

Tech Revolution: Unravelling the Impact of Cryptocurrencies, NFTs, and Metaverse on Taxation and Public Finance

Révolution technologique : Démystification de l'impact des cryptomonnaies, des NFT et du Metaverse sur la fiscalité et les finances publiques

Kamil TÜĞEN¹, Ramazan GÖKBUNAR², Ömer AYDIN^{3,*}

¹ Director of CEDIMES-TÜRKİYE, Public Finance Department, Faculty of Economics and Administrative Sciences, Dokuz Eylul University, Izmir-Türkiye, kamil.tugen@deu.edu.tr
Orcid: 0000-0002-7479-2608

² Public Finance Department, Faculty of Economics and Administrative Sciences, Manisa Celal Bayar University, Manisa-Türkiye, ramazan.gokbunar@cbu.edu.tr
Orcid: 0000-0003-2084-7332

³ Department of Electrical and Electronic Engineering, Faculty of Engineering, Manisa Celal Bayar University, Manisa-Türkiye, omer.aydin@cbu.edu.tr
Orcid: 0000-0002-7137-4881

* auteur correspondant : omer.aydin@cbu.edu.tr

Abstract: The effects of today's popular technology concepts in different disciplines are extensively discussed and examined in the literature. In terms of economics and administrative sciences, the effects of related technologies are evaluated and a roadmap is tried to be revealed for the policies and procedures to be put forward in the future. In other words, technology and the rapid development of technology force the social and human fields to change and adapt. Since technology develops for people with people, it should keep up with this change in human life and social areas. Technologies leading the development in the recent period are Internet of Things, Industry 4.0, 5G and emerging future mobile communication technologies, artificial intelligence, augmented reality, virtual reality, blockchain technologies and its applications, cloud computing, cyber security/cryptology and electric vehicles etc. Many of these technologies have been extensively studied in the literature and still continue to be studied. Recently, the concepts of cryptocurrencies, Non-fungible token (NFT) and Metaverse have come to the fore. While searching for the answer of these concepts whether they will be a popular bubble or permanent technologies that will actively exist in the future life, on the other hand these technologies have also reached a serious use and demand level. While the Metaverse has the infrastructure and technological constraints to reach its anticipated usage and potential, cryptocurrencies and NFT have settled into life in today's world. While it is obvious that these technologies have and will affect every field, it can be predicted that they have led the public sphere and public finances to a radical change and transformation. Considering all these important developments, in this study, first of all, technical information about cryptocurrencies, NFT and Metaverse, and information on what these technologies are and their effects on human life will be shared. Later, various evaluations will be made about what kind of transformations and changes the mentioned technologies can cause in imminent taxation in the near future or how public finance should deal with it. The aim of the study is to present a

vision for the measures that the taxing system should take against these rapidly developing or widespread technologies and the studies that should be done in order to adapt to these systems.

Keywords: Cryptocurrency, NFT, Metaverse, Tokenomic, token economy, tax, public finance.

