

The Potential of Non-Fungible Tokens (NFTs) in Higher Education as Perceived by Romanian Students

Cristian Bogdan Onete¹, Irina Albăstroiu Năstase², Mihai Felea³ and Răzvan Dina⁴

¹⁾²⁾³⁾⁴⁾ *The Bucharest University of Economics Studies, Romania.*

E-mail: cristian.onete@com.ase.ro; E-mail: irina.albastroi@com.ase.ro

E-mail: mihai.felea@com.ase.ro; E-mail: razvan@razvan.biz

Please cite this paper as:

Onete, C.B., Albăstroiu Năstase, I., Felea, M. and Dina, R., 2022. The Potential of Non-Fungible Tokens (NFTs) in Higher Education as Perceived by Romanian Students. In: R. Pamfilie, V. Dinu, C. Vasiliu, D. Pleșea, L. Tăchiciu eds. 2022. *8th BASIQ International Conference on New Trends in Sustainable Business and Consumption*. Graz, Austria, 25-27 May 2022. Bucharest: ASE, pp.804-811.

DOI: 10.24818/BASIQ/2022/08/106

Abstract

Non-fungible token (NFT) is a distinctive, digitized, and encrypted token fabricated and stored using blockchain technology. Artists, filmmakers, photographers, game developers, and fashion designers sell their work on the NFT marketplace. Nevertheless, NFTs are no longer a concept associated with art and design and they are starting to be used in different sectors. Now, NFT is branching out to higher education, where students, tutors, and institutions can use NFTs for different purposes. Given these coordinates, in this article we have chosen to discuss the applicability of NFT related to higher education.

Thus, our paper presents, in the introductory part, the conceptual delimitations regarding NFTs. Areas of application, and the main ways of use in education, are presented next, showing that adoption of NFTs in higher education has been too little addressed in the literature. Most of the work in the field insists on the technical aspects and only subsidiarily deals with the issues regarding the level of understanding of the NFT concept by potential or actual users and the degree of adoption and use of these as solutions to some problems of higher education. In order to cover these gaps identified in the literature, we presented, in the second part of the paper, the methodology and results of an exploratory research, conducted on a sample of 383 students from Faculty of Business and Tourism – Bucharest University of Economic Studies, which allowed us to identify the level of understanding the concept, the degree of openness to the adoption of NFTs as diplomas/certificates/attestations for the recognition of studies/knowledge/skills/competences acquired in the formal education system, and, also, the associated benefits and challenges, from the perspective of the Romanian students.

Keywords:

NFT (Non-Fungible Token), blockchain, higher education, Romania.

DOI: 10.24818/BASIQ/2022/08/106

Introduction

According to Stătescu, Olteanu and Anghel, 2022, an *NFT (non-fungible token)* is a cryptographic code stored in the form of a smart contract that joins a static or dynamic icon, a sound, a combination of the two, or even an object with physical materiality. Their trading is done through digital markets using blockchain technology, trading is done freely. They are unique, indivisible, and non-fungible, and must belong to a virtual wallet to be traded.

Their uniqueness is that each transaction is integrated into the *blockchain*, so that you can always identify who the owners were and who owns it at any given time. Due to this transformation, the original cryptographic code is no longer entirely the same as it is today, if it has gone through at least one new transaction and thus the succession of transactions can be easily proven. The transfer of ownership is done through smart contracts that contain all the terms and conditions agreed by the parties regarding the operation involving the NFT.

Following a transaction of an NFT, the ownership of the artwork is not transferred, just a digital copy of the artwork is sold together with all the information about the transactions that have been made with it. The artwork remains the property of the creator and he can always create another digital copy to sell.

There are three ways we can own and use them. The first and most widely used is holding them in the form of virtual assets. Another way to use them is in the form of virtual keys. Holding an NFT provided by a virtual community allows access to the community only to those who hold such an item. The holder of an NFT can use it as collateral, which is the third way it can be used. It is important to mention that if a transaction takes place, the collateral is transferred to the new owner.

