legal primer is intended to provide further clarity on the applicable frameworks, and the extent of the complexity involved in dealing with music licensing for non-legal audiences.

We chose the USA and EU as legal frameworks because the majority of automation approaches (projects, organizations, technologies) are based in these two areas, and both the USA and France and Germany (EU member-states) are in the top five (5) largest music markets in the world (as of 2018).[[533]](#footnote-533)

## 3.1. International Copyright Treaties

The international copyright framework has been heavily shaped by the following non-exhaustive list of treaties and agreements:

* the Berne Convention for the Protection of Literary and Artistic Works, first accepted in Berne, Switzerland, in 1886;
* the Universal Copyright Convention, adopted in Geneva, Switzerland, in 1952, then amended in Paris, France, 1971;
* the Rome Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organizations, Rome, Italy, 1961;
* the Geneva Convention for the Protection of Producers of Phonograms Against Unauthorized Duplication of Their Phonograms, Geneva, 1971;
* the WIPO (World Intellectual Property Organization) Copyright Treaty, 1996, under the Berne Convention;
* the WIPO Performances and Phonograms Treaty, 1996;
* the Agreement on Trade-Related Aspects of Intellectual Property Rights (the TRIPS Agreement), 1995, within the World Trade Organization; and
* the Beijing Treaty on Audiovisual Performances, 2012.[[534]](#footnote-534)

The international copyright treaties that have had the most influence in the past 100 years are the Berne Convention, Universal Copyright Convention, WIPO Copyright Treaty (WCT), and the TRIPS Agreement.[[535]](#footnote-535)

The Berne Convention requires contracting states to abide by three basic principles and provide minimum protections to copyrighted works of other contracting states.[[536]](#footnote-536) The three basic principles are:

* “[w]orks originating in one of the Contracting States must be given the same protection in each of the other Contracting States as the latter grants to the works of its own nationals”;
* “[p]rotection must not be conditional upon compliance with any formality”;
* “[p]rotection is independent of the existence of protection in the country of origin of the work.”[[537]](#footnote-537)

The minimum protections required by contracting states are:

* Providing protection for artistic, literary, and scientific works;
* The following exclusive rights of authors:
  + “the right to translate,
  + the right to make adaptations and arrangements of the work,
  + the right to perform in public dramatic, dramatico-musical and musical works,
  + the right to recite literary works in public,
  + the right to communicate to the public the performance of such works,
  + the right to broadcast,
  + the right to make reproductions in any manner or form,
  + the right to use the work as a basis for an audiovisual work, and the right to reproduce, distribute, perform in public or communicate to the public that audiovisual work.”[[538]](#footnote-538)

The Berne Convention also provides moral rights for authors.[[539]](#footnote-539)

Lastly, the Berne Convention requires duration of copyright to last for at least fifty (50) years.[[540]](#footnote-540)

The WCT is an agreement under the Berne Convention that requires contracting states to adopt national legislation that protects computer programs and compilations of data as copyrightable.[[541]](#footnote-541) The WCT recognizes the rights of 1) distribution, 2) rental, and 3) communication to the public, in addition to the rights granted under the Berne Convention.[[542]](#footnote-542)

The WCT is an agreement under the Berne Convention that obliges contracting states to adopt national legislation that provides legal remedies against circumvention of technological measures and removal or alternation of rights information.[[543]](#footnote-543)

The Universal Copyright Convention (UCC) is an alternative copyright convention to the Berne Convention developed by the United Nations Educational, Scientific and Cultural Organization, primarily for developing countries.[[544]](#footnote-544) The main features of the UCC are:

* contracting states should not accord domestic authors more protection than authors of other contracting states;
* “a formal copyright notice must appear in all copies of a work”;
* copyright duration must be the life of the author plus twenty-five (25) years; and
* all contracting states must grant “an [exclusive](https://www.merriam-webster.com/dictionary/exclusive) right of translation for a seven-year period, subject to a compulsory license under certain circumstances for the balance of the term of copyright.”[[545]](#footnote-545)

The TRIPS Agreement supports the rules set out previously in the Berne Convention and the Paris Convention, as well as sets out certain new rules. The treaties and international agreements provide minimum legal standards that the international parties to these acts (i.e., member-states) must comply with on a national level.

Setting an international framework for copyright was necessary to secure interests of the right owners across national borders.

Out of the agreements and treaties listed, the TRIPS Agreement is considered the most comprehensive. The TRIPS Agreement supports the rules set out previously in the Berne Convention and the Paris Convention.[[546]](#footnote-546) The rules laid out in the TRIPS Agreement relevant to copyright are:

* constraining national exceptions to copyright law under Article 9(2) (i.e., the Berne three-step test)
* computer programs are protected as literary works under the Berne Convention
* compilations of data are protected as copyrightable
* duration of copyright must be fifty (50) years unless calculated based on the life of the author.[[547]](#footnote-547)

The treaties and international agreements provide minimum legal standards that the international parties to these acts (i.e., member-states) must comply with on a national level.

Thus, international treaties help avoid major discrepancies between jurisdictions, allowing for a better exchange - of goods, services, art and ideas. However, it is often argued that, these international treaties, some of which are over 100 years old, are ill-equipped to deal with the challenges and opportunities presented by technology today.

## 3.2. United States of America (USA) Perspective

### 3.2.1. USA Copyright law

#### 3.2.1.1. General Copyright Law

Under [Article I, Section 8, Clause 8](http://www.law.cornell.edu/constitution/constitution.articlei.html#section8) of the United States Constitution, Congress has the enumerated power to legislate concerning copyright and patents.  Pursuant to its enumerated power, Congress has passed multiple versions of the Copyright Act, the federal statute governing copyright, with the Copyright Act of 1976 being the most recent version, with the most recent amendment being the Sonny Bono Copyright Term Extension Act passed in 1998.[[548]](#footnote-548)

Under the Copyright Act, only “works of original authorship” can receive federal protection.[[549]](#footnote-549) To receive federal protection, a work must satisfy three elements.[[550]](#footnote-550) First, there must be a human author (i.e., a human being creates the work).[[551]](#footnote-551) Second, the work must be original, i.e., it must exhibit a minimal degree of creativity.[[552]](#footnote-552) Third, the work must be fixed in a tangible medium of expression, such that it may be “perceived, reproduced, or communicated for more than a short time.”[[553]](#footnote-553) If all three conditions are met, the author’s copyright in the work is automatic, i.e., no formalities are required.[[554]](#footnote-554)

Under 17 U.S.C. § 102, the types of works eligible for copyright protection are:

* “literary works;
* musical works, including any accompanying words;
* dramatic works, including any accompanying music;
* pantomimes and choreographic works;
* pictorial, graphic, and sculptural works;
* motion pictures and other audiovisual works;
* sound recordings; and
* architectural works.”[[555]](#footnote-555)

An author will of a copyrighted work has exclusive rights to the copyrighted work for the duration of the copyright.

An author under 17 U.S.C. § 106 is granted an exclusive bundle of rights and may have more rights depending on the type of work.[[556]](#footnote-556) The six rights granted under 17 U.S.C. § 106 are:

1. to reproduce the copyrighted work in copies or phonorecords;
2. to prepare derivative works based upon the copyrighted work;
3. to distribute copies or phonorecords of the copyrighted work to the public by sale or other transfer of ownership, or by rental, lease, or lending;
4. in the case of literary, musical, dramatic, and choreographic works, pantomimes, and motion pictures and other audiovisual works, to perform the copyrighted work publicly;
5. in the case of literary, musical, dramatic, and choreographic works, pantomimes, and pictorial, graphic, or sculptural works, including the individual images of a motion picture or other audiovisual work, to display the copyrighted work publicly; and
6. in the case of sound recordings, to perform the copyrighted work publicly by means of a digital audio transmission.[[557]](#footnote-557)

Additionally, an author may have additional rights such as moral rights under the Visual Artists Rights Act (VARA), specifically the right to attribution and integrity, if their work can be described as a work of visual art under 17 U.S.C.  § 101.