Résumé : Les effets des concepts technologiques populaires d'aujourd'hui dans différentes disciplines sont largement discutés et examinés dans la littérature. Sur le plan des sciences économiques et administratives, les effets des technologies connexes sont évalués et une feuille de route est tentée de se dégager pour les politiques et procédures à mettre en place dans le futur. En d'autres termes, la technologie et le développement rapide de la technologie obligent les champs sociaux et humains à changer et à s'adapter. Étant donné que la technologie se développe pour les gens avec les gens, elle devrait suivre ce changement dans la vie humaine et les domaines sociaux. Les technologies à la pointe du développement au cours de la période récente sont l'Internet des objets, l'industrie 4.0, la 5G et les technologies de communication mobile avancées, l'intelligence artificielle, la réalité augmentée, la réalité virtuelle, les technologies et applications blockchain, le cloud computing, la cybersécurité/cryptologie et les véhicules électriques, etc.. Beaucoup de ces technologies ont été largement étudiées dans la littérature et continuent d'être étudiées. Récemment, les concepts et technologies des crypto-monnaies, Non-fungible token (NFT), Tokenomic et Beyond (Metaverse) ont commencé à être activement étudiés et évalués dans la littérature. Tout en cherchant la réponse à ces concepts, qu'il s'agisse d'une bulle populaire ou de technologies permanentes qui existeront activement dans la vie à l'avenir, ces technologies ont atteint un niveau d'utilisation et de demande sérieux. En plus de ceux qui ont encore des infrastructures et des contraintes technologiques pour atteindre l'utilisation et le potentiel prévus, tels que Metaverse, il existe également des technologies telles que les crypto-monnaies et NFT qui sont intégrées dans la vie même dans le monde d'aujourd'hui. S'il est évident que ces technologies ont touché et toucheront tous les domaines, on peut prédire qu'elles ont conduit la sphère publique et les finances publiques à un changement et une transformation radicale. Compte tenu de tous ces développements importants, dans cette étude, tout d'abord, des informations techniques sur les crypto-monnaies, NFT et Metaverse seront partagées et des informations sur ce que sont ces technologies et leurs effets sur la vie humaine seront partagées. Dans la suite, diverses évaluations seront faites sur les transformations et les changements que les technologies mentionnées peuvent entraîner dans la fiscalité dans un avenir proche ou sur la manière dont les finances publiques devraient y faire face. L'objectif de l'étude est de présenter une vision des mesures que le système fiscal devrait prendre face à ces technologies en développement rapide ou généralisées et des études qui devraient être réalisées pour s'adapter à ces systèmes.

Mots-clefs: Crypto-monnaie, NFT, Metaverse, Tokenomic, Token economy, fiscalité, finances publiques.

Classification JEL : E6, H2, D8, L86

1. Introduction

Moore's law, which was introduced in the late 1960s and is still debated, states that is expressed as "Every 2 years, the number of components that can be placed on an integrated circuit doubles, while production costs remain the same or even tend to decrease.". You can conclude from here: In an economy without inflation-like effects, you can buy a computer with twice the hardware and features of the computer you bought 18 months ago for the same money 2 years later (Moore, 1965). Of course, the mentioned sentence is not a definite law. From these statements, we can say that technology has changed very rapidly by evaluating today's developments and that the development of humanity in the last 20 years has exceeded the development that has been demonstrated for centuries. In such an environment, technology changes and transforms finance, economy, public finance, literature, art and all other disciplines. While engineering and technical

fields are constantly working to ensure and sustain this development, the field of social and human sciences also strives to keep up with these developments. In many cases, technology provides a way forward and innovation. Thus, it transforms and changes people, human life and the world. The first of the recent results of all this transformation is blockchain technology. Blockchain technology, on the other hand, has revealed cryptoassets and their derivatives. The most current applications of these assets are cryptocurrencies and applications such as NFT. All these applications have come to life in another up-to-date technology. This technology is Metaverse. after Mark Zuckerberg's decision to rename his Facebook company to Meta in November 2021, the concept and technology of Metaverse suddenly became hype. Many companies and individuals are interested in Metaverse, despite the many technical challenges and far from what was promised at the moment. For example, an academic journal called Journal of Metaverse began publication (JMv, 2021). In particular, the Metaverse promises people another world. This will reveal the necessity of establishing a new order there and re-determining the social life and rules. At this point, it is necessary to examine the reflections and results of applications such as Metaverse and NFT and cryptocurrencies in this new world in the social field. In this study, at this point, we will try to predict the future of the financial system in the new order that is likely to emerge with these concepts. In our study, firstly, the concepts of blockchain, cryptocurrencies, NFT and Metaverse will be explained and then the possible effects and changes in the public financial and tax system will be discussed.

2. Identification of Technologies

Knowing and understanding the technical background is important for a technical understanding of the subject. For this reason, we will touch on the basic features and usage areas of the technologies mentioned in the study. First of all, we will examine blockchain technology and then concepts and technologies such as cryptocurrencies, NFT and Metaverse, in which blockchain technology is used or related.