One of the applications of NFT is related to the field of *education*. NFTs can substitute for diplomas, recognitions, or certificates and securely verify academic credentials and achievements. Another benefit of non-fungible tokens is attributing authorship to the creators of different content or works, such as teachers and students. Given that these issues are addressed only in a few scientific papers (Sousa-Vieira, Ferrero-Castro and López-Ardao, 2022; Alammery et al., 2021; Pandey, 2021; Chen et al., 2018), we have considered them in this article. Thus, our paper presents, in the literature review part, the conceptual delimitations regarding NFTs and main areas of application, focusing on applicability in education, and then, the methodology and results of an exploratory research, conducted on a sample of 383 students from Faculty of Business and Tourism – Bucharest University of Economic Studies, which allowed us to identify the level of understanding the concept and the degree of openness to the adoption of NFTs in higher educations, from the perspective of the Romanian students.

1. Literature review

Blockchain is an emerging technology introduced in 2008, as part of an electronic payment system for the transactions of bitcoin cryptocurrency. Gilder (2018, p.241) describes blockchain as a “database, like a cadastre of real estate titles, extended to events, covenants, patents, licenses, or other permanent records. All are hashed together mathematically from the origin of the series, each record distributed and publicized on decentralized Internet nodes”.

Recent research (Delgado-von-Eitzen, Anido-Rifón, and Fernández-Iglesias, 2021) has found that there are three main *blockchain types*:

- *Public*: these are open to anyone who wants to be part of the peer-to-peer network (i.e., Bitcoin and Ethereum).
- *Private*: participants may only join if they are invited and they have to follow the rules set by the organization that controls the network (i.e., Hyperledger).
- *Consortium*: a combination of private (participants may only join if they are invited), but there is a group of organizations that controls the network.

Blockchain technology has the following *major features*:

- *Immutability*: Blockchain’s immutability consists of its impossibility for the data stored in the blocks to be changed (Raimundo and Rosário, 2021).
- *Dependability*: Blockchain technology provides a secure distributed ledger that is kept by all participants in the blockchain where it provides efficient, secured, reliable, and transparent systems (Bhaskar, Tiwari and Joshi, 2021).
- *Decentralisation*: Blockchain is decentralized because all nodes are joined together in an interconnected network (Shen and Pena-Mora, 2018) and anybody can directly access the system and store their assets such as cryptocurrencies, legal documents, licenses, and credentials (Son-Turan, 2022).
- *Traceability*: Blockchain traceability feature promotes the ability to recall of an event as each stored information is saved in blocks secured by the cryptographic unidirectional hash function (Chen et al., 2018).
- *Consensus algorithm*: Consensus algorithm refers to the mutual approval of all nodes associated with the blockchain network and uses the techniques of Proof-of-Work (PoW), Proof-of-Stake (PoS), and Delegated Proof-of-Stake (DPoS) (Balpande and Patil, 2021).

The progress in blockchain technology led to the development of two *main types of tokens*, fungible, and non-fungible tokens (Regner, Urbach and Schweizer, 2019)). *Fungible tokens* are identical and interchangeable tokens, while Non-Fungible Tokens (NFTs) are tokens that represent digital assets with a unique identifier that is stored on a blockchain. Valeonti et al. (2021, p.4) define a *non-fungible token (NFT)*

as a “cryptographically unique, indivisible, irreplaceable and verifiable token that represents a given asset, be it digital, or physical, on a blockchain”.

In their current format, *NFTs* was implemented in 2017, when it was introduced the ERC-721 smart contract standard, which enables the birth of a new type of Ethereum tokens, with additional functions to ensure that tokens based on it are distinctly non-fungible and thus unique (Entriiken et al., 2018). Afterwards, other ERC (Ethereum Request for Comments) standards for creating *NFTs* have also been proposed. The ERC-1155 multi-token standard outlines a smart contract interface that can represent any number of fungible and non-fungible token types (Radomski et. al., 2018). Another standard is EIP-2981, which enables universal support for royalty payments in all *NFT* marketplaces and ecosystems (Burks et al., 2020).

