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Decentralizing Music: Blockchain Solutions to Empower Emerging Artists, Aiming Toward an Ideal Meritocratic Music Industry

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Introduction

The music industry, a dynamic ecosystem of creativity and commerce, has undergone a profound transformation in the digital age. While digitalization has democratized access to music, it has simultaneously exacerbated long-standing challenges related to royalty collection, artist compensation, and copyright protection. Emerging artists, in particular, face increasing difficulties in gaining recognition and fair remuneration, while listeners are often disconnected from the creative process. This thesis argues that blockchain technology, with its inherent transparency, security, and potential for automation through smart contracts, offers a powerful new approach to address these systemic issues. This work explores how a blockchain-based platform can be designed to empower emerging artists, foster a more meritocratic and transparent music ecosystem, and ultimately reshape the relationship between creators and their audiences. Chapter 1 provides a technical overview of blockchain and smart contract technologies, examining their functionalities and potential regulatory implications. Chapter 2 analyzes the current state of the music industry, highlighting the challenges and opportunities presented by digitalization. Finally, Chapter 3 presents a vision for a blockchain-based platform, outlining specific incentives and mechanisms designed to support emerging artists and promote a more sustainable and inclusive music ecosystem. This research aims to demonstrate how blockchain can not only enhance efficiency and transparency but also redefine power dynamics within the music industry, creating a future where copyright empowers creators and fosters a thriving environment for musical talent.

Chapter 1: Blockchain Technology

1.1 A New Paradigm: The Blockchain

Blockchain can be interpreted in various ways, as it is not limited to a single perspective or point of view.

What can be said definitively is that it would be too much of a reductionism to consider it just as technology; it is better termed as a paradigm.
It is generally accepted that blockchain belongs to a subfamily of technologies that utilize a chain of blocks to record transactions. This chain is validated through a consensus mechanism, which is distributed across all nodes in a permissionless (public) blockchain or across authorized nodes in a permissioned (private) blockchain. Blockchain technologies, the main blockchain characteristics, include the immutability of the ledger, transparency of the system, traceability of all transactions and security based on cryptography.

Functionally, blockchain is based on a network that enables the management of a distributed database. Operationally, this system offers a robust alternative to centralized archives, enabling participants to update and share data in a distributed manner. This enables data management, including verification and authorization, without relying on a central authority.

In order to really understand what is behind the blockchain, it becomes necessary to dwell on some of the proposed definitions in an attempt to qualify them.
Some envision it as the future of the internet, potentially evolving into an "Internet of Transactions.

This leads us to pair it with the Internet of People, or the internet that we use and frequent every day, which has in turn extended to the Internet of Things, to create and represent the Internet of Value based on seven characteristics:

- Decentralization
- Transparency
- Security
- Immutability
- Consensus
- Accountability
- Programmability

These principles have served to start the blockchain journey as the digital declination of a new concept of trust to the point that it could also have a ‘social and political’ value.

In this context, blockchain serves as a foundation for a new form of social interaction, characterized by transparency and accountability. It enables individuals to verify and monitor actions and decisions, which are recorded in an immutable and tamper-proof manner.
However, the initial association of blockchain with Bitcoin led to confusion, prompting many to equate blockchain solely with cryptocurrencies.
Actually, blockchain is a much broader concept, encompassing various applications beyond cryptocurrencies and digital payments

Having said all that, we can conclude that blockchain is a technology used to manage distributed databases for the transactions taking place between multiple nodes of the network.
Blockchain, as the name suggests, is a chain of blocks containing transaction histories and each transaction has to be validated by a network, which means that a database is in a form of blocks, each of which has multiple transactions, and they are linked together.

All transactions are seen, controlled and approved by the nodes of the network which share the entire blockchain archive. All transactions and their history are contained in each block, and can only be modified with consent of all the nodes so as to guarantee transaction immutability.

In other words, blockchain is a kind of distributed and immutable digital log of blocks (say, for example, transactions or other data) that is maintained and updated by consensus of all participants in the network without a central authority.

1.2 Origins of the Technology

In 2009, Satoshi Nakamoto is credited with launching Bitcoin, the first modern cryptocurrency along with its supporting blockchain architecture. But we have to acknowledge that the concept of blockchain precedes this. The concept of blockchain, although not referred to by that name at the time, was first introduced by David Chaum in his 1982 doctoral thesis titled “Computer Systems Established, Maintained, and Trusted by Mutually Suspicious Groups”. It’s the invention of blockchain, 27 years before Bitcoin.

Although Chaum’s networks were not created for digital currencies, they were obviously related. Chaum founded DigiCash in 1989, which in 1995 introduced cryptocurrency digicash, also called eCash and cyberbucks. Amongst the old guard, DigiCash, established by David Chaum, promised countless features of modern crypto currencies, with a specific focus on maintaining anonymity during transactions. However, Chaum was unable to win over the banks on the project. The internet infrastructure needed to support peer to peer transactions didn’t exist, DigiCash failed and went bankrupt in 1998.

In 2008, interest in blockchain technology was revived with the publication of the document “Bitcoin: Described as A Peer to Peer Electronic Cash System” by Satoshi Nakamoto. Like

Chaum's blockchain, Nakamoto's network was similar, however, whereas Chaum's blockchain did not use proof of work consensus, Nakamoto included a way of validating blocks creating tokens. In 2008 Nakamoto released the code for the blockchain on SourceForge for developers international participation. Bitcoin and the first modern blockchain were launched in January 2009.

Initially, Bitcoin faced similar challenges to DigiCash. It took more than a year for a Bitcoin to climb to the value of one dollar. Bitcoin value only exceeded 1,000 euros in 2017. In that period, despite its volatility, the value of Bitcoin has been trending upwards. The first two years, Bitcoin was the only permitted cryptocurrency.

Following on, in 2011 there were derivative cryptocurrencies like Litecoin and Namecoin, 2012 saw Peercoin, and in 2013 Dogecoin.
But in 2015 Ethereum was introduced: a blockchain not just for cryptocurrencies, but a platform to run dApps (decentralized applications) on and play host to NFT's (non-fungible tokens) thanks to its ability to execute source code.