2.1. Blockchain

Blockchain technology is a digital ledger through which cryptocurrency transactions are carried out. This structure is in the form of a chain that is constantly growing by adding new blocks. Each new block stores a cryptographic hash value, transaction data, and timestamp derived from the previous block. In other words, Blockchain is a distributed system that works based on encryption. It forms the basis of systems in which cryptocurrencies and smart contracts are used. This technology was first introduced by an unknown person named Satoshi Nakamoto with the article titled "Bitcoin: A Peer-to-Peer Electronic Cash System" published on the bitcoin.org site on October 31, 2008 (Nakamoto, 2008). Although this article demonstrates an important technique, it has never been published in an academic journal or peer-reviewed. Despite this, when the citations made to the related article on January 20, 2024, on Google Scholar were examined, it can be seen that a total of about 32,369 citations¹ were made. Despite the perception that blockchain technology is used only in cryptocurrencies by a large part of the society, it has many different uses. Banking, financial technology, money transfers, Stocks, stock markets, Electronic notary, person-to-person borrowing and distributed credit methods, Electronic commerce and payments, Donation systems, creation and preservation of valuable documents, voting and election systems, micropayments, cloud computing and secure cloud storage (Turan, 2018; Mysoft, 2022). The problem solved with this technology, put forward by Nakamoto's article, is to eliminate the trust problem in central systems with a distributed system proposal. This system ensures that the parties keep a record of the content of the data and the unchangeability of the transactions with cryptographic algorithms (Pierro, 2017).

¹ https://scholar.google.com/scholar?as_sdt=0%2C5&q=A+peer-to-peer+electronic+cash+system

2.2. Cryptocurrencies

Cryptocurrencies are a digital or virtual currency that uses cryptographic algorithms for the security of the system. The main feature of this currency is that they are decentralized. It does not need a state, institution or person, in other words, it does not need an authority. The cryptocurrency called Bitcoin, which emerged in 2009, is the first known and important cryptocurrency. It is used in the English language as cryptocurrency by combining the words crypto and currency, which are the English equivalents of crypto and money. At the same time, crypto assets can be used in a broad term in the literature, including non-monetary assets. When we evaluate it in Turkish, we can also use it as encrypted money. These virtual currencies are used instead of physical paper money and other coins. The most well-known of these coins are Bitcoin and Ethereum. Apart from these, there are many sub-currencies and their number is increasing day by day. Some may fail in the process and become obsolete. The distinguishing feature of cryptocurrencies is that they are only available on the market virtually. In other words, there are no physical copies of these coins in circulation or their physical form in use and circulation. Just like the internet's ability to remove borders, cryptocurrencies using blockchain technology also eliminate borders. It also offers humanity the opportunity to transfer money without the need for an authority. These technological developments cause cryptocurrencies to shake up the financial system and cause significant changes (Çağlar, 2007).

We can say that the phenomenon/object we call money has 4 basic functions. The first is that money is a medium of exchange. Money as a medium of exchange is used in the exchange of various goods and values between the parties. Money is also a unit of account. The concept of money being a unit of account refers to the unification of the parties in various exchange transactions in a single and common value measure. On the other hand, it is a money saving tool. Individuals, institutions and governments hide their surplus money. This makes it a savings tool. Its last function is to ensure the payment of deferred debts (Boyes & Melvin, 2013). The features of cryptocurrencies such as whether they will be portable or not and whether they are rare or not have been discussed by comparing them with physical money (Erdem, 2008). Today, the portability of cryptocurrencies has been ensured with solutions such as cold wallets. At the same time, it is possible to access the account anywhere in the world with various platform-independent solutions. The rarity is a technical issue and the rarity for different cryptocurrencies may vary.

