

Non-Fungible Token valuation: State of the art and future insight

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Abstract

Purpose: This paper aims to provide an exploratory analysis of Non-Fungible Tokens (NFTs) valuation. NFTs are a new kind of digital asset born out of the disruptive technologies' introduction (i.e., blockchain). A lot of small and medium enterprises (SMEs), as innovative start-ups, are involved in this domain. Nowadays, several issues in the evaluation field remain unclear. To fill this gap, this research adopts a holistic approach is crucial to draw a clear picture of the first-time accounting treatment of these new digital assets.

Design/methodology/approach: Using a structured approach, this research considers some of the state-of-the-art international practices and reviews some major scholars' opinions on the matter. Particularly, the study analyses the main contributions provided by international entities (e.g., European Financial Reporting Advisory Group - EFRAG, Chartered Business Valuers institute - CBV, PriceWaterhouseCoopers - PWC), digital operators, and academia.

Findings: Based on the two main strands defined for the NFT's nature, NFTs valuation issues can be resumed in twofold. The first one that considers NFTs as intangible assets suggests following the traditional valuation approaches (cost, income, or market) that is already a part of international accounting standards. The second strand that considers NFTs as financial assets proposes a different valuation approach based on quantitative methods coming mainly from finance fundamentals.

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Originality/value: The originality of this study includes the different NFT valuation approaches, which enrich the literature and can help SMEs in managing and accounting for this new kind of digital asset.

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1. Introduction

The Tokenomics phenomenon is the last frame of web 3.0 and represents an economic system based on the tokenization process. It includes token features, monetary policy and the users' incentive system (Freni et al., 2022). The web 3.0 concept contains web use evolution and the interaction among possible evolutionary paths (Borup et al., 2006). This research is original in discovering this new landscape through an exclusive study of the economic-business treatment of new products such as non-fungible tokens (NFTs). Such products are born out of the disruptive introduction of new technologies (i.e., blockchain). By discussing issues related to NFTs, this contribution aims to provide an exclusively business-economic perspective without encroaching on other obscure areas such as the legal field. These tools' use from the business-economic perspective is often the exclusive subject of high-tech companies such as start-ups, as well as being one of the most interesting issues related to the socio-economic environment's evolution.

To enable Tokenomics, organizations generally need two groups of tokens: fungible token (FT) and non-fungible token (NFT). FTs consist of divisibility and non-uniqueness and may also include payment tokens such as cryptocurrencies. In contrast, NFTs can be defined as pure digital assets that cannot be exchanged like-for-like. They are unique and non-replicable. However, a third type of token called utility token can be fungible or non-fungible. This third type is mainly used to give users digital access to an application or service (Dowling, 2022a; Bao and Rouband, 2022). A smart contract and blockchain technology support the NFT transfer (Treiblmaier, 2021; Patrickson, 2021). These digital assets include several ranges (but not limited to collectables, gaming, physical and digital art, fashion, sports, cultural artefacts and history, real estate, education, and research; (PwC, 2021:7)). The NFT ecosystem involves both physical and virtual dimensions. This distinction is mainly related to the origin of NFT, the user's purchase place and the digital asset's fruition. For instance, it is possible to find NFTs related to

physical objects such as existing artworks or even NFTs connected to the music industry. In this first case, the digital asset originates from collateralizing an existing item. It is sold in unconventional marketplaces such as platforms created by traditional auction houses and buyers often purchase them for collecting or investing purposes. In contrast, it is possible to find NFTs exclusively connected to the Decentral and such as avatars for the Metaverse. This is a virtual world that allows real-time spatiality, immersion and interaction among virtual people (Stevenson, 1992). Nowadays, the metaverse could be considered one of the best expressions of web 3.0 where individuals can freely conduct their activities in a virtual space and interact with each other through the use of advanced technology¹.

In light of the above, NFT can be seen as a cross-cutting research area that requires scholars to be familiar with multiple areas such as economics and finance, computer science, law and others (Yue et al., 2021).

Without any doubt, NFTs represent a new business opportunity. In its current state, this business involves a single digital artist and digital firms developing NFT to generate revenue and retain their customers.

These digital firms are often Small Medium Enterprises (SMEs) with a highly innovative and technological vocation, which aim to develop their business through disruptive technologies such as blockchain. Firms operating in this sector, as in others, are also required to comply with specific accounting rules and non-financial reporting standards (Quagli and Paoloni, 2012). Although NFT treatment is problematic in this stream, several areas such as the valuation of these digital assets are still under-investigated and unclear².

To gain holistic knowledge and avoid partial conclusions, it is crucial to investigate the contributions made by the main actors involved in this innovative topic. At the current state, the actors can be classified into three categories: i) international entities: institutional actors conducting activities in support of national and supranational regulation; ii) digital operators: practitioners with interest in NFT valuation techniques; and, finally, iii) academia: the community of scholars interested in the scientific handling of NFT valuation.

¹ Recent data show that in the first quarter of 2022, the NFT market generated \$7.8 billion in verified trade volume (\$16.4 billion total, including unverified transactions) and involved 1.2 million buyers and 0.8 million sellers (Nonfungible.com, 2022: 15).

² NFT valuation is a complex issue because these assets' nature is still unclear. Some actors recognize NFTs as intangible assets; i.e., identifiable nonmonetary assets without physical substance, while others, given NFTs' close correlation to cryptocurrencies, consider them pure financial assets.

However, while the categories of institutional entities and digital operators are beginning to play an active role in the field, a gap is beginning to form in the academic contribution. For this reason, this paper aims to investigate:

RQ. How do scholars deal with the topic of NFT valuation?

