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1. Introduction

This paper investigated the inner workings of blockchain technology and any implications that the adoption of this technology might have on the music industry and its various stakeholders. Throughout this paper I will describe concepts related to blockchain such as smart contracts and provide some potential applications of this technology in areas such as digital rights management, royalty payments and the supply chain as a whole.

2. Blockchain Explained

In essence a blockchain consists of a decentralised set of time stamped data records. These data records are controlled by a network of computers that are not a part of a central database. Each of these individual blocks are joined together using cryptographic principles to create a chain (Rosic, 2019). This in turn creates an “incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value” (Don Tapscott, 2016)

The information on this chain is public and available for everyone to see due to blockchains decentralised and democratised nature. Therefore, whatever transactions are made on the blockchain and the subsequent blocks that are built are transparent by their very nature (Rosic, 2019). When a transaction is made a block is created and assigned a unique “hash”, this block is then verified by multiple individual computers from around the web. Once verified, this block can then be added to the chain creating a unique historical record complete with the block’s unique “hash”. Each block on the chain contains data, its own hash and the hash of the previous block in the chain (See Figure 1). If you were to alter the data within the block, the hash would also change. This will make the next block and all following blocks invalid as the blocks hash will not line up with the next block as they no longer store a valid hash of the previous block (See Figure 2). This block will therefore not be verified by the peer to peer network when it is updated. In order to alter this block, you would have to alter the entire chain of blocks which is extremely difficult and becomes virtually impossible as the chain grows. This is how the blockchain ensures security within its system, as there is no centralised database to corrupt someone looking to interfere with the blockchain would have to corrupt each computer used to distribute the blockchain throughout the “peer to peer” system. Blockchain adds a monetary incentive to uphold the networks integrity, for example many “Bitcoin miners” compete to add blocks to the chain and identify invalid blocks on the chain in exchange for varying amounts of Bitcoins, this involves solving a complex computational math problem which requires a lot of computing power. This is how the “proof of work” system is applied and upholds the integrity of the system (Luke Fortney, 2019).

Privacy is another element worth looking at when analysing blockchain technology. Although information about transactions are open to everyone, a person’s identity is encrypted and represented by their public address. So, when viewing a transaction on the blockchain it will not show that “John Doe sent 1 Bitcoin” but rather that “19ymgV8NmjT42iXYcAfVGVFwjJrM4sBGDg sent 1 Bitcoin” (See Figure 3). However along with this privacy comes a level of accountability as you can see every transaction ever made by a public address, this encourages honesty as if you know a person or institutions address then you can also see all of their historical transactions. As well as this blockchain technology will create a transparent record of ownership rights and clearly show who owns what. This is extremely beneficial when looking at creating a public register that accurately stores information regarding deeds and licenses. Blockchain technology has also brought about the advent of “Smart Contracts”. These smart contracts define the terms of the contract as well as any

penalties similar to how a typical contract does but also automatically enforce a set of obligations upon fulfilment of the contract (Rosic, 2019).

Blockchain also has the advantage of accessibility, this system does not require a bank account, proof of citizenship, birth certificate etc. Anyone with access to the internet can use this system and, in the process, cut out the bureaucracy and fees that other financial systems suffer from.

3. Blockchain and it's impacts on the music industry

As it currently stands the way we consume music is as follows; firstly, an artist creates music, then fans consume it, and subsequently various intermediaries such as labels and distributors act as middlemen. The system is designed so that artists who are the first to put in any work are in fact the last to see any profit from their work (Heap, 2017). The Internet altered the supply chain and labels roles within it significantly but labels still hold 50% of the value created by the artist (Tomo Hosoi, 2015). This is due to the advent of contracts such as 360 deals which insist that labels obtain a certain percentage of the artists performing rights as well as various other streams of income.

Royalty payment systems are notoriously slow and it is not uncommon for royalty payments to take upwards of 12 months before reaching the artist (Lorinczi, 2019). The addition of middle men to the revenue stream greatly decreases the flow and amount of payment and in the case of independent artists, royalty payment can be extremely difficult to obtain and often go unpaid (Ignacio De Leon, 2017).

