

## Association for Information Systems AIS Electronic Library (AISeL)

---

Research Papers

ECIS 2019 Proceedings

---

5-15-2019

# TUNING INTO BLOCKCHAIN: CHALLENGES AND OPPORTUNITIES OF BLOCKCHAIN-BASED MUSIC PLATFORMS

Alexandra Cecilie Gjør Torbensen  
*IT University of Copenhagen, alto@itu.dk*

Raffaele Fabio Ciriello  
*IT University of Copenhagen, raci@itu.dk*

Follow this and additional works at: [https://aisel.aisnet.org/ecis2019\\_rp](https://aisel.aisnet.org/ecis2019_rp)

---

### Recommended Citation

Torbensen, Alexandra Cecilie Gjør and Ciriello, Raffaele Fabio, (2019). "TUNING INTO BLOCKCHAIN: CHALLENGES AND OPPORTUNITIES OF BLOCKCHAIN-BASED MUSIC PLATFORMS". In Proceedings of the 27th European Conference on Information Systems (ECIS), Stockholm & Uppsala, Sweden, June 8-14, 2019. ISBN 978-1-7336325-0-8 Research Papers.  
[https://aisel.aisnet.org/ecis2019\\_rp/62](https://aisel.aisnet.org/ecis2019_rp/62)

This material is brought to you by the ECIS 2019 Proceedings at AIS Electronic Library (AISeL). It has been accepted for inclusion in Research Papers by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact [elibrary@aisnet.org](mailto:elibrary@aisnet.org).

# TUNING INTO BLOCKCHAIN: CHALLENGES AND OPPORTUNITIES OF BLOCKCHAIN- BASED MUSIC PLATFORMS

*Research paper*

Torbensen, Alexandra Cecilie Gjøøl, IT University of Copenhagen, Denmark, alto@itu.dk  
Ciriello, Raffaele Fabio, IT University of Copenhagen, Denmark, raci@itu.dk

## Abstract

*Blockchain technology is an intensely discussed enabler of large-scale societal and economic change, but the circumstances under which different industries succeed or fail in implementing blockchain are not yet sufficiently understood. One example is the music industry, in which the promise of blockchain is not yet fulfilled, despite a growing number of ambitious blockchain providers. This paper explores the challenges and opportunities of blockchain-based music platforms. Grounded in an exploratory qualitative case study within the music industry at seven organizations and related literature, we identify three main challenges for digital music business, namely: 1) Inconsistent and incomplete music metadata, 2) Historically grown complex licensing structures, and 3) Inefficient and non-transparent royalty payouts. We provide insight into how blockchain may address these challenges by means of a decentralized global song database that allows for automatic royalty payouts. Our results inform researchers and practitioners how the music industry may create value from blockchain-based music platforms. We offer a nuanced and balanced view on value creation with blockchain and outline a path for further research and development on blockchain-based solutions for the music industry.*

*Keywords: Blockchain, Use case, Business Model, Value, Music, Innovation, Case Study.*

## 1 Introduction

Many organizations face an increased pressure to keep up with the technological changes and digital demands of the consumer in order to stay relevant in today's rapidly evolving world. One example is the music industry, on which the ongoing digital transformation has had a drastic impact in recent years. The ease of which music can be shared and streamed online has radically changed the stakeholder landscape in the music industry (Crosby et al., 2016). With the large-scale migration from physical formats, such as CD, to online streaming services come also major challenges for artists, labels, publishers, songwriters and streaming service providers to keep up with the effects this has on royalty payout, licensing, and metadata management.

The music industry faces increased demand for streaming services, implying a growing need to reevaluate existing processes and business models. Simultaneously, new technological developments offer vast opportunities for creating new digital business models. Blockchain technology, in particular, has been recognized as a promising enabler of large-scale societal and economic change (Beck, 2018). Since 2008 the possibilities of blockchain technology have been widely postulated as having the potential to disrupt business models as well as value chains within many industries, e.g., Fintech, health care, arts, and music (De León and Gupta, 2017).

In this paper, we explore the challenges and opportunities of blockchain technology in relation to the music industry. The ongoing discourse surrounding blockchain in the music industry tends to fall into two polarized camps, namely enthusiastic optimists or skeptical pessimists. Thus, our aim is to provide a reflective and informed perspective on value creation with blockchain, which is why we raise and address the guiding research question:

**RQ:** *How can the music industry create value with blockchain technology?*

The contribution of this paper is twofold. Firstly, based on a qualitative case study in seven music organizations and related literature, we provide rich insight into the current practice of collecting as well as storing royalties and rights data. We also allude to improvement potential through the use of blockchain technology. Further, we examine whether blockchain may aid in defining relationships between different stakeholders and automate their interactions, with much-needed transparency and trust (Crosby et al., 2016). Secondly, we provide a nuanced and balanced view on how the music industry may create value through the use of blockchain technology. We critically reflect on how the music industry may benefit from a global decentralized song database that permits cryptocurrency to flow and transactions to be recorded in an immutable and transparent way.

The remainder of this paper is structured as follows. The literature review in section 2 summarizes the characteristics of blockchain technology and how it enables value creation in different industries. Next, we present our research approach and our qualitative case study in seven organizations. Section 4 presents the results of our study. Subsequently, we provide a forward-looking critical assessment of the challenges and opportunities of blockchain for the music industry in section 5. The paper concludes by summing up the key takeaways of the study as well as outlining a path for further research.

## **2 Literature Background**

### **2.1 Characteristics of blockchain technology**

Blockchain technology has gone a long way since an anonymous individual or a group of people under the pseudonym Satoshi Nakamoto released the Bitcoin white paper in 2008 (Nakamoto, 2008). A blockchain consists of a virtual chain of blocks, each of which contains a unique identifier (called hash) as well as information such as monetary transactions, contracts, or other documents. A blockchain runs on an intermediary-free distributed network of computers (called nodes) who collectively validate the information going into the block. Reaching a consensus of what information to place in the block is necessary to minimize the possibility of accepting incorrect information, as the majority of nodes would reject the block without the need for a central entity (Peters and Panayi, 2016). A malicious actor who tries to override the blockchain would require a significant amount of computational power, which in theory is possible but with today's technology considered prohibitively expensive. Due to this distributed network of trusted nodes, the blockchain technology eliminates the need for a third-party intermediary to validate peer-to-peer transactions, thereby enabling secure and transparent transactions operating on a decentralized network (Samelson, 2017). However, depending on the underlying mechanisms for consensus and governance, blockchains can be very resource-consuming and energy-intensive, and many blockchains have limited scalability and fault tolerance (Zhao, 2018).