From its emergence until now, the non-fungible tokens (*NFT*) market has experienced a meteoric growth (Stătescu, Olteanu and Anghel, 2022), reaching a market capitalization of 21.33 billion USD in 2022 (The Business Research Company, 2022), with a forecast growth of more than 50% compared to 2021 when it was 14 billion USD (Dowling, 2022; Ko et al., 2022; Yousaf and Yarovaya, 2022).

With the emergence of this phenomenon has come a new way for content creators, and especially artists, to sell their works without the need for an intermediary. Those who buy can do so for two reasons, on the one hand to help artists to monetise their work, on the other they will buy with the hope that their value will increase over time and they will be able to sell at a profit. We must understand that their value only increases if someone is interested in them. There are many cases where resale has been done at prices much lower than the purchase value. Price movements do not depend, as in the case of shares on the stock exchange, on certain economic or technical indicators, but on the public's interest in them.

NFTs became one of the most widespread applications of blockchain technology that covers various domains. Rehman et al. (2021) found diverse applications of *NFTs* that are summarized in Table no. 1.

Table no. 1. Various applications of *NFTs*

Categories	Applications
Digital Art	Cryptokitties
Fashion	Luxurious digital wearables
Licenses and Certifications	Course completion certificates Degrees Licenses
Collectibles	Trading cards Memes Tweets
Boosting Gaming Potential	In-game objects In-game lands Avatars
Domain Names	Candy.com Sushi.com
Virtual Worlds	Metaverse, Decentraland
Sports	Digital autographs Avatars, Stickers, Tickets Game Highlights.

Source: Rehman et al., 2021, p. 4

Based on a systematic review of the scientific literature, Alammary et. al. (2021) show that the *key applications of NFTs for education* are related to: issue and verify academic certificates, share students' competencies and learning achievements, and evaluate their professional ability. In addition, blockchain technologies for education include securing a collaborative learning environment, protecting learning objects, fees, and credits transfers, obtaining digital guardianship consent, competition, and copyright management, enhancing students' interactions in e-learning, examination review and supporting lifelong learning. These blockchain technologies have great potential for education due to *benefits* like empowering learners, enhancing security and efficiency for educational institutions and students, and giving trust and transparency in our society (Pandey, 2021).

The use of tokens reduces the possibility of falsification while managing student records and credits, tracking lifelong learning progress, and preserving educational data. Also, in the educational field, copyright

protection for students' works and projects is not considered. For this reason, creative recognition is necessary. NFTs allow these achievements to be known and shared, giving the corresponding credit to the authors.

Vilchis (2022) suggests that the range of opportunities for NFTs stored reliably on the blockchain goes far beyond the classroom. For example, if a student lost their academic record or certificates, their credentials could be checked. Another added value of NFTs, mentioned by Bohnke (2022), is verifying non-formal learning. Information such as research experience, projects, skills, mentoring, and online learning can be added to the student's portfolio.

Employers, in turn, can more easily verify the qualifications and studies that graduates pass on in their resumes. Thus, a simpler path, facilitated by NFT, could create significant time savings for applicants and employers.

Also, NFTs could help students, who are in possession of evidence of their achievements, to support their arguments more easily in order to benefit from scholarships, internships, study opportunities abroad.

Nevertheless, we should also consider one of the disadvantages of NFT - it is tied to a platform where the link between an NFT and its owner is established. If that platform becomes non-existent in the future, information about the NFT's creator could be lost forever. But VCs (Verifiable Credentials) have no such dependency since they are not platform-specific.

2. Methodology

The *aim* of the research was to highlight the Romanian students' perception regarding the applicability of NFT in education.

Subsequent to this goal, the *main objectives* of our research were to:

- establish the level of understanding of the NFT concept;
- highlight the benefits and challenges related to NFTs, from the perspective of Romanian students;
- identify the extent to which respondents would consider it appropriate to receive diplomas/certificates/attestations and digital badges in NFT format.

