Future Tendencies of Non-fungible Tokens

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Abstract

Blockchain has been one of the key innovations in information technology in the last 15 years. An important aspect of applying blockchain technology is the creation of so-called non-fungible tokens (NFTs). Although the name resembles cryptocurrencies because of the word token, in practice, NFTs do not represent electronic money but a digital certificate of ownership of an asset. They effectively behave like tokens whose total supply is one, and it is immutable. Considering their technical and conceptual basis, NFTs can be defined as digital certificates of ownership based on blockchain technology, the possession of which proves the indisputable ownership of the purchased digital asset. The subject of this paper is the conceptual basis of NFTs and the scope of their application in digital business. It aims to determine the value factors of NFTs and whether an expansion of their use can be expected in the future. The results of our research show that the essential advantage that NFTs bring to digital business is authentication. NFTs also enable the continuous collection of royalties by the author. The last, but potentially most powerful value generator of NFTs, is the creation of an ecosystem, where an online community is formed based on the initial forms of digital assets. Without standardization and regulation by states, NFTs will remain in the market niche of intensive Internet users.

Introduction

Blockchain has been one of the key innovations in information technology in the last 15 years. Along with Big Data, the Internet of Things, and machine learning, it is considered the driving force behind the fourth industrial revolution. The importance of blockchain for the future of electronic business is also confirmed by the European Union's efforts to become a global leader in developing blockchain-based platforms and applications. The European Commission has adopted a digital strategy, which states that blockchain will change the way information is shared and business is done online and that it needs to be regulated in accordance with European values and ideals (Beck, 2022). Although it was not directly named, the principles

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of its functioning were explained in the Bitcoin white paper (Nakamoto, 2008). This is precisely why uninformed individuals consider cryptocurrencies the only sphere of blockchain application. Thanks to its application in the decentralized management of large databases, blockchain has also found application in other processes of electronic business. Thus, blockchain has become the preferred choice where many participants, without mutual trust, manage records of data created continuously.

An important aspect of the application of blockchain technology is the creation of so-called non-fungible tokens (NFTs). They were created much later than the early forms of cryptocurrencies. Although the name resembles cryptocurrencies because of the word token, in practice, NFTs do not represent electronic money but a digital certificate of ownership of an asset (Nadini et al., 2021). Thanks to blockchain performances, digital ownership can be recorded, verified, and ultimately changed, if necessary, within an online community, without the involvement of a centralized institution. More importantly, NFTs, unlike cryptocurrencies, are designed to be non-fungible, i.e., each of these tokens confirms the ownership of a unique digital asset by only one holder (Bao & Rouband, 2022).

The paper's subject is the conceptual basis of NFTs and the scope of their application in digital business. It aims to determine the value factors of NFTs and whether an expansion of their use can be expected in the future. To achieve this aim, the paper will analyze a number of current examples while presenting assumptions and providing predictions of future trends.

The paper is organized into three parts. The first part explains both the functioning principles of blockchain technology, which form the technical basis of NFTs, and their conceptual basis through the explanation of the principle of irreplaceability. In the second part of the paper, the focus is on aspects of NFTs application. In this part, for each of the key areas in which NFTs have been applied, an appropriate number of examples is given to better understand the scale and depth of their influence. Finally, in the third part of the paper, the key factors of the value of NFTs are analyzed. Based on the previously mentioned, predictions of further directions of development of this concept are made.

Theoretical Background

Blockchain technology represents a reliable data record created in an environment where there is no mutual trust between participants, nor a central institution, entrusted with managing the system (Scardovi, 2016, p. 36). The blockchain is a new technology, but its foundations are based on previously known technologies and methods, such as asymmetric cryptography, timestamping, Merkel tree, hash function, and smart contracts. It enables data entry in the so-called ledger that records transactions between two parties so that records, once entered cannot be subsequently changed (Iansiti & Lakhani, 2017). The term transaction does not refer to payments only but to any instruction that leads to a change in the system's state. To enter a new transaction, it is necessary to reach the consensus of the participants, among whom there is no mutual trust. This is achieved through the so-called consensus algorithm (Schneider, 1990). After the transaction is accepted, the ledger is synchronized, meaning all participants have the same information about its current state. Therefore, their future decisions when achieving the consensus will be based on the same premises. Data can be shared among members regardless of time, space, or administrative constraints (Walport, 2015, p. 5).