However, rights under copyright are limited by defenses such as fair use, antitrust law, freedom of expression, and other specific limitations under the Copyright Act.[[558]](#footnote-558) Specific to sound recordings, 17 U.S.C. § 114 limits the scope of rights granted under § 106.

Copyright duration, as of the [Sonny Bono](https://en.wikipedia.org/wiki/Sonny_Bono) Copyright Term Extension Act of 1998 that amended the Copyright Act of 1976,is the life of the author plus seventy (70) years.[[559]](#footnote-559)

For works created on or after January 1, 1978, the duration of copyright is the life of the author plus seventy (70) years.[[560]](#footnote-560)

Copyright in the USA is under an international exhaustion scheme since the United States Supreme Court determined in *Kirtsaeng v. John Wiley & Sons, Inc.*, that the first sale of an authorized work in any market in the world will exhaust the author’s right to control further disposition of that copy.[[561]](#footnote-561)

An author is not required to undergo any formalities to copyright a work, but registration with the U.S. Copyright Office provides certain litigation advantages.[[562]](#footnote-562)

As the research topic of this report is automated music licensing, we shall specifically mention copyright as it relates to musical works (composition, sound recordings, streaming, etc.).

For musical works, there are two primary copyrights, one in the musical composition (e.g., sheet of music), and one in the sound recording.[[563]](#footnote-563) The musical composition refers to the music (“melody, rhythm, and/ or harmony expressed in a system of musical notation”) and lyrics of a composition, while a sound recording refers to the fixation of a performance of a musical composition.[[564]](#footnote-564) Under 17 U.S.C. § 101, phonorecords are defined as “material objects in which sounds, other than those accompanying a motion picture or other audiovisual work, are fixed by any method now known or later developed, and from which the sounds can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device.” Phonorecords includes “the material object in which the sounds are first fixed.”[[565]](#footnote-565)

The sound recording of the musical composition is often referred to as the “master.”[[566]](#footnote-566) The distinction is important because for example, only the copyright in the sound recording has an exclusive right to publicly perform a sound recording by means of a digital audio transmission.[[567]](#footnote-567)

Any right under copyright may be transferred or licensed to a third party (as a whole or percentage), and such transfer or license need not be recorded with the U.S. Copyright Office.[[568]](#footnote-568) Only exclusive agreements are required to be written and signed by the transferor or their authorized agent.[[569]](#footnote-569)

#### 3.2.1.2. Digital Millennium Copyright Act

The Digital Millennium Copyright Act (DMCA) of 1998 is an act that prohibits the circumvention of technological measure, or the trafficking of such technological measures, put into place by a  copyright holder, to prevent unauthorized access to a copyrighted work (i.e., access controls), or that affects the copyright holder's exclusive rights under the Copyright Act (i.e., copying controls).[[570]](#footnote-570) The DMCA provides legal protection against copyright infringement on for internet service providers (ISPs) if the ISP qualifies for one of four safe harbor categories under 17 U.S.C. § 512(a)-(d).[[571]](#footnote-571)

For an ISP to avail themselves of any safe harbor category, they must meet the following criteria:

1. Qualify as a service provider under 17 U.S.C. § 512(k)(1)(B),
2. Meet conditions of eligibility under 17 U.S.C. § 512(i), including having a repeat infringer policy,
3. Accommodate standard technical measures implemented by copyright holders/owners, and
4. Meet the specific requirements of a safe harbor category.[[572]](#footnote-572)

The Librarian of Congress can promulgate regulations to exempt classes of works from anti-circumvention rules if it would adversely affect users' ability to make non-infringing uses of such works under.[[573]](#footnote-573)

Under the DMCA, copyright holders can send a notice-and-takedown to an ISP to remove certain infringing content on the ISPs website.[[574]](#footnote-574)

#### 3.2.1.3. Music Modernization Act

The Music Modernization Act (MMA) of 2018 passed into public law three separate acts as titles:

1. The Music Modernization Act (Title I),
2. Compensating Legacy Artists for their Songs, Service, & Important Contributions to Society (CLASSICS) (Title II), and
3. The Allocation for Music Producers (AMP) Act (Title III).[[575]](#footnote-575)

The MMA primarily amended Sections 114 and 115 of the Copyright Act.[[576]](#footnote-576) Title I of the MMA  amended Section 115 to replace the bulk Notice Of Intent (NOI) with a Mechanical Licensing Collective (MLC), a non-government agency which will act as the respondent for mechanical licensing requests, collection of mechanical royalties from digital downloads and digital streaming, and distributor of such royalties to licensors.[[577]](#footnote-577) Title I of the MMA also creates a song ownership database that is “transparent and publicly accessible,” allow publishers to claim missing royalties based on songs in the database, and an audit right for songwriters and publishers.[[578]](#footnote-578) The database will be funded by digital streaming services.[[579]](#footnote-579)

Title I amended the rate setting dispute procedure (process for royalty rate disputes), so that instead of only one judge in the Southern District of New York overseeing the dispute, “a district judge in the Southern District of New York would be randomly assigned from the wheel of district judges for rate setting disputes” (aka “wheel” approach).[[580]](#footnote-580)

Title I amended Section 115 to require the Copyright Royalty Board, the administrative judges who “determine and adjust royalty rates and terms applicable to the statutory copyright licenses,” to use the “willing buyer/willing seller” (fair market value) standard for determining rates, for all online music platforms.[[581]](#footnote-581)

Lastly, Title I of the MMA repealed 17 U.S.C. § 114(i) to allow rate court judges to “consider royalties paid to recording artists when determining what streaming services will pay songwriters for the exact same performance”  as evidence in setting performance royalty rates for songwriters and composers.[[582]](#footnote-582)

Title II of the MMA granted federal copyright protection for public performance of sound recordings fixed pre-1972, and granting protection until 2067.[[583]](#footnote-583)

Title III of the MMA granted licensing collectives the ability to follow a letter of direction from a musician to distribute royalties for a sound recording “to a producer, mixer, or sound engineer who was part of the creative process that created the sound recording.”[[584]](#footnote-584)

### 3.2.2. USA Contract Law

We shall provide a brief overview of United States contract law because other than intellectual property law, music licenses are also subject to state contract law. The basic topics discussed here are also discussed by Giancaspro.[[585]](#footnote-585)

At common law in the United States, a contract is a legally enforceable set of promises between two or more parties.[[586]](#footnote-586) A legally-enforceable contract requires three elements: 1) offer; 2) acceptance; and 3) consideration. An offer is a “manifestation of the “willingness to enter into a bargain so made as to justify another person in understanding that his assent to the bargain is invited and will conclude it.”[[587]](#footnote-587) An acceptance “is a manifestation of assent to the terms thereof made by the offeree in a manner invited or required by the offer.”[[588]](#footnote-588) At common law, an acceptance is required to mirror the exact terms of the offer (aka the “mirror-image” rule).[[589]](#footnote-589)

For a valid offer and acceptance, there must be a meeting of the minds between the parties, such that based on an objective view of the facts,  the parties mutually understood and assented to the terms of the agreement.[[590]](#footnote-590)

Consideration is a “present exchange bargained for in return for a promise” between the parties that causes a change in the position of the either party. Consideration may be satisfied when a party makes:

* “a promise to do something you're not legally obligated to do, or
* a promise *not* to do something you have the right to do (often, this means a promise not to file a lawsuit).”[[591]](#footnote-591)

Other than the three basic elements, contract formation also requires the subject matter of the agreement to be sufficiently described, i.e., the material terms of the contract must be sufficiently described as to allow an objective viewer to understand what was material.[[592]](#footnote-592)

Uniform Commercial Code Article 2 (UCC Art. 2) is the contract law framework that is generally applicable to contracts between merchants, and between merchants and nonmerchants for the sale of goods.[[593]](#footnote-593) Common law is generally applicable to contracts for services and other subject matter not under UCC Art. 2.[[594]](#footnote-594) The UCC Art. 2 provides different rules from the common law, such as the abandonment of the “mirror image” rule discussed above for a less stringent acceptance rule.[[595]](#footnote-595)

The UCC Art. 2 is not applicable to music licenses because copyrighted works are not a *good* under UCC Art. 2-105, i.e., copyrighted works are intangible assets, and thus, are not movable.[[596]](#footnote-596)