Blockchain technology may act as a solution to many of these issues, reducing the monopolistic power that intermediaries such as labels have through control of distribution channels, information asymmetries and control over royalty payments.

i. Potential implications of blockchain for the music industry

Blockchain technologies have the ability to increase the overall value captured by artists and restore the balance of power in the industry through the creation of more efficient distribution channels. A peer to peer network such as the one underlying bitcoin could lead to the elimination of many if not all intermediaries by creating a direct link between the artist and the consumer (Nucciarelli, 2018). Figure 4 shows how this new supply chain could work. Artists would have the ability to independently publish their music directly onto blockchain networks, completely cutting out the middlemen. Consumers could then access this music through platforms directly connected to the blockchain network. This would greatly reduce the transactional cost meaning the consumer pays less while the artist makes more due to the expulsion of intermediaries. Artists would also, through the use of blockchain technology and data mining techniques, have the ability to collect aggregate data relating to their audience, providing them with information on customers purchase preferences as well as how and where people are listening to their music (Nucciarelli, 2018).

Every song has several stakeholders that helped to create the song and therefore intellectual rights over it. These stakeholders include; songwriters, sound engineers, producers and performers. Digital rights management systems are out of date and struggle with identifying and correctly paying stakeholders. The creation of a "verified global registry of music creatives and their works" backed by blockchain technology could be the answer.

The emergence of smart contracts backed by blockchain technology could be revolutionary regarding royalty payments and rights management. Smart contracts are blockchain backed contracts that automatically fulfil the terms of a contract such as the transfer of payments and/or

assets when completed. If applied within the music industry this technology could lead to the emergence of automatic royalty payments to the artist and other stakeholders such as producers or songwriters. When music is made available on blockchain networks consumers can directly access it through these networks. Through the use of smart contracts, the amount that consumers pay does not have to go through any intermediaries and is delivered directly to the artist.

ii. **How can blockchain change the face of the industry?**

The transparency associated with blockchain technology could bring about a massive change in the music industry, individual stakeholders would be able to monitor how much money a song is earning instantly and in real time. The chain will contain all the necessary information regarding intellectual property ownership and will transfer the agreed amount to each stakeholder immediately after the songs purchase. This can be achieved through microtransactions which pay royalties instantly and will eliminate associated middlemen, mistakes and delays in royalty payments.

Blockchain technology also reduces the difficulty of collecting aggregate data about consumers such as age, location etc. This would provide invaluable information perfect for when an artist is planning a tour. The use of the blockchain would also allow them to analyse their customers spending habits opening up opportunities to collaborate with overlapping brands and possibly even other artists that their customers also listen to.

Intermediaries such as labels will have to adapt to the changes in the supply chain that blockchain creates. These intermediaries will not become obsolete if they continue to provide value. Record labels could for example continue to provide value by providing technical, production and marketing services but would cease to act as a revenue collector for artists' intellectual property. (Nucciarelli, 2018)

Blockchain technology could also allow artists to take advantage of many different pricing strategies. By analysing data it is possible to identify information such as what time of the day is the song played most, and which fans play the song the most. Dynamic pricing strategies can then be applied in order to take advantage of this information. For example, after discovering what time of the day a song is most popular in it would be possible to charge more for this song during those time periods. Blockchain technology could also be used to identify superfans and give them discounts on certain songs and future releases.

Blockchain technology allows consumers to consume music through the blockchain network, providing a new way to consume music. Companies such as Bittunes, Peertracks and Voice all offer platforms that allow customers to download or stream music on the blockchain network. Companies such as Resonate provide credit based streaming services in an attempt to rival Spotify and Apple Music's subscription based streaming services. Resonate initially offers consumers 3 hours' worth of streaming credits and thereafter implements a "pay for what you listen" model. According to Resonate they are more affordable for the consumer, saying that spending €5 a month will give the customer access to over 2 hours' worth of music per day, and they are able to pay artists over double the amount that their competitors do. Their "stream to own" system also means that once a consumer listens to a track 10 times, they no longer have to pay to listen to it (Nucciarelli, 2018).

4. Legal implications

Although smart contracts automatically fulfil the conditions of an agreement there is still a need for a separate legal document underlying the smart contract. This is necessary in case the smart contract fails to execute its orders properly, in this case the underlying contract would provide proof of the agreement and its terms. Existing contractual obligations could also cause a disruption to the creation of a new supply chain as seen in Figure 4.