Blockchain makes the technical basis of cryptocurrencies. Transactions change the state of the system because one participant - the payer - reduces his cryptocurrency balance, while the other participant - the payee - has an increase in his balance. Depending on the applied consensus algorithm, transactions are packed into blocks representing the blockchain's building unit. Each subsequent block to be inserted must be in accordance with the data contained in the previously accepted blocks.

Cryptocurrencies come in two forms – coins and tokens. Coins are those cryptocurrencies that have their blockchain. Such are the most famous and commonly used cryptocurrencies - Bitcoin, Ethereum, Litecoin, etc. Tokens do not have their blockchain but are created by some application or platform on an existing blockchain. In this sense, the Ethereum blockchain is very important because it supports embedding intelligent contracts. Using smart contracts, tokens can be used not only as electronic money in the original sense but also as a means to initiate a certain process when conditions are met. Among the tokens with the highest market capitalization are Uniswap and Chainlink. Since 99% of cryptocurrency usage is a speculative investment, the users do not matter to what class their cryptocurrency belongs to. The existence of the term token in the name of NFTs is why many consider them a class of cryptocurrencies.

The characteristic that separates NFTs from cryptocurrencies is non-fungibility. To understand non-fungibility, it is necessary to explain what constitutes the fungibility of a commodity. Those commodities whose one piece can be

replaced by another without loss of value have fulfilled the property of fungibility. For example, a consumer buys any can of soda in the market because all products are made in the same way, have the same mass, and have the same chemical and nutritional composition. That is why the two cans of a specific soda are fungible. In the case of classified agricultural products, all units are considered to have the same properties. Thus, the distributor pays the same price for each first-class apple unit because they are interchangeable. Fungibility is inherent to financial products. A US$10 bill is exchangeable for another US$10 bill, as exchanging them does not change the total value.

Moreover, a US$10 bill is exchangeable for 2 US$5 bills. In this situation, the owner of a US$10 bill receives a larger number of other bills, but the total value does not change. In recent times, one can also talk about the exchangeability of money that has a physical form (coins and bills) for deposit money (money in a bank account) in those situations where there are no costs for such transactions. In addition to money, stocks are also fungible. Any stock of the same class (for example, common stocks) of a specific company is interchangeable for another because they all represent the same share of ownership and simultaneously have the same market value.

Finally, cryptocurrencies are fungible. Their creation can be determined by a mathematical algorithm that increases the supply at a certain rate (as with Bitcoin), or their supply can be determined and created in advance. Whichever of these two options is applied, practically all coins (or tokens) of a cryptocurrency are worth the same at the same time. That is why one Bitcoin is exchangeable for another; the owner can be indifferent to who he got his Bitcoin from because they are all the same.

The above does not apply to NFTs. They effectively behave like tokens whose total supply is one, and it is immutable. Therefore, owning one NFT excludes the possibility of other users owning it, because it is indivisible, so there is no possibility of co-ownership. It is irreplaceable because by exchanging it, the owner cannot get another token that has the same value, for the previous reason that the second token will not refer to the same digital asset. The only way for the owner to remain with the same value they already own is to not exchange the token. These tokens are called non-fungible because they represent a unique value to their owners.

Considering their technical and conceptual basis, NFTs can be defined as digital certificates of ownership based on blockchain technology, the possession of which proves the indisputable ownership of the purchased digital asset (Wang et al., 2021). Connecting an NFT to some form of digital asset becomes liquid and marketable. All changes related to the possession of liquid assets are recorded in the corresponding blockchain. Thanks to the immutability of content and the need for each transaction to be authenticated by the initiator, the blockchain is a reliable tool for keeping records of NFTs ownership and an efficient means of recording the changes that occur. The next part of the paper will focus on the key aspects of applying NFTs.

