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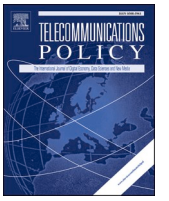

Digital transformation, blockchain, and the music industry: A review from the perspective of performers' collective management organizations

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ABSTRACT

This study examines the challenges related to the music industry's digital transformation and potential role of blockchain from the perspective of collective management organizations (CMOs). Building on desk research and primary data from semi-structured surveys conducted with C-level executives and managers, this empirical analysis identifies major projects, their state of development, and prospects for digital transformation based on blockchain in the music industry. The findings reveal that there are a limited number of blockchain projects led by and/or with the relevant participation of CMOs. However, most are just research projects, proofs of concept, or pilots, showing that blockchain is currently in an experimental phase of development on the periphery of the music industry's digital transformation. This is not very different from analysts' understanding of the current situation and perspectives on the mass adoption of blockchain in other industries. In summary, blockchain is neither at the core of the music industry's digital transformation nor a priority for CMOs leading this process from the perspective of intellectual property rights management. The limited quality of music metadata, sparsity of sound data sources, and absence of a common data governance framework among different stakeholders within the industry are the main impediments to transforming blockchain into a global solution with transformative potential. Overall, the results provide a snapshot of the current status and possible future trajectories of blockchain adoption as a paradigm for intellectual property rights exchange within the music industry.

1. Introduction

"Imagine if, some months, half your salary would go to some random company you'd never even met – sometimes all of it. This is what

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happens regularly to songwriters due to the metadata mess and entities wrongly claiming royalties that aren't theirs." Helienne Lindvall, a professional songwriter and musicians, tweeted this devasting sentence on October 12, 2022. This issue is popularly known as the "unclaimed black box royalties," which were estimated to have ranged from $200 million to $2.5 billion in 2019 by Billboard (Christman, 2019). A recent analysis estimated that this number had reached £500 million in 2021 (Ivors Academy, 2021).

Still, the digital age has caused fundamental changes in how music is consumed and rightsholders are increasingly compensated (Hesmondhalgh, 2020). First, music consumption via streaming has grown massively and displaced traditional physical sales, even representing around three-quarters of the entire business in the case of recorded music (IFPI, 2023). This massive expansion of new consumption modes has meant that previous paper-based processes are no longer suitable for allocating intellectual property rights and managing royalties.

In fact, a growing number of issues have been identified in these processes. While facilitating creation and distribution (Kjus, 2021), digital technologies, especially artificial intelligence (AI), have significantly added complexity to tracing creative processes. AI is fully present in the industry from the way music is created and produced (Mayfield & Aswad, 2023; Romo, 2023) to how it is consumed and experienced (Arenal et al., 2022; IPOL, 2023).

This adds to the complexity of music royalty accounting. There are governance issues related to validating dubious information (Lyons et al., 2019; Senftleben et al., 2022), a lack of metadata[1] standards (Gronau & Schaefer, 2021; UK Intellectual Property Office, 2023), and the absence of unified databases (Barr et al., 2022; Elshan et al., 2021). Together, these are the fundamental reasons for incorrect transactions, inefficiencies, and inaccuracies in royalty allocation. Consequently, rightsholders not only experience considerable delays in receiving their payments, but also quite often do not receive the remuneration they are owed by law (GESAC, 2023).

Within this context, blockchain technologies have emerged as a potential solution to similar problems in other creative industries. Kapsoulis et al. (2020) have identified blockchain features to be especially attractive for music copyright, including their transparency, trustability, traceability, decentralization, support in conflict resolution, and efficiency. Other scholars have emphasized blockchain's relevance for the viability of different "smart contract" developments, which can a form of efficiently adapting music copyright management to the liquid nature of digital environments (Halgamugue & Guruge, 2022; Hardjono & Pentland, 2019; Rauman, 2021).

However, although blockchain technologies are considered transformative for copyright management in the music industry (Centorrino et al., 2022; Ciriello et al., 2023), no evidence-based assessments exist on the digital transformation advances from the perspective of collective management organizations (CMOs). Moreover, the adoption of blockchain technologies as a potential solution to the challenges in collective music copyright management remains unexplored.

Addressing these gaps, this study explores the challenges involved in the potential deployment of blockchain technologies as a key constituent in the music industry's digital transformation through the lens of CMOs, who are one of the key players in the industry. A qualitative approach was combined with primary and secondary data sources. First, desk research was used to map the main projects related to blockchain with the involvement and/or participation of at least one CMO. The authors gathered primary feedback from a semi-structured survey conducted with a purposive sample of relevant C-level executives and managers of different CMOs. Through this, the status of the adoption of blockchain technologies by these CMOs was identified. Then, this study analyzed the existing level of knowledge of blockchain technology applied to the collective management of intellectual property rights and perception of its potential adoption by CMOs.

The remainder of this article proceeds as follows: Section 2 reviews the characteristics of blockchain and main solutions available from the music industry's perspective, with particular emphasis on CMOs. Section 3 then describes the methods and sample used for the analysis, followed by the results and discussion in section 4. Section 5 presents the main conclusions and suggests future research avenues.

2. Background/Research context

2.1. The black box of music royalties: the data management and attribution issue in the music industry

Rightsholders often experience significant delays in receiving payments for the use of their musical works (Butler, 2021). However, if it were only a matter of delay, it could be corrected with some type of financial advancement or the use of more efficient technologies. Unfortunately, delay is just the tip of the iceberg, as there are frequent cases of mismatched, unmatched, or even unlocated or untraceable royalties. In short, a significant proportion of royalty payments are often not received for lengthy periods. Even worse, royalties are frequently delivered to the wrong party altogether or never delivered to anyone at all (Rauman, 2021).

To explore the causes behind the incorrect or absent attribution, the structure of music rights ownership, and key issues around the flows of data and revenues when a song is played anywhere need to be first understood.

[1] Metadata are the data associated with tracks which provides information on the artist(s) and songwriter(s), as well as other features such as length or genre (CMA, 2022).

2.1.1. Music rights: structure, ownership, and revenue streams

The inefficient attribution of royalties is primarily explained by the complexity arising from the multiple copyrights associated with the same musical work (or song[2]). Each track typically involves two separate copyrights[3] (Hesmondhalgh et al., 2021):

1. The master or sound recording copyright: This belongs to the performer(s) featured in the recording, as well as the owner of the master or phonogram producer, which typically the record company (the label[4]).
2. The composition or musical work: This belongs to the songwriter(s) and composer(s) of the song and/or the publisher in cases where authors have publishing agreements.

Every individual who creates original lyrics or compositions is considered a songwriter. Hence, they are entitled to receive remuneration, among other rights, whenever their music is used. Likewise, any person who performs on a recording is considered a performer. They are also owed royalties when their music is utilized.[5]

Originally, the exploitation of these rights was administered on an individual basis. Over time, this individual approach became ineffective for both rightsholders and users, with collective management emerging as a solution (WIPO, 2022). The implementation and role of CMOs[6] differ by country depending on the institutional and regulatory framework, including the structure of the rights conferred by the law, existence of statutory provisions to protect authors and/or performers, and use of collective bargaining (Guibault et al., 2015). Typically, CMOs are deemed to operate in the interest of their members. They became the specialized organizations in charge of: (a) licensing the use of music works (those assigned to them, also known as their "repertoire"); (b) tracking and monitoring their use; (c) collecting due remuneration on behalf of rightsholders; and (d) distributing this among rightsholders in accordance with objective criteria.