Problems relating to data privacy could also arise due to the element of transparency blockchain systems provide. For example, GDPR grants rights to the individual's companies collect data on. These rights include the right to delete all your data and the right to alter and update your data. The problem here is that blockchain does not allow data within the blocks to be altered after it becomes part of the chain. This will surely cause some problems for companies using blockchain technology and will require some element of gaining permission to be included into the blockchain system.

However, if these legal issues can be resolved blockchain alongside tools such as smart contracts will greatly reduce the complexity in regard to many legal aspects of the music industry such as intellectual property ownership, royalty splits and royalty payments while improving automation, verification and efficiency.

5. Conclusion

Blockchain has been called the most potentially transformative technology since the internet and its implementation should cause major disruption across many industries. This technology is still in its infancy however and it will require more time in order to weave into the global economic fabric. However, the implementation of blockchain driven models throughout the music industry could result in the irreversible alteration of the industry's structure and the power dynamics within it. Blockchain's implementation will surely lead to new innovative business models within the industry but this will depend on the speed at which new modernised laws are implemented to meet the legal implications associated with blockchain.

Word count: 2292

Diagrams

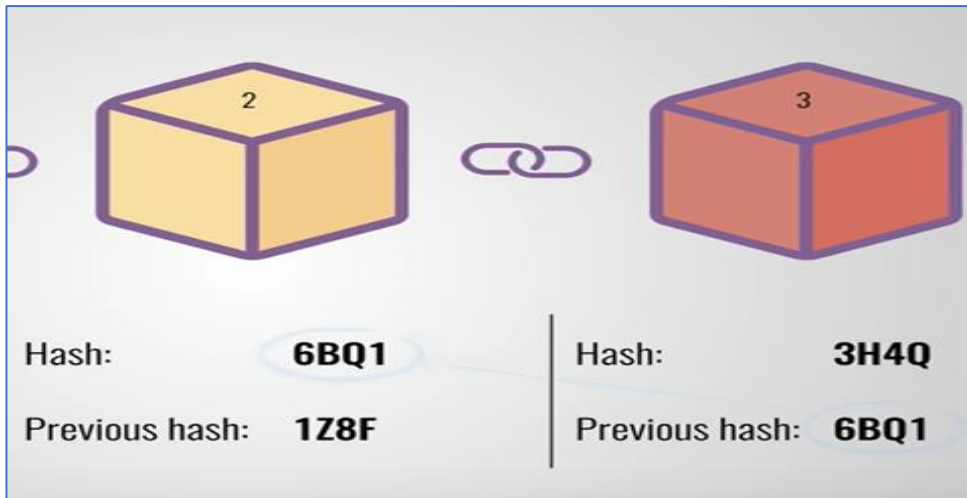


Figure 1 (Simply

Explained - Savjee, 2017)

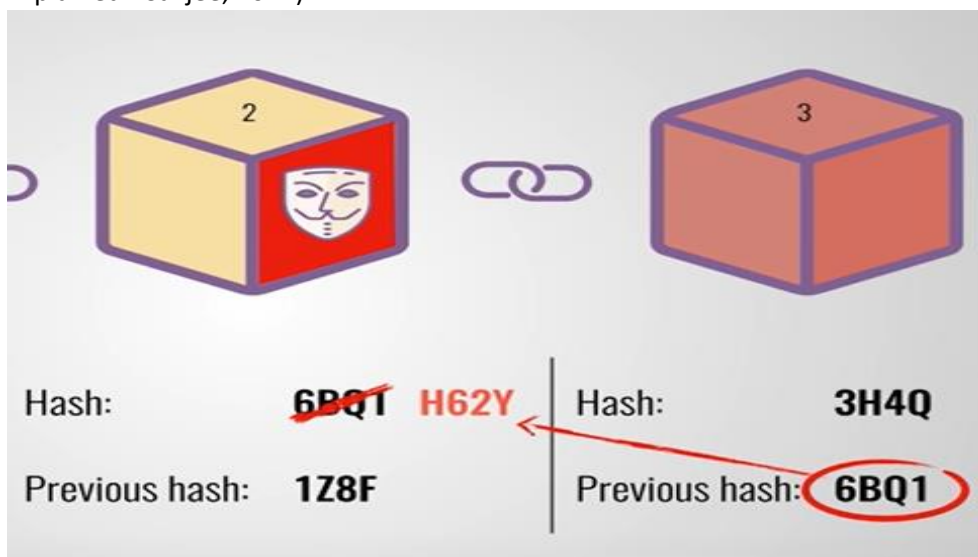


Figure 2 (Simply Explained - Savjee, 2017)