To reach the declared goal, this paper is supported by a structured literature review (SLR) methodology (Paoloni et al.2022; Massaro et al., 2016).

The analysis shows divergent results regarding the topic of NFT valuation. Within the economics field, scholars are divided into three main strands. The first considers NFTs as intangible assets, the second considers them as financial assets and finally, the third marginal strand considers the NFTs as commodities. Consequently, different valuation methodologies emerge. The first strand is in line with the international bodies' recommendations, which suggest following the cost, income and market approaches already known in international accounting standards (IAS/IFRS). Conversely, the second strand suggests evaluating NFTs through methodologies based on fundamentals of finance. This second alternative view can reveal poor consideration of needs that may arise within the enterprise dimension.

The originality of this first explanatory study can be recognized in several theoretical and managerial implications. From a theoretical perspective, the study contributes to the valuation field and provides a first-time discussion on NFTs treatments within the company's non-financial disclosure policy (Rizza et al., 2011; Bianchi, 2019). From a managerial perspective, this study can be useful for the practitioners' community as a correct interpretation of NFT recognition. Moreover, the discussion could help SMEs to manage this new kind of asset. Especially, the results can contribute to improving the accounting process and the information provided to stakeholders within non-financial disclosure limits (Vagnozzi, 2017; Quagli et al., 2016).

The research's main limitations can be attributed to the topic's recent development and the paucity of contributions. Future research will be focused on providing concrete insights into NFT valuation from a business perspective.

This work is organized as follows. Section 2 proposes an insight into the main work developed by international practitioners until now; section 3 describes the structured literature review (SLR) methodology and the research protocol framework, while section 4 presents the findings from the review. Section 5 provides concluding remarks and section 6 summarizes the work's main implications. The final section details the research limitations and future direction.

2. NFTs value in international practice

The debate on NFT (Non-Fungible Tokens) valuation is growing fast. The discussed issues found their origins, firstly, in the analysis of the new digital assets' nature, which even now remains unclear. For this reason, before presenting the issue from the perspective of academia, this section details the contributions of the main players interested in the topic. To date, the players can be summarized as international entities and digital operators.

2.1. NFT valuation from the view of international entities

The main actors involved in the NFTs issue can be summarized as international accounting organizations, namely, standard setters or international rating companies. Starting from notions already accepted by the existing accounting standards apparatus, the studies the above-mentioned entities developed have attempted to deal with the issue of NFT valuation in meticulous detail. The notions explored and referred to within the studies below refer mainly to a) "intangible assets" accepted in IAS38; and b) "fair value" contained in IFRS13.

a) Intangible assets definition provided by IAS 38

IAS 38 defines intangible assets as non-monetary assets without physical substance that can be identified and controlled and are capable of generating future economic benefits (IASB, 2014; Quagli et al., 2021).

An intangible asset is identifiable if it is possible to distinguish it from the future economic benefits it can generate; namely, if it can transfer them without depriving itself of the benefits and the use of other resources. This will be controllable if the company is able to obtain the future economic benefits flowing from the intangible asset and, at the same time, restrict others' access to those benefits. With regard to the expectation of future benefits, the observations mainly focus on the concept of "probability," which the IASB requires to be evaluated. Measuring the probability of future benefits calls into question some variables and forward trends that are difficult to predict and can be resolved only through estimates and conjectures, leaving significant doubts about this condition.

Thus, such assets' main characteristics are identifiability, controllability, and the probability of generating expected economic benefits. To shed light on the topics that this study aims to explore, it can be underlined that the attributes described above can also be found in NFTs.

IAS 38 requires an enterprise to measure an intangible asset initially at cost if two conditions are verified: a) it is probable that future economic benefits will flow to the enterprise from the intangible asset; and b) the asset's cost can be measured reliably. Regarding the reliability of cost determination, IAS 38 distinguishes different cases based on how the intangible asset was acquired, including both purchased and internally generated resources. If an asset is not definable in the above terms and if the two conditions for recognizing an intangible asset are not verified, IAS 38 requires for the expenditure incurred on this item to be recognized as a cost in the period it is incurred.

On the other hand, the expenses incurred for research, start-up of a business or company, personnel training, and advertising must always be recognized as costs and not as intangible assets.

After initial recognition, an intangible asset's value is determined through the following accounting processes: 1 - reference, according to which an intangible asset is measured at net cost of the aggregate amount of accumulated amortization and accumulated impairment losses (cost model); 2 - alternative, according to which an intangible asset is carried at a revalued amount; its fair value on the revaluation date minus any subsequent accumulated amortization and any subsequent accumulated impairment losses (revaluation model). Fair value, defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants on the measurement date, must be determined by reference to an active market defined above.

An enterprise that adopts this accounting method must perform revaluations with sufficient regularity so that the accounting value does not differ materially from the one derived from using the fair value on the date when the balance sheet is completed. On this issue, IAS 38 refers to International Financial Reporting Standards (IFRS) 13, which regulate three different approaches: cost, income and market.

b) Fair value definition provided by IFRS 13.

IFRS 13 defines the concept of fair value and the techniques to determine it (IASB, 2011). IFRS 13 places fair value on three hierarchical levels, based on the type of information available and the parameters used to evaluate it (Quagli, 2009; Mechelli et al., 2018). The first level refers to the fair value determined by adhering to quoted prices (without adjustment) in active markets for identical assets or liabilities that the entity can access on the valuation date. The second level considers the fair value determined using an valuation technique, the inputs of which identify the quoted prices included in

Level 1 and are all substantially observable, directly or indirectly. Finally, Level 3 includes fair value determined by valuation techniques with inputs that are not substantially observable. If quoted prices are available in active markets for assets and liabilities identical to those valued, fair value must be determined based on those prices without any adjustments (Level 1 fair value). Without Level 1 inputs, the valuation technique must maximize observable inputs and minimize the use of unobservable inputs.