Currently, CMOs play a crucial role in the music value chain (Sitonio & Nucciarelli, 2018). Whenever a service utilizes music, they must compensate the respective rightsholders (authors/publishers, performers, and record companies). Depending on the type of exploitation and regulatory framework in each territory, collective management is mandatory; that is, CMOs collect revenue from users in accordance with the repertoire they are entitled to manage. Subsequently, they distribute the collected amount to the rightsholders after deducting their operating expenses.[7]

An overview of this value chain, including its main data and revenue flows, is presented in Fig. 1[8]. The most common example of how the entire system works is royalty derived from public performances. When a song is played on terrestrial radio or at a bar, these businesses are obligated to remunerate both songwriters and publishers through composition CMOs. Additionally, they must remunerate performers and owners of the master (record labels) through sound recording CMOs.[9] As shown in Fig. 1, these processes involve multiple flows of data and revenue among different stakeholders (services/uses, CMOs, and right holders for composition and sound recording).

However, fully understanding the structure of music rights ownership and collection across different countries is complicated because they mostly occur in fragmented, if not opaque, environments. Almost every country has a specific legal and institutional framework to detail relevant issues, such as which uses and how much rightsholders should be compensated when their music is used, and which CMOs are entitled to which rights. Consequently, a rightsholder may even confront 177 different national copyrights and related rights, multiplied by a plethora of CMOs, depending on the particular right at the national level and their reciprocal agreements at the international level.

2.1.2. Music rights management: main issues and their causes

The situation described above has become even more complicated owing to the acceleration of digital music distribution, increasing number of collaborations between performers, and internationalization of the use of repertoires. According to industry

[2] "Musical work" is the technically correct term. However, here, we use the term "song" as an equivalent, although not all musical works appear in the shape of songs. We also use the term "track" when referring to a musical work that has been recorded (recording) and is available in digital format.

[3] Whereas music copyright is granted to those considered "authors" under the relevant national legislation, related (or neighboring) rights are conferred upon performers and owner of the masters/phonogram producers (Guibault et al., 2015).

[4] Independent music artists also play the role of the label as they do their own recordings. Thus, in this case, they are the full/sole owners of the related rights (or neighboring rights).

[5] According to the law of each country, there are exceptions to the performers' remuneration. The most notorious of these exceptions is radio broadcasting in the US (Guibault et al., 2015).

[6] CMOs are also known as "collecting societies" or "collective rights management organizations." CMOs operate on behalf of a combination of rightsholders, including composers, lyricists, and music publishers, and performers independently, or along with owners of the master to monitor, license and monetize uses of all of their works and recordings (Hesmondhalgh et al., 2021).

[7] Traditionally, CMOs operate as not-for-profit organizations. Lately, in some jurisdictions, competition has been allowed and private players are allowed to charge fees for the distribution of royalties with the expectation, yet to be ascertained, that this will enhance the entire system's efficiency.

[8] Examples of services and uses in Fig. 1 are non-exclusive. CMOs collect due remuneration for several type of uses of composition and/or sound recordings depending on the regulatory framework in each territory. Then, they distribute them among the rightsholders.

[9] With some exceptions, such as the radio broadcasting in the US for the use of sound recordings (Guibault et al., 2015), mentioned above or the case.

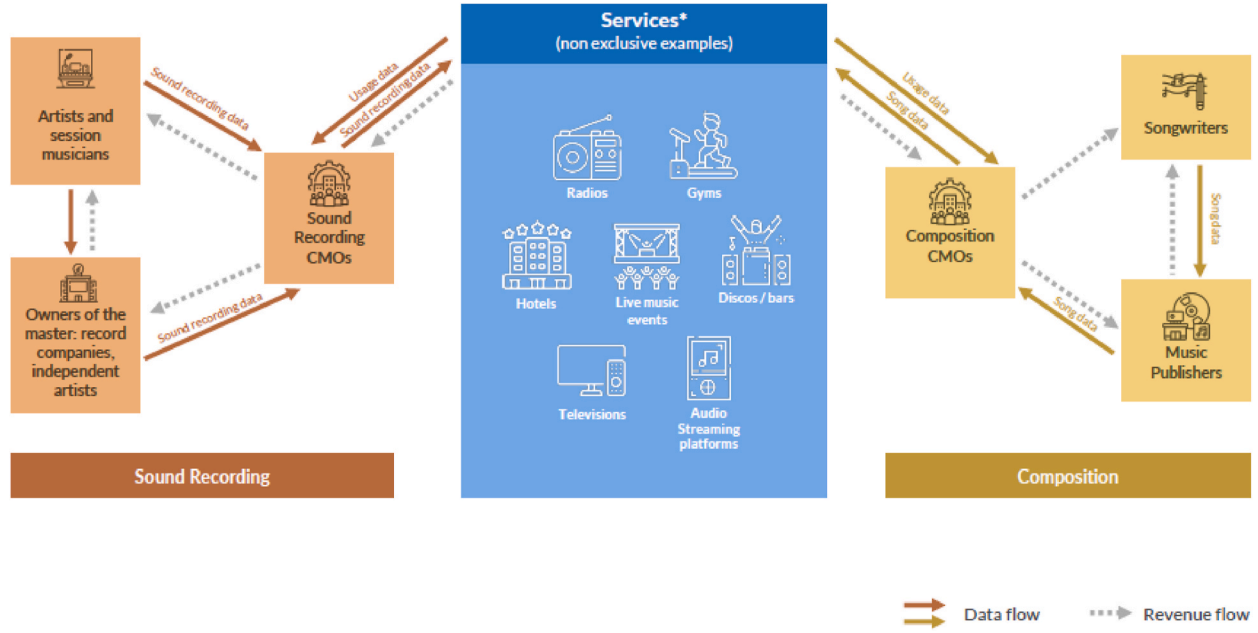

Fig. 1. Music industry copyright and collective management uses and services, stakeholders, and data and revenue flows. Adapted from Sitonio and Nucciarelli (2018).

sources, more than 120,000 songs were uploaded to streaming platforms every day during the first semester of 2023 (Stassen, 2023). Additionally, the music industry has become more global and collaborative, and the number of parties credited for successful songs is greater than ever (Ingham, 2019).

Consequently, correctly collecting and distributing music rights depends on too many variables and actors. Further, the reliability of the base information or accountability of the actors introducing this information is often uncontrollable on many occasions. To map the problems in the music rights value chain and challenges derived from them, researchers and industry players have provided insights into tackling the existing issues as described below.