This research was based on a *standard methodology*, which is applied in *opinion survey*. The method of data collection was the use of a *self-administered questionnaire*. The questionnaire was posted on the website *www.isondaje.ro* and was distributed as a link by e-mail to students and master students from Faculty of Business and Tourism – Bucharest University of Economic Studies. The beginning section of the questionnaire provides a brief explanation of its purpose to provide a common frame of reference for all potential respondents.

The *sample* used in the research was 383 *persons*. Given the limited sample size, this online questionnaire-based study is exploratory research. Data collection took place *between March and April 2022*.

3. Results and discussions

The sample of our research consisted of 383 young people from Romania, 86.4% students and 13.6% master students at the Faculty of Business and Tourism – Bucharest University of Economic Studies. Most of the respondents (66.1%) are women - the explanation lies in the fact that the courses of this faculty are mainly attended by women.

45% of respondents had only a *basic understanding* of NFT. Also, most respondents did not sell (96%), buy (94%), or create (97%) NFTs.

Given the purpose of our research, it is important to note that very few students (4%) consider *education* as an area of applicability for NFTs, while most respondents appreciate that art (24%), marketing (23%), or gaming (22%) are areas where NFTs find their applicability.

However, respondents associate NFT with an original digital or virtual creation (28.5%), cryptocurrency (19.1%), digital asset (16.7%), or blockchain registry (15.2%). The association with blockchain is obvious, given the fact that, as shown in this paper, their uniqueness is that each transaction is integrated into the blockchain. Also, the association with cryptocurrencies occurs because their trading is done through cryptocurrencies. However, the difference between cryptocurrencies and NFTs is fungibility. NFT-utilities

are not interchangeable, mean that they cannot be exchanged for other items, which makes them unique and therefore valuable. Cryptocurrencies, on the other hand, are nothing more than virtual money that can be transferred from one owner to another, their code remaining the same no matter how many transactions they go through. The relationship between NFTs and cryptocurrencies is that you need a virtual wallet to be linked to. The virtual wallet can belong to a person or a marketplace.

The main reason for the use of NFTs by Romanian students is related to a *potential financial gain* (66%), followed by reasons like interest in emerging technologies, owning a genuine digital asset or entertainment. Again, we note that no answer correlates the purpose of using NFT with education, obtaining diplomas, certificates, assessments, etc.

The respondents were asked about the *advantages* of NFTs, considering as their main benefit the capitalization of an authentic digital work, as can be seen in Figure no. 1.

Regarding the *disadvantages*, the respondents consider as the most important the lack of regulations and control mechanisms, as can be seen in Figure no. 2. However, in our opinion, the fact that the NFT trading market is not yet regulated is both an advantage and a disadvantage. The advantage is that there are no restrictions on access to them, anyone can create and trade such digital assets, the disadvantage is that there are no regulations by which the authorities can intervene if legal disputes arise or illegal transactions take place.