IFRS 13 provides three different valuation models: the cost method, income method and market method. According to the cost method, the fair value reflects the amount that would currently be required to replace the service capacity of an asset (often referred to as current replacement cost). The income method converts projections of future amounts (i.e., net cash flows or differences between revenues and expenses) into a single discounted amount. The market-currency method uses prices and other relevant information from market transactions that are related to identical or comparable assets and liabilities (Socoliuc and Grosu, 2016).

Considering NFTs as intangible assets, the method described so far represents the international framework for their valuation. However, since the debate about classifying these digital assets³ is still open, the possibility of identifying and treating non-fungible tokens as intangible assets is still being discussed.

International entities' contributions to NFT valuation can be chronologically analyzed as follows:

In 2019, the Chartered Business Valuators (CBV) Institute provided the first report, "DECRYPTING CRYPTO: AN INTRODUCTION TO CRYPTOASSETS AND A STUDY OF SELECT VALUATION APPROACHES," expressing three different valuation approaches, which link traditional companies' valuation methodologies to those applicable to cryptocurrencies (Singh and Tylar, 2019). The CBV proposed three different approaches, mining cost, equation exchange and network value to transaction (NVT) ratio.

Adam Hayes's proposed "mining cost" approach is preferred for valuing cryptocurrencies. According to Hayes (2015), the miners (i.e., those who produce cryptocurrencies, operating in a competitive market and encouraged by expectation of profits), will continue to mine as long as the production cost is less than or equal to the mined currency's market price. In other

³ To our best knowledge, the phrase digital asset refers to an immaterial object with its own intrinsic characteristics created through technology. For more details, please see the introduction section.

words, the digital assets here are specific tokens called digital coins or more commonly cryptocurrencies. Specifically, they are related to the consensus mechanisms together with (in some Blockchains) validators. The validators play an important role in PoS and there is broader consensus as well.

The second approach expressed in the CBV report is the “equation exchange,” proposed by Burniske and Takar (2018). It is based on solving an equation that considers the crypto-assets price, quantity and speed of exchange. According to EFRAG, 2020 crypto assets can be defined as digital representations of value or contractual rights created, transferred and stored on some type of distributed ledger technology (DTL) network (e.g., Blockchain). Crypto assets are often related to cryptocurrencies the most popular of which is the Bitcoin. Created in 2008 by Satoshi Nakamoto, the main features of Bitcoin and other cryptocurrencies are: pseudo-anonymity of the network participants, intrinsic value of the currency due to its high volatility and intangible nature, and their acceptance as payment method (Ramassa and Leoni, 2022). Recently, England Law Commission (2022) has defined crypto assets as any asset that is represented digitally or electronically. Many different types of digital assets exist, and not all of them will be capable of attracting personal property rights.

Finally, CBV suggests the market method using the “Network value to transaction ratio” (NVT) instead of the commonly used multiples approach. The NVT model is based on the ratio of two variables, the crypto assets’ network value at the numerator and the daily transactions’ value at the denominator. (Woo, 2017a; 2017b; Kalichkin, 2018). In contrast to the P/E ratio, where the denominator represents the income produced by a company (earnings), many crypto assets do not generate cash flows; therefore, the volume of daily transactions is used as a proxy for earnings and represents the value moving through the network on a given day. The NVT approach is the most popular crypto-assets valuation market method.

The CBV Institute report concludes that the three approaches are still in the early development stages. Therefore, they are likely to continue to undergo significant refinement in line with the crypto-asset market’s maturity level.

In the same year that the CBV report was published, PricewaterhouseCoopers (PWC) prepared a paper in which it proposed parallelism between the notion of the fair value of crypto-currencies and that of IFRS 13 (PWC, 2019). More specifically, they proposed that fair value hierarchies should be considered when estimating a digital asset’s value.

The fair value hierarchy requires that Level 1 inputs be used first, then Level 2 inputs and, residually, Level 3.

In 2020, the European Financial Reporting Advisory Group (EFRAG) commented on the CBV's work (2019) and criticized the Canadian entity's suggested techniques, highlighting the information limitations due to the use of the valuation methods mentioned above (EFRAG, 2020).

Specifically, concerning the production cost (i.e., the mining cost), it pointed out that the approach was flawed since it did not consider the Proof of Stake (PoS), a security protocol for the cryptocurrency network. Likewise, it did not consider the transaction costs and eventual benefits linked to economies of scale which the miner tends to pursue in business. Recent studies confirm that while most blockchain solutions are developed in advanced economies, miners often take advantage of low energy costs in developing countries (Massaro, 2021). This can be seen as evidence for EFRAG's conclusion on the method, according to which the production cost does not correspond to the current value (i.e., the collected fair value). To elaborate even more on the topic of this work, it is useful to recall the distinction between PoW (Proof-of-Work) and PoS (Proof of Stake) mechanisms, which are now at the center of the mechanisms governing the blockchain registration system. According to Spanò et al. (2022: 1495), "*POW requires solving a cryptographic mathematical equation in which the expected hash (a long string of characters) matches the target hash characteristics (e.g., an initial number of zeros). POW mechanisms require a lot of computational power, often leading miners to aggregate in pools to win the competition of generating a valid hash. POS requires miners to have a stake to be able to validate transactions. When users add new blocks, the blockchain system assigns each transaction to a randomly chosen miner via a weighted algorithm that considers the miners' relative power. Therefore, POS is considerably more environmentally friendly and can significantly improve scalability.*" Certainly, in the latter mechanism lies the most relevant consensus mechanism itself as it is driven by governance with several tokens (Centobelli et al., 2022).