A. Low data quality, limited metadata, and lack of accountability

The first step in a potential solution to music rights management issues is ensuring the correct identification of music creators and rightsholders. Proper crediting has been a traditional problem in the music industry (Burgess, 2013). In the era of digital music, metadata have emerged as a critical idea. Metadata refer to the information that should be completed for each song uploaded to streaming services, including creative contributors, performers, and other rightsholders in sound recording and composition. Essentially, metadata describe who has contributed and how during the creation of a particular song. It is vital for creators and performers in terms of certification and payments (UK Intellectual Property Office, 2023).[10]

However, the quality of the above metadata is often a problem, including information that is not accurate, complete, or comprehensive (Gronau & Schaefer, 2021). Moreover, the allocation of the responsibility of adding the corresponding information is often missing without common frameworks, best practices, or auditing systems. Moreover, data flow can be erratic, and the same information changes along the value chain and/or is not always synchronized across all music industry databases (Deahl, 2019; GESAC, 2023).

Numerous industry players have made efforts toward standardization and improving metadata accuracy, and provide some attribution of responsibility with a view of precise recognition and remuneration (Dredge, 2022; UK Intellectual Property Office, 2023; Worldwide Independent Network (WIN), 2023). However, metadata issues are still far from being resolved. Consequently, the precise identification of all creative contributors and rightsholders is not guaranteed when a track is played.

[10] The standard metadata fields include (or should include) (UK Intellectual Property Office, 2023):1 – Creator(s) identifiers and role codes:• The Interested Party Identifier (IPI): It is a code assigned to songwriters, composers, and music publishers by CMOs. These are attached to International Standard Musical Work Code (ISWC) numbers to include information about authorship to works with an ISWC.• The International Performer Number (IPN): It is a code to identify a performer and is used in data exchanges between CMOs.• The International Standard Name Identifier (ISNI); It is used to identify persons, including persona stage names, and organizations involved in creative activities, such as record labels.2 – The International Standard Musical Work Code (ISWC); It is a musical work identifier. 3 – The International Standard Recording Code (ISRC): It is the recording identifier.4 – Song title and alternative song title.5 – Writer(s), performer(s), producer(s), and contributor names (all of them).

B. No one-stop shop for international collection of music remuneration

As previously mentioned, music rights involve multiple parties because of the existence of two copyrights for every recording, and the frequent collaboration of multiple individuals in both the songwriting and recording processes. The ownership and administration of these rights are shared by various global actors, including songwriters/composers, publishers, performers, distributors, labels, CMOs, and even, lately, purely financial investors. Revenue collection often requires substantial time and multiple interactions because of the numerous variables and actors involved in the process (Barr et al., 2022).

The main reason is that the economic, institutional, and regulatory landscape is extremely heterogeneous at the international level (Guibault, 2020; Klobučník, 2021). Every country has its own legal framework around intellectual property and music rights. The operation of collective management in each country depends on the statutory provisions at the national level. Tariffs for users, distribution schemes, and even the type and number of CMOs are according to national rules (Guibault et al., 2015; Senftleben et al., 2022).

Consequently, multiple CMOs exist worldwide.[11] International reciprocal agreements are indeed present among CMOs administering the same type of music rights. However, rightsholders, authors, and performers have no one-stop shop for collecting revenues from the usage of their repertoires at the national level. This situation is even more complex because CMOs use multiple databases, none of which are comprehensive (Barr et al., 2022; Elshan et al., 2021). In addition, because these databases are not synchronized in a timely manner, the management of changes is complicated and time-consuming (Lyons et al., 2019). Together with frequent mistakes in metadata and credits, especially those related to the proper identification of authors and performers, the proper remuneration of creative people remains challenging globally.

C. Limited/incomplete data on the usage and exploitation of works

Data on the exploitation of musical works are limited, especially regarding non-digital uses as in the case of public performance (terrestrial radio, discos, gyms, bars, …) (Ebin & Reitman, 2021). Given the nature of the analog world, it is not directly possible for CMOs to know exactly who is using a track, when, and how.

However, notable technological developments in music recognition software have occurred since the early 2010s (Dredge, 2015). Today, private monitoring companies track the usage of repertoires, mainly in terrestrial radio, but also in connection with other public performance uses (e.g., discos). These monitoring companies are commercializing their services to CMOs, among other industry clients dealing with music rights, and providing usage reports so that they can distribute royalties (EUIPO, 2020).

Yet, no global automatic, precise, or cost-effective monitoring and reporting of music usage exists. This is especially noticeable in less-developed markets. Moreover, because most systems employed are based on metadata, accreditation mistakes are exacerbated by music identification systems.

Practically, as in the case of repertoires, there are multiple isolated silos of incomplete information on music usage that impact the proper remuneration of music rights and involve significant transaction costs (Douglas, 2023). Even worse, performers may allocate different collection permissions to different modes of exploitation in different countries, complicating a uniform approach to the distribution of royalties for a particular track.

The result of the aforementioned situation is a fragmented landscape with geographically dispersed legal and institutional frameworks, non-comprehensive repertoire databases, and limited data quality regarding both the ownership of musical works and sound recordings, as well as the usage of repertoires, especially in the analog world. As long as songs are played worldwide, many potentially harmful situations exist for authors, performers, and rightsholders, ranging from cases in which authors and performers are not properly identified. Thus, songs are collecting royalties, but they are not being correctly allocated. Other situations include those where usage is not tracked accurately, and royalties are not collected at all or allocated to other rightsholders following spurious criteria (Tam, 2019).

2.1.3. The long and winding road to finding solutions

Major issues surrounding music rights management are not new. Still, several industry players, especially CMOs and major record companies, have made significant efforts to deal with them since the 1990s. However, all such attempts, from individual initiatives to joint projects, have mostly failed, or in some cases, have led to incomplete solutions.

The International Music Joint Venture was one of the first failed attempts. It was initiated by the American CMO ASCAP, Dutch CMO BUMA-STEMRA, and British MCPS-PRS Alliance (currently PRS for Music) with the goal of building a centralized music copyright database in the digital age. This project was halted in 2001 for financial, technical, and cultural reasons (Andersen et al., 2000; Wallis, 2001).

Around the same time, in early 1999, a multi-party consortium called the Secure Digital Music Initiative was formed as a response to the success of the MP3 format and threat of piracy (Wallis, 2001). The consortium comprised more than 200 representatives from different sectors, including traditional music industry players, such as record companies and authors' CMOs, and technology companies (Internet Service Providers, consumer electronics, etc.). Its ambitious goal was defining the technological and security specifications to lead the use of music in the new digital world. The initiative failed in the early 2000s without achieving its proposed

[11] As non-exclusive examples, the joint figure provided by CISAC and SCAPR., the main confederations of authors' and performers' societies, respectively, surpassed the astounding figure of 280 societies (CISAC, 2023; SACPR, 2023).

objectives because of disparities in perspectives among members.