### **2.2 Value creation with blockchain technology**

Bitcoin became one of the first and most widely known instantiations of a blockchain-based payment system but its underlying blockchain technology enables an array of applications aside from payments (Beck, 2018). Blockchains use smart contracts to execute decentralized governance within distributed user communities to manage and reward content creation, curation, and consumption (Ciriello et al., 2018a). Smart contracts allow for the protection of individual property rights, enforcement of revenue streams, and resolution of network issues via a voting mechanism without depending on central authorities (Beck et al., 2018). Being essentially a multipurpose technology, blockchain enables vast opportunities for value creation and social business via business rules embedded in smart contracts, providing decentralized platform infrastructures, replacing intermediaries, lowering transaction cost, and storing records of value transfer on a replicated, immutable ledger (Schweizer et al., 2017).

Blockchains are capable of engendering new economic systems that allow for new forms of organizational design – so-called decentralized autonomous organizations – in which decision rights, accountability, and incentives are embedded in governance rules specified in the blockchain (Beck et al., 2018). Many organizations in several industries have started to experiment with the potentials of blockchain for value creation. Promising industries that could benefit from blockchain-enabled value

creation include logistics (Nærland et al., 2017), automotive (Bauer et al., 2019), software (Ciriello et al., 2018b), banking and finance (Peters and Panayi, 2016), and social media (Ciriello et al., 2018a).

In content-creating industries, such as the music industry, blockchain technology makes it possible to track and collect royalty income and payout, potentially increasing the scalability of the licensing process through smart contracts, automated and intermediary-free royalty payouts, and micropayments via cryptocurrency, as well as the possibility to detect metadata discrepancies. Various startups have already initiated blockchain-based solutions for the music industry. For instance, Spotify acquired the blockchain startup Mediachain in 2017 to improve royalty payout via an authoritative database covering all existing music rights (Perez, 2017). Whether or not these will fulfill the potential of blockchain technology remains to be seen. Thus, the aim of this paper is to provide a forward-looking critical assessment of the challenges and opportunities for the music industry to adopt blockchain technology.

### 3 Research Method

As we study the subjective values, beliefs, and meanings people assign to blockchain technology in the music industry, we utilize qualitative research methods, which “are designed to help researchers understand people and the social and cultural contexts within which they live” (Myers, 1997, p. 3). We are guided by the principles of interpretive field studies, which postulate that “our knowledge of reality is gained only through social constructions such a language, consciousness, shared meanings, documents, tools, and other artifacts.” (Klein and Myers, 1999, p. 69). Our approach to data collection follows the logic of exploration, which is useful when the goal of an investigation is to obtain a qualified conceptualization of an emerging phenomenon (Olsen, 2018), such as blockchain. This approach allows researchers to be open to new information and perspectives (Kvale and Brinkmann, 2009).

We started with a literature review to provide orienting frameworks for data collection and analysis in a subsequent theory-generating study (Vom Brocke et al., 2015). We followed Boell and Cecez-Kecmanovic's (2014) hermeneutic framework to structure the search, acquisition, analysis, and synthesis of literature. We searched for relevant literature on Scopus and Google Scholar and selected relevant literature through orientational reading, i.e. glancing through identified texts to gain an overall impression. Furthermore, we utilized the method of snowballing as a time-efficient way of finding relevant literature. The outcome of the literature review is presented in section 4.1.

#### 3.1 Sampling strategy and presentation of cases

Since the reviewed literature suggests that many different stakeholders are involved in the music industry's challenges, which blockchain technology has the potential to mitigate, we chose a diverse sample (Koerber and McMichael, 2008). Using purposive sampling (Tongco, 2007), we selected the case organizations based on where the related literature indicated that the phenomenon in question could be observed. This led us to select seven organizations in the UK, US, Canada, Finland, and Denmark, with representatives from the established music industry as well as emerging blockchain start-ups. We first chose different representatives of the music industry to obtain an in-depth understanding of the current structure and associated challenges. These included a Collecting Society, a Performance Rights Organization, a Music Manager, a Musician and a Digital Rights and Licensing Platform. Additionally, we selected two blockchain organizations, one of them trying to use blockchain to support the current establishment and another one trying to disrupt the current structure altogether. We introduce the organizations in the following using pseudonyms as per their wish to remain anonymous.

*ABC* is a collecting society, which serves the music copyright societies and their members ensuring that money is collected and distributed to the rights holders on behalf of the music copyright societies. When accommodating the offline market, *ABC* guarantees the collection and payout of royalty when selling CDs and DVDs. When ensuring collection and payout of the online market, *ABC* ensures digital service providers (DSP) are invoiced, so the rights holders get paid when their music is used online. We chose *ABC* to obtain insight into the current challenges of the music industry.

*Sound* is a digital rights and licensing platform ensuring remuneration from YouTube content. *Sound* builds system interfaces to the various DSPs identifying customers repertoire, collecting and distrib-

uting royalties. Furthermore, they offer users the possibility to use pre-cleared licensed music in their video, thereby enabling them to legally share this content with all DSPs while allowing for remuneration within a month from usage. We chose Sound to explore new modes of work in the music industry.

*Nuotit* is a non-profit performance rights organization (PRO) that collects and distributes royalties on behalf of composers, publishers, musicians, and arrangers. Nuotit represents the public performance and the mechanical reproduction of their customers' music. Furthermore, Nuotit functions as an intermediary between composers and companies providing music licenses to said. We chose Nuotit to obtain insights into the current challenges and explore the potentials of blockchain technology, which they are currently evaluating to counter said challenges.

*AUX* is a startup focused on creating a blockchain that will allow the music and media industry to collaborate on a global view of content ownership and rights. Through the creation of a shared metadata repository, AUX's goal is to create an aggregated single point of reference to know who owns different content within the music industry, thereby simplifying the licensing process. We chose AUX to get insights into possibilities to incrementally improve the current industry structures with blockchain.

*Voix* is a startup that has created smart contracts, based on the Ethereum blockchain, for transactions, focused on P2P music sharing between artists and consumers. Voix develops a platform that, through the use of their cryptocurrency, can provide artists with 100% of their royalty payouts. We chose Voix to get insights into the possibilities of blockchain technology to radically disrupt the music industry.

In addition, we selected an *Indie Musician*, who has been in the industry for 10 years, publishing 15 EP's, singles and albums as well as starting two of his own labels. He provided an insight into the challenges artists perceive in the music industry. We also selected a *Music Manager* who worked for a major label to obtain insights into challenges within established firms from a managerial perspective.

### 3.2 Data collection

Data collection proceeded between March and April 2018. Figure 1 provides an overview of how the analytical process unfolded from data collection over data analysis to the integration into findings. Our primary data sources were interviews, observations, and archival documents, as these allow access to the different perceptions and interpretations of participants (Klein and Myers, 1999).

The first author of the paper was the primary responsible for collecting all data to ensure consistency of the process. She engaged with the case organizations as an outside observer who, having no direct personal stake in the interpretations and outcomes of the data, could access the different views of the participants through interviews, with participants being more likely to be honest and frank about their views (Walsham, 1995). By interviewing people in different roles, we could obtain a diverse picture and provide contextual, nuanced and authentic accounts of the various worldviews (Schultze and Avital, 2011). Using a semi-structured interview guideline provided a framework to structure the conversation in a way that guided participants through their introspective journey while honoring their freedom of thought and expression (Schultze and Avital, 2011). Furthermore, using laddering interview techniques allowed the participants to draw on experience while also allowing the interviewer to ask questions on the participants' social world and the enclosed meaning (Schultze and Avital, 2011).