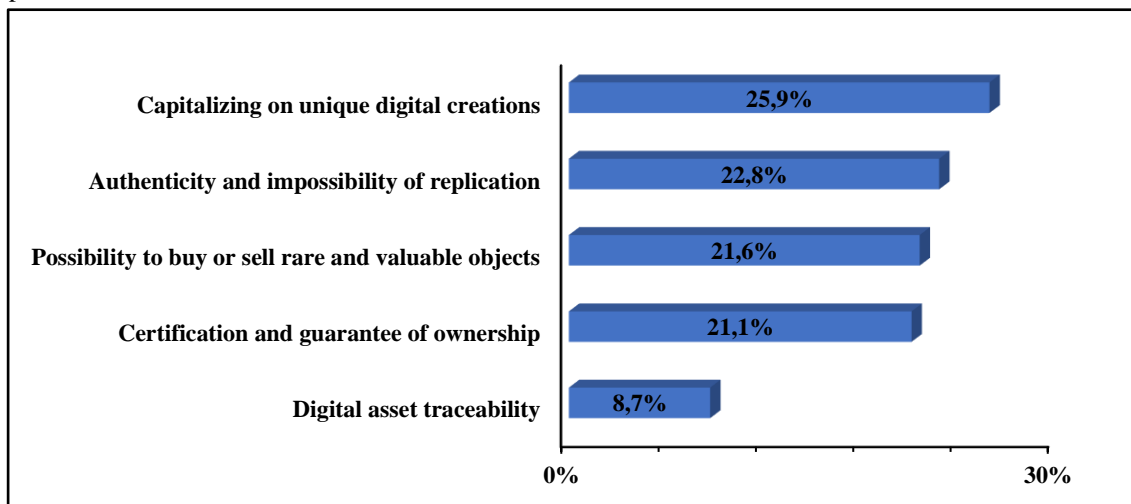


Figure no. 1. The advantages of NFTs, according to Romanian students

Source: Authors' own research

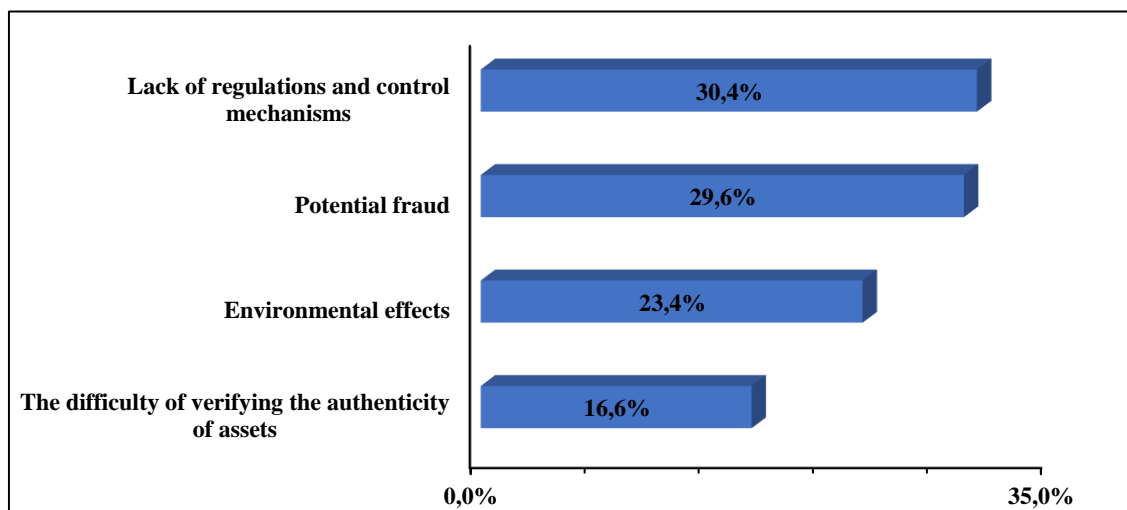


Figure no. 2. The disadvantages of NFTs, according to Romanian students

Source: Authors' own research

Universities world-wide have begun to offer NFTs. In this context, Romanian students were asked about the extent to which they would consider it appropriate to receive in NFT format *diplomas, certificates, and attestations* for the recognition of studies/knowledge/skills/competences acquired in the formal education system. A 5-levels scale was used for this question, from 1 (“to a very small extent”) to 5 (“to a very large extent”). Most of the answers (32%) indicated a moderate openness regarding this approach, as can be seen in Figure no. 3. However, it is worth noting that 26% of respondents considered it appropriate to a large extent to receive diplomas and certificates in this format.

Likewise, respondents were asked about the extent to which they would consider it appropriate to receive *digital badges* as a result of fulfilling some criteria of reference in the learning experiences or for the accomplishment of some themes/projects/activities on the e-Learning/blended learning platforms. A 5-points scale was also used. In this case, most respondents (29%) chose the option “to a very large extent”. Also, many respondents (28%) indicated the option “to a large extent”, as can be seen in Figure no. 3. Thus, it is noted that Romanian students are more willing to receive digital badges in the form of NFTs than they are willing to accept diplomas and certificates in this way, which is understandable, given that these digital badges are not practically official documents.