Another prominent attempt was made to create a global database including European policy support. In September 2008, Neelie Kroes, the European Union Commissioner for Competency at the time, promoted the cross-sectoral Global Database Repertoire Working Group with the task of defining the requirements for a unique and comprehensive database of musical works. The initial group included record labels and publishers (Universal, EMI Music Publishing), technology companies and platforms (Apple, Nokia, and Amazon), and CMOs (PRS, STIM, and SACEM). More than 80 organizations participated in the process. Yet, the project was eventually cancelled due to issues related to governance and funding (Cook, 2014; Milosic, 2015).

Even the World Intellectual Property Organization (WIPO) initiated its own International Music Registry in 2011 with the aim of building a global music rights database (WIPO, 2011). The project collapsed after two years due to controversies among parties and funding problems.

Recently, two ongoing initiatives have built on the idea of creating a global proprietary database for music rights. The first is VRDB, under the administration of the Societies' Council for the Collective Management of Performers' Rights (SCAPR), the international association for the development of practical cooperation among performers' CMOs. VRDB is a centralized system aimed at enabling performers' CMOs to identify sound recordings more efficiently, thereby easing the flow of royalties exchanged among SCAPR members (SCAPR, 2023c). Meanwhile, in 2018, ASCAP and BMI launched a joint database of musical works, called "Songview" (ASCAP &BMI, 2023). Songview aggregates data for more than 25 million musical works, combining ASCAP and BMI repertoires, and including ownership information. While these examples are relevant, neither is comprehensive, given that they do not include information about musical works (VRDB) or sound recordings (Songview).

2.2. Principio del formulario

At the time of writing, none of these efforts had been successful due to the preference for proprietary, non-interoperable, and non-harmonized databases, or "proprietary walled data silos" as defined Barr et al. (2022). Consequently, numerous investments have been made in individual data infrastructures. However, ultimately, these investments cause increasing switching costs for all players. In addition, different stakeholders involved in the process—mainly publishing companies, record labels, and CMOs—have traditionally shown special interest in controlling relationships with suppliers and upholding their individual roles within the industry framework. Thus, conflicting incentives within them emerge as underlying reasons for the current situation (Senftleben et al., 2022). Consequently, no accessible global repository with updated information on sound recordings, musical works, and the rights and interested parties associated with them are available, and music databases continue to be fragmented globally.

2.3. Data management issues in the music industry: can blockchain play a role?

Given the current situation in the music industry, technology has emerged as a potential main hope for achieving the acclaimed revamp of how music rights are managed (Chalmers et al., 2021). Blockchain, in particular, has been recognized as a potential "pain reliever" for some major issues, especially among the more innovative industry players and proposals originating in the research sphere (Ciriello et al., 2023; Neysen, 2020; O'Dair & Owen, 2019).

Beginning with the research on the potential of blockchain for data governance, different blockchain applications can resolve different challenges ranging from information sharing to consensus generation (Sun et al., 2022). In this regard, the blockchain architecture can be implemented as public, private, or hybrid (Buterin, 2014; Hearn & Brown, 2019; Hoskinson, 2017; Libra Association, 2019; Nakamoto, 2008) depending on the network's type of governance. While private networks limit access to blockchains and are governed by trusted nodes, public blockchains do not require permission and are generally administered by the public (Hardjono & Pentland, 2019). Hybrid blockchain networks can combine both approaches to provide access to the public, but with control and administration for designated users (Halgamugue & Guruge, 2022).

The key features of blockchain, such as its transparency, traceability, decentralization, and immutability, are said to provide a more robust system when dealing with data issues in general (Kapsoulis et al., 2020, p. 2; Risius & Spohrer, 2017). For example, the management of centralized networks is particularly difficult and expensive for data-intensive applications (Kshetri, 2017). In addition, blockchain potentially enables the early-stage detection of conflicts when different agents can gain access to a unified system with disjoint claims, which is a common situation arising from multiple sources and data flows in the music industry. Blockchain technologies also represent a potential solution to problems in other industries that are similar to the data issues affecting the music industry. Several studies have examined its potential in various industries and fields, including public administration, healthcare, finance, agriculture, food, energy, and trade (Niknejad et al., 2021; Sun et al., 2022).

Scholars have analyzed the advantages and challenges of the widespread adoption of blockchain in these industries. Dujak and Sajter (2019) conclude that blockchain enables flow optimization and enhances trust in the supply chain. Al-Jaroodi and Mohamed (2019) investigate the benefits of implementing blockchain in various fields, including the entertainment industry. The authors indicate that blockchain can provide better control for gamers and enable new business models.

Examining the use of blockchain in the agri-food value chain, Martínez-Castañeda and Feijoo (2023) highlight the difficulties of involving different players in practice. In addition, research has noted the scalability problems mentioned by the surveyed professionals mainly because of the lack of standards for the government and heterogeneity of the data in the network. Issues related to governance and scalability are also raised when studying the challenges of blockchain in other sectors such as healthcare (Ramzan et al., 2022), finance (Shrimali & Patel, 2022), and public service organizations (Shahaab et al., 2023).

Most investigations note blockchain's transformative role in almost every industry that requires decentralization, robustness,

trustability, and automated decision-making in multi-stakeholder situations. Yet, it still seems rather difficult to fully understand the advantages in comparing traditional solutions, such as centralized databases, and evaluating the decision about whether, and if so, when to adopt blockchain (Belotti et al., 2019).

Besides considering the advantages that blockchain theoretically introduces in these business fields, some challenges remain that need to be resolved from a research perspective. The main limitation is that research on blockchain technology in business is exploratory and fragmented, focusing mainly on its application in specific industries (Sun et al., 2022).

Creative industries are no exception when considering the possible benefits and challenges of applying blockchain to their production, distribution, and management processes. The initial insights have mostly addressed possible ways of disintermediating processes, and exploring new forms of value creation and trust improvement through tokens and smart contracts (Baytas et al., 2022; Dutra et al., 2018; Tripathi, 2018). Traceability and intellectual property issues arise soon enough as a promising sphere of possibilities in this respect (Wen, 2023).

Accordingly, blockchain is considered a key element in the music industry for improving the royalty distribution systems by connecting artists directly to consumers, thereby minimizing the level of intermediation currently required by streaming platforms (Sitonio & Nucciarelli, 2018). Researchers and industry players have designated blockchain as the next big thing in dealing with these issues (Baytas et al., 2022; Ciriello et al., 2023; Hardjono & Pentland, 2019). Blockchain offers the following benefits to the music industry: (a) universal transparency among all parties, (b) automatic execution of payments, (c) removal of unwanted third-party intermediaries, and (d) increased royalty payouts for content creators (Rauman, 2021; Taghdiri, 2019).

However, numerous difficulties and social challenges have been noted, especially while implementing blockchain-based solutions (Baym et al., 2019). The fragmentation of licensing schemes owing to national regulations, attribution issues regarding metadata inconsistencies, and the resistance of current key stakeholders to limit their roles continue to be legacy hurdles to be overcome (Ciriello et al., 2023; Lovett, 2020). In addition, new practical threats appear, such as blockchain's lack of capacity to manage and store vast amounts of data, or the security and reliability concerns related to potential attacks from hostile parties introducing incorrect data into the system (Savelyev, 2018; Tam, 2019). Indeed, no major practical implementation seems to have yet been adopted, either by platforms or CMOs.