### 3.2.3. Electronic Records & Signatures Law

At the federal level, Congress has passed the Electronic Records in Global and National Commerce Act contained in 15 U. S. C. §§ 7001 *et seq*. (“E-sign”) to regulate electronic records and signatures.[[597]](#footnote-597) Under E-sign, electronic signatures are defined as “an electronic sound, symbol, or process, attached to or logically associated with a contract or other record and executed or adopted by a person with the intent to sign the record.”[[598]](#footnote-598) Under E-sign, electronic records are defined as “a contract or other record created, generated, sent, communicated, received, or stored by electronic means.”[[599]](#footnote-599)

E-sign does not expressly preempt state law in this field, thus forty-seven (47) states have passed their own electronic signatures and records law, namely, a version of the Uniform Electronic Transactions Act (UETA) that is consistent with E-sign.[[600]](#footnote-600) E-sign and UETA’s main objective is to give electronic transactions the same enforceability and legal interpretation as transactions memorialized on paper.[[601]](#footnote-601)

For a valid electronic signature under UETA and E-sign, four requirements must be met:

1. “Intent to sign”,
2. “Consent to do business electronically”,
3. “Association of signature with the record”, and
4. “Record retention.”[[602]](#footnote-602)

In the electronic agreement context, the federal courts have had relatively few chances to consider whether a transfer of copyright in an electronic agreement would satisfy 17 U.S.C. § 204(a).[[603]](#footnote-603) In *Metro. Reg'l Info. Sys., Inc. v. Am. Home Realty Network, Inc.*, the Fourth Circuit Court of Appeals considered whether a transfer of copyright via an electronic agreement satisfies the *in writing* requirement of 17 U.S.C. § 204(a).[[604]](#footnote-604)

Specifically, the Court need to resolve whether “a subscriber, who ‘clicks yes’ in response to MRIS's electronic TOU prior to uploading copyrighted photographs, has *signed* a *written* transfer of the exclusive rights of copyright ownership in those photographs consistent with Section 204(a).”[[605]](#footnote-605) The Court ultimately concluded that a written transfer of copyright had occurred by referring to the Federal Electronic Signature Act (E-Sign) for guidance.[[606]](#footnote-606)

The Court determined that Sections 7001(b) and 7003 of the E-sign Act conclude that a transfer of copyright may occur via electronic agreement.[[607]](#footnote-607)

Section 7001(b) applies to 17 U.S.C. § 204(a) because 7001(b) states that the E-sign Act only affects “a requirement that contracts or other records be written, signed, or in nonelectric form[[608]](#footnote-608),” and 17 U.S.C. § 204(a) “requires transfers be ‘written’ and ‘signed.’”

Section 7003 applies to 17 U.S.C. § 204(a) because 7003 does not specifically enumerate agreements to transfer copyright  as a specific contract or record excepted from the E-Sign Act’s applicability.[[609]](#footnote-609)

The District Court for the Southern District of Florida reached a similar conclusion to the Fourth Circuit Court of Appeals in *Vergara Hermosilla v. Coca–Cola Co.,* but only offered a brief analysis on the issue.[[610]](#footnote-610)

## 3.3. European Union (EU) Perspective

### 3.3.1. Digital Single Market

There are several areas which can be covered by the European Union legislation. One of the foundations of the European Union is the single market policy, effected through principles and legislation concerning free movement of goods and services, alongside free movement of persons, capital, labor and establishment. One of the policies currently building the single market in the EU is the Digital Single Market, announced in 2015. Acts related to the Digital Single Market include directives and regulations related to digital marketing, E-commerce and telecommunications, covering also such areas as copyright, data protection, cybersecurity, electronic signatures, digital administration services and other issues specific to digital and online activities. Some of the achievements of the DSM were the end of the roaming charges within the EU, research initiatives concerning artificial intelligence and cybersecurity. There are several acts relevant from the perspective of music license contracts. The short description provided below is not exhaustive, in particular it does not consider issues such as competition or data protection that often require the most attention from non-EU establishments. Contract law is not unified *per se* across the EU - the areas that can be observed as common relate to selected aspects, such as competition, very often consumer protection, e-commerce, copyright - or various aspects of jurisdiction and the conflict of law rules, which have a great impact on contract law in practice.[[611]](#footnote-611)

### 3.3.2. Copyright

Copyright is regulated in the EU by several acts, mostly directives that require national legislation to achieve their purposes (harmonization) and some regulations, applicable directly. Certain aspects or copyright are not harmonized (such as the moral rights), while the economic aspects of copyright are harmonized.

The acts regulating copyright in the EU include:

* Regulation on cross-border portability of online content services in the internal market (“Portability Regulation”) (June 2017);[[612]](#footnote-612)
* Directive and a Regulation implementing the Marrakesh Treaty in the EU (September 2017) concerning the visually impaired persons;[[613]](#footnote-613)
* Directive on copyright and related rights in the Digital Single Market (May 2019), regulating a number of issues related to copyright (this Directive is in the process of being implemented by Member States);[[614]](#footnote-614)
* Directive on television and radio programmes (May 2019), facilitating access to online TV and radio across borders - these are the acts initiated under the Digital Single Market policy;[[615]](#footnote-615)
* Directive on collective management of copyright and related rights and multi-territorial licensing of rights in musical works for online use in the internal market (“CRM Directive”) (February 2014);[[616]](#footnote-616)
* Directive on the harmonisation of certain aspects of copyright and related rights in the information society ("InfoSoc Directive") (May 2001);[[617]](#footnote-617)
* Directive on rental right and lending right and on certain rights related to copyright in the field of intellectual property ("Rental and Lending Directive") (December 2006);[[618]](#footnote-618)
* Directive on the resale right for the benefit of the author of an original work of art ("Resale Right Directive") (September 2001);[[619]](#footnote-619)
* Directive on the coordination of certain rules concerning copyright and rights related to copyright applicable to satellite broadcasting and cable retransmission ("Satellite and Cable Directive") (September 1993);[[620]](#footnote-620)
* Directive on the legal protection of computer programs (“Software Directive”) (April 2009);[[621]](#footnote-621)
* Directive on the enforcement of intellectual property right (“IPRED”) (April 2004);[[622]](#footnote-622)
* Directive on the legal protection of databases (“Database Directive”) (March 1996);[[623]](#footnote-623)
* Directive on the term of protection of copyright and certain related rights amending the previous 2006 Directive (“Term Directive”) (September 2011);[[624]](#footnote-624)
* Directive on certain permitted uses of orphan works (“Orphan Works Directive”) (October 2012);[[625]](#footnote-625)
* Directive on certain permitted uses of certain works and other subject matter protected by copyright and related rights for the benefit of persons who are blind, visually impaired or otherwise print-disabled (Directive implementing the Marrakech Treaty in the EU) (September 2017).[[626]](#footnote-626)

Most of the above acts may be relevant specifically to the music industry sector although one of these acts regulates the music industry sector specifically (the CRM Directive). The CRM Directive deals with certain issues related to the operations of the collective rights management organizations (CMOs), attempting to make them more democratic and to tackle the issue of the value gap, bringing certain new accountability and transparency requirements for the CMOs, as well as requirements to speed up royalty payments (which had in practice taken a long time in the EU). The preparations for the 2014 CRM Directive involved a few extensive reports analyzing, i.e., transactions costs of music licensing.[[627]](#footnote-627) The Directive introduced the multi-territorial licensing scheme, aiming at improving competition in that sector and larger music portfolios.