Application Areas of NFTs

There are several aspects of the application of NFTs. Some of them, like digital art and collectibles, are self-imposed, while others, like video games, are less obvious but potentially very lucrative applications (Fortnow & Terry, 2021, p. 25).

Digital arts

Digital art refers to works of art whose creation was done digitally and should remain in digital form. This does not mean that one cannot obtain a physical form of some of these creations (for example, photographs can be printed). Still, their primary purpose is digital preservation and distribution. Photographs, digital graphics, 3D models, gif animations, audio and video content are obvious examples of digital art. In addition to traditional professions such as photographers, actors, or singers, who participate in creating digital assets, digital artists - graphic designers, 3D modelers, or animation engineers - are taking an increasingly important position. To sell a piece of digital art as an NFT, it must have a theme and content that is of interest to potential buyers. Works of art that are part of a wider series can have a special value because then, in addition to their own value, they also derive value from the possibility of creating a collection.

Another important thing is the processing. Old photographs can be processed to combine an authentic setting with modern themes, giving familiar characters or surroundings a whole new context. Video materials for sale are often processed so that the end scene coincides with the opening scene so that in the case of automatic replay, the video loops seamlessly. A whole new dimension of digital art was initiated in 2023 with the application of artificial intelligence (AI) in the process. Using AI algorithms, any user can create a digital work of art, which is created based on photos and graphic solutions that a certain AI service has access to and can use as a basis for

further work. In addition to the undoubted legal problem regarding copyright that this process can create, another problem is the possession of the newly created works since the user does not have exclusivity (Vincent, 2023). With adequate regulation, this is precisely where NFT can be a solution.

Collectibles

Collecting is a trendy and expensive hobby in Western culture. In the United States, there is a significantly developed community of cards collectors, usually related to a certain theme (for example, many individuals have been collecting cards of baseball players for generations). NFTs enable the collection of digital forms of assets, some of which can be considered works of art. For example, NFL player Rob Gronkowski created four cards related to the seasons in which he won championship titles. The cards were sold as NFTs and art pieces, as digital artist Black Madre designed them. Each series has 87 unique illustrated cards because Gronkowski wore the number 87 on his jersey during his career. A collector buys an NFT that refers to only one card in one series, for example, 1/87 in the 2014/2015 series. Possession of this NFT gives the collector ownership of that card, but it does not mean he possesses other cards in the same series nor the cards numbered 1/87 in the remaining three series (Daniels, 2021).

Video games

During the second decade of the 21st century, video games have already transformed monetization. Initially, video games were sold once at a premium price, which varied depending on the size of the game and the investment in production (Tomić, 2017, p. 240). With the advent of microtransactions, publishers began to charge for certain in-game content, whereby the game in its basic form could be available for free or at a certain price. The content most often sold through microtransactions are cosmetic changes to the appearance of in-game characters (so-called skins) or enhancements that make gameplay easier and reduce the time required to progress (Statt, 2013). The second group is particularly present in mobile video games, where, with characteristically casual gaming, a player needs a lot of time to progress. Over time, gamers have faced a problem regarding their investments in video games. The amounts they spent in microtransactions were many times higher than previously paid premium prices for an entire game.

On the other hand, a secondary market was created where players who no longer wanted to play a game could sell their game account, thereby selling their previous investments. Publishers usually do not approve such trades, so players are exposed to the danger of having their accounts suspended. Therefore, in some video games, developers implemented microtransactions via NFTs. This ensures the authenticity and uniqueness of enhancements and skins purchased in-game. For example, some games offered certain microtransactions as very rare or unique at a high price. However, there was nothing stopping the publisher from offering a larger amount of these exclusive microtransactions after a certain time, putting the player who made the first purchase at a disadvantage. The ability to purchase unique skins, which makes his character different from all others in the gaming community, gives the player great added value. That is why the video game F1 Delta Time introduced the practice of registering all purchased in-game items as NFTs. Each player thus has a unique driver, his equipment, and the characteristics of the racing car he drives. The online multiplayer video game Axie Infinity involves characters created by players whose uniqueness is protected by an NFT (Paul, 2023).