While blockchain technology has been successful around the world, researchers are busy finding out new variations of blockchain architecture to fix the problem of scalability in terms of high fees and long processing times. However, the efforts to resolve these challenges create new challenges with new blockchains that use innovative solutions like alternative consensus mechanisms and private blockchains. There are many new cryptocurrencies and blockchain applications specific to certain industries, others not related to cryptocurrencies, and still, others to replace fiat currencies.

1.3 The Blockchain Paradigm

The blockchain paradigm is based on the structure of several fundamental elements that determine the operation and security of the blockchain.
Firstly, blockchain is a decentralized ledger: a global and public register for every transaction that is recorded. Consisting of blocks of data, added in an immutable, sequential and transparent manner.
Mining is the process of verifying transactions using multiple machines operating concurrently. Block verification requires significant computing power to ensure the integrity of the ledger. Miners are responsible for verifying the transactions within a block. The amount of that cryptocurrency they earn (Either on the Ethereum blockchain, for example, or Bitcoin on its own blockchain) is what's exchanged for their work. When a miner correctly verifies a block of transactions, the network approves the block as complete and is ready to head on to the next one, with each block mined on Ethereum every 15 seconds.

Each block in the blockchain can be visualized as a page in a ledger, containing a record of transactions and associated data. Contextual details, e.g. the identity of the node who mined it, the reward earned, and the timestamp, are contained in each bit.

Each node (i.e., each participating device), such as a personal computer, laptop, smartphone or any other device equipped with a network connection, has the same rights and powers, and an up to date copy of the transaction ledger is stored in each node. If someone wants to do a transaction, they set the amount and the recipient and sign the whole thing with their private key. With the public Key, other nodes vouch for authenticity and when consensus is reached then the transaction is added to a block and recorded on the Blockchain.

With these characteristics, blocks are intended to store varying information; transaction data could be stored, however it is not intended to store user specific data, such as unique personal

information.This is all made possible thanks to a cryptographic function, which is called hashing, that turns the data into a bit sequence, a so called 'digest', which is unique to that data, and the function is essential to uniquely identifying and checking for alteration of blocks. An important characteristic of this function is that it is irreversible, that is, when you know only the output of the function you can not calculate the input data.

The blockchain consists of transactions, which contain details about who sent and who received funds, what data has been exchanged, and the value of the exchange (e.g. cryptocurrency). A transaction is created when an exchange happens and then put into a block.

The consensus mechanism is essential for the operation of the blockchain and implies that all involved parties must agree on three fundamental aspects:
the history of the transactions, the rules of the protocol and the value of the currency.

The so-called “problem of the Byzantine Generals” is a well-known issue among the blockchain world. It addresses the difficulty of achieving uniform agreement among the generals in the presence of the dishonest or faulty nodes.

Various consensus mechanisms are used to ensure the integrity and security of the blockchain, including:

- Byzantine Fault Tolerance (BFT): Provides an ability to reach an agreement even when some nodes in the network are faulty or even malicious.
- Proof of Work (PoW): This means that nodes must solve complex mathematical problems (referred to as cryptographically hashing) to validate the transactions and create new blocks of blocks, as such requiring major computational resources to be able to do this.

- Proof of Stake (PoS): Based on a pseudo random election and based on a multi dimensional scoring system which takes into consideration factors such as node wealth and the age of staking.
- Delegated Proof of Stake (DPoS): Allows voting for their rights to third parties (delegates), which controls the building of blocks and their verification processes. Users are assigned a proportional vote to the number of coins they hold.

The blockchain will rely on these elements and these mechanisms working together to ensure it is a secure, decentralized, and manipulation resistant system.

1.4 Classification of Blockchain

You can generate a blockchain in a number of ways, with public, private, permissioned, or consortium networks.

Public Blockchain Networks (Permissionless) are something like Bitcoin. Anyone can join them. While they need high computational power, they afford little privacy and can have weak security, which makes them less good for corporate usage.

Private Blockchain Networks are decentralized like public Blockchain Networks, but under the jurisdiction of a single organization who are able to dictate who has access, what consensus will be used, and what is recorded by the ledger; their use makes available greater trust and security and where needed can be run behind corporate firewalls or on-premise.

Private or public blockchain networks are permissioned Blockchain Networks that are either private or public networks with restrictions on who can participate and in which transactions. Participants are required to be invited or authorized.

Finally, you have Consortium Blockchains, that require maintenance by multiple pre selected organizations that have shared responsibility and are useful when all the participants need to be authorised and also need to maintain shared responsibility.

1.5 The Security of the Technology

A blockchain system must fully depend on the security pillar in order to be compliant and serves as an essential component to uphold the integrity and reliability of the network.

This is as explained in the paragraph above, and as the structure of the blockchain itself brings security. The hash of each block links to the previous block, making a chain of blocks that's very hard to tamper with.

In fact, if an attacker modifies a block, he must modify all blocks that follow because each block holds the hash from the preceding block. It would require an insane amount of brute force computational power, which no today's miners are likely to have.

The attack is called a "51% attack" and the critical limit it's associated with is referred to as "the 51% threshold."

In a 51% attack, an original scenario is when the attacker controls more than half of the sum total of the overall computing power of the network. With this control, an attacker could have prevented new transactions from being recorded by preventing them from being included in the ledger and users would have been unable to transact and, conversely, could reverse

transactions—cancel already confirmed transactions so that the same cryptocurrency would be able to be spent twice (a.k.a. ‘double spending’).

While technically feasible, a 51% attack would be nearly impossible to pull off on more well known and well defended blockchains such as Bitcoin or Ethereum. They have an enormous aggregated computing power, and a vast network of distributed miners.

To bring these attackers to control more than half of the computing power in the network would require a lot of resources from a single attacker or coalition of attackers, and therefore be economically infeasible.

As a result, security plays a very important part in blockchain technology, impacting on reliability, integrity and adoption.

In this thesis, we consider several aspects of blockchain security, namely, identifying and analysing vulnerabilities, security measures, and best practices for blockchain networks to withstand attacks and frauds.

Blockchain indeed utilizes several fundamental security principles to ensure the protection of data and transactions, including:

- Cryptography: The blockchain protects transactions with the use of the cryptographic algorithms. Asymmetric cryptography means for public key and private key cryptography, making sure only the owner of the private key can sign a transaction.
- Immutability: Once data is put into a block and on the chain, there is no way to change it without changing every other block thereafter, which in turn renders tampering almost impossible.