In all, we conducted ten interviews ranging from 30 to 90 minutes, out of which two were via phone, two via video call, and six in person. The participant's roles were two executive board members, a business expert, and a general manager at ABC, one executive manager each at Nuotit, Voix, and AUX, a business expert at Sound, an independent musician, and an independent music manager.

In addition, we conducted observations of the internal processes and collected archival documents (e.g. graphical overview of the licensing process, presentations on metadata from *Sound* and *ABC*), to get insight into music licensing, the current structure in the music industry, and existing standards.

### 3.3 Data analysis and interpretation

We took an inductive data analysis approach, departing in the empirical data and deriving patterns to analyze the challenges and opportunities of blockchain technology in the music industry. We tran-

scribed the interviews using a denaturalized approach, which focuses on the substance of the meanings and perceptions provided in the interview rather than depicting accents or involuntary vocalization (Oliver et al., 2005). After crosschecking the transcriptions, we engaged in open coding by focusing on the level of meaning to detect common patterns in the data (DeCuir-Gunby et al., 2011). In an iterative matter, we created and refined data-driven codes as concepts became clearer through various iterations between the interviews, creating subsample themes and comparing the themes with each other (DeCuir-Gunby et al., 2011). This led us to generate fifteen tentative categories, namely *metadata, data exchange, inefficiencies, long lead time, royalty payout, lack of transparency, need for collaboration, politics, regulations, question of ownership, licensing process, possibilities and limitations of blockchain, ideals, and imagined future.*

In a subsequent step, we re-analyzed the open codes through the process of axial coding, which enabled us to identify connections that existed between the codes (DeCuir-Gunby et al., 2011). Thereby, we linked the open codes to two axial codes, namely *current digital challenges in the music industry,* and *challenges and opportunities for blockchain-based music platforms.* The right-hand side of figure 1 illustrates the connections made between the open and axial codes and further how these relate to the findings, which we present in the following section.

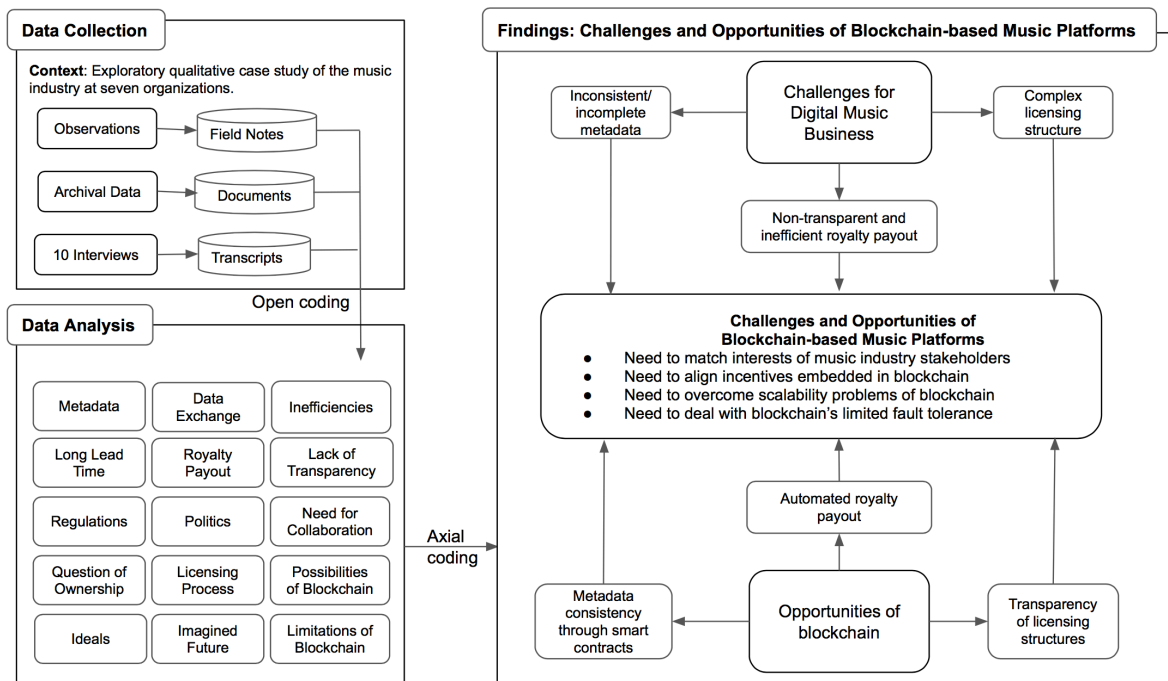


Figure 1. Overview of analytical process and findings (own illustration).

## 4 Results

### 4.1 Literature review on the status quo of the music industry

With the digital transformation, due to the internet and related technologies, the music industry has faced various changes in recent years, as music has become more readily available through streaming services that are satisfying on-demand needs (Crosby et al., 2016; De León and Gupta, 2017; Graham et al., 2004; Warr and Goode, 2011). However, the handling of copyrights, licenses, and royalty payouts still largely follows the outdated structures of the pre-digital era, resulting in increasingly complex revenue streams, lack of transparency, incomplete and inconsistent data, and a lack of compensation for the majority of artists and composers (De León and Gupta, 2017; O’Dair, 2016). Figure 2 provides an overview of the different stakeholders, rights, and licenses involved.

Whenever a song is created, we can broadly distinguish two copyrights that are tied to it: recording rights and composition rights. Publishers control composition rights whereas recording rights remain

with a record label who typically also owns the master recording. The publisher and label need to register the rights with a Performance Rights Organization (PRO), such as PRS in the UK, GEMA in Germany, or Koda and Gramex in Denmark, who administers the rights and collects royalty payouts from various digital service providers (DSP), such as iTunes, Spotify, or YouTube, in order to ensure remuneration of the rights holders. The fact that royalty payouts work quite differently for recording and composition rights adds further complexity to the process. Recording and composition rights may have two different PRO representatives. Additionally, the PRO assigns an International Standard Recording Code (ISRC) to the recording right and an International Standard Musical Work Code (ISWC) to the composition right. In some countries, those codes are assigned by two different PROs (e.g. Denmark), in other countries one PRO assigns both codes (Beaumont-Thomas and Rushe, 2018).