Virtual worlds

Over the past few years, several virtual worlds have been created, intended to be populated by user avatars. Virtual worlds are a kind of video game with a different purpose than the classic ones. The user/player of a virtual world guides his avatar practically through a virtual form of life - he buys a house, furnishes it, finds a job, earns money, buys and sells various items, meets other avatars, and socializes with them (Tucci, 2023). The concept of virtual worlds gained particular importance after the change of the name of the company Facebook to Meta and their announcement that in the future, they will work on the development of the Metaverse - a virtual universe in which all the virtual worlds of social networks and video games will meet and which should be the next stage of Internet development (Klein, 2021). In this context, the virtual world Decentraland was born, in which users/players buy lots, build houses and equip their avatars using NFTs while paying with the cryptocurrency MANA. The moment in which it started functioning played a big role in the growth of its popularity, as it was three weeks before the declaration of the COVID-19 global pandemic. Not only did the video game industry experience an extraordinary growth of 23% during 2020 (Williams, 2022), but at the end of that year and the beginning of the following year,

NFTs also became extremely relevant. The amounts paid for real estate in virtual worlds can be very high, even up to several thousand US dollars (Howcroft, 2021).

Methodology

A SWOT analysis will be performed to identify the drivers of NFTs value. It represents a helpful tool for sizing up a product's market capabilities and deficiencies, its opportunities, and the external threats to its future (Thompson, Strickland & Gamble, 2007, p. 97). It includes the analysis of four aspects of the product: strengths, weaknesses, opportunities, and threats. While strengths and weaknesses refer to the product's characteristics, opportunities and threats, have an exogenous character because they are based on the environment.

Results

Strengths

The essential advantage that NFT brings to digital business is authentication. One of the main problems in the trade of works of art and collectibles is the confirmation of authenticity. There are numerous examples of selling counterfeit art or antiques at high prices. Also, there are cases of selling real masterpieces of old painters at low prices due to the impossibility of proving and confirming their provenance. Thanks to their provenance performance, NFTs offer an undeniable ability to authenticate a digital object. Each NFT is essentially an intelligent contract recorded on the blockchain (Chandra, 2022). Each smart contract has its address that can be accessed. By accessing a specific NFT, one can check the complete history of its possession regarding changes in ownership and the amount of cryptocurrencies paid for purchases. Determining the complete origin can eventually lead to the author. With adequate verification, a buyer always knows if the NFT refers to the specific digital object he wants to own and if that object is exactly what the seller claims it to be.

Equally important as the routine authentication of digital objects is their scarcity. Just as there cannot be two original works of art, the NFT should ensure the uniqueness of the digital object to which it refers. Scarcity is one of the primary sources of value for collectibles, along with age, belonging to a specific collection, and subjective emotional value. While it is difficult to talk about historical aspect as a value factor in digital objects, NFTs confirm scarcity and belonging to a certain series (if such exists).

Being a variant of an intelligent contract, NFT enables the continuous collection of royalties by the author. Unlike works of art or collectibles, where the author generates income only once in case of a sale, NFT allows the author to receive a certain percentage of the sale price for each secondary sale. The address of the author's digital wallet can be entered into the smart contract, which allows him to automatically receive percentage for each subsequent resale. The condition for realizing continuous royalties is that successive trades are realized on the same digital marketplace where the digital item was initially sold. The smart contract may not link secondary sales on other digital marketplaces to the author's digital wallet, in which case he may be left without subsequent royalties.

Weaknesses

At this time, it is impossible to give a completely objective prediction of the future of the NFTs. Limitations in such an attempt are numerous. First, it is a very young concept whose success has been sudden and unpredictable. Just as it was not possible to predict the rise of this concept, it is also impossible to predict the circumstances that could stand in the way of its development. Second, it is based on a technology that is also young and innovative, which is very present in academic, professional, and general literature but has not yet shown its full potential. Blockchain is a technology that is still expected to offer more than it has delivered to e-business. Third, NFTs closest relatives - cryptocurrencies - are unpredictable and have an equally uncertain future. Therefore, there is no similar product, service, or concept whose experiences can be used to form completely reliable predictions. Finally, the unpredictability of NFTs is also contributed to by the fact that this concept was not created in response to an articulated user need. At times when most authors were discussing the meaning and role of cryptocurrencies in modern finance, NFTs appeared with different attributes and application possibilities. Their performance began to be exploited initially by enthusiasts and later by an ever-widening circle of users. Therefore, when discussing the future of NFTs, the following question should be answered. If both cryptocurrencies and NFTs were created when no one was looking for such digital products, and if, despite that, they survived and began to develop and evolve, what exactly needs to happen for them to disappear completely?