About the income method, EFRAG points out that cryptocurrency-linked tokens do not always generate cash flows. Therefore, it is not always possible to estimate an appropriate risk rate to use in the discounting process.

Finally, regarding the use of the market approach according to NVT, EFRAG finds a lack of historical data as well as difficulties in identifying significant interested buyers.

Finally, again according to EFRAG, the common thread linking cryptocurrency valuation methodologies to traditional ones is certain intellectual property characteristics that can be observed in crypto currencies themselves.

PWC proposed the last work about NFTs and crypto currencies in 2021 but did not address the topic of NFT valuation.

2.2. NFT valuation from the view of digital operators

Digital operators can be defined as all those individuals with economic, IT, digital and financial expertise who operate on the Web and exchange NFTs. In digital practice, several machine learning models focus on valuation. These models usually base the valuation on three main variables:

- 1) Visual characteristics of the NFT;
- 2) Previous transactions of that NFT;
- 3) Notoriety of buyers and/or sellers.

Specifically, the NFTs' visual characteristics such as their colors and shapes are evaluated with machine learning algorithms that extract objects' visual properties and look for similarities; the more prevalent a visual characteristic, the higher its value.

Previous NFT transactions, on the other hand, are evaluated by considering the sales history of tokens with similar characteristics; the more transactions have taken place, the higher the value attributed to them.

Finally, the notoriety of buyers and sellers is assessed, considering the total number of purchases and sales made by each trader. The more active an entity is in the market, the better known and more trustworthy it becomes and as a result, the items it trades also gain value.

Each of the above three factors plays a different role in value composition. According to a study performed last November and published in *Il Sole 24 Ore*, 10 to 20 percent of the value can be attributed to the asset's visual characteristics, 50 percent to previous sales and 10 percent to the notoriety of those involved in the transaction (Tremolada, 2021). The percentage weights were calculated by studying previous exchanges and analyzing Big Data transactions to extrapolate recurring percentages. These three elements together can constitute up to 70 percent of an NFT's total value. This means that the residual part of the value depends on the market's randomness. This affects its variability, preventing an exhaustive global value representation, and makes its global value representation impossible. In this way, machine learning (ML) and artificial intelligence (AI) techniques can provide a material contribution to the evaluating process. Having clarified the main issues that fuel the debate on NFT valuation by international entities and digital operators, this paper's next sections are devoted to a structured analysis of issues that are useful for clarifying how scholars are addressing the valuation of non-fungible tokens.

3. Methodology

To provide a holistic observation about the topic on NFT valuation from an academic perspective, a structured literature review (SLR) methodology supports this research (Paoloni et al., 2022; Secundo et al., 2020; Paoloni et al., 2019; Massaro et al., 2016). NFTs as well as blockchain remain developing topics. Blockchain fits in the emerging technology topic (Borup et al., 2006) and can be considered a multifaced topic with multiple implications for the accounting research field (Spanò et al., 2022). Hence, also the analysis of NFTs issues with regard to methods will be helpful when dealing with unexplored phenomena in a holistic manner. In this way, SLR can be useful to analyze new issues as well as evaluating non-fungible tokens in the accounting field. It usually adopts a critical approach, which may assess theories or hypotheses by critically examining the methods and results of single primary studies, emphasizing background and contextual material (Snyder, 2019; Jesson et al., 2011; Petticrew and Roberts, 2008). The topic of NFT valuation falls within this definition, as it is a current issue. Its complete comprehension requires interdisciplinary skills. According to Massaro et al., 2016 SLR is a method for studying a corpus of scholarly literature, to develop insights, critical reflections, future research paths and research questions. Hence, to perform a transparent and replicable study, this SLR follows some specific steps such as defining (i) research questions, (ii) research protocol, (iii) papers and coding framework as well as the type of analysis to perform.

As mentioned above, this study's (i) *research question* is:
RQ. How do scholars deal with the topic of NFTs valuation?

Regarding the *research protocol* (ii), the research is developed by identifying the reference database and defining the inclusion and exclusion (I&E) criteria. These will facilitate obtaining the available results that will be submitted to the quality assessment process.

The scientific contributions were extracted on June 14, 2022, from the SCOPUS database, the most extensive and widely used database for multi-disciplinary scientific literature (de Moya-Anegòn et al., 2007). SCOPUS is absolutely valid when it comes to the publications' quality and information about the authors' affiliations. According to literature (Liberati et al., 2009; Tranfield et al., 2003; Wong et al., 2013), regardless of the type of literature review to be conducted, the methodology requires the following several steps of identifying, screening and selecting contributions for analysis.

The first step in conducting a literature review is identifying the contribution sample to analyze; namely, all the contributions dealing with non-fungible tokens. For this purpose, we first mentioned keywords such as “NFT,” “non-fungible token” and “non-fungible token.” Since the acronym “NFT” is also utilized in literature to identify other research topics, the authors excluded the contributions containing the words “nutrient film technique” and “need for touch.” resorting to the function “AND NOT.”

The contributions with NFT in their title, abstract or paper’s keywords amount to 4,136 results.

The second step, according to research protocols, regards the subject areas, delimiting the sample only to economic studies, considering only “Business, Management and Accounting” (with thirty-five results) and “Economics, Econometrics and Finance” (with nineteen results) areas of studies. The number available contributions was fifty-one (three contributions belonged to both categories).

The third step focused on the NFT valuation topic to specifically answer the research question. To include the sample containing only the papers addressing this theme, the keywords “value” (with seven results) and “evaluation” (with four results) were inserted. As a result, there were 10 eligible and available papers (a contribution including both the topics). However, the resulting works still showed marginal interest in the topic, hence the authors chose to deepen the study with a manual search within Google Scholar. From this last step, two additional contributions emerged.