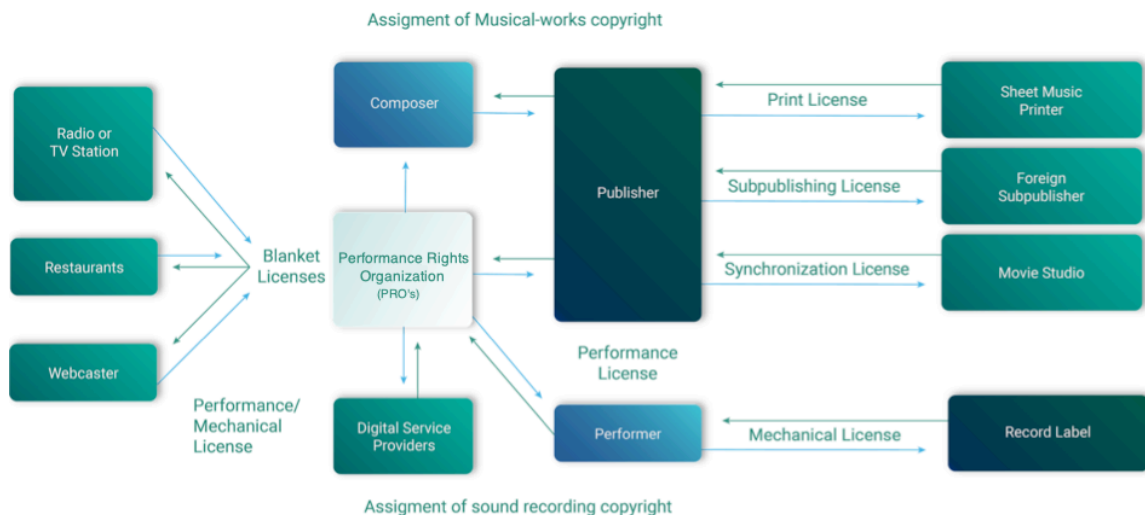


Figure 2. Copyright assignment of musical works and sound recordings (own illustration based on De Leon and Gupta, 2017).

As PROs represent a wide range of artists, they can enlist the help of a back-office royalty collecting and payout agency, working on behalf of the PROs, receiving usage files from DSP, calculating the royalty payout and providing both the PROs and the DSPs with this information allowing for artist compensation. The DSPs need to obtain different licenses from PROs to be able to offer music through their platforms, both for streaming and downloading, which involves both a mechanical license to account for downloading and a performance license for streaming services. If a DSP allows users the possibility of downloading music to their phone, this is a copy of the music, and thereby the DSP would need to obtain a mechanical license. However, as users can stream the song without downloading it, the DSP will also need to apply for a performance license and agree on a percentage split between the two licenses. Additionally, direct licensing allows DSPs to enter into a bilateral agreement with labels, bypassing collecting societies and PROs to save fees (Pitt, 2016). However, this direct licensing agreement can result in less compensation for the composers, as they are usually not tied to a specific song but an entire catalogue, leaving the composition right unallocated. Furthermore, copyright law states that any remuneration from unallocated advances goes to the artist rather than the composer (Gordon, 2011).

It is also possible to bypass labels and publishers through the use of digital aggregators, such as AWAL and Kobalt, who allow artists to retain ownership of their master recording and receive royalty payout by distributing their works through digital stores and streaming platforms. However, as 37% of musicians are signed to record label deals that do not consider digital revenues (Cooke, 2015), it becomes hard to remunerate these artists in a way that reflects the online streaming structures. Additionally, DSPs are not legally responsible for the uploading of unlicensed content by their users, provided they either compensate the rights holders or remove content when it is found to be infringing (Beard et al., 2017). However, studies show that DSPs fail to recognize two out of five infringements (Kostaras, 2016), resulting in a music industry revenue loss of over one billion US dollars a year in the US alone

(Beard et al., 2017). This incongruity between the value online services extract from music and the revenue returned to the music community became known as the ‘value gap’ (GMR, 2018).

In the licensing process, metadata is of paramount importance as it outlines split deals between different entities. This large body of data is known as the performance rights metadata, which may include song title, performing artist, year of release, composer, producer, publisher, physical retailers, DSPs, PROs, and record label (Brooke, 2014). It is of paramount importance to organize performance rights data in a way that enables easy access for relevant parties who are involved in the royalty payout process (Brooke, 2014). This was relatively easy in the age of the CD, where all artist and composer data had to be in place before the CD could be produced, allowing for a complete works database. Nowadays a song can be uploaded to different DSPs within minutes without entering the complete metadata into the works databases, resulting in a lack of remuneration when PROs and collecting societies cannot match the streamed song to the respective rights. Additionally, a PRO typically receives metadata from the composers and artists and then enters it into their system manually, allowing for human error. An example of this is the composer Tchaikovsky, whose name is spelled in over 70 different ways in the various works databases (MusicBrainz, 2018). This lack of accurate metadata means that about 25% of revenues do not make it to their rightful owners (Molinder, 2018).

The Global Repertoire Database (GRD), a recent initiative by the European Union involving organizations such as Apple, Amazon, Google, various collective management organizations, and music publishers, attempted to counter this problem through a single, shared, standardized music database with a global view of the rights ownership for the world's musical works. The GRD failed in 2014 due to financial backing after the collecting societies withdrew their support (Creative Industries, 2014; Edwards, 2016). In 2016, the Swedish-based ICE started working towards a shared works database, offering online matching of works as well as providing multi-territory licenses from eight collecting societies in Europe (ICERights, 2018). Other works databases include MusicBrainz, Gracenote, AMG, The Echo Nest, and Discogs, which all offer API access for organizations to tap into and utilize the data (Brooke, 2014). However, as none of these works databases offer a global repertoire, having to tap into many siloed databases increases the risk of inconsistent and incomplete data (O’Dair, 2016). It becomes evident that this is part of a more significant issue that relates to the lack of standards enabling the exchange of metadata through and across the digital supply chain (Penick, 2016).

In essence, the music industry has not yet been able to keep pace with the digital transformation, resulting in a lack of standards for handling metadata that allows for inconsistent and incomplete performance rights metadata, leading to long lead times or even lack of royalty payouts and complex licensing structures that have a high margin.

## 4.2 Challenges for digital music business: Metadata, licensing, and payout

*1) Inconsistent and incomplete metadata:* As we learned from our qualitative case study, inconsistent and incomplete metadata is a pervasive problem with far-reaching consequences. Human errors result from manually entering the data into siloed databases that are spread across multiple organizations. This makes it very difficult to correct metadata (e.g. wrong spelling) because there is no single point of truth nor a universally agreed upon standard for handling that data. Several participants explain that the music industry lacks metadata standards, on which other industries depend:

*“It is still very unstructured. [The music industry] is built on the ideas that you take the old world and make it digital but through the same standards. And this is where the challenges occur. [...] You need to be sure what is actually being played and this requires very good data”* (Translated from I5, Executive Manager, ABC, DK).

*“One of the biggest problems within the industry is that the work information and the actual recording information are not connected. There is a metadata problem. The music industry lacks standards that would make the business more powerful.”* (I7, Executive manager, Nuotit, FIN).

In addition to typing errors, poor quality metadata can also result from rights owners not revealing their share of a composition or recording accurately or, conversely, claiming rights to compositions or recordings that they do not actually own. This also happens frequently after a company merger or ac-



quisition, whereby the metadata is often forgotten or not transferred correctly and completely. As one participant explains:

*“[In the] streaming top 100, there are 5 million reported tracks, [...] 42% [of them] are missing composer/author titles. Metadata is a problem of the major labels and the major publishers. [...] A third of all commercially relevant tracks still have no Composer/Author information.”* (I4, Business Expert, Sound, DK).