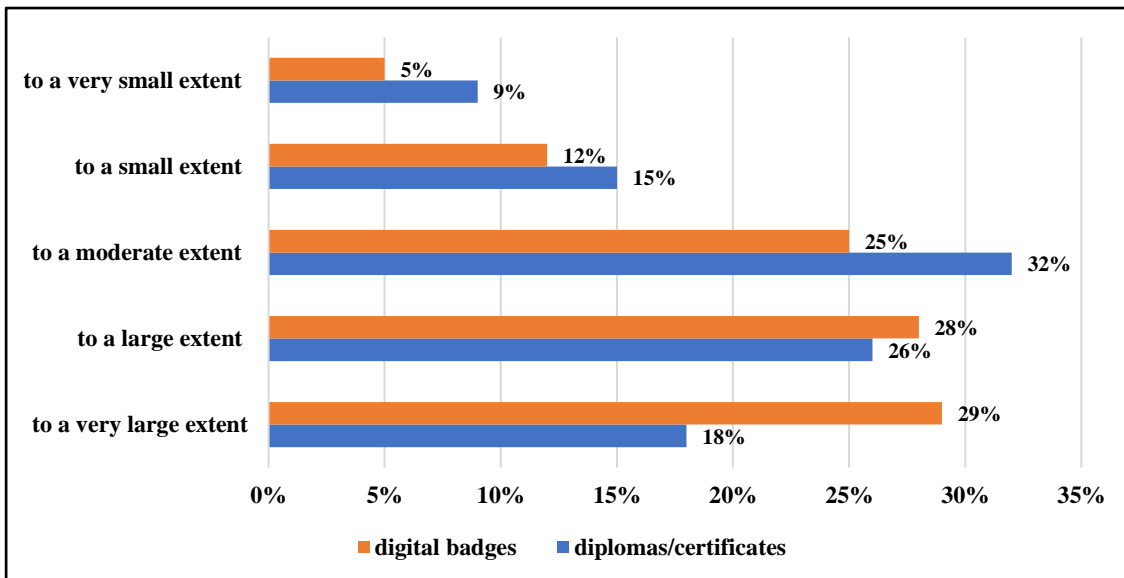


Figure no. 3. The extent to which Romanian students consider it appropriate to obtain diplomas/certificates and digital badges in NFT format

Source: Authors' own research

Conclusions

Our research has shown that Romanian students are open to using NFTs and would like an evaluation and reward system based on NFTs but are not as open to the idea of adopting NFTs as diplomas and certificates.

The adoption of such an evaluation and reward system based on NFTs would also mean the implementation of *gamification in higher education*. Evaluation and incentives are critical elements of the educational process. In addition, these are key ingredients for improving students' knowledge acquisition. For evaluation to be effective, an incentive must be linked to an achievement, or the process becomes meaningless. One of the most successful positive mechanisms known is gamification. In these systems the learning process is transformed into a game with a positive reward system. Historically, the implementation of such a gamification system it was very difficult to achieve due to the inadequacy of the support technology. Thus, a new approach to the use of non-fungible token (NFT) would be to implement a stimulus mechanism related to student assessments to positively stimulate both students and their teachers. This approach allows positive incentive reinforcement through the bragging rights and special access to benefits granted to the NFT holders, as the study of Sousa-Vieira, Ferrero-Castro and López-Ardao (2022) confirms.

The reluctance of Romanian students to obtain diplomas and certificates in the form of NFTs is understandable, given that respondents do not know very well the meaning and characteristics of NFTs and do not fully understand the benefits of using NFT in this domain. In fact, they do not even consider education as a main area for the application of NFTs, as our study has shown.

Obviously, our research has its limits, being carried out on a statistically insignificant sample. New research carried out on a larger number of students, from different specializations, but also taking into account other possibilities of application in education and the opinion of teachers and representatives of higher education institutions in Romania, would complete the overall picture regarding the perspective on the use of NFTs in higher education.

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