2.3. NFT

Non-fungible token (NFT) is a cryptographic data unit (Fairfield, 2022) generated by smart contracts of Ethereum (Wood, 2014). When we look at the NFT development, we can see that Ethereum Improvement Proposals EIP-721 (William et al., 2018) was first proposed. Later, the development process continued in EIP-1155 (Witek et al., 2018). NFT is fundamentally different from classical cryptocurrencies such as Bitcoin (Nakamoto, 2008; Shirole et al., 2020). Bitcoin is a standard cryptocurrency in which all coins are indistinguishable, or in other words equivalent. NFT, on the other hand, guarantees being unique but also unchangeable. Due to these features, it allows to keep every unique thing in this structure. Using NFTs in Ethereum (Wood, 2014) smart contracts, a creator can take ownership and ownership of many digital assets such as images, videos, music, art (Franceschet et al., 2021), event tickets (Regner et al., 2019). makes it easy to prove. In this way, it becomes possible to earn royalties with a product sold as NFT. NFT sales in December 2020 are estimated at 12 million. This amount of sales was estimated to increase to 340 million in just two months and in February 2021. This rapidly increasing development makes NFT a craze. NFT is described by some as the future of digital assets (Wang et al., 2019). The NFT market reached a value of 41 billion dollars at the end of 2021. . In OpenSea, 250,000 people trade NFTs every month (Wise, 2022).

2.4. Metaverse

Metaverse is a decentralized virtual world. The term metaverse was first coined in the science fiction novel *Snow Crash* by Neal Stevenson, published in 1992 (Stephenson, 2003). It represents a virtual universe created on a computer, which users from different parts of the world access with equipment such as glasses and headphones. Work continues on a wide variety of hardware or technologies for access. The backbone of Metaverse is a protocol called "Street" that connects different virtual environments. Users are represented in the Metaverse by a digital body whose properties can be configured by the user, called "Avatar". Although Stevenson's Metaverse is digital and artificial, users' experiences in this world affect people both physically and mentally. Another pioneering literary work of the Metaverse is the VR cyberspace called *The Matrix* in William Gibson's 1984 science fiction novel *Neuromancer* (Dionisio et al., 2013).

A modern interpretation of the Metaverse is OASIS (Mystakidis et al., 2021), featured in the 2011 science fiction novel *Ready Player One* by Ernest Cline. OASIS is a simultaneous multi-user virtual world created for entertainment, business and education (Mystakidis, 2022).

3. The Future of Taxation with New Technologies

Tax; It is the money received by the state from individuals and institutions for the purpose of performing public services as determined by law. Taxes are the money that other public institutions and the state receive from individuals and institutions for the provision of public services. Although it is compulsory, tax is an issue in which everyone has different obligations according to their ability to pay and has a place in the constitution (Isbasi.com, 2020).

3.1. Cryptocurrencies and Taxation

In order for cryptocurrencies to be taxed, they must first be placed on a legal basis. First of all, it can be considered that these are defined as money or assets by law and then taxed accordingly. For this, first of all, some countries' perspectives on cryptocurrencies will be given, and then taxation will be emphasized. Considering the legal status of cryptocurrencies in the European Union countries, it is seen that only 4 out of 28 European Union countries have chosen to define these currencies. Out of the remaining 24 countries, 13 (Bulgaria, Southern Cyprus, Greece, Netherlands, Ireland, Lithuania, Romania, Latvia, Austria, Hungary, Portugal, France, Slovakia) did not take any positions on Bitcoin, and 11 did not agree Bitcoin as a currency. It only focused on what it is not. Malta, Croatia, Belgium, Italy, Poland, Finland and Luxembourg have not accepted such currency as either legal or electronic money. The Czech Republic claimed that Bitcoin is not banknotes, coins, written or electronic money. Spain has recognized that such coins cannot be considered a legal currency as they are not issued by the monetary authority of any country. On the other hand, Slovenia, not only did not recognize such coins, but argued that they could be used for financing terrorism or money laundering (Kowalski, 2015). Denmark has stated that Bitcoin has no real trading value compared to gold and silver, so it is more like glass beads. Although these 24 countries have not accepted cryptocurrencies and have not made any taxation arrangements for them, it can be said that it is very difficult to escape from this ecosystem. Countries that legally accept cryptocurrencies from European Union countries are Estonia, Sweden, Germany and the United Kingdom. The German Ministry of Finance saw Bitcoin as a financial instrument or accounting unit rather than as a legally valid currency, accepting that it could be used for private transactions and only if a company obtains permission from the Federal Financial Supervisory Authority. The Central Bank of Estonia and the Ministry of Finance have accepted cryptocurrencies as an alternative payment method, not currency. It is not illegal to sell or buy Bitcoin and see these coins as an alternative means of payment for entrepreneurs. In Sweden, the Tax Office did not

accept Bitcoin as a currency because it is not tied to any central bank, but suggested that it should be classified as "another asset". Moreover, every cryptocurrency owner in Sweden must be registered with a Financial Supervisor (Finansinspektionen) (Serçemeli, 2018).