Without an industry-wide collaboration towards metadata standards, the metadata problem is likely to prevail, often leaving artists and composers empty-handed. Unfortunately, uncertainty about the responsibilities and governance of a global system pose barriers to such an industry-wide collaboration, as expressed by several participants:

*“New technology is great but who is going to pay for it? [...] Is it the studio’s responsibility to take a note when they do the master recording and send it to the label and then they send it throughout aggregators? Is it the PPL societies? I mean who has that [responsibility]? We don’t know. [...] How do they grab that data and how do they transmit it? That’s the big question.”* (I4, Business Expert, Sound, DK).

*“Who should control this system, [...], and who will benefit most from it?”* (I2, Business Expert, ABC, DK).

This lack of cooperation standards seems to be a remnant of the pre-digital mode of operation. In the time of the CD, metadata had to be in place before anyone would release an album, ensuring that all relevant parties provided the necessary information. Now that a song can be uploaded to a DSP within minutes, the metadata is often incomplete or not provided at all.

2) *Complex licensing structures:* As we also learned from our study, inconsistent and incomplete metadata is just one major problem next to the historically grown complex licensing structures. Again, licensing was straightforward in the age of the CD, where the compensation would relate to the amount of sold CDs. But in the online world, artist compensation is calculated on a per stream basis creating substantially larger data files for processing. This has created a demand for better IT systems within the collecting societies and additionally made the matching process more resource-consuming. As one participant explains:

*“It’s always two challenges that have been on the market since online began: [...] volume and the complexity of direct licensing. [...] There are 10 other units who are doing the same, so we are taking the same file, multiplying 15 times and having the 15 servers doing that [processing] in order to find our different parts and bits that we want to invoice.”* (I2, Business Expert, ABC, DK).

The structures for sharing the files are often outdated. Sending data files back and forth between different societies and countries as well as having multiple organizations working on the same data file is a vestige from the past structure of the music industry:

*“You have 20 different societies in Europe processing exactly the same data from all over Europe plus 10-15 publishers. [...] That means that the same amount of data is being transported every month [multiple] times, instead of just having one repository that you query every time you get something new, so there is a lot of overhead* (I4, Business Expert, Sound, DK).

These outdated structures are preventing the music industry from advancing into a more structured and collaborative whole, working together to create a global solution:

*“I don’t see [the music industry] growing with the amounts of bad data and enormous data files.”* (Translated from I5, Executive Manager, ABC, DK).

3) *Non-transparent and inefficient royalty payout:* The above-described challenges of metadata and licensing structures often also bring about a non-transparent and inefficient royalty payout for artists. If metadata is insufficient and does not state explicitly who should receive compensation, the wrong people might be paid, or no one gets paid at all. As one participant explains:

*"We also have a lot of repertoires not being paid for - royalties not being paid out because the work documentation is not sufficient. [...] When we receive a usage report, we cannot identify all the lines in the report correctly."* (I6, General Manager, ABC, DK).

Furthermore, as different organizations tap into different databases, they each lack the complete repertoire picture. As a result, data (and money) is restricted and contained within various organizations. In addition, the manual handling of data is disposed to human error. Music managers need to send their data to different entities who all manually input the data in their respective system:

*"There is a lot of room for error. Even though we spend so much time to register our albums [...] it just doesn't get shared. You know someone is getting a list and they are typing it off, which for me is just completely insane."* (I3, Music Manager, Independent, DK).

*"[It is] usually the youngest interns [entering the data], who don't know what they're doing."* (I4, Business Expert, Sound, DK).

### 4.3 Challenges and opportunities of blockchain-based music platforms

During our interviews, it became evident that digital ways of music consumption require digital ways of compensating artists and composers. Blockchain technology can facilitate that in multiple ways, as one participant explains:

*"There are four different [blockchain] use cases I can think of. The first one is for the ticketing industry. Then there are the ones doing artist coins, like a Bowie bond. The third one is startups who are trying to do a new streaming solution where artists can create their own streaming services. And we are building infrastructure."* (I1, Executive manager, AUX, UK).

These four use cases – ticket sales, cryptocurrency enabled music platforms, blockchain powered streaming startups, and providing an infrastructure for decentralized music business – can further be divided into two kinds. Some startups want to use blockchain to disrupt the music industry by creating entirely new blockchain-based streaming platforms with concomitant cryptocurrency meant to allow artists to function as their own publisher, label, and collecting society. These startups envision blockchain as a means to redistribute power to the artists. Other startups see the value in the current structures and thus believe that innovation should come from within the current structure, using blockchain as a means to optimize existing processes incrementally. As a participant explains:

*"There are other blockchain music startups who are only working with unsigned acts to try and build out something that is fresh from the beginning, whereas our strategy is to work with the biggest music industry companies. We believe we need to work with the biggest in the industry to actually make this a viable business."* (I1, Executive manager, AUX, UK).

Digital aggregators and digital labels provide the artists with the opportunity to both offer their music on traditional DSPs as well as through new blockchain powered platforms. These platforms make it possible to leave one record label for another by allowing artists to forgo long-term contracts and release music on their own terms. As a result, artists do not have to release a certain number of albums on one label and contracts do not keep them tied to one label or publisher. As two participants explain:

*"[Platforms like] Kobalt and AWAL have been challenging the big labels. [Being able] to do label deals with a commitment of two months is insane in a very good way. I don't think they will remove [labels and publishers] but they will challenge them a lot because [they are] both doing publishing, neighboring rights, and recordings now and you can pick and choose."* (I3, Music manager, Independent, DK).

*"The artists are ready to move on [from the current structure], because of the sheer amount of labels that are being created every year."* (I9, Executive manager, Voix, CAN).

Other participants envision that, through blockchain, it will eventually be possible to eliminate intermediaries entirely, giving back the power to the artists and their supporters:

*"We want to put the power in the artist's hands. We want to create a network of fellow artists, sound people, people that work in media creation making music videos. So that's basically what we are try-*

*ing to do: create a community of artists and their support system.*" (I9, Executive manager, Voix, CAN).

While such platforms sound promising, the question remains whether artists would actually be willing to use them. As our data shows, not all musicians are willing or able to cope with the work that comes after the recording of the music:

*"I put all my albums out on the label because, to be frank, I don't want to deal with any of that stuff. When the record is done and turned in, it's their job."* (I8, Musician, Independent, US).

Against this backdrop, it seems unlikely that the music industry will be decentralized entirely because the major labels and publishers are still seen as value-adding intermediaries. Several participants are skeptical about blockchain and decentralization, as one participant explains:

*"I think it's naive to think [...] that we will have no middlemen because those middlemen actually provide value. A songwriter doesn't want to do accounting or their own marketing. All these services should be done by somebody who can allow the creator to just create."* (I1, Executive Manager, AUX, UK).