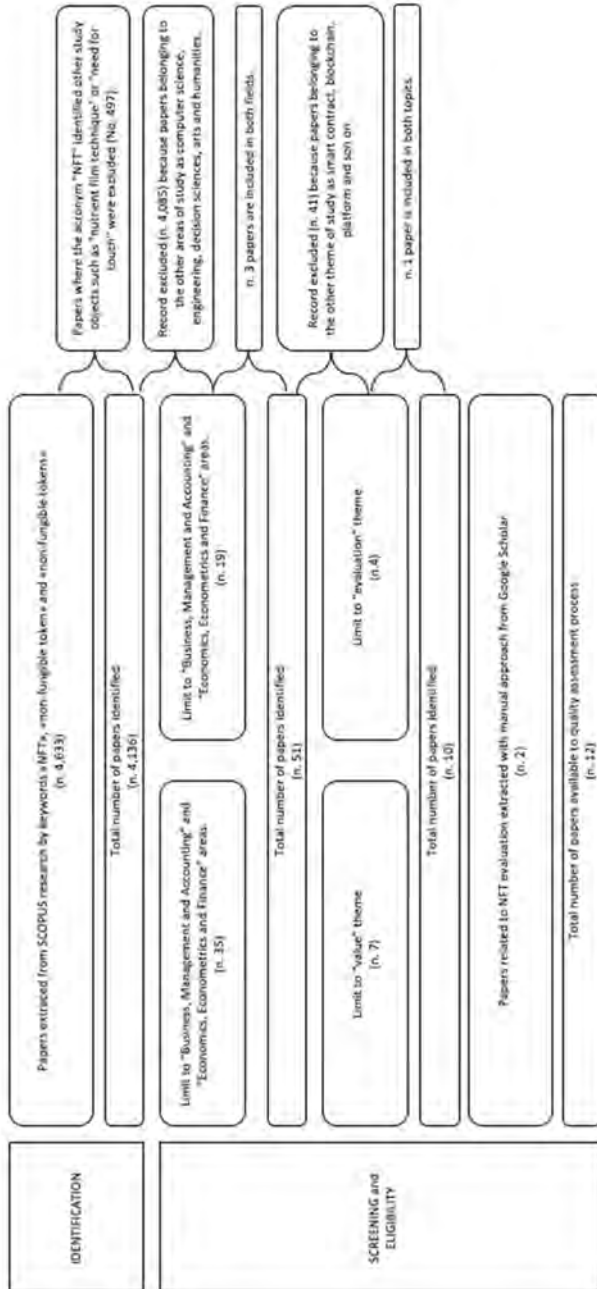
The following figure (Fig. 1) summarizes the above research steps.

The above-mentioned twelve eligible papers are now available for analysis through the coding framework provided for point iii) of the research protocol (Paoloni et al., 2022; Massaro et al., 2016). The framework’s characteristics are analytically set out in the following sub-section.

3.1. Analytical framework for the analysis

Defining the analytical framework is useful for identifying the units of analysis within selected documents as independent items. Through this protocol, this work intends to investigate several dimensions of NFTs from the accounting perspectives. The dimensions that the protocol intends to investigate are summarized in the following figure 2.

Figure 1 – Paper selection chart



Source: Authors

Figure 2 – Analytical framework dimensions

A – NFTs definition and nature	B – Research Method
A1. Financial Asset A2. Intangible Asset	B1. Literature analysis; B2. Qualitative research; B3. Quantitative analysis; B4. Research mix; B5. Theoretical analysis;
C – Geographical Area	
C1. East Europe; C2. Middle East; C3. South and Central America; C4. North America; C5. Northern Europe; C6. Southern Europe; C7. Asia; C8. Africa; C9. UK; C10. Oceania; C11. Mixed;	

In detail, “NFT definition and nature” (A) classifies the eligible papers in two categories:

A1. Financial Asset: including all contributions that interpret NFTs as financial investments; i.e., the ones that estimate these digital assets’ value to study their correlation with the value of crypto-currencies, or to analyze investors’ preference for alternative investments.

A2. Intangible Asset: involving all contributions that define NFTs from their intrinsic characteristics. For example, this category includes contributions that provide specific NFT valuation techniques following the fundamentals of traditional approaches (cost, income and market) as well as the ones that emphasize the creator’s ability/possibility to generate income.

With respect to the research method (B), the framework categorized the reviewed articles as follows:

B1. Literature analysis: results of the available literature reviews that are related to the topics of this paper (bibliometric review, structured literature review, systematic literature review).

B2. Qualitative research: analysis performed using case studies, content analysis, surveys through interviews, etc.

B3. Quantitative analysis: analysis performed with statistical model (e.g., Automatic Variance Ratio - AVR; Squared Wavelet Coherence technique – SWC; Partial Least Square Technique – PLS; regression modelling).

B4. Research mix: where more than one method was applied.

B5. Theoretical analysis: conceptual or discursive contributions.

B6. Other: a residual category that includes research written with any method not described above.

Regarding the geographical area (C), the framework grouped the articles in eleven categories based on the authors' country of affiliation as follows:

C1. East Europe, including Hungary, Russia, Slovenia, Romania, Lithuania, Croatia, Serbia and Macedonia.

C2. Middle East, including Israel, Lebanon, United Arab Emirates, Qatar, Jordan, Saudi Arabia, Iran, Iraq, Oman and Kuwait.

C3. South and Central America, including Argentine, Dominican Republic, Brazil, Jamaica, Mexico and Chile.