- Decentralization: It resists attacks because there is no one place to be attacked. It takes the consensus of a network of nodes to make decisions.
- Consensus: Blockchain transactions are only made valid through consensus mechanisms, which are mostly Proof of Work (PoW) and Proof of Stake (PoS).

Despite its security principles, blockchain is not immune to vulnerabilities and threats:

- 51% Attacks: When a single actor or small group of actors control more than 50% of the network's computing power, they can change the blockchain, double spend, and block transactions.
- Smart Contract Bugs: When smart contracts, which are executable code on the blockchain, have vulnerabilities they can be exploited. A good example is the DAO attack on Ethereum in 2016.
- Phishing and Social Engineering: Phishing attacks to obtain user private keys by any sort of social engineering technique.
- Sybil Attacks: A malicious actor uses a large set of fake identities to acquire unproportionally large influence over the network.

To mitigate vulnerabilities, several security measures are implemented, including:

- Auditing and Code Review: Code reviews and security audit is conducted on smart contracts and blockchain systems.
- Advanced Cryptographic Techniques: Techniques homomorphic encryption and zk-SNARKs are used to improve privacy and security within transactions.
- Multi-Signature: The signatures of multiple private keys are required to perform transactions that make them less risky in case a single one of them gets compromised.

- Hybrid Consensus: To address the issue of the security and resilience of the network, we combine different consensus algorithms.

Best practices for ensuring blockchain security include:

- Secure Key Management: Hardware wallets, secure key management system.
- Education and Awareness: Providing education to users about risks, and security, like what is phishing and social engineering.
- Updates and Patches: Doing all they can to ensure that node software and smart contracts are running the latest security patches.
- Incident Detection and Response: Putting in place monitoring and rapid response systems that will detect and mitigate such attacks in their real time.

Chapter 2: The Music Industry

2.1 Introduction

One of the many industries disrupted by Digitalization, the music industry holds a special place. Selling digital radio as MP3s meant changing the nature of the relationship between the different components of that value chain, as well as business models: sharing, online sales, streaming services, to name just a few ways of addressing the long-standing issue of how to manage copyright and remunerate artists.

With the advent of streaming, the process of distributing and monetizing music has become even more complex and seemingly less fair, increasingly inefficient, centralized, and opaque: they explained that the supply chain is long and fragmented that on various occasions intermediaries

reduce artist compensation in favour of the aggregation of earnings in the hands of a few intermediaries, while artists, in particular emerging or anonymous artists, in many cases receive stumbling and insufficient compensation, compared to the real spread of their works.

The profits streaming generates are massive, yet not fairly shared with all of the stakeholders involved.

The 2015 report from Berklee College of Music, titled Fair Music: Highlighting this, Transparency and Payment Flows in Music Industry in the Music Industry explains how blockchain could be utilized to solve some of the key problems in the music industry, that includes rights management and how revenues are distributed when online music is involved.

The first major point is the inefficiency and unfairness of the royalties distribution from music streaming, up to 70 percent of which goes into labels, distributors and other middle men party pockets. With the growth of streaming, this system has only become more opaque and shoddier, so that even as fans spend money to access music, a smaller and smaller amount of earnings makes its way to the artist.

Furthermore, this thesis attempts to examine how blockchain technology can propose a pragmatic resolution for the structural problems of the music industry on royalty management and fair remuneration for artists.

This technology would create a shared information circuit within a fragmented, sometimes opaque system to facilitate clarity and transparency on each transaction related to a given musical work.

Additionally, the micro payments generated from daily streams of platforms could be handled efficiently and automatically by the use of smart contracts, bypassing the delays and uncertainties of current payment models.

2.2 Evolution in the Music Industry

Historically, music was primarily experienced through live performances or direct interaction with musical instruments. Prior to the late 19th century, the music market was dominated by the printing and distribution of sheet music. The invention of the phonograph by Thomas Edison in 1877 marked a turning point, enabling the mechanical recording and playback of sound and paving the way for music consumption without live performance. Spreading within a few decades, this technology brought about a genuine market of recorded music thanks to the phonograph, the main music distribution medium until the late 1800's. Further on, the phonograph was substituted for the gramophone of Emile Berliner using discs rather than cylinders to record. This innovation enabled entrepreneurs to duplicate discs and expand the record market.

In the course of the 19th-20th century the main music distribution devices were phonographs and gramophones, and it is in this context that the turn of the century records industry started to be dominated by major record companies like Edison Records, Columbia Records and Victor Records. As the 1930s neared, technological innovation had brought in tape recorders, replacing gramophones and offering a better quality recording and the beginning of the idea of an 'album'. In 1948 vinyl made its debut, and the 33 rpm record took the place of the 78 rpm for classical

music, while the 45 rpm record, with its higher pitch, replaced the old 78 rpm for popular music. Yet the changes in music distribution did not change the world of the record industry.

Other milestones were introduced when the audio cassette appeared in 1963, and the CD in 1982. Due to its ease to be carried about, the audio cassette became very popular indeed upon the arrival of the Walkman in 1979. Through the introduction of CD, taking music to the digitized form started a revolution and it gave us superior quality and higher capacity than vinyls and cassettes. This new medium, in turn, was ground zero for the growth explosion of the music industry which culminated economically in the late 1990s—early 2000s. Along with the explosion of the Internet and digital technologies came a crisis for the record industry, precisely in the new millennium.

The evolution of the compression formats, in these cases MP3, and the phenomenon of the spread of file sharing platforms Napster were determinants of a dramatic fall in the physical record sales. However, MP3 became a growing threat to the industry that MP3 eventually found its way onto some legal platforms such as iTunes, which debuted in 2003 and symbolized the move of music from a physical product to a digital good. The evolution did not, however, stop there, and the rise of on demand streaming platforms like Spotify, YouTube, Deezer, and Tidal came along and completely changed the rules by introducing a new model of music consumption: unlimited access to songs by monthly subscription. In doing so, this process also reinvigorated the cost controversy surrounding artist remuneration, as earnings have moved from physical sales to streaming royalties, a model that is widely believed to pay artists too little.

A major restructuring of the value chain of the music industry has resulted from these innovations and have profoundly changed the methods of music distribution.

2.3 The Industry's Current State

As previously discussed, the pre-digital era saw a thriving music industry, valued at $38.6 billion, with CDs as the dominant format and a 15-year growth period. It's referred to as the industry's 'golden age'. However, the rise of the internet and online piracy in the late 1990s significantly impacted the music industry.