Consequently, finding real-world evidence of the realized benefits of blockchain use in music rights management remains difficult. From a research and industry perspective, evidence is fragmented based on specific case studies or pilot projects, with limited evidence provided from the perspective of CMOs. Clearly, there is room for a better understanding of the challenges faced by the music industry from the CMOs' perspective in their digital transformation path and the potential role of blockchain in facing them.

3. Methodology

The methodology combined a qualitative approach with primary and secondary data sources. First, desk research and fieldwork were employed to assess the current state of and trends in the digital transformation of CMOs, including the adoption of blockchain technologies (if any).

The authors reviewed the state of the art concerning the development and incorporation of blockchain technologies in collective management worldwide, including both commercial and pilot solutions. The objective was to map the main blockchain projects/solutions developed with the involvement of at least one CMO.

A semi-structured survey was conducted with a purposive sample of relevant executives from different CMOs related to performers' rights. The goal was mainly exploratory with non-standardized data; therefore, a semi-structured survey offers enough flexibility to address different interviewee profiles while covering the same dimensions of data collection (Noor, 2008).

Overall, the data collection approach makes it possible to obtain two streams of feedback: First, inside information about the digital transformation priorities of the organizations under study can be obtained. Second, the potential role of blockchain in both collective management and, in general, in the music industry can be understood. CMO representatives were selected for this purpose because they have in-depth knowledge of the current workflows of rights, including general issues and the main constraints. Further research could extend the sample to other types of stakeholders such as record labels, publishers, and/or digital music service providers.

3.1. Survey design

The semi-structured survey combined open, multiple-choice, and closed-ended questions to enable comparability, collect more in-depth information, and uncover evidence while considering the important aspects noted by each interviewee.

The survey included four sets of questions covering the following: (a) manager/executive background and previous experience both in the music industry and their current position; the type of organization they represented was also categorized; (b) general questions about the role of different technologies in the music industry; (c) specific questions about the current and potential use of blockchain in both the music industry and collective management; and (d) privacy choices. Annexes provides the full questionnaire.

The criteria for challenges and specific technologies for the survey were chosen considering the data management and attribution issues researched in the second section, and the authors' experience in the music industry. They are noted as relevant disruptive challenges and technologies both in general (Bongomin et al., 2020; Likens, 2022; Pavaloia & Necula, 2023) and in the case of creative industries (WEF, 2018).

Respondents were first asked about five technological challenges: data visualization, integration of architectures, information trustability, massive data processing, and massive data storage. They then ordered eight technologies in terms of their impact on CMOs' operations over the next five years: AI, blockchain, cloud storage and computing, Internet of Things (IoT), machine learning

(ML), real-time sync systems, robotics process automation (RPA), virtual reality (VR), and augmented reality (AR).

In both cases, the order of the options was presented in a randomized manner to reduce bias.

As indicated in the survey, all responses were treated as confidential by default and are included anonymously in the study without mentioning people's or companies' names, unless an interviewee provided explicit authorization to mention their name and/or company as a participant, and/or associate them with their answers.

3.2. Stakeholders' identification and data collection

The survey was delivered only to managers/executives from CMOs related to performers' rights (performers' CMOs),[12] excluding organizations related to other types of repertoires/rights (music licensing companies, mechanical rights organizations, and reproduction rights organizations) according to WIPO categorizations (WIPO, 2020).

To disseminate the survey, the authors contacted the main global performers' CMO federation: SCAPR. It is the international association for the development of practical cooperation among performers' CMOs. According to its statutes, members should be organizations authorized by national law or by way of assignment, license, or any other similar contractual arrangement to manage the rights assigned to them for the benefit of performers. Furthermore, organizations must meet two additional criteria: (i) they must be owned and/or controlled by their members, and (ii) they must be organized on a not-for-profit basis. At the time of writing, SCAPR represented 56 CMOs from 41 countries (SCAPR, 2023b).

The survey was also distributed through AEPO ARTIS, the main international association for performers' CMOs in Europe. As in the case of SCAPR, AEPO ARTIS is a non-profit-making organization that represents the management organizations of performer-related (or neighboring) rights. At the time of writing, AEPO ARTIS represented 38 CMOs from 28 European countries (AEPO Artis, 2023).

Finally, the authors individually reached a group of performers' CMOs who were neither members of either SCAPR nor AEPO Artis. Owing to its relevance and size, the authors first contacted SoundExchange, as it has not been a member of SCAPR since 2018. SoundExchange is the CMO in charge of collecting and distributing neighboring rights in the US and is the largest performers' CMO globally in terms of collection distribution. In addition, the authors reached a group of five performers' CMOs based in the Latin American region to obtain diversity.

This specific type of CMO (performers' CMOs) was selected for two main reasons. At a methodological level, the authors believed that it is better to delimit the sample to a specific intellectual property right in terms of gaining consistency and accuracy for the results and conclusions. Further research can include primary data from other types of organizations to complete the picture. In addition, the authors' experience in the music industry provides a professional network that makes it possible to reach more representative people within performers' CMOs.

The survey was distributed via online invitation by email using the form provider Typeform between February and June 2023.

3.3. Sampling and analysis

The survey was distributed to 89 CMOs, with a response rate of 10%. According to the IFPI[13] Global Music Report 2023; IFPI, 2023), the global neighboring rights market grew to $2.5 billion in revenue in 2022. The collection of the CMO members of SCAPR was €880 million (SCAPR, 2023a) and SoundExchange collected $1.017 billion (SoundExchange, 2023). The survey was distributed to CMOs representing at least 80% of the total neighboring rights (related rights) market.

At the time of writing, ten executives (N = 10) from nine different CMOs participated in the survey, covering different typologies of performers' CMOs and jurisdictions, as indicated in Tables 1 and 2. The total collection declared by the CMOs in the survey for 2022 was €1.143 billion,[14] which represents almost 50% of the total neighboring rights collection worldwide. In addition, five sampled CMOs were among the top ten countries for neighboring rights in 2020.[15] Given the specificity of this sector, which is concentrated in a few organizations, the collected answers represent prominent CMOs according to their market weight and international reach, thereby providing a representative sample.

As shown in Table 1, four interviewees were executives of organizations dealing with featured and non-featured artists' rights; three of them belonged to CMOs dealing with owners of master's rights in addition to artists' rights. Based on the authors' professional experience in the music industry, this sample also guaranteed that different sensibilities and states of technological development were represented in the sample.

[12] Due to the institutional and legal fragmentation at global level, the configuration of the collective management organizations in charge of the collection and distribution of related rights (or neighboring rights) is not harmonized. The most common (but non-exclusive) approaches are: (a) those territories with a unique CMO in charge of the neighboring rights collection for both owners of the master and performers (for instance, PPL in the UK or SoundExchange in the US); and (b) those territories with two separate CMOs in charge of the neighboring rights collection (for instance, RIAJ - owners of the master - and CPRA – performers - in Japan; or AGEDI - owners of the master - and AIE – performers - in Spain). This study focuses on those CMOs that collect and distribute related rights (neighboring rights) at least to performers.