C4. North America, including USA and Canada.

C5. Northern Europe, including Austria, Belgium, Denmark, Ireland, France, Germany, Netherlands, Scandinavian countries, Switzerland, Poland, Czech Republic and Slovakia.

C6. Southern Europe, including Italy, Spain, Portugal, Greece, Turkey

C7. Asia, including China, Japan, Korea, Singapore, Sri Lanka, Malaysia, Pakistan, India, Indonesia, Hong Kong, Thailand, Vietnam, Armenia, Nepal and Kazakhstan;

C8. Africa, including Tanzania, Uganda, Botswana, South Africa, Nigeria, Ethiopia, Zambia, Mauritius and Tunisia.

C9. UK, including England, Scotland, Northern Ireland and Wales.

C10. Oceania, including Australia and New Zealand.

C11. Mixed, including all the papers created by two or more authors with different country affiliations.

Having defined the analysis protocol, the next section develops the detailed analysis of each eligible research item, as recommended by the SLR protocol.

4. Analysis of results

This section provides a systematic and critical content analysis of the twelve eligible papers according to the research protocol features.

4.1. (A) NFTs definition and nature

The analysis shows academia’s preference in considering NFTs as financial assets; 58.33% of the eligible papers provide a definition in this direction. The following figure (Fig.3) summarizes the results.

Figure 3 – Different NFT definitions provided by scholars

Financial Asset			Intangible Asset		
Authors	Year	Journal	Authors	Year	Journal
Yousaf I., Yarovaya L.	2022	Global Finance Journal	Bao H., Roubaud D.	2022	Journal of Risk and Financial Management
Ko H., Son B., Lee Y., Jang H., Lee J.	2022	Finance Research Letters	Vidal-Tomás D.	2022	Finance Research Letters
Umar Z., Gubareva M., Teplova T., Tran D.K.	2022	Finance Research Letters	Trevisi C., Moro Visconti R., Cesaretti A	2022	Media Laws
Dowling M.	2022b	Finance Research Letters	Wang Q., Li R., Wang Q., Chen S.	2021	arXiv:2105.07447
Dowling M.	2022a	Finance Research Letters	Mofokeng N.E.M., Matima T.K.	2018	African Journal of Hospitality, Tourism and Leisure
Maouchi Y., Charfeddine L., El Montasser G.	2021	Finance Research Letters			
Aharon D.Y., Demir E.	2021	Finance Research Letters			

Source: Authors

Based on the data (Fig. 3) considering the contributions’ publication year, scholars first focused on defining the intrinsic characteristics of NFTs and only later delved into their definition as financial assets. To elaborate further, the definitions of NFT according to the analyzed contributions are listed below.

Starting from the intangible asset view, Mofokeng and Matima (2018: 5), recalled a definition provided by Nash (2017), stating that “*In order to define NFTs, it is important to define the term that underpins them. According to Nash (2017) ‘Fungibility is, essentially a characteristic of an asset or a token in this case, which determines whether items or quantities of the same or similar type can be completely interchangeable during exchange or utility.’ Currently, the most well-known and well-used non-fungible token standard is by far Ethereum’s ERC-721 standard. Another NFT standard has been proposed for Ethereum, the ERC821 standard (Ordano, 2018). There are, in addition, other NFT standards for other blockchains, such as NEO and*

EOS". Wang et al. (2021) provided a NFTs definition like as intangible asset, relating the creator's earning capabilities to the intrinsic characteristics of digital asset. The authors state *"NFT is unique and cannot be exchanged like-for-like (equivalently, non-fungible), making it suitable for identifying something or someone in a unique way. To be specific, by using NFTs on smart contracts (in Ethereum), a creator can easily prove the existence and ownership of digital assets in the form of videos, images, arts event tickets, etc. Furthermore, the creator can also earn royalties each time of a successful trade on any NFT market or through peer-to-peer exchanging"* (p. 2). Trevisi et al. (2022: 9) define NFTs as *"a metadata file that has been encoded using a digitized underlying asset and it is this metadata file that is purchased. It is, therefore, the (non-fungible) token that identifies the good/ the work that is transferred, not the underlying asset as such, and its value is partly conditioned by the so-called bragging rights; that is, the "right to be able to boast" of being the sole holder of a specific NFT"*. This is the work that comes closest to the issues discussed in section 2 since it provides a treatment of NFT valuation in line with what has been discussed by international bodies such as CBV and EGRAG. Also, for Bao and Rouband (2022: 1), NFTs are *"widely used in collectibles, artwork, gaming, and other markets"* and *"NFT is a unique and indivisible token, hence theoretically there should be an infinite number of NFT types. The researchers usually classify NFTs into six major categories according to the scenarios in which they are most widely used: art, collectibles, games, metaverse, other, and utility"* (p. 5). Finally, in Vidal-Tomás (2022: 2): *"NFTs are defined as digital pure assets that cannot be exchanged like-for-like; consequently, they are unique and 'non-fungible.' This intrinsic feature allows NFTs to demonstrate the authenticity and ownership of different kinds of items in distinct fields, which explains its fast expansion on virtual events, digital collectibles (e.g., trading cards, digital images, videos, virtual real estate, domain names, and crypto stamps), play-to-earn games, and metaverses."*