There have been several initiatives and studies concerning the music industry sector in the UE, including a "Licences for Europe" stakeholder dialogue[[628]](#footnote-628) between 2012 and 2013, with certain statements made by participating stakeholders and Music Moves Europe (MME) framework of the European Commission active since 2015. Within the MME, EU provides funding for music-related projects under the umbrella of the Creative Europe Project Results platform, with plans to provide additional funding after 2020 with such goals in mind as promoting diversity, creativity and innovation in the field of music, in particular in the distribution of musical repertoire in Europe and beyond. In terms of policy and adoption of new legal acts, there have been efforts to make the marketplace for music more transparent and fairer - such purposes were set out both for the CRM Directive and the new Copyright in the Digital Single Market Directive. MME allows also for dialogue through conferences and exchange of ideas, as well as awards for achievements in the field of popular and contemporary music. A competition under the MME framework produced a book including 10 winning business models for online and offline distribution of music, none of which used blockchain or distributed ledger technology.[[629]](#footnote-629)

### 3.3.3. Electronic Identification

Another large topic falling under the scope of the Digital Single Market policy, is related to e-signatures and digital exchanges requiring a high degree of trust. The eIDAS Regulation (Regulation (EU) N°910/2014 on electronic identification and trust services for electronic transactions in the internal market, July 2014),[[630]](#footnote-630) sets out a legal framework for authentication solutions and schemes which may be adopted by people and businesses, and allow to facilitate (or digitalize) citizen-government exchanges and filings. The eIDAS Regulation is particularly relevant to technological solutions utilizing blockchain or distributed ledger.

### 3.3.4. General Data Protection Regulation (GDPR)

As mentioned at the beginning of this section, the Digital Single Market tackles also the issues of data protection and cybersecurity. The main act related to the protection of personal data is the Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, known as GDPR.[[631]](#footnote-631) The Regulation applies across the EU since May 2018. The Regulation applies directly, however, there is a number of country-specific provisions enacted in every Member State. Another act covering the protection of personal data is the Directive (EU) 2016/680 on the protection of natural persons regarding processing of personal data connected with criminal offences or the execution of criminal penalties, and on the free movement of such data, with the transposition deadline for the Member States in May 2018. A wide framework of initiatives has been set for the development of cybersecurity in the EU, with examples such as (i) the European Cybersecurity Act in force since June 2019 concerning cybersecurity certifications issued by ENISA, the EU Agency for Cybersecurity,[[632]](#footnote-632) and (ii) the NIS Directive (Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union, July 2016)[[633]](#footnote-633) which sets out standards, collaboration topics and supervision sectors concerning cybersecurity issues across the EU.

# **4. Music Licensing Primer**

Music licensing is an extremely important tool for musicians and copyright owners (“rightsholder”) to exploit the marketability of a musical work. As only authors and copyright owners (“rightsholder”) may exploit a musical work, any third party that intends to use the copyrighted work for a purpose that falls under 17 U.S.C. § 106[[634]](#footnote-634) will need to obtain a license from rights holders to use the work.[[635]](#footnote-635) For example, if a TV show wanted to play a certain sound recording in an episode, the company producing the TV show would need to obtain a synchronization license from the rightsholder(s) to perform the sound recording in the episode.[[636]](#footnote-636)

Though music licensing is an important tool for rightsholders to exploit their music, it is also very difficult for rightsholders (licensors) and users (licensees) because of a lack of coordination and information.[[637]](#footnote-637)

Rights holders are unlikely to have the resources to track down every use of their music, and intended users may not understand how, when, and who to contact about licensing.[[638]](#footnote-638) This is where collective management organizations (CMOs), such as ASCAP, SACEM, and Harry Fox Agency, become particularly important.[[639]](#footnote-639) CMOs play the role of intermediary between the rightsholder and user, ensuring that licenses are being followed while collecting and distributing royalties to rightsholders.[[640]](#footnote-640)

## 4.1. Music License Typology

The most common types of music licenses in the United States are mechanical, synchronization, public performance, and print.[[641]](#footnote-641) Mechanical licenses are licenses from the copyright owner for the right to reproduce and distribute a musical work in a recording (e.g., CDs, tapes, digital configurations).[[642]](#footnote-642) Synchronization licenses are licenses from the copyright owner for the right to synchronize the performance of a musical work with visual images.[[643]](#footnote-643) Public Performance licenses are licenses from the copyright owner for the right to perform the musical work in public settings.[[644]](#footnote-644) Print licenses are licenses from the copyright owner for the right to print their musical composition in a print format such as sheet music, folio or collection.[[645]](#footnote-645)

In the European Union, the framework of rights subject to licensing is set out in the Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001[[646]](#footnote-646) on the harmonisation of certain aspects of copyright and related rights in the information society, including the rights of reproduction (Art. 2), rights of communication to the public of works and right of making available to the public other subject-matter (Art. 3), the rights of distribution (Art. 4). The rights which may be granted under licenses are listed in EU legislation and international treaties, leading to the same scope being reflected at national levels though using different wording, categorization and specific rules.[[647]](#footnote-647)

## 4.2. Licensing Paradigms

In the music industry, there are two general licensing paradigms: 1) licensing on a collective basis (“collective licensing”), and 2) licensing on an individual basis (“individual licensing”)[[648]](#footnote-648).[[649]](#footnote-649) Collective licensing is the most popular form of licensing, wherein musicians will give certain rights to their works to a collective management organization (CMO), that will negotiate licensing fees, collect & distribute royalties, and monitor use of copyrighted works on the rightsholder’s behalf.[[650]](#footnote-650) The most popular CMOs for performance royalties arethe American Society for Composers, Authors and Publishers (ASCAP), the Society of Authors, Composers and Publishers of Music (SACEM), and PRS for Music.[[651]](#footnote-651) In addition to CMOs for performance royalties, there are also CMOs for mechanical royalties, such as the Harry Fox Agency.[[652]](#footnote-652) In contrast to collective licensing, individual licensing is when rightsholders directly negotiate with users on the terms of use for their music.[[653]](#footnote-653)

Collective licensing is the dominant paradigm because CMOs enable markets when rightsholder *cannot directly contact* the user, which is generally the case in the music industry.[[654]](#footnote-654) CMOs play such a prominent role in music licensing because they reduce the administrative costs associated with the complexity of licensing copyrighted works.[[655]](#footnote-655) The administrative costs for rightsholders are: 1) negotiating license fees, 2) collecting royalties, 3) stopping infringements, and 4) monitoring use of copyrighted works among multiple and different types of users.[[656]](#footnote-656)

While the administrative costs for users are 1) identifying rightsholders, and 2) avoiding conflict with rightsholders.[[657]](#footnote-657)

CMOs provide economies of scale for the administrative costs of rightsholders and users when the two following conditions are met:

1. licensees are identical, i.e., the same information needs to be investigated for each licensee; and
2. when average costs fall as the number of works increases indefinitely.[[658]](#footnote-658)

## 4.3. Blanket Licensing Model

The primary licensing model employed by CMOs is a blanket license.[[659]](#footnote-659) A blanket license is a license that “bundl[es] the entire repertoire” and then charges users a price depending on the “intensity of their use.”[[660]](#footnote-660) Blanket licensing is administratively efficient because it “spares market participants the costs of negotiating the exact size of the bundle of rights and its price for every transaction.”[[661]](#footnote-661)

Ruth Towse identified the main differences between transactional licensing and blanket licensing.[[662]](#footnote-662) In transactional licensing, every transaction is itemized and valued, which gives greater transparency and clearer market signals that users are interested in the work.[[663]](#footnote-663) In blanket licensing, the user pays set rates for the whole repertoire and revenue is distributed to members based on the quantity of a work’s (within their repertoire) usage.[[664]](#footnote-664)

## 4.4. Compulsory Licensing Model

Under the US Copyright Act of 1976 and amendments thereto, compulsory licenses are pre-negotiated, statutorily-created licenses that allow specific uses of a copyrighted work if certain conditions are met, without the permission of the rightsholder.[[665]](#footnote-665)

Statutory exemptions to rights under copyright in 17 U.S.C. § 106 can be found in multiple sections in the U.S. Copyright Act, including 17 U.S.C. §§ 110, 112, 114, and 115.[[666]](#footnote-666)

For example, under Section 115 of the US Copyright Act, after a songwriter has released the first sound recording of their song, a compulsory mechanical license is automatically granted for subsequent sound recordings, thus allowing for the creation of cover songs.[[667]](#footnote-667)

Under Sections 112 and 114, an organization may obtain a compulsory license to digitally transmit a sound recording to the public, “under the limitation on exclusive rights specified by Section 114(d)(1)(C)(iv) or under a statutory license in accordance with Section 114(f).”[[668]](#footnote-668) Under Section 112, an organization may obtain a compulsory license to make one ephemeral recording (i.e., make and keep a copy of the sound recording) of a sound recording, if a Section 114 compulsory license has been met.[[669]](#footnote-669)