[13] The International Federation of the Phonographic Industry (IFPI) is the organization that represents the interest of the recording industry worldwide.

[14] Information provided by SCAPR (2023a), SoundExchange (2023) and FILAIE (UIA, 2023), the Latin American Federation of Performers.

[15] According to the latest available data (IFPI, 2021), the top ten countries for neighboring rights collections, in descending order, in 2020 were: the US, France, the UK, Germany, the Netherlands, Japan, Italy, Spain, Canada, and Australia.

Table 1
Categorization of performers' CMOs surveyed during the analysis (N = 10). Confidentiality and anonymity are guaranteed by default.

CMO	Country	Type of member (s)			
		Artists/featured performers	Non-featured performers	Owners of master rights/ rightsholders	Other (which one/s)
SoundExchange	USA	✓	✓	✓	Songwriters and/or composers, engineers, producers, mixers
AADI	Argentina	✓	✓	X	X
CPRA	Japan	✓	✓	X	X
SENA	Netherlands	✓	✓	✓	Conductors
AIE	Spain	✓	✓	X	X
RAAP	Ireland	✓	✓	X	X
PPL	UK	✓	✓	✓	X
SAMI	Sweden	✓	✓	X	X
European CMO 1	European country	✓	✓	X	X

Table 2
Categorization of performers' CMO executives (C-level/directors) surveyed during the analysis (N = 10). Confidentiality and anonymity are guaranteed by default.

Executive/manager role	Company name	Country	Years of experience in the music industry
CTO	SoundExchange	USA	More than 5 years
CIO	AADI	Argentina	More than 5 years
C-level executive, prefer to be anonymized	CPRA	Japan	More than 5 years
Data and IT manager	SENA	Netherlands	More than 5 years
CEO	SENA	Netherlands	More than 5 years
C-level executive, prefer to be anonymized	AIE	Spain	More than 5 years
CEO	RAAP	Ireland	More than 5 years
CIO	PPL	UK	More than 5 years
Head of digital solutions and IT	SAMI	Sweden	More than 5 years
CIO, prefer to be anonymized	European CMO 1	–	More than 5 years

Table 2 shows that all respondents held relevant positions in their organizations as C-level executives and/or officers of aspects of information technology. They all had more than five years of experience in the music industry.

Thanks to this background and previous experience, they provide a representative sample for well-founded feedback about the present and future of the music industry, especially regarding digital transformation strategies and their implications.

Finally, data were analyzed using the framework proposed by Miles and Huberman (1994). The analysis was the result of an iterative process, including answers and a review of relevant literature on the topic, which was useful for multiplying insights (Srivastava & Hopwood, 2009).

4. Findings and discussion

The findings are presented in the following three subsections. The first provides an overview of the main music blockchain projects in which at least one CMO participates and the main trends identified during the process. In second subsection, building on the expert survey, the authors examined the role of new technologies in digital transformation challenges in the case of performers' collective management, including blockchain. The third section discusses the present and future of blockchain-based implementations in these organizations and the entire music industry, including experts' reflections on the main advantages, opportunities, and challenges ahead.

4.1. CMOs' managing rights in musical works: a map of the main blockchain projects in music

Table 3 displays the results of desk research about blockchain projects in music developed and/or participated in by at least one CMO managing the rights to musical works. This analysis provides a snapshot of the blockchain strategies of this type of organization and is limited by publicly available information. However, it is useful for understanding the main trends in terms of scope, state of development of the projects, and relevance of their digital transformation strategies, especially regarding the common areas and approaches.

Blockchain projects in which CMOs participated began in 2017. In 2016, Teosto, an organization that manages the copyrights of music authors in Finland, joined the Music Tech Fest Blockchain Lab in Berlin. During a five-day course, experts from different backgrounds explored ways in which blockchain technology could improve the music industry (Music Tech Festival Berlin, 2016). The result was a white paper summarizing the advantages and disadvantages of blockchain by considering the perspectives of different stakeholders.

Table 3
Blockchain projects developed and/or participated in by at least one CMO (musical works).

Project/solution	URL	CMO(s) (country)	Type of membership	Degree of implementation	Launch year	Main objective/description
ELIXIR – joint project: SACEM, PRS, ASCAP	https://www.prsformusic.com/press/2017/prs-for-music-ascap-and-sacem-initiate-joint-blockchain-project	SACEM (France) PRS (UK) ASCAP (US)	Authors/ publishers	Pilot	2017	The goal is to prototype how the music industry could create and adopt a shared, decentralized database of musical work metadata with real-time update and tracking capabilities.
Pigeon – joint project: Teosto and Chainfrog	https://www.teosto.fi/en/teosto-develops-a-blockchain-platform-for-music-copyright-organisations/	Teosto (Finland)	Authors/ publishers	Prototype, pilot	2017	Developing a blockchain platform for faster and more transparent tracking and processing of royalties for music authors and publishers.
Joint project: SENA-BUMA	https://sena.nl/files/original/sena-annual-report2019.pdf https://sena.nl/files/original/sena-annual-report2019.pdf	SENA (Netherlands) BUMA (Netherlands)	Artists/owners of the master Authors/ publishers	Preliminary study	2019	Joint study on how blockchain technology might be integrated into the music rights field. After an in-depth exploration of the pros and cons, it was decided not to make any further investments into the possible implementation of this technology at this time.
Joint project: Revelator, BMAT, and Teosto	https://www.teosto.fi/en/faster-payments-for-music-rights-holders-pilot-project-by-teosto-revelator-and-bmat/ http://bloomen.io/how-and-why-teosto-the-cmo-of-finland-supports-exchange-of-metadata-of-musical-works/	Teosto (Finland)	Authors/ publishers	Pilot	2019	Polaris Works API Kendraio.
JASRAC, verification experiment	–	JASRAC (Japan)	Authors/ publishers	Trial	2019	Verification experiment on the use of blockchain to manage transaction records for copyrighted material usage.
JASRAC, demonstration experiment	https://www.jasrac.or.jp/ejhp/release/2020/0204.html	JASRAC (Japan)	Authors/ publishers	Trial	2020	Demonstration experiment by developing a blockchain base and web application that will record “hash value of digital content”, “creator ID”, and “timestamp information” for each music work. Arbitrary metadata relating to the music work can also be added to this record.
Joint project: Algorand and SIAE	https://algorand.com/resources/ecosystem-announcements/siae-launches-4-million-nfts-on-algorand-for-creators	SIAE (Italy)	Authors/ publishers	Pilot	2021	–
Musicstart	https://www.musicstart.com/	SACEM (France)	Authors/ publishers	In production, beta	2022	A new blockchain-based creative protection service, available via its subsidiary URights, allowing authors or composers, including beginners, to create proof of anteriority for their creations.
KENDRIX	https://kendrix.jp https://www.jasrac.or.jp/ejhp/release/2022/0628.html	JASRAC (Japan)	Authors/ publishers	In production, beta	2022	Closed system to manage and certificate the works.

i Authors and/or publishers, featured performers/non-featured performers, and/or owners of the master.