In addition, blockchain technology is still in its infancy and there are a number of issues that hinder the creation of a global music platform:

*"Blockchain has some major scaling issues, which need to be addressed. We can't fully distribute content on the blockchain right now."* (I9, Executive manager, Voix, CAN).

1) *Metadata consistency through smart contracts:* Regarding the above-mentioned metadata problems, which blockchain could technically handle, a central question is where the metadata would come from and who would enter it into the platform. A blockchain-based music platform without comprehensive data would not be very useful. As all music metadata today is spread across different organizations in different databases, integrating all these datasets into one platform is a tremendous challenge, especially for older music that has already been released through a label or publisher. As several participants explain:

*"But for a platform, you also need the data and that's one of the problems. They don't have the data, they only have a platform and that's why they need to interact with the existing players who eventually have the data."* (I7, Executive manager, Nuotit, FIN).

*"You need to go to each rights holder to be able to license their content so if you are a young app developer and you want to create something that is legal, and you want to have content, then you have to get every single one."* (I1, Executive Manager, AUX, UK).

However, one participant also suggests that a shared platform for handling music metadata would be highly desirable:

*"If everybody could share their information into the same engine it would make everybody's life much easier."* (I3, Music manager, Independent, DK).

For this to happen, major labels would need to be willing to license out their music repertoire to the blockchain-based music platform, which seems unlikely without them charging a considerable fee. The platform would then have to pass on the fee to consumers or artists, limiting the economic advantage over the current situation. Hence, some blockchain startups aim at creating interfaces to aggregate metadata and make the complex licensing structures more transparent via smart contracts:

*"The vast majority of conflicts are due to errors and missing data. So, what [our platform] will do is [to] aggregate everyone's data so hopefully the impact of missing data will be a lot less but also it will be able to highlight areas where there are doubts so people can come in and fix it."* (I1, Executive Manager, AUX, UK).

2) *Automated royalty payout:* Blockchain could also help address the issue of inefficient and non-transparent royalty payouts. Once a blockchain-based music platform would have the necessary metadata, payout processes could simply be automated via smart contracts with transparent business logic. As several participants explain:

"Right now, you still have a stage period. You wait some time, you make an invoice. So, you are not close to having this in real time, but [...] I think that's where blockchain is the option." (I6, General Manager, ABC, DK).

"For me, this is what could make it beneficial to have one [decentralized database], where the artists would register their data and have control of that data and this is what you would integrate into when you need to payout royalties. [...] The artists get more transparency in regard to their data uploaded there." (Translated from I5, Executive Manager, ABC, DK).

3) *Transparency of licensing structures*: Although some participants ask for more transparency, others are more critical about said, as the transparency of a public blockchain would also allow everyone to see contractual details:

"Everybody who owns anything would have to put it in commercial terms in that block. Now, part of being a competitor in the music industry is trying to get as much repertoire as you can and then get the best possible deal for that repertoire. Now, that's part of your f\*\*\*ing business secret. I am not going to put publicly into a blockchain what I have been able to negotiate for my repertoire. That's my business, why would I put it in there for everyone to see?" (I4, Business Expert, Sound, DK).

Other participants support that argument and argue that a blockchain-based music platform would have to find the right balance between transparency and discretion:

"If you make it completely open who owns what and your deals with the rights owner, then it becomes very easy for others to come in and provide an offer and steal that business. [...] I know that there were some ideas in relation to a closed blockchain, which might be something to start out with, [but then] you create intransparency again (Translated from I5, Executive Manager, ABC, DK).

"I would love to have a system where I could upload [the data] and it was registered and I could have my back free and be like 'okay, I have done my part of the job, now guys please tap into this and share this information in a safe way'. It should only be me and maybe a few other people who I said can go in and edit but no one else." (I3, Music manager, Independent, DK).

## 5 Discussion

In this study, it became evident that the ongoing digital transformation poses significant challenges to the music industry. The historically grown complex licensing structures have not fully kept up with this development, leading to the digital reinforcement of power structures and revenue streams that mainly benefit established labels and publishers, often leaving artists and composers empty-handed. Our data also shows that blockchain promises to counter some of these challenges by enabling completeness and consistency of metadata, as well as automating royalty payouts and enabling micropayments via smart contracts. While blockchain-based music platforms are promising, it remains to be seen whether and how they will fulfill that promise. The following section provides a forward-looking critical assessment of the challenges and opportunities of blockchain-based music platforms.

### 5.1 Need to deal with limited fault tolerance and scalability problems

Technically, blockchain technologies could enable distributed control of music metadata by providing a decentralized, immutable, and transparent public ledger. It is also within the range of possibilities provided by blockchain to make royalty payout processes more transparent and efficient through smart contracts. However, a blockchain-based solution can be very resource-consuming and energy-intensive, and many existing blockchain's have scalability issues (Zhao, 2018), making the implementation of a blockchain-based music platform an expensive and risky endeavor. This endeavor will likely fail if cost and risk are passed on primarily to the established publishers and labels. Although they may have the necessary resources, labels and publishers are the ones who benefit from the status quo, which allows them to legally keep money that belongs to artists and composers in their own pocket. Previous attempts to build a Global Repertoire Database have already failed due to major labels and publishers retracting their content (cf. section 4.1), and there is no reason to believe that this time would be different. In turn, artists and composers, who would primarily benefit from decentralized,

transparent, and efficient royalty payouts, may not have the necessary resources or political leverage to build up a platform and involve all relevant stakeholders. Another aspect that should be considered is the limited fault tolerance of blockchain, making it arduous to change data management and governance rules once they have been implemented in the blockchain (Zhao, 2018).

## 5.2 Need to match interests of music industry stakeholders

Although our data indicates that each stakeholder individually seems to cognize the need for a better way to handle metadata and licenses, there still seems to be a lack of cooperation and mismatch of interests, leading to fragmented solutions that feed into the current silo structures. Even if artists, composers, publishers, and labels could somehow agree to cooperate on a platform, the question would still remain who would be willing and able to provide the necessary information. In many cases, labels partly or completely own the entire repertoire of an artist (e.g. in the case of deceased artists), so it is in their hands to decide whether the music and related metadata can be offered on a blockchain platform. Thus, the lack of support from major labels would likely result in a music platform that would offer a limited repertoire, which would drastically decrease the platform's chances to compete with established DSPs such as Apple Music, which provides around 45 million songs (GMR, 2018). So, a viable blockchain-based music platform requires aligning incentives with the needs of all involved stakeholders and providing appropriate governance structures (cf. Beck et al., 2018).

Our data indicates that labels and publishers have little incentive to make the contractual details of their deals with artist or composer public, as is required in a public blockchain. An alternative would be a private blockchain that runs on premises created by major labels and publishers, enabling faster payment and creating transparency of contracts between the artist and the PRO, between label and artist, and between composer and publisher. This would locally optimize payments without globally encompassing the complete value chain but could still be an improvement to the current situation, where artists and composers often do not get paid at all. The question is then, again, whether the provided incentives are aligned with the needs of labels and publishers. Existing blockchains lack appropriate incentives at the music industry level.