On the opposite side, one of the first research studies that defines NFTs as financial assets can be found in Aharon and Demir (2021), according to which *"NFTs are pure assets and their non-fungibility makes them unique. NFTs create the chances for developing the 'provenance' of the assigned digital item by providing undebatable answers to such questions as who owns, owned, and created NFTs. [...] Traded items in the NFT market are categorized in collections based on their common features. Most collections can be classified into Art, Collectible, Games, Metaverse, Other and Utility. [...] Bitcoin and Ethereum prices affect the NFT market, although the NFT market has no effect on cryptocurrencies"* (pp. 1-2). The definition provided

in this paper seems to connect with those already discussed regarding the other category. However, a peculiarity emerges when NFT value is linked to the prices of the cryptocurrencies at which the digital asset is traded. The authors observe how this relation can affect investors' choice. This peculiarity shows that the holder of NFTs is no longer only interested in the digital asset's characteristics but also evaluates the opportunity to hold it, regarding the value of the underlying cryptocurrency, as a financial investment. Maouchi et al. (2021) provide no clear definition of NFTs but according to the contents just outlined, the authors state, *"Another area of focus should be the financial incentives and practices, such as liquidity mining and yield farming, and more recently the financialization of NFTs and NFTs mining. These mechanisms can generate unsustainably high returns due to massive new capital inflows, potentially distorting investors' expectations, and amplifying bubbles in these markets"* (p. 7). In this direction, Dowling (2022: 2) states *"NFTs are most frequently bought with cryptocurrencies as the means of payment, and are based on ethereum smart contracts, there should be some commonalities"*. Also, Dowling (2022b: 1) highlights that: *"NFTs can be any type of digital assets. The most common types are collectibles and artworks, objects in virtual worlds, and digitalized characters from sports and other games. An NFT starts with registering ownership of a digital asset on a blockchain, usually on an ethereum network. This digital asset can then be sold, with changes in ownership and the cryptocurrency payment received registered on the blockchain"*. To elaborate on this view, we can refer to even more recent studies such as Yousuf and Yarovaya (2022: 2) that define NFTs as *"unique, rare, and non-interchangeable digital assets based on blockchain technology that add value for investors beyond price growth"*; Ko et al. (2022: 1), as *"tradable rights that can be recorded as non-fungible ownership tokens on the blockchain using smart contracts [...] several studies began to look into NFTs as an alternative asset"*; and Umar et al. (2022: 1) that state: *"Over the last four years, the world finance industry has witnessed a digital asset revolution, in terms of their market trends, trade networks, and visual features). It is worth highlighting that NFTs are distinct vis-à-vis digital coins because each digital coin is indistinguishable from the other coin of the same cryptocurrency, whereas the main feature of the NFTs is the uniqueness of each token, i.e., non-fungibility"*, relating NFT directly to the financial market.

4.2. (B) Research method

This section is devoted to analyzing the scholars' methodological choice in dealing with NFT valuation. Considering the category proposed by the research protocol, the most recurring research method is quantitative methodology. It was applied by 66.67% of the sample (8 papers), followed by 25.00% of qualitative research (3 papers) and 8.33% of theoretical analysis (1 paper). The following figure (Fig.4) shows the results.

Fig. 4 – Eligible papers by research method (B) applied

Category	Research Method	Contribution(s)
B2	Qualitative Research	Mofokeng and Matima (2018); Wang et al., (2021); Trevisi et al., (2022);
B3	Quantitative Analysis	Aharon and Demir (2021); Maouchi et al., (2021); Dowling (2022a); (2022b); Umar et al., (2022); Vidal-Tomás (2022); Ko et al., (2022); Yousaf and Yarovaya (2022).
B5	Theoretical Analysis	Bao and Roubaud, (2022).

Source: Authors

The data summarized shows a direct relation between applying quantitative methods and defining NFTs as financial asset. Several researchers have chosen TVP-VAR methodology to observe the interaction between NFTs' value and other investment classes. Aharon and Demir (2021) investigate the relationship between NFTs and other financial assets (equities, bonds, currencies, gold, oil, Ethereum). The authors conduct both static and dynamic analysis, revealing that from a static perspective, NFTs have only weak interaction with other financial assets while from a dynamic perspective, NFTs present some similarities in terms of risk absorption with gold and USD index. Yousuf and Yarovaya (2022) analyze return and volatility spillovers between NFTs and oil, gold, Bitcoin and S&P 500. The results show that NFTs are still relatively decoupled from traditional asset classes. Also, Ko et al. (2022) investigate whether the presence of NFTs could improve a well-diversified portfolio strategy for investors. In the sample, the research uses stock, bonds, US dollar, commodity index and cryptocurrencies as traditional assets and NFTs as alternative assets. The quantitative analysis particularly observes the correlation, co-movement and volatility transmission of assets through Pearson's product-moment pairwise correlation coefficients and the Gerber Statistic and the corresponding Gerber correlation matrix (Gerber et al., 2021). To quantify volatility transmission between NFTs and traditional

assets, the study uses the volatility spillover index based on the generalized variance decomposition methods from a VAR (Diebold and Yilmaz, 2009; 2012; 2014) and the spillover index based on Time-Varying Parameter Vector Autoregression (TVP-VAR) (Antonakakis et al., 2019; Antonakakis and Gabauer, 2017).

Person's correlation and the Gerber Statistic analysis show that NFTs are rarely correlated with a traditional asset. However, thanks to the spillover indices based on DY and TVP-VAR, a different movement in volatility by NFTs' markets can be observed compared with the traditional ones. The study demonstrates that investors can diversify their traditional asset-based portfolios by including NFTs. Umar et al. (2022) studies the time-frequency connection between NFTs and Bitcoin, bonds, equity, gold and crude oil during the pandemic emergency. Using the squared wavelet coherence (SWC) technique (Zaremba et al., 2019; Gubareva and Umar, 2020), the research asserts that NFTs lag behind stocks (2017) and that bitcoin (2018) lead gold (2018). The phenomenon of NFTs lagging behind stocks and bitcoin before the pandemic may be ascribed to the NFT market's embryonic stage at that time. In contrast, the uptrend equity and cryptocurrency markets are among the first to absorb market news.