In 2017, Teosto launched Pigeon, a joint project with the Finnish private company Chainfrog. In addition, Teosto partnered with its counterparts, Koda (Denmark) and Tono (Norway), under the Polaris Nordic alliance. They aimed to build a back-end system to collect and distribute music rights. In 2019, the joint project partnered with the private blockchain-based company Revelator.

Similarly, in 2017, the PRS (UK), ASCAP (US), and SACEM (France) announced their collaboration in ELIXIR, the first joint project involving the three main global authors' organizations. As in the case of Pigeon, ELIXIR was a pilot project aimed at understanding the potential of blockchain technology but with no specific road map for the commercial phase in the short term.

Between 2017 and 2022, seven additional projects were identified in which at least one CMO participated. Their analysis revealed some similarities. First, blockchain projects seem specific to authors' CMO. The exploratory partner project between SENA and BUMA (Netherlands) in 2019 was the only project led by a performers' organization, and it was just a preliminary study.

Moreover, the development of the projects is at a somewhat exploratory stage. The majority are pilots with no clear roadmap to the commercial phase, apart from those led by JASRAC (Japan). Furthermore, only two projects were in production in 2022, which were developed by SACEM (France) and JASRAC (Japan). SACEM's project, Musicstart, is a service that allows authors, composers, and arrangers to create a proof of anteriority for their creations. The service is offered by URights, a subsidiary of SACEM, and is free for its members. Non-members can choose to pay to protect one work (a one-off payment of €3.99) or opt for a subscription model to protect as many works as they want (€4.99 per month). JASRAC's project, KENDRIX, is the logical evolution of their previous works. They developed a management tool for musical works by their members aimed at solving common issues among creators, such as unauthorized object use and music spoofing.

In summary, the adoption of blockchain is at a very early exploratory stage and is far from being central to organizations managing rights in musical works. Desk research does not allow strong conclusions to be drawn on the causes of this slow adoption curve. Still, the quantity and size of the projects reveal that at the time of writing, blockchain was more of a commercial or marketing-oriented term than a technological driver for this type of organization.

4.2. New technologies and digital transformation challenges in collective music management

Table 4 presents the main statistics (mean/average, median, and mode) related to the scores for the five proposed digital transformation themes. Surveyed respondents had to order options according to the impact they thought these technological challenges would have on their company's operations during the following five years.

The results revealed that the massive data storage required is by far the main challenge for CMOs in the medium-term, followed by information trustability and integration architectures. However, massive data processing and data visualization seem to be the least relevant digital transformation aspects considered significant among the digital transformation strategies of CMOs. Notably, no respondent saw data visualization as the main or relevant challenge for their companies during the next five years.

Similarly, Table 5 displays the main statistics (mean/average, median, and mode) related to the scores received by the eight new technologies in terms of their impact on CMOs' operations during the next five years. As in the previous case, the surveyed executives had to order options according to the impact they thought these new technologies would have on their respective company operations over the following five years.

AI, IoT, and cloud storage and computing were the most relevant. Further, VR and/or AR were rated as the least impactful technologies for the interviewees' company operations. These results are consistent with previous answers regarding the technological challenges. In addition, answers about blockchain were homogeneous among respondents. Generally, executives expect that it will have a moderate impact on their business operations. Meanwhile, heterogeneous perceptions were observed about the roles of ML and RPA.

4.3. Blockchain adoption: present, future, and challenges ahead

Regarding the potential adoption of blockchain for their activities, only three sampled CMOs had conducted or planned to conduct research or pilot projects in this area, with no practical implementation at the time of writing. Moreover, no CMO was currently using blockchain technology to manage music rights and distribute royalties. In addition, interviewees did not provide any blockchain-based solutions in other CMOs other than those listed in Table 3. Specifically, Kendrix (JASRAC, Japan), the Teosto initiatives, and joint projects involving the PRS, SACEM, and ASCAP were just mentioned as examples.

Given the representativeness of the sample, these answers are insightful regarding the current state of blockchain development and adoption in the field.

Looking into the future, there was no common understanding of whether there will be opportunities to use blockchain in the music

Table 4
Survey respondents, technology challenges (measures of central tendency): mean, median, and mode scores (1: least impact – 5: biggest impact).

Technology challenge	Data visualization	Massive data processing	Integration of architectures	Information trustability	Massive data storage
CMO executives (N = 10) – mean/ average score	2	2.5	3.2	3.5	3.8
CMO executives (N = 10) – median score	2	2	3.5	3	4
CMO executives (N = 10) – mode score	1	1	2	3	5

Table 5
Survey respondents, technology impact (measures of central tendency): mean, median, and mode scores (1: least impact – 8: biggest impact)rning (ML).

Technology	VR and/or AR	Blockchain	Real-time sync systems	Robotic process automation (RPA)	Machine learning (ML)	Internet of things (IoT)	Cloud storage and computing	Artificial intelligence (AI)
CMO executives (N = 10) – average/ mean score	3.9	4.1	4.3	4.4	4.7	4.8	4.9	4.9
CMO executives (N = 10) – median score	2,5	4	4	5	5	5,5	5,5	5
CMO executives (N = 10) – mode score	2	4	2, 4, 8	5, 7	3, 5, 6, 7	6	1, 4, 6, 7	8

industry and/or collective management. Moreover, none of the surveyed executives believed that blockchain is the solution to data management problems. Consequently, none of them thought it will be adopted in the short or medium term.

Three of them summarized the situation as follows:

> I do not see that blockchain will revolutionize the industry as a whole, but it will find implementations in certain areas and maybe grow organically over time.
>
> I don't think blockchain will impact the music industry as a whole.
>
> You can achieve the same results with already-existing technologies. There's no need to reinvent the wheel.

Two interviewees openly refused to consider any opportunities for this technology in the music industry. One of them, Mark Douglas, CIO at PPL (UK), publicly detailed their views in the summer of 2022 (Music Business Worldwide, 2022).

> Mark Douglas (CIO at PPL, UK): […] *This key attribute of blockchains doesn't address the challenges we face in music data. Our problem is that the necessary data is not being captured in the first place. Our problem has never been not having a tamper-proof place to store that data, it has been one of data management.*

The remaining surveyed executives believed that blockchain could help them to some extent. While most of these types of answers are references to the general advantages of the technology (traceability, trust, transparency, immutability, etc.), two interviewees provided potential examples in terms of payments.

> [The] most logical response is that: a) blockchain will be used to include all rights, participations, identifiers, and credentials of all actors during the production process of a recording (i.e. create the digital footprint of the recording); b) blockchain will be used to clear rights and usage and make pay per play possible via microtransactions to all right holders using smart contracts.
>
> At CMO level, blockchain could be used to build a global database for monitoring, assuring that information is immutable.

Practically, interviewees generally agreed that governance and not technological issues are the main barriers to overcome.