## 5.3 Need to align incentives embedded in blockchain

The emerging blockchain economy promises much to create peer-to-peer platforms and decentralized organizations (Beck, 2018). In the context of the music industry, blockchain technology could allow artists and composers to monetize their music. Publishers and labels could also offer their services through a platform. However, those who have the power to change something seem to have little incentive to do so while those who would benefit from a blockchain solution seem to lack the power to bring about that change. While our data indicates that everyone individually acknowledges the necessity for a change, most professionals in the music industry still hesitate to make the risky first step towards an integrated solution without knowing whether others will follow. The more aligned the incentives provided by a blockchain-based music platform are with the needs of all involved stakeholders, the more likely it will become an integrated solution. This integrated solution would also elicit a need for a shift in mindset regarding the way in which music is offered and consumed in a decentralized environment. For this to happen, it is necessary to understand how blockchain technology can support collaboration across different organizations and stakeholders in the music industry to embrace a solution that can create a more transparent, efficient, and standardized music exchange in an ever-more digitized world. Moreover, it is important to understand how the music industry currently operates in terms of licensing structures, royalty payouts, and metadata management, and how the existing business models may be digitally transformed through blockchain technology.

This study makes a first step in that direction by illustrating the current needs of the music industry along with the challenges and opportunities of blockchain technology to address these needs. Our data illustrates some of the problems that the ongoing digitization has posed to the music industry, where historically grown complex licensing structures and inconsistent metadata have led to inefficient, non-transparent, and error-prone royalty payout processes that often leave artists and composers uncompensated. Contrasting that with the potentials of blockchain technology, we argue that a satisfactory

solution needs to provide incentives that are aligned with the needs of all involved stakeholders. Thereby, this paper contributes a nuanced and reflective understanding of blockchain technology in a music context. Our findings also inform design-oriented studies that aim at providing blockchain-based music platforms that counter the here identified problems of complex licensing structures, inconsistent and incomplete metadata, and inefficient and non-transparent royalty payouts. Recent design science projects have shown promising prototype implementations of blockchain for cross-organizational workflow management and automation in banks (e.g. Fridgen et al., 2018), which may be transferred to the music industry.

#### **5.4 Limitations and outlook**

This study needs to be seen in the light of its limitations. Although we chose a broad sample of seven different organizations in various countries, the findings are by nature of the research method strongly tied to the subjective interpretations of the participants and the social, cultural, economic, and regulatory frameworks they are situated in. Thus, the generalizability of the obtained insights to the entire global music industry or related industries may be limited. While our findings may likely be transferred to other organizations that share the here described context factors (cf. Walsham, 1995), further research is necessary to determine whether and how the aforementioned identified phenomena can be found in other contexts, too. Further research could study additional organizations within the music industry and the emerging blockchain economy. Specifically, the following questions could be posed to further research the value creation enabled by blockchain in the music industry: What kind of token system could mitigate incentive misalignment in the music industry? What is a viable business model for a decentralized global song database? Which governance issues arise and how can they be met?

### **6 Conclusion**

The present study set out to examine the challenges and opportunities of blockchain technology in the music industry. Through a qualitative case study and related literature, we contribute a forward-looking, reflective, and nuanced view on the possibilities and limitations of blockchain-based music platforms. We find that historically grown complex licensing structures, inconsistent and incomplete music metadata, as well as inefficient and non-transparent royalty payout processes hinder the music industry in keeping up with the rapidly proceeding digital transformation. Although blockchain can technically counter some of these challenges via smart contracts that ensure metadata consistency and completeness, automate royalty payouts, and make licensing structures more transparent, there are also scalability problems, unresolved ownership questions, and limited fault tolerance that pose limitations to what the technology can solve. More importantly, we identified a misalignment of incentives between labels, publishers, artists, and composers.

Unfortunately, those who want change and those who can bring about that change seem to be skewed in their respective inducements. Publishers and labels have little incentive to unveil contractual details about their deals with artists and composers, as a public blockchain would require. Previous failed attempts to build a Global Repertoire Database have shown that it is unlikely to overcome the prevailing silo structures if major labels and publishers do not participate in the endeavor. Any blockchain-based music platform that does not appropriately incentivize all relevant stakeholders according to their different needs is therefore likely to fail, too.

It is possible that a global and public blockchain-based music platform, through providing aligned incentives, radically innovates the digital music business towards a decentralized and artist-driven business model and urges established organizations to follow suit. Another potential scenario is that a private blockchain, running on the premises of established organizations, incrementally improves existing business models by making metadata management, licensing, and royalty payouts more efficient within the prevailing structures. Our data cannot predict which scenario is more likely but either way, a standardization and simplification of metadata management and licensing structures would be necessary for blockchain-based music platforms to fulfill their potential.