A rough prediction of the future of NFTs can be made based on experience with cryptocurrencies. Although,

from year to year, cryptocurrencies recorded a greater number of active operational solutions and an increasing number of users, at the same time, their separation from the traditional financial system grew (Gowda & Chakravorty, 2021; Wolf, 2022). Instead of becoming the electronic money of the new generation of the Internet, as initially conceived, cryptocurrencies are being implemented as an instrument of speculative investment. With the growth of the total number of users, paradoxically, the number of opponents of this concept also increased. Cryptocurrencies have created their online community, certainly numerous and diversified, but simultaneously separated from everything that can be considered traditional. There is a high probability that NFTs will have a similar fate. Although they have great potential to create their own self-sustaining online community, NFTs have gone one step ahead of the needs of the average internet user with their innovation. However, the main spheres of application of NFTs also differ from the needs of the average internet user. In the following, the key advantages of NFTs, which are the main generators of their value, will be analyzed.

Opportunities

A potentially powerful value generator of NFTs is the creation of an ecosystem, where an online community is formed based on the initial forms of digital assets. The meaning of community formation refers to deeper exploitation of the topic, whereby NFT and accompanying contents achieve the effect of commercial synergy. For example, Bored Ape Yacht Club, one of the most famous NFT series, gives token holders membership in an online community. The project started with private chat rooms and evolved into social events, luxury goods consumption, and an actual yacht party. SupDucks grew from a series of hand-drawn ducks into a virtual world-type video game, while the Gutter Cat Gang project grew from anthropomorphic cat cards into extravagant social events (Kaczynski & Kominers, 2021). From the above, it can be concluded that one of the key value generators of NFT is its ability to integrate into current commercial flows on the Internet and exploit their virality. By adding NFTs to the business model, the degree of exclusivity is raised and allows for building an online community identity of the "chosen ones."

Threats

An NFT is essentially a permanent proof of ownership of a digital asset. Blockchain, as its technical basis, ensures the unlimited duration of each token in theory. However, blockchain only records tokens as proof of asset ownership, while the digital asset cannot be stored in it. The authors have two options: commercial cloud storage providers, or the InterPlanetary file system (IFPS), which, due to its decentralized structure, is more reminiscent of the principles on which the blockchain is based. The problem with cloud storage systems is that no matter how reliable the providers claims these services to be, they all have a single point of failure (Ranjithprabhu & Sasirega, 2014). A natural disaster, sabotage, war, or simply bankruptcy of the provider can lead to the loss of control over the servers used to store data, thereby losing all digital assets stored on them. IFPS uses the peer-to-peer principle for data storage and thus creates a branched decentralized network of participants who share data. The advantage of this approach is that the exit of one member or a smaller group does not cause any damage to the system. However, the problem is that this method is not commercial, so its long-term sustainability is questioned.

Discussion

The NFTs owe their high popularity to cryptocurrencies, which paved the way for high-tech products in finance a decade earlier. Thanks to this, NFTs have become a current topic practically from the day of their creation, in contrast to Bitcoin, which spent the first two years of its existence outside the focus of both academic authors and mainstream media. It can be concluded that cryptocurrencies have prepared the public for a new generation of financial products and also for a new approach to electronic business. Therefore, NFTs are more easily accepted by users.