To determine tax obligations in the United States, an essential factor is examining the utilization of your crypto. Transactions that incur tax liabilities are termed taxable events, while those that do not trigger tax implications are referred to as non-taxable events. Let's begin with non-taxable transactions, which encompass (Coinbase, 2023):

- Acquiring crypto with cash and holding it.
- Donating crypto to a qualified tax-exempt charity or non-profit.
- Receiving a gift of crypto.
- Giving a gift of crypto.
- Transferring crypto to oneself.

On the other hand, transactions subject to taxation include:

- Selling crypto for cash.
- Converting one crypto to another.
- Using crypto to make purchases of goods and services.

Additionally, it's important to highlight transactions considered taxable income:

- Receiving payment in crypto.
- Receiving crypto in exchange for goods or services.
- Mining crypto.
- Earning staking rewards.
- Earning other forms of income.
- Receiving crypto from a hard fork.
- Receiving an airdrop.
- Receiving other incentives or rewards.

3.2. Taxation of NFT

As NFTs have significant potential in some sectors due to their structure, they also have the potential to develop in many areas with their characteristic features such as being unique. It also has great potential to protect the gaming industry and digital collections. NFT blockchain technology has a high development potential in the digital collectibles industry as it is more practical in proving uniqueness and originality. In addition to these, it has the potential to be one of the basic building blocks of Metaverse (multiverse) technology, which is generally produced with a series of techniques such as augmented reality and internet technology and allows digital activities to be carried out in a virtual world. Generating, storing and trading NFTs costs the user a so-called gas price. In addition to these, one of the most important problems that NFTs have to overcome is their situation within the scope of public law. This situation, led by legal barriers and taxation, seems to be the biggest obstacle to the potential of NFTs. Legal recognition and identification problems still persist, and although there are a number of studies, the number of governments that have taken an official step towards the taxation of NFTs is quite low (Gazioğlu, & Özen, 2022).

The status of cryptocurrencies can be considered when considering the positions of NFTs in the context of public law. So much so that since commercial activities for NFTs are carried out over cryptocurrencies, the discussion of taxability of cryptocurrencies can also shed light on NFTs. The fact that cryptocurrencies will gain such prevalence, power and importance in the future forces states to make moves in this area. So much so that the control of states over money is not only an economic issue, but also a political issue that concerns the sovereign right of states (Şanlısoy & Çiloğlu, 2021).

The NFT sector, which reaches billions of dollars in volume and users from all over the world, has attracted the attention of governments, as in cryptocurrencies. The United States pioneered tax regulation for NFTs. For example, the Internal Revenue Service (IRS) introduced a

legal regulation in November 2021, and in this context, if profits are made due to transactions made in the context of NFT purchases and sales, it is obligatory to declare them (Kugelman Law, 2022). In this regulation, although a clear guide could not be prepared due to technical problems regarding the taxation of NFTs, it is stipulated that every cryptocurrency transaction of \$10,000 or more must be reported to the IRS (Will, 2021). While there is no comprehensive document or detailed text available, the taxation of NFTs in both the United Kingdom and the USA is generally perceived as a form of capital gains tax, reflecting the increase in value. Many countries lack explicit provisions addressing NFTs in their tax legislation, and none of the existing definitions fully encapsulate NFTs, leading countries to implement practices based on income tax regulations. However, in certain jurisdictions such as Singapore, when NFT buying and selling transactions are conducted by a company, they fall under the purview of corporate tax regulations (Cheong, 2022). The studies of countries on this subject continue and it can be foreseen that special regulations will be made in different countries for NFT taxation in the future.