Txn Hash	Block	Age	From	To	Value	[Txn Fee]
0xe2b9896998e8b4f...	9307592	30 secs ago	0x34d2a478a1d686...	→ 0xdc0b0bbe7c297f8e...	0 Ether	0.00009728
0x9bc0b1e92301fc7...	9307592	30 secs ago	0xd8f52dcadb62e04...	→ 0xdc0b0bbe7c297f8e...	0 Ether	0.00009728
0x72266e25c643f0c...	9307592	30 secs ago	0x1f5c04f204bb834...	→ 0xdc0b0bbe7c297f8e...	0 Ether	0.00009728
0x68b722480c2b66...	9307592	30 secs ago	0x27b526bb744dd8...	→ 0xdc0b0bbe7c297f8e...	0 Ether	0.00009728
0x0c5baa1f715083b...	9307592	30 secs ago	0xc87982cfcd23f3...	→ 0x6506f0a65177f8e...	0 Ether	0.0005972
0x3ab5cae9d9d2e...	9307592	30 secs ago	0xc87982cfcd23f3...	→ 0x6506f0a65177f8e...	0 Ether	0.0005972
0x04f50742ece2ba8...	9307592	30 secs ago	0xc87982cfcd23f3...	→ 0x6506f0a65177f8e...	0 Ether	0.0005972
0xa25ea2f74d51c59...	9307592	30 secs ago	0xc87982cfcd23f3...	→ 0x6506f0a65177f8e...	0 Ether	0.0005972
0x61ab538bfc0b969...	9307592	30 secs ago	0xc87982cfcd23f3...	→ 0x6506f0a65177f8e...	0 Ether	0.0005972
0x0f490bc8bde791e...	9307592	30 secs ago	0xc87982cfcd23f3...	→ 0x6506f0a65177f8e...	0 Ether	0.0005972
0x60fd9e75ec10092...	9307592	30 secs ago	0xc87982cfcd23f3...	→ 0x6506f0a65177f8e...	0 Ether	0.0005972
0xe523556836850e...	9307592	30 secs ago	0xc87982cfcd23f3...	→ 0x6506f0a65177f8e...	0 Ether	0.0005972

Figure 3 (EtherScan, 2020)

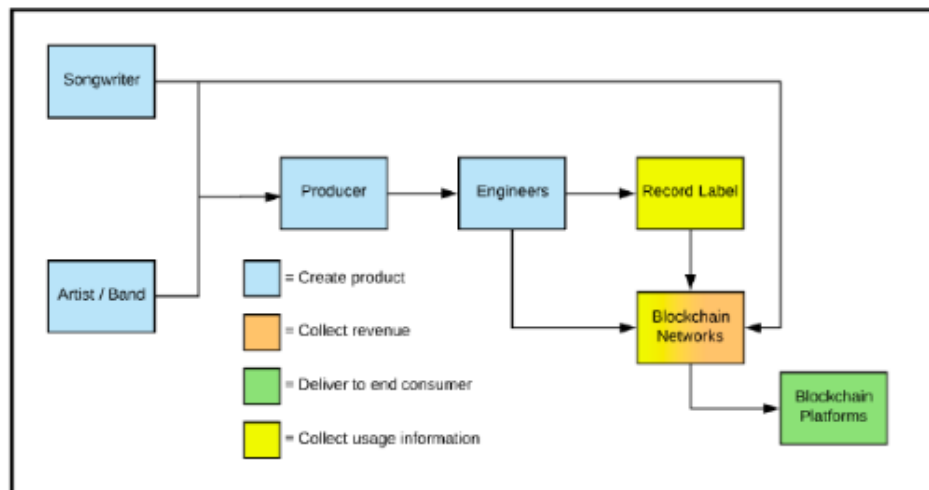


Figure 4 (Nucciarelli, 2018)

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