To obtain a compulsory license, a user needs to “(1) serve a timely Notice of Intention to Obtain a Compulsory License (NOI), either on the copyright owner or on the Copyright Office if the identity or address of the copyright owner is unknown; and (2) when the copyright owner is known, make monthly royalty payments and provide monthly statements of account to the copyright owner.”[[670]](#footnote-670)

The traditional NOI for compulsory mechanical licensing was recently amended with the passage of the Music Modernization Act (MMA).[[671]](#footnote-671)

## 4.5. Creative Commons Licensing Model

Creative Commons (CC) licenses are a suite of public copyright licenses developed by the Creative Commons, a U.S. nonprofit, that are geared towards rightsholder who desire to make their works accessible, distributable, and usable by members of the general public.[[672]](#footnote-672) CC licenses are generally applicable to any copyrighted work, but are preferred for creative works (music, art, books, etc.), and are drafted to be amendable to any copyright framework.[[673]](#footnote-673)

CC licenses can be commercial or noncommercial, and generally deal with three types of permissions: 1) attribution, 2) adaption, and 3) redistribution.[[674]](#footnote-674) CC licenses present advantages for those who want to grow the digital commons because CC licenses, specifically the CC Attribution-ShareAlike license, offers the option of controlling future licensees down the road to the same terms as the original licensee for derivative works.[[675]](#footnote-675)

The current CC license suite is comprised of six licenses, with varying degrees of openness:

* Attribution (CC BY),
* Attribution-ShareAlike (CC BY-SA),
* Attribution No-Derivs (CC BY-ND),
* Attribution Non-commercial (CC BY-NC),
* Attribution-NonCommercial-ShareAlike (CC BY-NC-SA), and
* Attribution-NonCommercial-NoDerivs (CC BY-NC-ND).[[676]](#footnote-676)

Attribution (BY) requires that licensees credit the licensor for all uses of the copyrighted work.[[677]](#footnote-677) ShareAlike (SA) requires that the licensees distribute derivative works under identical terms to the license governing the copyrighted work.[[678]](#footnote-678) Non-commercial (NC) requires that licensees do not use the copyrighted work for any non-commercial purposes.[[679]](#footnote-679) NoDerivs (ND) requires that the licensee does not make a derivative work from the copyrighted work.[[680]](#footnote-680)

CC licenses are comprised of three layers: 1) legal code, 2) human readable, and 3) machine readable.[[681]](#footnote-681) The legal code is the traditional legal language involved in licensing.[[682]](#footnote-682) The human readable layer is a summary of the legal code intended for non-legal audiences.[[683]](#footnote-683) The machine readable code is a summary of the legal code formatted for software (primarily web services) to know that a work is licensed under a CC license under the standardized CC Rights Expression Language (ccREL).[[684]](#footnote-684) ccREL is a means of expressing copyright licensing metadata based on the WorldWideWeb Consortium (W3C)’s resource description framework (RDF) and eXtensible Markup Language (XML), and can be embedded in various file types.[[685]](#footnote-685)

## 4.6. Territorially-restrictive Licensing

Neil J. Conley in *The Future of Licensing Music Online: The Role of Collective Rights Organizations and the Effect of Territoriality* discussed the inefficiencies of CMO reciprocal agreements that include territorially-restrictive clauses, stating that such licenses are inefficient in an online music context/marketplace because transactions over the internet are inherently cross-border.[[686]](#footnote-686)

CMOs enter into reciprocal agreements with foreign CMOs to collect royalties, and distribute their repertoire, on the CMO’s behalf in the foreign CMOs territory.[[687]](#footnote-687)

Additionally, Conley highlighted four major issues with territorially-restrictive licenses imposed by CMOs (named Collective Rights Organizations (CROs) in the paper) that lead, summarized in the list below:

* Online music providers can infringe CMO’s reciprocal agreement with a foreign CMO by foreign users accessing music in a foreign territory subject to the foreign CMOs control;
* Online music providers can infringe copyright holder's public performance right in a foreign jurisdiction by allowing a foreign person access to the music in the foreign jurisdiction without obtaining permission from the copyright holder to perform songs in the foreign jurisdiction;
* Online music provider infringes foreign CMO right to collect royalties and distribute repertoire in foreign jurisdiction on behalf of native CMO; and
* Online music provider breaches their blanket license with CMO when music is accessed in a foreign territory.[[688]](#footnote-688)

Conley proposed many reasons why territorially-restrictive clauses remain in reciprocal agreements, in particular, that CMOs receive a large portion of their revenue from licensing their repertoire, and charge administrative fees (which are unknown what services they are for).[[689]](#footnote-689)

## 4.7. Licensing Issues

For our research topic, we organized the licensing costs and issues into four categories, some of which were described *supra* in Section 2. Literature Review.

The first category of issues can be categorized as transactional costs. Transactional costs identified by Bodo et al. were: 1) “identifying and matching rights holders and users, 2) the high costs of monitoring use, 3) the costs of enforcement, and 4) the complexities of setting the price and negotiating the terms of use.”[[690]](#footnote-690)

*Ex ante* transaction costs (costs before a transaction is concluded) identified by KEA for online music service providers include:

* “Identification costs, which correspond to all the costs incurred to identify and find the rights owners”; and
* “Negotiation costs, which correspond to all the costs incurred between identification and the actual agreement.”[[691]](#footnote-691)

*Ex post* transaction costs (costs after a transaction is concluded) identified by KEA for online music service providers include “identifying repertoire and uses for reporting and invoicing purposes.”[[692]](#footnote-692)

The second category of issues can be categorized as collective management organization (CMO), which we define as membership costs. Handke and Towse identified the three following membership costs: 1) membership fee; 2) revenue distribution; 3) few if any alternatives to joining a CMO.[[693]](#footnote-693)

The third category of issues can be categorized as multi-territorial issues. Multi-territorial issues include:

* Multiple copyright frameworks, and
* Territorially restrictive licenses in a digital market context.[[694]](#footnote-694)

The fourth category of issues can be categorized as contract management issues. Contract management issues include:

* How contracts should be stored and audited;
* Parties not fulfilling obligations under the agreement;
* Poor communication between the parties;
* Hidden risks in a contract; and
* Hard to find the important information in the contract.[[695]](#footnote-695)

# **5. Technology Primer**

## 5.1. Blockchain

Blockchain[[696]](#footnote-696) is an append-only database, often described as a *trustless*, *trust-minimization*,or *low-trust* system, that is secured by a peer-to-peer (p2p) network of computers.[[697]](#footnote-697) In the network, the blockchain is replicated so that each node has a copy of the blockchain.[[698]](#footnote-698) The main advantage of a blockchain is that it allows counterparties to transact in a secure manner without the need for a trusted third (or centralized) party.[[699]](#footnote-699) The term “blockchain” originates from Satoshi Nakamoto’s whitepaper, *Bitcoin: A Peer-to-Peer Electronic Cash System*, though Satoshi Nakamoto never mentions the word *blockchain* in the whitepaper to describe the block-based data structure.[[700]](#footnote-700)

The blockchain data structure is an ordered list of blocks that each reference the previous block by the previous block’s cryptographic hash.[[701]](#footnote-701) “Each block consists of a set of transactions[[702]](#footnote-702).”[[703]](#footnote-703) Once a new block is mined, each node will add the newly mined block to their copy of the blockchain.[[704]](#footnote-704) Once a block is appended to the blockchain, the newly-appended block cannot be removed or modified as to ensure the blockchain’s data integrity.[[705]](#footnote-705)

The first blockchain implementation, Bitcoin, mitigated two major problems: 1) double spending[[706]](#footnote-706), and 2) eliminating fraud, through the Proof of Work (PoW) mining algorithm and the Longest Chain Rule consensus algorithm*[[707]](#footnote-707)* process.[[708]](#footnote-708)