In reality, this made it possible for downloading music free illegally, which brought about a steep drop in revenue and a crisis that has been brandied in the sector until 2012.

However, from 2015 the industry started to make back the losses, and thanks to the fast evolution of digital models and particularly to the implementation of music streaming, it is just standing still.

The music industry is today valued at $19.1 billion and present growth rate is 9.7% from previous years. Streaming is up a whopping 34% now accounting for $8.9bn in total or 58.9% of the total digital market and thus driving the sector’s growth. CD sales, which have been falling, now account for revenues replaced by this phenomenon.

On the back of digital revenues — which have been largely driven by paid subscription models for streaming — overall music revenue has spiked massively in recent years, while music downloads have tumbled 21.2%. Even as the physical sales have fallen vinyl format do continue to grow, particularly in markets such as India, Japan, and South Korea where there has been an increase in sales. Streaming has seen revenue growth, as have performance rights (derived from revenue from radio broadcasters and public venues) and synchronization (the placing of music in ads, video games, television).

Therefore, in music, we can clearly see that the music market has adjusted to digitalization and new vitality has been revived in the business models that are concentrated on the digital, to ensure the gradual recovery after years of crisis.

2.4 Changes Brought by New Technologies

The advent of the internet and digital technologies, along with new forms of control and distribution, significantly disrupted the music industry and its previously steady growth trajectory.

To fully grasp the impact of these changes, it is essential to analyze the evolving structure of the music industry, including the roles of various players, the shift in revenue models, and the influence of technological innovation on the value chain, barriers to entry, and relationships between incumbents and new entrants.

As stated in the previous paragraph, the record industry represents only a part of a broader music sector, and within it, three main phases can be distinguished: for production of music, intermediation, and final consumption of music.

The actors involved in these phases are: Such as types of collective management companies (PROs), copyright management societies, musicians and authors (including composers and performers), record companies, distributors, retailers and publishers.

Together, these actors constitute the value chain which ultimately comprises the supply chain that makes the music sector operate.

By first link, music is created (songs, lyrics, arrangements, etc.) and its performance by authors, composers, and performers.

Second link is that of record companies, which are indispensable entities at the turn of analog and played a central role adding value to the work of artists by offering them financial support in

addition to recording activities, production of media (vinyl, cassettes, stereo8, CD, etc.) marketing and access to distribution channels (Hosoi, Kim, Stainken et al., 2015).

Just as record companies deal with musicians/artists, publishers sign contracts with lyric authors, support them financially, promote and license their creations, and so on, oversee the final distribution of revenues.

Along the supply chain we find distributors that receive physical media from record companies, and store them and they ship them to the retailers, or to the final consumer.

Finally, societies for the performance rights (PROs) collect the royalties emanated from the exploitation of musical pieces of work on behalf of the record industry chain, the intermediaries between the record industry chain and the music licensing chain.

Traditionally, the record industry has exhibited an oligopolistic structure in which the major record companies, the 'Majors', are increasingly dominant in the market leaving small room for the independent record companies (indie).

According to several studies, the "Majors", i.e. Sony, Warner, Universal, BMG, Emi, enjoy ownership of over 70% of the market. This is the consequence of great economies in the distribution as well as promotion phases.

The huge distribution networks and fixed costs of CDs to distribute pre digital phase only allowed the majors to drum up the money. The dominance of the Majors was further reinforced by the very high investments in marketing and promotion of new albums activity, which added a promotional aspect to the launch of new albums.

The potential for economies of scale presents very difficult barriers to entry for new players in the market. In physical format distribution, the majors had control of the entire supply chain infuriating and keeping a fair amount of revenues, the absolute top portion for the record company which was around 30% of CD sales.

2.5 The Five Promised Innovations

Usually research about music has usually been about the recorded music market, but it is important to distinguish the 'record industry' from 'music industry.' "The record industry is just part of a bigger thing: you've got other things like the manufacture of musical instruments or the creation of the music, or control of [the] copyright or broadcasting," Ardizzone added. Wikström expands this view by distinguishing three macro-sectors of the music industry: The record industry, which encompasses most of the focus of our course, and deals with recording and distributing music; the live music industry, which handles concerts and events; and finally, the licensing industry, which manages the use of musical works in different contexts for example advertising and TV.

Williamson and Cloonan suggest use of the term 'music industries' in the plural, to reflect both the complexity and variety of actors involved, and that to describe a single music industry would be reductive.

Today, the adoption of blockchain hinges on different participants and institutions within the music industry coming to agree on a common vision, and like other industries, is propagated by promises of technology that can spur the adoption of the technology.

Science and technology scholars have observed that current promises of the future are used to attract resources in order to procure support for and shaping of innovation. In short, blockchain requires a network of support based on expectations about its promise….

What these promises promise in addition to the technical properties of blockchain are the political and social implications that blockchain entails. In the specific case of music, there are five main promises that could transform the industry:

1. Efficient and Frictionless Copyright Distribution: The use of smart contracts on blockchain could speed and direct payment of royalties to artists, labels and other rights holders, improving fairness of royalty redistribution.

2. Creation of a Perfect Music Database: Complete and transparent information on authors and rights to musical works could be stored, between others, in a decentralized ledger on the blockchain, thus solving the current fragmentation of music databases and improving global copyright management.

3. Transparency in the Music Value Chain: Use of blockchain would make it visible who the rights holders are and the role of intermediaries in distributed music, reducing the number of intermediates and related expenses and improving the efficiency of the system.

4. Access to New Funding Sources for Artists: Fans could become real investors, through blockchain they could buy a fraction of the rights to this song at the moment of writing it, increasing artists financing opportunities.

5. Elimination of Music Piracy: Due to the traceability and the fact that blockchain gives direct control over reproduction rights, blockchain could make it more difficult to use music in unauthorized ways, to prevent piracy and to give better protection of copyright.

Yet, while the promises seem plausible, it’s worth it to remember that such promises may face practical difficulty: adopting blockchain might not be so simple as the promises would indicate.

The adoption of blockchain in the music industry promises to deliver a range of changes in the distribution and management of copyright, but with it comes a series of questions and problems that need to be critically analyzed.