## References

- Bauer, I., Zavolokina, L., Leisibach, F. and Schwabe, G. (2019). “Exploring Blockchain Value Creation: The Case of the Car Ecosystem”. In: *Proceedings of the 52nd Hawaii International Conference on System Sciences (HICSS)*, Hawaii, USA.
- Beard, T.R., Ford, G.S., and Stern, M. L. (2017). “Safe Harbors and the Evolution of Music Retailing”. *Phoenix Center Policy Bulletin No. 41*. <http://dx.doi.org/10.2139/ssrn.2963232>
- Beaumont-Thomas, B., and Rushe, D. (2018). *Spotify sued for \$1.6bn in unpaid royalties as it reportedly files for IPO*. URL: <https://www.theguardian.com/technology/2018/jan/03/spotify-sued-for-16bn-in-unpaid-royalties> (visited on 03/05/2019).
- Beck, R. (2018). “Beyond Bitcoin: The Rise of Blockchain World”. *IEEE Computer* 51, 54–58.
- Beck, R., Müller-Bloch, C., and King, J.L. (2018). “Governance in the Blockchain Economy: A Framework and Research Agenda”. *Journal of the Association of Information Systems*.
- Boell, S.K., and Cecez-Kecmanovic, D. (2014). “A hermeneutic approach for conducting literature reviews and literature searches”. *Communications of the Association of Information Systems* 34, 12.
- Brooke, T., 2014. “Descriptive Metadata in The Music Industry: Why It Is Broken And How To Fix It”. *Journal of Digital Media Management*. 2, 263–82.
- Ciriello, R.F., Beck, R. and Thatcher, J. (2018). “The Paradoxical Effects of Blockchain Technology on Social Networking Practices”. In: *International Conference on Information Systems (ICIS2018)*, San Francisco, USA.
- Ciriello, R.F., Richter, A. and Schwabe, G. (2018). “Digital Innovation”. *Business & Information Systems Engineering* 60(6), pp.563-569.
- Cooke, C. (2015). *Dissecting the digital dollar – How streaming services are licensed and the challenges artists now face*. URL: [https://themmf.net/site/wp-content/uploads/2015/09/digitaldollar\\_execsummary.pdf](https://themmf.net/site/wp-content/uploads/2015/09/digitaldollar_execsummary.pdf) (visited on 03/05/2019)
- Creative Industries (2014). *Music Case: Global Repertoire Database*. URL: <http://www.thecreativeindustries.co.uk/industries/music/music-case-studies/music-case-global-repertoire-database#> (visited on 03/05/2019).
- Crosby, M., Pattanayak, P., Verma, S., Kalyanaraman, V. (2016). “Blockchain technology: Beyond bitcoin”. *Applied Innovation* 2, 6–10.
- De León, I.L., Gupta, R. (2017). *The Impact of Digital Innovation and Blockchain on the Music Industry*. URL: <https://publications.iadb.org/en/publication/17327/impact-digital-innovation-and-blockchain-music-industry> (visited on 03/05/2019).
- DeCuir-Gunby, J.T., Marshall, P.L., McCulloch, A.W. (2011). “Developing and using a codebook for the analysis of interview data: An example from a professional development research project”. *Field Methods* 23, 136–155.
- Edwards, A. (2016). *Who will build the music industry’s Global Rights Database?* URL: <https://www.musicbusinessworldwide.com/who-will-build-the-music-industrys-global-rights-database/> (visited on 03/05/2019).
- Fridgen, G., Radszuwill, S., Urbach, N. and Utz, L. (2018). “Cross-Organizational Workflow Management Using Blockchain Technology-Towards Applicability, Auditability, and Automation”. In: *51st Hawaii International Conference on System Sciences (HICSS)*, Waikoloa Village, USA.
- GMR (2018). *Global Music Report: Annual State of the Industry*. URL: <https://www.ifpi.org/downloads/GMR2018.pdf> (visited on 03/05/2019).
- Gordon, S. (2011). *The future of the music business: how to succeed with the new digital technologies*. Hal Leonard Corporation.
- Graham, G., Burnes, B., Lewis, G.J., Langer, J. (2004). “The transformation of the music industry supply chain: A major label perspective.” *International Journal of Operations & Product Management* 24, 1087–1103.
- ICERights (2018). *Our Customers: CMOs. ICE Serv*. URL: <https://www.iceservices.com/our-customers/collection-management-organisations/> (visited on 03/05/2019).
- Klein, H.K., Myers, M.D. (1999). „A set of principles for conducting and evaluating interpretive field studies in information systems.” *MIS Quarterly* 67–93.

- Koerber, A., McMichael, L. (2008). “Qualitative sampling methods: A primer for technical communicators.” *Journal of Business and Technical Communication* 22, 454–473.
- Kostas, M. (2016). *YouTube’s Safe Harbor | Music Business Journal | Berklee College of Music*. <http://www.thembj.org/2016/12/youtubes-safe-harbor/> (visited on 05/03/2019)
- Kvale, S., Brinkmann, S. (2009). *InterView: An introduction to qualitative research*. Copenhagen: Gyldendal. Print.
- Molinder, N. (2018). *Why Building More Rights Databases Won’t Solve The Music Industry Metadata Problem*. URL: <http://www.hypebot.com/hypebot/2018/01/why-building-more-rights-databases-wont-solve-the-music-industry-metadata-problem.html> (visited on 03/05/2019).
- MusicBrainz (2018). *Пётр Ильич Чайковский - Aliases - MusicBrainz*. URL: <https://musicbrainz.org/artist/9ddd7abc-9e1b-471d-8031-583bc6bc8be9/aliases> (visited on 03/05/2019).
- Myers, M.D. (1997). “Qualitative research in information systems.” *MIS Quarterly* 21, 241–242.
- Nærlund, K., Müller-Bloch, C., Beck, R., Palmund, S. (2017). „Blockchain to Rule the Waves – Nascent Design Principles for Reducing Risk and Uncertainty in Decentralized Environments.” In: *International Conference on Information Systems (ICIS2017)*, Seoul, South Korea.
- Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system.
- O’Dair, M. (2016). “Music On The Blockchain: Blockchain For Creative Industries Research Cluster.” *Middlesex University Report 1*.
- Oliver, D.G., Serovich, J.M., Mason, T.L. (2005). “Constraints and opportunities with interview transcription: Towards reflection in qualitative research.” *Social Forces* 84, 1273–1289.
- Olsen, P.B. (2018). *Problemorienteret projektarbejde: En værktøjsbog*. Samfundslitteratur.
- Penick, B. (2016). *5 reasons why songwriters need to know about metadata – Soundstr*. URL: <https://www.soundstr.com/5-reasons-songwriters-metadata/> (visited on 03/05/2019).
- Perez, S. (2017). *Spotify acquires blockchain startup Mediachain to solve music’s attribution problem*. *TechCrunch*. URL: <http://social.techcrunch.com/2017/04/26/spotify-acquires-blockchain-startup-mediachain-to-solve-musics-attribution-problem/> (visited on 03/05/2019).
- Peters, G.W., Panayi, E. (2016). “Understanding modern banking ledgers through blockchain technologies: Future of transaction processing and smart contracts on the internet of money.” *Banking Beyond Banks and Money*. Springer, pp. 239–278.
- Pitt, I. (2016). *Direct licensing and the music industry: How Technology, Innovation and Competition Reshaped Copyright Licensing*. Springer. ISBN 978-3-319-17653-6
- Schultze, U., Avital, M. (2011). “Designing interviews to generate rich data for information systems research.” *Information and Organization* 21, 1–16.
- Schweizer, A., Schlatt, V., Urbach, N. and Fridgen, G. (2017). “Unchaining Social Businesses–Blockchain as the Basic Technology of a Crowdfunding Platform.” In: *International Conference on Information Systems (ICIS2017)*, Seoul, South Korea.
- Statista (2018). *Topic: YouTube*. URL: <https://www.statista.com/topics/2019/youtube/> (visited on 03/05/2019).
- Tongco, M.D.C. (2007). “Purposive sampling as a tool for informant selection.” *Ethnobotany Research and applications* 5, 147–158.
- Vom Brocke, J., Simons, A., Riemer, K., Niehaves, B., Plattfaut, R., Cleven, A. (2015). “Standing on the Shoulders of Giants: Challenges and Recommendations of Literature Search in Information Systems Research.” *Communications of the Association of Information Systems* 37, 9.
- Walsham, G. (1995). “Interpretive case studies in IS research: nature and method.” *European Journal of Information Systems* 4, 74–81.
- Warr, R., Goode, M.M. (2011). “Is the music industry stuck between rock and a hard place? The role of the Internet and three possible scenarios.” *Journal of Retailing and Consumer Services* 18, 126–131.
- Zhao, H. (2018). *Bitcoin and blockchain consume an exorbitant amount of energy. These engineers are trying to change that*. URL: <https://www.cnbc.com/2018/02/23/bitcoin-blockchain-consumes-a-lot-of-energy-engineers-changing-that.html> (visited on 03/05/2019).