Are NFTs subject to taxation? Absolutely, the proceeds arising from the disposal of NFTs attract tax liabilities. US-based taxpayers have no access to any NFT tax loophole or legal means to evade tax implications resulting from NFT sales. NFTs are commonly categorized under property taxation, akin to cryptocurrencies like Bitcoin or Ethereum. Whether your NFT falls under the classification of regular property or a collectable, it is essential to disclose gains and losses incurred from NFT sales when filing your tax return. The applicable tax rate is contingent on the duration for which a particular NFT was held, alongside your overall taxable income. Ordinarily, losses stemming from the sale of NFTs can be employed as deductions to counterbalance capital gains.

Which NFT transactions incur tax obligations? Taxable capital gain/loss events for hobbyists encompass the following NFT activities (Teller, 2023):

- Acquiring an NFT using cryptocurrency.
- Exchanging an NFT for another NFT.
- Offloading or disposing of an NFT in exchange for a fungible cryptocurrency.

Conversely, which NFT transactions do not trigger tax liabilities? The act of creating an NFT itself does not constitute a taxable event. However, for professional creators engaged in full-time NFT minting, it is imperative to declare NFT income and associated business expenses. NFT royalties and gas expenses incurred during the NFT minting process are also subject to NFT taxes.

3.3. Taxation of Metaverse Transactions

The digital transformation of works of art and the buying and selling of these works on digital platforms have brought along discussions in terms of taxation. The fact that works of this nature are subject to purchase and sale transactions on digital platforms and the resulting earnings are not subject to taxation both reveal the income losses of the States and harm the tax justice. The determination of the earnings obtained in the Metaverse will be a guideline about which income type can be taxed according to the Turkish tax system among the 7 income elements listed in the Income Tax Law (Official Gazette, 1961) by looking at the nature of the activity. For example, NFTs can be expressed as the conversion of digital or physical assets into tokens with smart contracts. In practice, NFTs of videos and works of art such as paintings are sold at the price agreed between buyers and sellers. NFTs are not within the scope of tax as they are not yet defined in the Turkish tax system. Therefore, NFTs can be defined as digital assets or intangibles with a special law to be enacted (Orkunoğlu Şahin & Çiftçi, 2022).

Since shopping transactions on the metaverse virtual world will be made with cryptocurrencies, the transactions that are basically foreseen for existing internet applications can also be used for the metaverse. Here, technically, it will be necessary to follow the transactions in the metaverse environment. The main difficulty is how and by whom these transactions will be controlled in a decentralized environment. It is clear that there will be developments following the development of the system in the coming years regarding the transactions that may be subject to tax

on the metaverse. The taxation of metaverse transactions seems to be possible only through the company that establishes and operates the metaverse. Considering that this environment will be accessed from all over the world, structures similar to the taxation of a website serving the whole world can be established. It may be planned to establish local offices of these metaverse companies in the future.

Even within the Metaverse, users are obligated to fulfil tax responsibilities, mirroring the real-world scenario, despite the exclusively online nature of their transactions. The presumption is that all sales transactions within the U.S. will carry tax implications unless a specific exemption applies (Anasız and Küçük, 2023).

Anticipating that income generation within the Metaverse will predominantly stem from NFTs and analogous solutions, the prevailing expectation is for taxation to manifest in the form of NFT taxation.

Furthermore, given the capability to record all transactions within the Metaverse and the likelihood of utilizing cryptocurrencies for shopping and crypto assets for savings, it is foreseeable that the taxation procedures elucidated in the preceding sections will remain applicable within the Metaverse.

4. Conclusion

New technological developments have entered our lives and even with environments such as metaverse, it is a candidate to become our life itself. Taxes, which are the main source of income for the states, are shaped following these technological developments and try to keep up with the new regulations and developments. The spread of blockchain technology and the most important examples being cryptocurrencies have revealed a series of developments. New technologies and developments such as NFT and Metaverse are popular today. With the widespread use of these popular technologies, the taxation of the transactions made or to be made here is of great importance for the states. The main reason for this is that decentralized and unauthorized transactions take the place of authority-based transactions, physically or over the internet in daily life. In order to carry out critical transactions such as tax transactions, these situations can be observed during the establishment or development stages of technologies. In the future, countries may want to take measures to establish the necessary legal standards in these environments or transactions. In addition, it is clear that legal arrangements will be made in accordance with the requirements of the day. The legislation is insufficient at this stage and cannot progress in parallel with the development of technology. However, it is the responsibility of the states to monitor these developments carefully, to make the necessary legal arrangements and to develop the taxation system.