> However, I do not think the music industry will resolve governance issues in the next 10 or more years when it comes to blockchain.
>
> The main barrier to implement this type of solution would not be technological, but in terms of governance.
>
> Could be hard to implement a solution that is accepted and used by all parties.
>
> When governance is fixed, technology will follow.

Building on these governance issues, several interviewees noted that the main problem was the low quality of data, especially when a musical work was first created. There are mistakes, omissions, and misinformation when information related to musical works is initially set. These issues have persisted over a long time.

During an interview at Music Business Worldwide, Mark Douglas pointed out this issue to be fundamental:

> Firstly, it is a fundamental shift in behaviours we need. We need artists, and those around them, to understand the importance of data management and to then follow good processes to make sure that it is captured and passed on. […]
>
> Secondly, the absence of a counterparty to verify the data that is being added to a blockchain is a problem. So much so that the primary strength of a blockchain becomes its massive Achilles' heel.

Two C-level interviewees emphasized similar arguments related to data quality and difficulties in establishing a unique reliable source:

> *Integrity and immutability of the data are smaller issues than data quality* (in relation to the opportunity for blockchain and main challenges/risks).

> There are no authoritative sources of data to create the first link of the chain.

Again, these organizations focus on standardizing and ensuring data quality.

> My focus is on standardization, including identifiers and a single source of high-quality data; respectively activities like DDEX, IPN, and RDx.

Regarding the potential role of CMOs as prescribers or industry leaders in the adoption of blockchain technology, no respondent saw their respective organizations as early adopters of new technological advances given their non-profit base. Some respondents pointed to major record companies as potential prescribers.

> My company will keep up with developments in blockchain technology and explore ways to potentially incorporate these into our business model if appropriate.

> If the music industry is changed by blockchain it needs to be adopted by the major record labels, with UMG ahead. I do not plan to stay ahead of this curve … if blockchain will start impacting the music industry, we will adopt.

> I don't plan on being ahead of the curve, just not falling behind is enough, from my point of view.

> Most CMOs are not-for-profit organizations. Spending musicians' and/or rightsholders' money pursuing blockchain projects is not an appropriate use of that money. There are far simpler and lower-cost things all CMOs can be doing that will deliver far more value than blockchain projects.

Regarding the role of CMOs in the music industry, the respondents noted the value of collective management beyond the role of collection and distribution. The interviewed managers believed that CMOs played a key role in negotiating fair remuneration and tariffs for all repertoires, although there were no specific questions about it.

> The collective management organizations will be used to negotiate tariffs for the many who are not big or famous enough to negotiate the tariffs themselves and include them in the smart contracts.

> […] role of collective management organizations will change. To keep collective management is not a purpose on itself, it is to ensure rightsholders receive fair compensation for the use of their music.

Therefore, the surveyed experts believe that blockchain technology cannot solve the "original sin" of attribution problems in the music industry: data are not being properly gathered when music is created. In addition, experts felt that governance issues were far more significant than technological aspects as the main barriers to overcome while considering blockchain's adoption in the music industry.

Crucially, none of the interviewees saw their organizations and/or counterparts as leading the adoption of blockchain. Moreover, it was not a central issue in any of their digital transformation strategies. They prefer to wait and see how the rest of the music industry adopts (or does not) blockchain, taking a reactive stance.

5. Conclusions

This study evaluates the opportunities and challenges presented by blockchain in the music industry's digital transformation from CMOs' perspective.

Blockchain is believed to have the potential to affect various industries in the coming years. In the media and creative industries, some applications of blockchain technology may address typical challenges such as disintermediation, new sources of value, and enhancing transparency, trustability, and security. While sharing common issues with other creative industries, the music industry faces specific challenges that may create a field of application for blockchain-based solutions. One of these concerns the allocation and payment of royalties in an increasingly global digital environment specifically involving CMOs.

This study evaluates how CMOs understand, plan, and implement (if they do) blockchain technology applications to provide solutions to issues regarding the allocation and payment of royalties. Building on desk research and primary data from a representative survey with executives of performers' CMOs, the results provide deeper insights into the real prospects of adopting this technology within the music industry.

First, this study provides a map showing the main blockchain-related projects during 2017–2022. Specifically, CMOs participate in a limited number of blockchain projects. Moreover, most are simply research, proof-of-concept, or pilot projects, meaning that blockchain adoption is far from being a massive commercial phase. Authors' CMOs from Finland (Teosto), Japan (JASRAC), and France (SACEM) appear to be the most active organizations in this field, with no performers' CMOs developing projects in this field according to publicly available information.

From the CMOs' perspective, massive data storage, information trustability, and integration architectures are the most significant challenges when considering their digital transformation strategies. Consequently, AI and ML, followed by cloud storage and computing, appear to be the key technological enablers for these organizations in the short and medium terms.

From the perspective of CMOs' respondents, the attribution problem is a governance and data management problem rather than a transparency problem. However, they recognize that the traceability of data may be an area for the application of blockchain. Performers' CMOs tend to believe that blockchain is not a priority. It cannot solve the "original sin" of attribution problems in the music industry: data are not being properly gathered when music is created. Additionally, governance issues, far more than technological

aspects, emerge as the main barriers to overcome in the context of blockchain adoption by the music industry.

Consequently, at the time of writing, CMOs were not leading players in blockchain adoption. Moreover, this was not a central issue in any of their digital transformation strategies. Their position is perceived as reactive. They are waiting and seeing how the rest of the music industry adopts (or does not adopt) blockchain. This reactive stance contrasts with CMOs' decisive role as promoters of the attribution of rights and fair payment of royalties in the music industry, especially regarding the traceability of data. C-level CMO managers have limited knowledge of some existing projects, which suggests that blockchain-based solutions are not on the road map of CMOs in the medium term. However, as CMOs identify data management as a source flaw in the context of issues regarding the allocation and payment of royalties, other technological breakthroughs may open new fields to find solutions, especially AI applications.

These insights and conclusions are framed as snapshots of the ever-increasingly complex environment in the music industry. For example, in the time taken to conduct this research, the explosion of generative AI applications has brought new possibilities, challenges, and uncertainties to the music industry (David, 2023; Smith-Muller, 2023). Along with the increasingly rapid pace of technological disruptions, the main limitations of this research are due to the nature of the sample. It is limited to executives of performers' CMOs and excludes organizations managing authors/composers' rights or other relevant stakeholders, such as labels or publishers. While the long experience of interviewed executives in the music industry makes it possible to guarantee the consistency of the results, further research can broaden the sample to include other roles/stakeholders and look for new visions in terms of strategy.

From a broader perspective, despite the specificity of its problems and challenges, the ways in which the music industry innovates and implements more effective data management procedures may also be relevant for other creative industries, as this has become a key issue in the digital media value chain.

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CRediT authorship contribution statement

Alberto Arenal: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Cristina Armuna:** Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sergio Ramos:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Data curation, Conceptualization. **Claudio Feijoo:** Writing – review & editing, Validation, Supervision, Investigation, Funding acquisition, Conceptualization. **Juan Miguel Aguado:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Investigation, Funding acquisition, Conceptualization.

Data availability

Data will be made available on request.

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