Another feature that cryptocurrencies and NFTs have in common is that they are not a response to consumer demand. On the contrary, both products represent a supply that creates its demand, not previously articulated. Speaking of the attention that cryptocurrencies and NFTs are getting and the amounts invested in them, one could conclude that consumers were not aware that they needed such products. Such a conclusion would undoubtedly be wrong; both products owe a large part of their success to innovation, exclusivity, and exploitation of ICT development trends. The innovation of cryptocurrencies and NFTs is undeniable; however, their long-term applicability must be proven. This is the segment where cryptocurrencies are still failing because their application is practically non-existent outside of speculative investments. At the same time, NFTs will try to prove their essential applicability in the years to come. Exclusivity seems attractive to investors in both cryptocurrencies and NFTs. Early investments in cryptocurrencies were difficult and borderline illegal.

The number of investors during the first four years of Bitcoin's functioning remained very small, even after this topic became present in public. Therefore, in 2012-2016, many investors wanted to invest money in some cryptocurrency without understanding the technology behind them and the possibilities of their application. NFTs are, by their very nature, exclusive. By owning an NFT, an investor prevents everyone else from owning it, often giving them a sense of importance and power. In this sense, investing in NFTs has a deeper meaning for the investor than investing in cryptocurrencies. In addition to speculating on the token's growth, the investor buys a sense of uniqueness and advantage over others. Finally, computerizing society and business takes on more advanced and unexpected forms. Although social networks were considered the highest form of users' interaction, over time, the first forms of virtual worlds were developed, and the developments of meta universes were announced, in which users can interact with a large dose of reality. NFTs fit into the vision of Internet 4.0, based on connectivity with objects and devices, AI, and machine learning.

Conclusion

The future of NFTs is challenging to predict, especially since their present lasts too short to make any predictions. It is evident that there is a market for innovative products at the global level and that the Internet community has grown enough to be able to absorb technological novelties, no matter how atypical they may be at first glance. In the context of continuous informatization of society and business, it can be expected that NFTs are here to stay and will not disappear or become marginalized like, for example, centralized forms of electronic money. There are several drivers of NFT expansion in 2023, including NFT-backed video games tokenization, continuous efforts to create a functional metaverse, and, above all, at this moment, the sudden impetus of AI and the art patterns created with its help. Standardization procedure and regulation by states are genuinely needed in this situation. Otherwise, NFTs will remain just another market niche of intensive Internet users.

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Prihodnji trendi nezamenljivih žetonov

Izvleček

Veriženje blokov je ena ključnih inovacij na področju informacijske tehnologije v zadnjih 15 letih. Pomemben vidik uporabe tehnologije veriženja blokov je ustvarjanje tako imenovanih nezamenljivih žetonov (non-fungible tokens (NFTs)). Čeprav ime zaradi besede žeton spominja na kriptovalute, v praksi NFTs ne predstavljajo elektronskega denarja, temveč digitalno potrdilo o lastništvu sredstva. Dejansko se obnašajo kot žetoni, katerih skupna ponudba je 1 in je nespremenljiva. Glede na njihovo tehnično in konceptualno podlago lahko NFTs opredelimo kot digitalna potrdila o lastništvu, ki temeljijo na tehnologiji veriženja blokov in katerih posedovanje dokazuje nesporno lastništvo kupljenega digitalnega sredstva. Predmet tega prispevka je konceptualna osnova NFTs in obseg njihove uporabe v digitalnem poslovanju. Njegov namen je ugotoviti vrednostne dejavnike NFTs in ali je v prihodnosti mogoče pričakovati širitev njihove uporabe. Rezultati naše raziskave kažejo, da je bistvena prednost, ki jo NFTs prinašajo v digitalno poslovanje, avtentifikacija. NFTs omogočajo tudi kontinuirano pobiranje avtorskih honorarjev. Zadnji, a potencialno najmočnejši generator vrednosti NFTs, je ustvarjanje ekosistema, v katerem se na podlagi začetnih oblik digitalnih sredstev oblikuje spletna skupnost. Brez standardizacije in regulacije s strani držav bodo NFTs ostali v tržni niši intenzivnih uporabnikov interneta.

Ključne besede: umetna inteligenca, veriženje blokov, kriptovalute, nezamenljivi žetoni, ekskluzivnost