It will also be able to benefit from the features of technology for the tracking and taxation of transactions. In particular, elements related to data can be added to blockchain-based distributed and decentralized cryptocurrency systems. Taxation elements can be inserted into the existing technical setup. Since different countries will have different taxation standards, we are faced with the question of which legislation will be taxed. Likewise, there is the problem of how the transaction will be owned by the relevant states. In order to solve these problems, the country or other personal information of the people making the transaction may be needed. This also means that the privacy feature offered by the blockchain is compromised. Creating a balanced solution to all these in terms of technology, security and privacy will be the challenge of the future.

Bibliographie

1. Anasız, E., Küçük, O. (2023). Turkey: Will Virtual Transactions Be Taxable On Metaverse ? Mondaq Website. <https://www.mondaq.com/turkey/tax-authorities/1321102/will-virtual-transactions-be-taxable-on-metaverse->. Access Date:01.11.2023
2. Boyes, W., & Melvin, M. (2013). Fundamentals of economics. Cengage Learning.
3. Cheong, B. C. (2022). Application of Blockchain-enabled Technology: Regulating Non-fungible Tokens (NFTs) in Singapore. Singapore Law Gazette, January
4. Çağlar, Ü. (2007). Elektronik Para: Enformasyon Teknolojisindeki Gelişmeler ve Yeni Ödeme Sistemleri, Sosyal Bilimler Dergisi, 17, 177-186.
5. Coinbase (2023). Understanding crypto taxes. Coinbase Crypto Basics. <https://www.coinbase.com/learn/crypto-basics/understanding-crypto-taxes>. Access date: 01.11.2023
6. Dionisio, J. D. N., Burns III, W. G., & Gilbert, R. (2013). 3D virtual worlds and the metaverse: Current status and future possibilities. ACM Computing Surveys (CSUR), 45 (3), 1-38.
7. Erdem, E. (2008). Para Banka ve Finansal Sistem. Ankara: Detay Yayıncılık.
8. Fairfield, J. A. (2022). Tokenized: The law of non-fungible tokens and unique digital property. Ind. LJ, 97, 1261.
9. Franceschet, M., Colavizza, G., Finucane, B., Ostachowski, M. L., Scalet, S., Perkins, J., ... & Hernández, S. (2021). Crypto art: A decentralized view. Leonardo, 54(4), 402-405.
10. Gazioğlu, A. & Özen, A. (2022). NFT'nin Gelişimi ve Vergilendirilmesi Üzerine Genel Değerlendirme. İzmir Sosyal Bilimler Dergisi, 4 (1) , 23-33. DOI: 10.47899/ijss.1107237
11. Isbasi.com (2020). Vergi Nedir? Vergi Çeşitleri Nelerdir?. isbasi.com. Retrieved from <https://isbasi.com/blog/vergi-nedir-vergi-cesitleri-nelerdir> access date:17.09.2022
12. Jmv (2021). Journal of Metaverse. <https://dergipark.org.tr/en/pub/jmv>
13. Kowalski, P. (2015). Taxing Bitcoin transactions under Polish tax law. Comparative Economic Research, 18(3), 139-152.
14. Kugelman Law, (2022). NFT Accounting a tax Compliance. Kugelman Law. Retrieved <https://www.kugelmanlaw.com/nft-accounting-and-tax-compliance.html>, Access date:17.09.2022
15. Moore, G. (1965). Moore's law. Electronics Magazine, 38(8), 114.
16. Mysoft (2022). Blokzincir Teknolojisi Nedir? Blockchain Kullanım Alanları Nelerdir?. Mysoft.com.tr. Retrieved from <https://www.mysoft.com.tr/blokzincir-teknolojisi-nedir-blockchain-kullanim-alanlari-nelerdir>, Access date: 17.09.2022
17. Mystakidis, S. (2022). Metaverse. Encyclopedia, 2(1), 486-497.
18. Mystakidis, S., Fragkaki, M., & Filippousis, G. (2021). Ready teacher one: virtual and augmented reality online professional development for K-12 school teachers. Computers, 10(10), 134.
19. Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. Decentralized Business Review, 21260.
20. Orkunoğlu Şahin, I. F. O., & Çiftçi, T. E. (2022). Metaverse'de Gerçekleştirilen İşlemlerin Vergilendirilmesi. Fiscoeconomia, 6(2), 677-698. DOI: 10.25295/fsecon.1104368
21. Pierro, M.D. (2017), What Is the Blockchain?, Computing in Science & Engineering, 19 (5), pp. 92-95, 2017, Doi: 10.1109/MCSE.2017.3421554.
22. Regner, F., Urbach, N., & Schweizer, A. (2019). NFTs in practice—non-fungible tokens as core component of a blockchain-based event ticketing application. Non-Fungible Tokens as Event Tickets Fortieth International Conference on Information Systems, Munich 2019.
23. Resmi Gazete (1961). 31/12/1960 tarihli ve 193 sayılı Gelir Vergisi Kanunu. Resmi Gazete. <https://www.mevzuat.gov.tr/mevzuatmetin/1.4.193.pdf>. Access date:17.09.2022
24. Serçemeli, M. (2018). Kripto Para Birimlerinin Muhasebeleştirilmesi ve Vergilendirilmesi. Finans Politik ve Ekonomik Yorumlar , (639) , 433-465.
25. Shirole, M., Darisi, M., & Bhirud, S. (2020). Cryptocurrency token: An overview. IC-BCT 2019, 133-140.
26. Stephenson, N. Snow Crash: A Novel; Random House Publishing Group: New York, NY, USA, 2003; ISBN 9780553898194.
27. Şanlısoy, S. ve Çiloğlu, T. (2021). Uluslararası Parasal İlişkiler ve Kur Savaşları Bağlamında Kripto Para Birimlerinin Geleceği, Teknoloji ve Uluslararası İlişkiler (Editör: Dr. Ömer AYDIN ve Dr. Çağdaş CENGİZ), Nobel Yayınevi, Ankara.