Mining is the process of authenticating and adding blocks of transactions to the blockchain, and is a means of stopping spam (i.e., anti-sybil measure).[[709]](#footnote-709) Nodes on the p2p network *mine* (“miners”)attempt to solve a complex math problem by ordering transactions in a manner to have the hash of the block have a certain number of leading zeros.[[710]](#footnote-710) Once the problem is solved, the block can then be added to the Bitcoin blockchain.[[711]](#footnote-711) In exchange for authenticating and adding a block, miners are rewarded with new Bitcoins.[[712]](#footnote-712)

To ensure that each node has the correct copy of the blockchain without a trusted intermediary, the Bitcoin blockchain also implements the Longest Chain Rule, a consensus algorithm on the state of the Bitcoin blockchain.[[713]](#footnote-713) In simplest terms, the longest chain rule will rear or steer the nodes on the Bitcoin p2p network towards the blockchain which has the most work done, i.e., the chain that has the most computational effort supplied.[[714]](#footnote-714)

The hashing of each block maintains the integrity of the data stored in the blockchain.[[715]](#footnote-715) In a hashing algorithm, the input is an arbitrary amount of data that is mapped to an output of a unique, fixed-size number of bytes.[[716]](#footnote-716) Since the output is unique for each input, it is nearly impossible to get the same hash for two different inputs.[[717]](#footnote-717)

A new block primarily holds a set of transactions, an index, a timestamp, and in the header, it includes two hashes: 1) the previous block’s hash, and 2) it’s own hash.[[718]](#footnote-718) By requiring new blocks to reference the cryptographic hash of the previous block, we obtain an immutable sequential chain of transactions.[[719]](#footnote-719) If someone tried to change the contents of a block, that particular block’s cryptographic hash would change, and this would change the hashes of all the sequential blocks after the altered block.[[720]](#footnote-720) Thus, it becomes nigh impossible for one party to commit fraud because a fraudster would need to alter the copy of the blockchain for fifty-percent or greater (>50%) of the nodes, and that’s before a new block gets added to the blockchain (small window of time to make that happen, especially since a new block on the Bitcoin blockchain is added every ten (10) minutes).[[721]](#footnote-721)

Horst Treiblmaier in *Toward More Rigorous Blockchain Research: Recommendations for Writing Blockchain Case Studies*, summarized the most important characteristics of blockchain as:

* “[i]mmutability”,
* “[t]ransparency”,
* “[p]rogrammability”,
* “[d]ecentralization”,
* “[c]onsenus”,
* “[d]istributed trust.”[[722]](#footnote-722)

Blockchains can be categorized based on a permission typology.[[723]](#footnote-723) In the permission typology, there are two types of blockchains: permissioned and permissionless.[[724]](#footnote-724) A permissionless blockchain is a blockchain in which anyone may read (examine transactions contained in blocks) and write (submit a transaction to be stored in a block) to the blockchain.[[725]](#footnote-725) A permissioned blockchain is a blockchain in which there is a restriction on who can read and/or write to the blockchain.[[726]](#footnote-726)

The issues with the current state of blockchain architecture, mentioned in the literature and in the industry, are readily summarized by Treiblmaier and reproduced here for convenience:

* “Throughput: Number of transactions being processed within a specific period of time.
* Latency: Amount of time before a transaction is processed.
* Size and bandwidth: The Blockchain grows over time as new blocks are constantly added. This also consumes considerable bandwidth for downloading data.
* Wasted resources: Blockchain-intrinsic inefficiencies such as redundant data transmission, storage and energy-consuming consensus protocols.
* Usability Users’: interactions with Blockchain applications.
* Versioning: Hard forks, multiple chains. A multitude of Blockchain versions and forks facilitate attacks and hamper cross-transactions.
* Privacy: The right to control access to (personal) information as well as to delete it.
* Evidentiary quality: Trustworthiness of Records; Questions pertaining to the truthfulness of content on the Blockchain.
* Lack of Standards: No standards have emerged yet for access rights, data structures and allowable transactions.
* Regulations: Legislation is lagging behind technological development.
* Shared governance: Blockchain solutions call for new structures that might disrupt existing governance.
* Viable ecosystem: The attraction of a critical mass of adopters.
* Attack Surface: The Blockchain as a target of potential attacks.”[[727]](#footnote-727)

The blockchain characteristics we explicitly sought to utilize in our research and in the creation of our Ricardian music license were:

* Immutability,
* Transparency,
* Programmability, and
* Decentralization.[[728]](#footnote-728)

We desired the immutability characteristic because we wanted to ensure that once an agreement is signed by the parties, the contents and signatures of the signed agreement cannot be modified in the future.[[729]](#footnote-729)

We desired the transparency characteristic because we wanted to make the licensing terms publicly viewable so that musicians and users have a commonplace to negotiate licenses, a negotiating reference from other parties prior negotiations, and to mitigate against disputes such as disputes over the terms of the license or confusion regarding whether a license has been signed.[[730]](#footnote-730)

We desired the programmability characteristic because we wanted to utilize smart contracts to guarantee the fulfillment of certain objective demands and requirements envisioned by the parties, optimize the licensing process by reducing transaction costs, and the need to ensure that programs embedded in the license will execute without any worry for down-time or third party malfeasance.[[731]](#footnote-731)

We desired the decentralization characteristic because we believe further decentralization will enable musicians to gain a greater foothold in the music industry’s value chain by reducing the number of intermediaries needed to license their works, will lead to fairer remuneration, and will help alleviate concerns of colluding third parties (such as Spotify colluding with the major record labels) whose interests do not align with the musician’s interests.[[732]](#footnote-732)

## 5.2. Smart Contracts

A smart contract is executable code stored on a blockchain to facilitate agreements among two or more parties that will automatically execute based on a set of predefined conditions.[[733]](#footnote-733) The idea of smart contracts came from Nick Szabo in 1994.[[734]](#footnote-734) According to Nick Szabo, despite the digital era creating entirely new tools, applying the known concepts of contract law may be key, given the rapid development of the modern world: “By extracting from our current laws, procedures, and theories those principles which remain applicable in cyberspace, we can retain much of this deep tradition, and greatly shorten the time needed to develop useful digital institutions”[[735]](#footnote-735). As D. Szostek points out, smart contracts were defined by the UK Government in 2016 in the report titled “Distributed Ledger Technology: beyond block chain”, where smart contracts were defined as “contracts whose terms are recorded in a computer language instead of legal language (...) can be automatically executed by a computing system, such as a suitable distributed ledger system [and having the benefits of] low contracting, enforcement, and compliance costs; consequently it becomes economically viable to form contracts over numerous low-value transactions.”.[[736]](#footnote-736) M. Kolvart, M. Poola and A. Rull (2016) define smart contract as an autonomous agent, a programmed functionality. These authors noticed that IT professionals view smart contracts differently than lawyers, treating them as free of any jurisdiction - while lawyers note that the grounds for putting contracts outside of any jurisdiction are simply not there.[[737]](#footnote-737) Another definition, from Andreas Sherborne, provides that smart contracts automatically execute coded contractual terms without requiring a lawyer, a central entity, a legal system or an outside authority, thus providing clarity, predictability, control mechanism and enabling easy enforcement.[[738]](#footnote-738) Some authors make distinction between smart contract code and smart legal contract, the latter depending on “legal, political and business institutions”.[[739]](#footnote-739) J. Czarnecki defines smart contract “as a legal bond that can function independently in the digital space, without the need to refer to the real world”.[[740]](#footnote-740) J. Goldenfein and A. Leiter define automated transactions (rather than smart contracts) as “as a means of exchanging value in which some dimension of the actual exchange is processed by a machine, without human intervention”.[[741]](#footnote-741) The authors point out that we are yet to see how legal systems react to the fact that transactions on the blockchain cannot be edited or deleted and how they address the need of having some kind of dispute resolution in place (arbitration courts an already tested and internationally regulated alternative to national courts, as suggested by the Mattereum White Paper). Goldenfein and Leiter also make the point that “[i]n many ways, [the] engineers are building the legal standards for engaging and transacting on these systems, and like many systems of standardization, their authorizing force is market dominance” and several blockchain initiatives are already “competing over the authority to shape the legal rules” - while jurisdictions, as Werbach (quoted therein) noted, are competing for the title of the leading jurisdiction for the crypto economy.