In his musings on the MP3 format, Jonathan Sterne suggested that new digital technologies not only change the ways music circulates, but that they can completely reshape the ways music is attributed with cultural and economic value as well.

In this situation, it is also necessary to pay attention to technical characteristics of infrastructures and devices used, but also to such social and cultural aspects of their adoption, as a possibility to turn the music into a valuable object for listeners and, through this, to make it attractive from an economic point of view for the music industry.

The proliferation of blockchain platforms is problematic in contrast to a promise of a unified database where all information regarding copyright and musical property will be stored. While it initially seemed a promising solution for helping establish a centralized, legitimate, and transparent registry of musical rights, the result has been a proliferation of competing platforms that use different, and to some extent incompatible, models.

In the last year and a half, since 2015, blockchain projects in music have started cropping up, such as Imogen Heap's Mycelia and Gareth Emery's Choon – trying to minimize density of intermediaries and increase fairness in revenue sharing to ways less direct and centralized such as One Click License for optimizing rights management at an industrial scale.

Yet, mainstream companies like Spotify and YouTube are taking a more cautious approach to blockchain adoption, they study ways to integrate the technology to enable copyright management at the cost of centralized control of the platforms. Spotify's purchase of Mediachain in 2017 was an effort to enhance rights management via private blockchain, an attempt which could defeat the hopes for democratization and, thus, exacerbate the exclusively 'big' players monopoly in music distribution.

The differences between various blockchain platforms extend beyond governance models to technical and economic choices: The like of Choon and Ujo Music on the other hand do make use of Ethereum and the cryptocurrency Ether, while others such as Vezt and Muse are developing blockchain on their own, as well as proprietary cryptocurrencies. In addition, platforms like Bittunes and Token.fm based on paying in Bitcoin appear which promote business models that give artists and fans more direct contact – when, for instance, purchasing a "limited edition," or in the case of distributing copyright.

Technical divergences in these terms introduce fundamental problematics regarding the interoperability of data, a difficulty that, as shown in studies on the computing infrastructures (Mongili and Pellegrino, 2014), is particularly difficult to tackle in the scenario of the blockchain. Without common standards and where platforms differ structurally, effectiveness and reliability of the whole system becomes a threat.

The proliferation of blockchain platforms has also paradoxically led to the appearance of new intermediaries who exploit the incongruities and disputes among data regarding musical rights as their specialization. Although the CAD workflows and digital platforms promise reducing the intermediaries and simplifying the value chain through automation and transparency, the

complexity of managing heterogeneous data created an extra layer of intermediaries with specially acquired skills. This phenomenon raises a tension between the desire for a fairly distributed royalty, and the realities of such a complex system resulting in, possibly, new ways of concentrating decision making powers.

Lastly, the use of blockchain for monetizing music brings with it new issues of musical content commodification. Other music platforms like Vezt proffer models in which fans can purchase shares of copyright in songs, much in the form of an Initial Coin Offering (ICO), turning music into a financial investment. If this is a new form of engagement that fans can offer, it also threatens to take music and push it even closer to the logic of the financial market, to reduce music to a commodity traded in automated micro-markets.

2.6 Thinking About Business Differently

A clear view of how innovation can have a 'disruptive impact' on transforming an industry, and turning a way of operating on its head, is the rapid transformation of the music industry.

Because the abilities that major record companies depended on are now out of date, like control of the physical manufacture of discs, managing of stores sales, and unique control of physical circulation; this transformation has forced the industry to reconsider the business model of the company.

Because of declining revenue due to record companies, these companies have tried to compensate by increasing revenue from other sources, namely music licensing. Digitalisation has

created new economic opportunities, but it has also brought with it major new challenges for rights holders as has become clear.

The management of licenses has become much more complex, as with the shift to a model of accessing content through streaming, rights holders are no longer just tracking physical sales but must monitor every single play of a song: This generates a micro payment every listening and the transaction between listens must be tracked and correctly distributed.

There was much debate over the remuneration of artists, following the evolution of the industry, and although the industry of musical rights has tried to evolve and create new licensing models for the past decade the problem of distribution of revenue remains problematic and unclear. Any paperwork you are signing may be highly insecure, there are uncertainties about how licensing for digital services works, how much each service should pay and how things are divided up among the various rights holders.

2.7 Metadata

Complete, correct, and consistent metadata must be available for the licensing process and every stage of the supply chain in order for all rights holders to be paid for the correct use of their work.Basic information, like title, authors, publishers and record companies, forms part of metadata; in the pre-digital time you had this metadata in the sense that, in order to produce CDs and albums, they all had to be documented with complete metadata before pressing the art.

Today however, there are no global standards and no verification of metadata accuracy prior to tracks being released. This data is usually split between multiple players in the supply chain

(record companies, streaming platforms, collective management organizations), who have separate, non-talking, databases, so there is an increased risk of errors and inconsistency. The problem is exacerbated because there is no central authority or "single point of truth," and manual data management complicates syncing and correcting errors. This inefficiency is estimated to cost 25% of revenues (which will never reach the rightful beneficiaries).

But this persistent fragmentation makes management of intellectual property and rights very difficult.

In such a case, blockchain is the innovative solution for such a scenario. With Distributed Ledger Technologies (DLT), metadata could be stored in a distributed register, replicated and updated automatically without the need of additional databases, and blockchain would securely trace rights, thanks to cryptography and hashing, and certify the source and attribution of each track, thus reducing errors, transaction costs and operational complexity.

This innovation would aid in making the supply chain more efficient, overseeing transparent and exact management of music rights, and making the data accessible throughout the whole music supply chain.

The complexities of copyright and licensing processes add other important problems: it yields ineffective revenue flows, a lack of transparency, and more importantly missed earnings for artists and authors.

Very different to the models of current licensing structures, based on the physical models of the sale of musical media and not adapted to the changes presented by the digital technology, nor the new business models such as streaming.

In the context of a musical track, there are primarily two types of copyright: First, the matter describing the record – the music and lyrics, generally dealt with through publishers – and second, the matter relating to the recording – the business of the record companies. It depends on how the protected content is used (for example, copying, reproduction, public performance and

so on), and the types of licenses, such as mechanical (for public performances, for synchronizations, for printed music) apply.