28. Teller, A. (2023). The Essential NFT Tax Guide for 2023. TokeTax. <https://tokentax.co/blog/nft-tax-guide>. Access date: 01.11.2023
29. Turan, Z. (2018). Kripto Paralar, Bitcoin, Blockchain, Petro Gold, Dijital Para ve Kullanım Alanları. Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 11 (3), 1-5. Doi:10.25287/ohuiibf.431283
30. Wang, Q., Li, R., Wang, Q., & Chen, S. (2021). Non-fungible token (NFT): Overview, evaluation, opportunities and challenges. arXiv preprint arXiv:2105.07447
31. Will, N. (2021). NFT owners in the US to start paying taxes on their investments. NME. Retrieved 30/03/2022 from <https://www.nme.com/news/gaming-news/nft-owners-in-the-us-to-start-paying-taxes-on-their-investments-3090185>
32. William, E., Dieter, S., Jacob, E., & Nastassia, S. (2018). Erc-721 non-fungible token standard. Ethereum Improvement Protocol, EIP-721. Ethereum.
33. Wise, J. (2022). NFT Statistics 2022: Market Size, Growth, Sales & Trends. Earthweb. Retrieved From <https://earthweb.com/nft-statistics/>. Accesed date: 17.09.2022
34. Witek, R., Andrew, C., Philippe, C., James, T., Eric, B., & Ronan, S. (2018). Eip-1155 : Erc-1155 multi token standard. Ethereum Improvement Protocol, EIP-1155.
35. Wood, G. (2014). Ethereum: A secure decentralised generalised transaction ledger. Ethereum project yellow paper, 151(2014), 1-32.