## 5.3. InterPlantery File System (IPFS)

“Distributed data storage is data stored among multiple devices rather than a single device.”[[742]](#footnote-742) “Distributed peer-to-peer (p2p) data storage is a type of distributed storage where data is shared among the nodes on a p2p network.”[[743]](#footnote-743) “The InterPlanetary File System (IPFS) is a project by Filecoin that enables distributed storage and transfer of files among nodes in a peer-to-peer network.”[[744]](#footnote-744) “In the IPFS, file storage is distributed among the nodes on the network such that each node has a chunk of the file data, thereby ensuring that no single node holds a complete copy of a file.”[[745]](#footnote-745) “To achieve the above, the IPFS implements a distributed hash table (DHT) that allows ‘any participating node to efficiently retrieve the value associated with a given key.’”[[746]](#footnote-746) “By relying on a p2p network, the DHT can scale to an ‘extremely large numbers of nodes and to handle continual node departures, arrivals and failures.’”[[747]](#footnote-747) “A major advantage of using the IPFS is that it ensures that a node requesting a file will receive it from the closest nodes storing the file, thereby making file retrieval faster.”[[748]](#footnote-748)

## 5.4. Data Oracles

Data oracles (“oracles”) are data providers, akin to application programming interfaces (APIs), that input external information into smart contracts on a blockchain.[[749]](#footnote-749) Oracles are very powerful because they not only control what information gets inputted into the blockchain, they also determine which functions a smart-contract will execute in response to the information.[[750]](#footnote-750)

## 5.5. Decentralized Applications (DApps)

Decentralized applications (commonly known as dApps or DApps, but for the purposes of this paper, DApp shall be used) are becoming increasingly popular in the blockchain ecosystem, and are deemed the biggest application of smart contract platforms such as Ethereum and EOS.[[751]](#footnote-751)

DApps are applications that run on peer-to-peer (P2P) computer networks, and for our purposes, applications that run on a blockchain P2P network.[[752]](#footnote-752) DApps provide several advantages over traditional web applications, such as decentralization (no single entity can shut it down) and open source (the source code is available to the public).[[753]](#footnote-753) Blockchain DApps, at least in their current form, are Web3-enabled websites (websites that interact with blockchains) that use smart contracts and the blockchain as a backend.[[754]](#footnote-754)

## 5.6. Non-fungible Tokens (NFTs)

Non-fungible[[755]](#footnote-755) tokens (NFTs) are unique tokens, commonly based on the ERC-721 standard, that have a “name, a description, and a URI.”[[756]](#footnote-756) The ERC-721 is a token standard on the Ethereum blockchain that “defines a minimum interface a smart contract must implement to allow unique tokens to be managed, owned, and traded.”[[757]](#footnote-757) NFTs are generally created for one-of-a-kind collectibles, and can represent anything ranging from art, in-game items, tickets, to even digital pets (e.g., CryptoKitties).[[758]](#footnote-758)

## 5.7. Application Programming Interface (API)

An application programming interface (API) is a software intermediary that allows interaction between two distinct software programs, i.e., how one software application can request another software application to provide a service.[[759]](#footnote-759)

In general, API often refers to web-based APIs, APIs that provide a connectivity interface for applications to communicate with servers over web protocols such as HTTP, and the use of JavaScript Object Notation (JSON) format.[[760]](#footnote-760)

For example, when an end user authenticates their identity on a software application via their Facebook profile or email address, they are utilizing an API that interfaces between the software application and Facebook or their email provider.[[761]](#footnote-761)

There are three types of APIs: 1) public; 2) private; and 3) partnership.[[762]](#footnote-762)

A public API is an API that is accessible to developers or the public (developers, startups, governments, etc.) on a free or structured freemium basis (e.g., a limited number of API calls per month).[[763]](#footnote-763) A private API is an API that is only used internally within an organization.[[764]](#footnote-764) A partner API is a platform-esque API that multiple organizations can integrate within their systems.[[765]](#footnote-765)

## 5.8. Cryptocurrency & Tokens

A cryptocurrency (also known as coins) is a digital token created on a blockchain, that is uncorrelated to any physical or virtual asset, that operates as a medium of exchange.[[766]](#footnote-766) Cryptocurrencies are generally the first tokens created on a blockchain, and rely on mining to secure transactions and control the creation of new units of the cryptocurrency.[[767]](#footnote-767)

A token is a digital token created on a blockchain, that is a digital representation of a real or virtual asset (e.g., a representation of a US dollar such as TrueUSD), or as a utility for a DApp (they behave similarly to gift cards).[[768]](#footnote-768)

Common token standards are ERC-20 and ERC-721 on the Ethereum blockchain.[[769]](#footnote-769)

## 5.9. Linked Data

Linked Data is a design approach to connect machine-readable, interlinked resources across the Semantic Web, i.e., the web of data, via technologies such as Uniform Resource Identifiers (URIs) and the Resource Description Framework (RDF).[[770]](#footnote-770)

The Semantic Web refers to an extended functionality of the WorldWideWeb where data is interlinked and machine-readable by adding additional data descriptors to existing content on the web.[[771]](#footnote-771) URIs are unique identifiers for any type of content or data utilizing a single global identification system.[[772]](#footnote-772) RDF is a model for data publishing and interchange developed by the WorldWideWeb Consortium (W3C).[[773]](#footnote-773) In RDF, all data is published in a database as a triplestore.[[774]](#footnote-774) Triplestores materialize the links between data through a subject, predicate (or verb) and object linked model (subject > predicate > object).[[775]](#footnote-775)

The four principles of Linked Data are:

* “Use URIs as names for things”;
* “Use HTTP URIs so that people ca look up these names”;
* “When someone looks up a URI, provide useful information, using standards (RDF, SPARQL)”;
* “Include links to other URIs so that they can discover more things.”[[776]](#footnote-776)

An example project working with Linked Data is SoLiD, another project by Sir Tim Berners Lee, in which the Linked Data approach defines the relationships among data by: 1) by having a uniform resource location (URL) for each piece of data, and 2) explicitly stating how each piece of data is related to each other.[[777]](#footnote-777)

## 5.10. Ricardian Contracts

Ricardian[[778]](#footnote-778) contracts are semi-automated, human- and machine-readable contracts that are expressed and executed as software, with the parties signing the contract via cryptographic signatures.[[779]](#footnote-779) Ricardian smart contracts were first conceptualized by Ian Grigg in 1995.[[780]](#footnote-780) Ricardian smart contracts utilize markup language for combining legal prose with machine-readable tags.[[781]](#footnote-781) The goal is to automate generally objective terms so that they may be performed by software programs, while leaving subjective language to be determined by the parties.[[782]](#footnote-782)

The Accord Project, OpenLaw, Clause, and other similar projects are developing software stacks and techno-legal standards for Ricardian contracts.[[783]](#footnote-783) With the emergence of such software, users will be able to draft legal prose in markup language that interacts with blockchains, the semantic web, and other software.[[784]](#footnote-784) Though these platforms are in their infancy, they represent the potential for Ricardian contracts to dramatically change contract management.[[785]](#footnote-785)

DocuSign, a member of the Ethereum Enterprise Alliance and the Accord project, has implemented two Ricardian contract-related services that interact with the Ethereum blockchain.[[786]](#footnote-786) The first service is a document verification service that allows anyone to verify a DocuSign agreement exists (or compare the authenticity of a copy of the agreement) via a hash of the original DocuSign agreement stored on the Ethereum blockchain.[[787]](#footnote-787) The second service is providing a Trust Service Provider model for projects that work on digital identity management to integrate their blockchain application with DocuSign’s platform.[[788]](#footnote-788)