Traditionally the music industry has relied on collective management systems for licenses, most of which have been delegated with tasks to collect companies that exist in the form of Performing Rights Organisations (PROs) or Collective Management Organizations (CMOs). But, streaming only presented more confusion. Via regulations and licensing structures, technology advancements have not been in tune and have favoured the centralization of mechanisms and informational asymmetry that favours a few actors in particular, the record companies and streaming platforms. These entities manage licenses and revenues (through confidential agreements) in non-transparent ways (imposing inability to the artist to get a clear view of where its money is calculated and how it is distributed in its earnings).

Willard Ahdritz, Chief Executive Officer of Kobalt Corp summarizes the problem with traditional infrastructures in the music industry that 'were not built to handle high volume and complexity of data required today in the digital age'.

Therefore, the sector's digital transformation calls for innovative solutions to overcome these limitations, guaranteeing the economic sustainability of the music market, and promoting artists' and composers' creative activity.

One such solution which has been implemented to revolutionize the music market is the blockchain in the music market, that can rewrite the rules of the licensing process on a decentralized and transparent network.

However, this system is in effect only if based on reliable metadata infrastructure, as previously described. Because of the distinctive characteristics of blockchain, data related to musical tracks can be made complete, correct and verifiable to enable greater reliability, efficiency, and transparency for licensing processes and payment to rightful beneficiaries.

Blockchain usage in the sector is innovative, especially the use of Smart Contracts, tools that serve to automate transactions on rights and licenses.Through blockchain protocol, Smart

Contracts make rights digital assets, with their release, traceability and accounting handled in a decentralized and verifiable manner. These contracts simplify operations by removing a large number of intermediaries and ensuring that the exchange rights ownership is more efficient and transparent.

For composers and authors, who maintain an independent right to license for tracks to 3rd parties e.g. publishers or other artists, Smart Contracts are a useful construct to allow them to manage their license transfers independently.

The process is based on several key steps:

- Registration of Metadata: The composer records all the complete verifiable metadata for the work into the ledger. This registration is crucial in order to make sure that the Smart Contract has an unambiguous and precise reference for this particular content, and even in case of multiple versions of the same track has zero ambiguity.
- Creation of the Smart Contract: Out of a composer or an assigned entity creates a Smart Contract that holds the text of the licenses and rights on duration, territories, rights granted and payments. The licensee can sign with a certified digital signature on this digital contract.
- Execution of the Contract: The licensee is then free to obtain the rights to a particular musical track by interacting with the related Smart Contract – which runs on the blockchain and is accountable for approval – to pay royalties and other fees for a period of use in subsequent months. The Smart Contract checks the needed conditions (ie. upfront payment) and after that grant automatically the license and record the transaction in the ledger.
- Transparency and Traceability: At any time, each transaction can be documented and visible in real time, and it’s transparent for all parties. Furthermore, since each agreement on blockchain is immutable, it will be captured and never be changed.

Nowińsky and Kozma identify three main ways in which blockchain can innovate: These are authentication of assets, enhancement of efficiency, and disintermediation.

This technology could make an interconnected record industry a reality in the music sector, with rights traceability (a transparent and reliable system for attributing rights in musical works and verifying their origins), simplified licensing (using standardized metadata and automated tools to effect license grants) and instant payments (smart contracts for the automatic distribution of proceeds and elimination of delay and reduction of transaction costs).

Considering the potential of this technology, to do away with many of the traditional intermediaries is the most revolutionary. Artists could directly manage data, transactions, and distribution of content through peer-to-peer (P2P) networks, reducing costs and addressing informational asymmetries that raise costs for traditional firms. It's also something that Deloitte and Pwc both focus on, saying that this could enable content creators to monetize their works without using local currencies, payment systems or centralized distribution platforms.

Because of Blockchain, artists can sell their music directly, and set prices and the use terms, and have direct relationships with the fans, i.e., ‘More power to the artists’.Moreover, transaction data which is available on blockchain networks would increase efficiencies in the distribution of royalties and enhance artists’ access to strategic information.

Total decentralization is not the world we live in, nor is it a result of blockchain, yet blockchain can reshape the established value chain.

Certainly, artists would enjoy greater autonomy, as they’d be able to upload their tracks to blockchain networks with direct access to consumers (with reduced costs and increased royalties on rights). Additionally, this technology can solve problems such as lack of intermediaries' monopoly power, control of distribution channels and royalty payments in order to bring to life a fairer and more efficient ecosystem.

Around the world are about 40 similar projects dedicated to the use of blockchain in the music industry to solve problems of copyright management and payment of royalties, as well as being able to create new consumer experiences.

Among such enterprises, however, there are a few that are particular interesting: networks aimed at solving the problem with technology, and the Open Music Initiative (OMI) is one of them, a non-profit working on open-source protocols to standardize rights management, as well as on education of the creators on such subjects, to promote innovation via workshops and events.

But other projects have set themselves up as they previously used existing blockchains like Ethereum or Bitcoin, or have dedicated systems. The first type tries to make rights registration and management more efficient, transparent and fast payments through the use of smart contracts and the possibility of the artist talking to the fan. The growth of interest in these solutions is reflected in the acquisition of MediaChain, a startup acquired by Spotify in 2017 to improve the distribution of royalties via smart contracts.

Applications are still early, and there is yet no way to fully understand the possibilities.

2.8 The Regulatory Framework

When new technologies like blockchain emerge, they typically need new legislation to fill regulatory gaps addressing issues like contracting, consumer protection and other ramifications. An appropriate regulatory framework is urgent because of its potential ability to redefine economic and social systems.

First are the issues of cryptocurrencies and tokens regulation, including the special aspects of the risks of money laundering, fraud, and tax evasion, lack of legal clarity as to their status (currency, asset or commodity), and differences of approaches taken by governments, countries and gray areas of law.

Worldwide, the regulation gap of blockchain is still fragmented and uncertain. The big snag is in balancing regulations to allow for the legal and global adoption of the technology, as well as managing the legal and political and social barriers that stand in the way of its development.

2.9 The Case of Choon

A blockchain based music streaming platform called Choon was launched in 2018, with an attempt to change the music industry with an innovative and decentralized model. Notable founders from both the music and technology industries make up the founding team including Gareth Emery (CEO) as a musician and producer, Scott Sartin (CFO) as a music manager, Bjorn Niclas (CMO) as an entrepreneur in electronic music, and Matt Hall (CTO) as a computer engineer and co founder of Cryptopunks.

This platform will offer an alternative to the structural problems of the established musical industry, based on the abolition of intermediaries to ensure direct payments to artists, transparence with the Publication of listens and profits data, the publication of the logic of promoted content in the platform, smart contracts to facilitate the contractual and accounting processes through intelligent contracts, and transparent involving listeners to allow them to be rewarded with cryptocurrencies (popularly called "Notes") for their active participation in the ecosystem.

Ethereum provides the tech behind it while Notes is a cryptocurrency built by Choon with a pre-defined quantity of 2 billion units. Composed of any artists in the world, so long as they own 100% of the rights to the works uploaded: no intermediary required. While the core of Choon

functions on the blockchain, payments are also accepted in the traditional currency, which is then auto converted into Notes for ease of use and scalability.

2.10 The Challenges of Implementation

While the music industry is full of promise for all that blockchain may offer, this implementation faces major obstacles. The main obstacles are the necessity to achieve the widespread adoption for all the stakeholders, the development of a unified global standard, and surmounting the resistance of the people who live from the existing, more centralized system.

- Technical Challenges: Blockchain requires robust infrastructure and an expertise in technology that is not easy to set up. The lack of requisite technical knowledge in many on the music side makes the move to blockchain an intimidating and slow process.

- Legal and Regulatory Challenges: As blockchain is decentralized, it presents unique legal issues in this context, particularly in the area of copyright enforcement, licensing and property of intellectual property. Additionally, the making of a general accepted platform is further complicated by different countries having different regulations for the digital rights and the blockchain.

- Economic Challenges: Setting up and maintaining a blockchain system comes at a high cost. But also the economic model of blockchain: how rights holders get compensated,

how transactions are taxed, and how royalties are distributed, needs to be defined in order to make sure it's to the benefit of everyone in the music industry.

- Cultural Resistance: Maybe the biggest leap is an unwillingness within the community to change. A lot of veterans in the industry are used to how business has been done in more traditional ways and have a hard time wrapping their heads around blockchain. Some artists and labels are also feared the technology will result in lower revenues or loss of control of their own music.

- The Need for Collaboration: In order to succeed in the music industry, blockchain must involve collaboration among artists, music companies, technology providers and legal experts. It can be hard to get consensus amongst such a varied group.

Chapter 3: A Vision for the Future of Music: Incentives for Emerging Artists and a Meritocratic Ecosystem

3.1 A Blockchain-Based Evolution: The Case of Choon

The blockchain-powered streaming platform Choon started operations in 2018 to solve fundamental problems in the music business that affect rights clarity and musician payment fairness. Music producer Gareth Emery and his music and tech industry experts launched Choon which illustrates blockchain's practical application within creative industries.

Through its platform design the company removes all traditional market intermediaries so artists can share their work directly to Choon. Through this system musicians retain complete control of their music rights while directly receiving payment from users.

The "Note" crypto system operating on Choon represents a proprietary token with 2 billion fixed units issued through the platform. Through Notes users can stream music while rewarding artists and taking part in all platform activities. Artists receive automatic payment via Notes through blockchain smart contracts that use streaming playcounts to send royalties under the same system without traditional system complexities.

Another innovative aspect of Choon is its transparency: Blockchain technology enables open verification of all playing and earnings records thus building enhanced trust across artist and user relationships. Choon compensates its listeners through cryptocurrency rewards that increase when they participate actively in the audio platform.

3.2 Proposed Incentives for Emerging Artists: A Model of Support and Growth

Attracting young musicians to join a new-borned platform represents a significant challenge., considering the music market current state; therefore I am thrilled to share proposed incentives that I believe might be a good starting point for either enhancing the presented case, or even create a new one from scratch. A platform able to benefit emerging musicians, specifically through an incentive system which rewards new artists at their starting stages might be able to attract, potentially, numerous people that want to follow their passion for music, and maybe even spur people to enter the music world

To address the challenges faced by emerging artists and foster a more inclusive and meritocratic music ecosystem, I imagine a blockchain-based platform with the following key features:

1. **Starter Fund for Emerging Artists:**

    - **Tokenomics:** To support emerging artists, the platform will utilize a dedicated cryptocurrency token, tentatively named "SoundSeed." These tokens will be initially allocated to a special fund and subsequently distributed to eligible artists upon registration. The distribution criteria will be transparent and publicly accessible, ensuring fairness and preventing any potential manipulation. Additionally, SoundSeed tokens will be introduced into the ecosystem through various activities like user rewards and transaction fees, creating a sustainable economic model.

- **Smart Contract Functionalities:** Two main smart contracts will govern this incentive:
  - **Registration Smart Contract:** This contract, coded in Solidity (a programming language specifically designed for Ethereum-based smart contracts), will automatically verify an artist's eligibility for the starter fund based on predefined criteria (e.g., number of listens or followers on other platforms). Upon successful verification, the contract will execute the transfer of SoundSeed tokens to the artist's account, ensuring a seamless and transparent process.
  - **Funding Smart Contract:** This contract will be responsible for continuously funding the dedicated wallet for emerging artists. It will automatically deduct a small percentage (e.g., 1%) from all transaction fees generated on the platform and deposit it into the fund. This mechanism ensures a steady flow of resources to support new talent. Additionally, the contract will include transparency features, allowing anyone to audit the fund balance and transaction history on the blockchain, promoting accountability and trust.

2. **Increased Visibility through a Merit-Based Algorithm:**

- **Smart Contract Integration:** To enhance transparency and fairness, the platform's merit-based algorithm will be deeply integrated with smart contracts. All relevant data points, such as the number of listens, user interactions (likes, comments, shares), and ratings received by each song, will be immutably recorded on the blockchain. This ensures data integrity and prevents any potential manipulation. Furthermore, smart contracts will automate the calculation of the "merit score" based on predefined rules and criteria, eliminating any potential bias. When an artist achieves certain milestones or thresholds, the smart contracts will automatically trigger rewards and benefits, such as playlist placements or homepage features, ensuring a consistent and objective system.