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141. Reforming the contract because of an error or misstatement in the terms of the contract that was not agreed upon by the parties. [↑](#footnote-ref-141)
142. Restraining the other party from taking a course of action, such as violating a term or terms of the contract. [↑](#footnote-ref-142)
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229. Michèle Finck & Valentina Moscon, Copyright Law on Blockchains: Between New Forms of Rights Administration and Digital Rights Management 2.0, 81 (Dec. 20, 2018). [↑](#footnote-ref-229)
230. Machine-readable markup languages with their own syntax and semantic vocabulary that are often used to express the terms of licenses. [↑](#footnote-ref-230)
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237. Private ordering refers to the private sector’s usage of mechanisms to protect copyrightable materials.Alternative: Private ordering refers to the private sector’s usage of mechanisms separate from government legislationa dn regulation to protect copyrightable materials. [↑](#footnote-ref-237)
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242. The first sale of a copyrighted work exhausts the copyright holder's right to prevent further distribution of that copy. [↑](#footnote-ref-242)
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     evidencing creatorship and provenance authentication, registering and clearing IP rights; controlling and tracking the distribution of (un)registered IP; providing evidence of genuine and/or first use in trade and/or commerce; digital rights management (e.g. online music sites); establishing and enforcing IP agreements, licenses or exclusive distribution networks through smart contracts; and transmitting payments in real-time to IP owners”). [↑](#footnote-ref-296)
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350. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 31 - 33, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-350)
351. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 33, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-351)
352. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 34, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-352)
353. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 34, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-353)
354. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 37, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-354)
355. The fees charged to execute operations in the Ethereum Virtual Machine (EVM) and store data on the Ethereum blockchain. [↑](#footnote-ref-355)
356. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 38, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-356)
357. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 49, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-357)
358. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 49, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-358)
359. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 49 - 50, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-359)
360. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 49 - 50, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-360)
361. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 49 - 60, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-361)
362. This mapping is very interesting because it ensures that the contributors have all agreed on the registering the work before it is added to the database. Such an approach ensures that contributors are aware of registration and at least have some time to raise concerns or doubts before the work is officially accessible to third parties. before a work can be registered, but a problem that may arise here is that if there are joint owners, either of the joint owners has the right to upload without worrying about the other joint owner’s opinion on payment splits? [↑](#footnote-ref-362)
363. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 49 - 52, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-363)
364. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 53, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-364)
365. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 53, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-365)
366. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 53 - 56, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-366)
367. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 56, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-367)
368. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 56, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-368)
369. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 57, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-369)
370. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 58-59, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-370)
371. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 59, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-371)
372. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 60, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-372)
373. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 63, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-373)
374. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 63 - 64, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-374)
375. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 64, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-375)
376. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 64, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-376)
377. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 69 - 94, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-377)
378. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 70, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-378)
379. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 71, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-379)
380. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 74, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-380)
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382. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 80, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-382)
383. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 80, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-383)
384. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 87 - 94, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) (very good discussion of blockchain and the bitcoin protocol) [↑](#footnote-ref-384)
385. Alharby, Maher & van Moorsel, Aad. (2017). Blockchain Based Smart Contracts : A Systematic Mapping Study. 10.5121/csit.2017.71011. [↑](#footnote-ref-385)
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388. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 88, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) [↑](#footnote-ref-388)
389. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 88 - 89, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) [↑](#footnote-ref-389)
390. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 89 - 90, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) [↑](#footnote-ref-390)
391. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 89 - 90, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) [↑](#footnote-ref-391)
392. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 90, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) [↑](#footnote-ref-392)
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402. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 93, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) [↑](#footnote-ref-402)
403. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 94, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) [↑](#footnote-ref-403)
404. Andreas Fougner Engebretsen and Hallvard Kristoffer Boland Haugen, *The Music Industry on Blockchain Technology* 95 - 96, Norwegian University of Science and Technology, (Danilo Gligoroski, IIK & Chris Carr, IIK, Jun. 2018) [↑](#footnote-ref-404)
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406. Bill Rosenblatt & Digimarc Corporation, WATERMARKING TECHNOLOGY and Blockchains in the Music Industry (Digimarc Corporation), <https://www.digimarc.com/docs/default-source/digimarc-resources/whitepaper-blockchain-in-music-industry.pdf?sfvrsn=2> (last visited Jun. 2, 2019) [↑](#footnote-ref-406)
407. Unique identifiers commonly used to identify sound recordings and musical compositions. [↑](#footnote-ref-407)
408. Bill Rosenblatt & Digimarc Corporation, WATERMARKING TECHNOLOGY and Blockchains in the Music Industry 8 - 10 (Digimarc Corporation), <https://www.digimarc.com/docs/default-source/digimarc-resources/whitepaper-blockchain-in-music-industry.pdf?sfvrsn=2> (last visited Jun. 2, 2019) [↑](#footnote-ref-408)
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415. A special type of hash function that returns the same value for all inputs that sound the same to a human listener. [↑](#footnote-ref-415)
416. Bill Rosenblatt & Digimarc Corporation, WATERMARKING TECHNOLOGY and Blockchains in the Music Industry 13 - 14 (Digimarc Corporation), <https://www.digimarc.com/docs/default-source/digimarc-resources/whitepaper-blockchain-in-music-industry.pdf?sfvrsn=2> (last visited Jun. 2, 2019) [↑](#footnote-ref-416)
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418. “A digital audio watermark is a set of data embedded directly into audio in such a way as to be imperceptible to listeners.” [↑](#footnote-ref-418)
419. Bill Rosenblatt & Digimarc Corporation, WATERMARKING TECHNOLOGY and Blockchains in the Music Industry 14 (Digimarc Corporation), <https://www.digimarc.com/docs/default-source/digimarc-resources/whitepaper-blockchain-in-music-industry.pdf?sfvrsn=2> (last visited Jun. 2, 2019) [↑](#footnote-ref-419)
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427. Music not supplied through feeds from labels, aggregators or distributors to DSPs. [↑](#footnote-ref-427)
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432. Bill Rosenblatt & Digimarc Corporation, WATERMARKING TECHNOLOGY and Blockchains in the Music Industry 19 (Digimarc Corporation), <https://www.digimarc.com/docs/default-source/digimarc-resources/whitepaper-blockchain-in-music-industry.pdf?sfvrsn=2> (last visited Jun. 2, 2019) [↑](#footnote-ref-432)
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435. Bill Rosenblatt & Digimarc Corporation, WATERMARKING TECHNOLOGY and Blockchains in the Music Industry 19 (Digimarc Corporation), <https://www.digimarc.com/docs/default-source/digimarc-resources/whitepaper-blockchain-in-music-industry.pdf?sfvrsn=2> (last visited Jun. 2, 2019) [↑](#footnote-ref-435)
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439. Bill Rosenblatt & Digimarc Corporation, WATERMARKING TECHNOLOGY and Blockchains in the Music Industry 19-20 (Digimarc Corporation), <https://www.digimarc.com/docs/default-source/digimarc-resources/whitepaper-blockchain-in-music-industry.pdf?sfvrsn=2> (last visited Jun. 2, 2019) (*See Figure 8*). [↑](#footnote-ref-439)
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604. 722 F.3d 591, 600 (4th Cir. 2013) (“Courts have elaborated that a qualifying writing under Section 204(a) need not contain an elaborate explanation nor any particular “magic words,” *Radio Television Espanola S.A. v. New World Entm't, Ltd.,* [183 F.3d 922, 927](https://casetext.com/case/radio-television-espanola-v-new-world-ent#p927) (9th Cir.1999), but must simply “show an agreement to transfer copyright.” *Lyrick Studios,* [420 F.3d at 392](https://casetext.com/case/lyrick-studios-inc-v-big-idea-productions#p392) (citation omitted). ”) [↑](#footnote-ref-604)
605. *Metro. Reg'l Info. Sys., Inc. v. Am. Home Realty Network, Inc.*, 722 F.3d 591, 600 (4th Cir. 2013) [↑](#footnote-ref-605)
606. *Metro. Reg'l Info. Sys., Inc. v. Am. Home Realty Network, Inc.*, 722 F.3d 591 (4th Cir. 2013). [↑](#footnote-ref-606)
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609. *Metro. Reg'l Info. Sys., Inc. v. Am. Home Realty Network, Inc.*, 722 F.3d 591, 601 (4th Cir. 2013) (“Agreements to transfer exclusive rights of copyright ownership are not included in these exceptions.”) [↑](#footnote-ref-609)
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