3. **Collaborations and Rewards: An Opportunity for Growth and Learning**

    - **Smart Contract Applications:** Smart contracts will play a crucial role in facilitating collaborations and ensuring fair compensation for all participants. The platform will feature a decentralized "collaboration marketplace" where artists can connect and propose projects. Once a collaboration is finalized, a smart contract will be created to automate the distribution of rewards (in SoundSeed tokens or other incentives) to both established and emerging artists upon the project's completion. This distribution will be based on pre-agreed terms, ensuring transparency and fairness. Additionally, smart contracts will track the success of collaborations (e.g., number of listens, revenue generated) and automatically distribute further rewards based on predefined performance milestones, incentivizing both parties to contribute their best efforts.

    In addition to traditional collaborations, the platform could also facilitate fractional ownership of music rights. This would allow artists to offer a percentage of their future royalties to fans and investors in exchange for upfront funding or other forms of support. This model could provide emerging artists with new avenues for financing their creative endeavors and allow fans to directly participate in the success of their favorite artists. Smart contracts could be used to automate the distribution of royalties to fractional owners, ensuring transparency and fairness.

I would like to emphasize that this platform, while inspired by Choon, represents a broader and more ambitious vision. The goal is not simply to improve an existing platform but to imagine a music ecosystem that is fairer, more transparent, and stimulating for all participants.

3.3 Engaging and Empowering Listeners

While attracting and supporting emerging artists is crucial, a thriving music ecosystem also relies on the active participation of engaged listeners. To this end, my proposed blockchain-based platform will offer a range of features and incentives designed to enhance the listening experience, foster direct engagement with artists, and promote ethical and transparent music consumption.

Enhanced Listening Experience: The platform will prioritize music discovery and curation, offering personalized recommendations powered by a constantly learning AI algorithm that aligns with each listener's evolving profile. This AI will be designed to prioritize fairness and accuracy, ensuring that recommendations reflect the listener's genuine preferences and are not influenced by external factors or biases. This will be complemented by curated playlists by experts and tastemakers, and innovative search functionalities that allow users to explore music based on mood, genre, or even specific instruments. To promote healthy listening habits, the platform will also incorporate features similar to Apple's headphone safety technology, allowing users to monitor their volume levels and receive alerts if they are listening at potentially harmful levels. Additionally, the platform will foster a strong community around music, with features like forums, social listening sessions, and artist-fan interactions, creating a more engaging and interactive experience for listeners. High-fidelity audio streaming will be a core feature, ensuring that listeners can enjoy music in its purest form.

- **Direct Engagement with Artists:** Listeners will have the opportunity to engage directly with their favorite artists through exclusive content, such as behind-the-scenes footage, unreleased tracks, and live performances. The platform will also facilitate direct-to-fan interactions, such as Q&A sessions, meet-and-greets, and virtual concerts. Furthermore, listeners will be able to directly support artists through crowdfunding campaigns or tokenized patronage systems, fostering a deeper connection between creators and their audiences.

- **Rewards and Incentives:** Active participation will be rewarded through a tokenized system. Listeners can earn SoundSeed tokens by engaging with the platform, such as rating songs, curating playlists, or contributing to the community. These tokens can then be redeemed for rewards, such as merchandise, concert tickets, or premium features. Additionally, elements of gamification will be introduced, allowing listeners to earn points or badges for completing challenges, discovering new artists, or attending virtual events, making the listening experience more interactive and rewarding.

- **Ethical and Transparent Music Consumption:** The platform will prioritize fair artist compensation, ensuring that artists receive a greater share of revenue compared to traditional streaming platforms. This will give listeners the satisfaction of knowing that their listening habits directly support the creators they love. Additionally, the platform's operations will be transparent, allowing listeners to see how their contributions are being used and how artists are being rewarded, fostering trust and accountability.

3.4 An Inclusive and Sustainable Ecosystem: Fostering a Thriving Music Landscape

The vision for this platform extends beyond simply addressing the needs of emerging artists. It aims to cultivate a truly inclusive and sustainable music ecosystem that benefits all stakeholders, including artists, listeners, and the industry as a whole.

Inclusivity:

The platform's design inherently promotes inclusivity by removing barriers to entry and providing equal opportunities for all artists, regardless of their background or location. The merit-based algorithm ensures that visibility and rewards are based on talent and engagement, not on social capital or connections. Furthermore, the platform's community features foster a sense of belonging and encourage collaboration among diverse artists and listeners.

Sustainability:

The platform's economic model, based on blockchain technology and tokenization, ensures fair compensation for artists and promotes transparency and accountability in revenue distribution. This creates a more sustainable and equitable music industry, where artists can thrive and focus on their creative endeavors. Additionally, by empowering listeners to directly support artists and participate in the music ecosystem, the platform fosters a sense of shared ownership and responsibility, contributing to the long-term health and vibrancy of the music industry.

3.5 Empowering Listeners and Meritocracy for Emerging Artists

To complete my vision platform, I therefore propose giving listeners full evaluation authority over new artists as the platform's essential content-evaluating component. The music-listening process with active participation for emerging-talent tracks builds users' "judgment power" over time. This system would develop a meritocratic approach by using listener endorsements as fundamental components that guide which artists appear most prominently in recommendations.

The platform's ranking system awards emerging artists through points obtained through transparent authentic engagement from listeners. Grade is determined by musical merits instead of relationships or advertising money. Planned milestones reflecting both increased visibility and appreciation enable artists to access the platform's official release process as recognition for their talent. This dual strategy of embracing meritocratic principles combined with community participation functions as a transformative model which aims to modernize the digital music industry and creates proper balance for each participant.

Conclusion

This thesis has explored the transformative potential of blockchain technology to address critical challenges within the music industry. By examining the limitations of current systems and proposing a vision for a blockchain-based platform, this work has demonstrated how smart contracts can be leveraged to create a more transparent, equitable, and meritocratic ecosystem for emerging artists. The proposed incentives, including the Starter Fund, merit-based visibility, and collaboration rewards, are designed to empower creators, foster stronger artist-audience connections, and promote a more sustainable music industry.

While challenges remain, including the need for widespread adoption, regulatory clarity, and overcoming resistance to change, the potential benefits of blockchain are undeniable. This technology offers not just incremental improvements but a fundamental shift in how music is created, distributed, and consumed. By embracing innovation and fostering collaboration among stakeholders, the music industry can unlock a future where copyright empowers creators, musical talent thrives, and listeners are more deeply engaged with the art they love. The vision presented in this thesis serves as a starting point for further exploration and development, paving the way for a truly democratic and vibrant music ecosystem.

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