Vidal Thomas (2022) developed another quantitative study, supporting the NFT valuation to verify these assets' profitability and their relevance as diversifiers for cryptocurrency portfolios. To evaluate performance tokens, the study proposes the "average first-day and average buy-and-hold returns" method (Momtaz, 2021), relating, as the sum over all tokens, to the closing and opening price difference over the opening price on the first day of trading, divided by the number of tokens in each category. To evaluate the token dynamism, the authors propose the Pearson and Kendall correlations between NFTs and the cryptocurrency market (cCi30) index.

The debate on NFT value is also alive and is mainly about the context in which these digital assets are traded. Dowling (2022) explores the efficiency in NFTs' pricing across several quantitative techniques, such as Automatic Variance Ratio (AVR) (Kim, 2009); Automatic Portmanteau (AP) (Escanciano and Lobato, 2009) and Domínguez and Lobato (2003) (DL), revealing an inefficiency in NFTs pricing, but a rapid rise in value despite this. Moreover, the efficiency in the NFTs pricing material affects the investors' choice (Dowling, 2022b).

Another phenomenon that distinguishes trading in virtual environments (DeFi) is the likelihood of encountering fraudulent behavior such as bubbles. The research by Maouchi et al. (2021) suggests the Total Value Locked (TVL) as a technique to predict fraudulent behavior. It represents the total

amount of resources currently staked in a specific blockchain protocol. TVL, volume and investors’ sentiment have a stronger connection with bubble occurrences. The trading volume and investors’ sentiment are positively associated with bubbles, whereas the Total Value Locked is negatively linked.

Analyzing the contribution developed through qualitative methods (B2), Mofokeng and Matima (2018), underlie the relevance of NFTs as financial resources and supplementary sources to gain revenue. Although the research draws on all of these digital assets’ characteristics, it does not focus on the valuation techniques. This aspect is probably connected to the theme’s novelty in the year of publication, in which no contribution had yet started to address the issue.

Wang et al. (2021) provides a material approach in evaluating NFTs using a qualitative approach. The valuation method, namely STRIDE, suggests following a prudential approach that considers all the elements of a system’s security. The following figure (Fig. 5) is the acronym of:

Figure 5 – STRIDE method description

Item	Description
Spoofing	It refers to the likelihood that a malicious attacker may exploit authentication vulnerabilities or steal the user’s private key to transfer the NFTs’ ownership illegally. The authors suggest a prudential evaluation of the smart contract characteristics to prove the system’s authenticity.
Tampering	It means the risk of data coming out of blockchain circuitry and thus being manipulated. The authors suggest verifying the NFT’s hash stored within the blockchain to verify the system’s integrity
Repudiation	It refers to the risk of the hash being acquired by hackers. According to the authors, using a multi-signature contract can partly solve this issue since more than one participant must confirm each binding.
Information Disclosure	It refers to information leakage that occurs when the information is sent to unlicensed users. The authors recommend setting a solid privacy policy into a smart contract.
Denial of Service (DoS)	It is a kind of network attack aimed at rendering a server unavailable, interrupting its normal functions. The authors assert that DoS can also be used to attack the centralized web applications or the raw data outside the blockchain, resulting in denial-of-service to NFT service. A hybrid blockchain architecture can solve the availability issues through two algorithms
Elevation of Privilege	It refers the permission gained by an attacker beyond those initially granted. In the NFTs’ world, the selling permissions are managed by smart contracts, and therefore, according to the authors, a solution could be a strong designed smart contract.

Source: Authors

Finally, Trevisi et al. (2022) uses a qualitative approach for the research. In our opinion, this contribution comes closest to the field of typical business studies. The authors use a scientific outlook to address the approaches al-

ready examined in the previous section (n° 2 – NFTs value in the international practice) by international entities. For each of the valuation methods (cost, income and market approaches) typical details are given for NFTs. This shows that none of the three approaches alone can reflect the NFT value. Specifically, the cost approach cannot exhaustively determine the value of a non-fungible token, as the cost of creating an NFT has too high a degree of specialization. These, for example, are based on the characteristics of the adopted blockchain technology or the object's specific peculiarities, and this makes cost a non-usable parameter.

The market approach, however, would also not be entirely reliable, considering its extreme novelty and thus volatility. However, the income approach would be inappropriate, given that an NFT does not generate stable income/cash flows.

Finally, category B5 (theoretical research) involves only one research article provided by Bao et al. (2022). In this work, the authors recognize, in a descriptive way, several methods of estimating NFT pricing. The study highlights many markets to investigate and analyze the NFTs' valuations, considering some factors all inspired by the financial market. The main indexes that could help observe these market phenomena are the Volatility Index (VIX), the Economic Policy Uncertainty (EPU), the Consumer Confidence Index (CCI), and the Consumer Sentiment Index (CSI). All these factors are useful for understanding the correlation between NFTs and crypto-currencies trends. In our opinion, this theoretical contribution could be linked with the contributions already analyzed for category B3 (quantitative methodology).

In light of the above, it can be argued that the topic of NFT valuation is closely correlated with some typical topics of business economics and some others of finance fundamentals.

4.3. (C) Geographical Area

This section highlights the twelve eligible papers' origin in terms of author's affiliation. According to research protocol, the main geographical area category is C11, namely research mix. This category represents 50% of the sample with 6 contributions, followed by category C9-UK with 3 contributions (25%) and other categories C6-Southern Europe, C7-Asia and C8-Africa, all with one contribution.

Based on the data, a particular feature emerges regarding the lack of contribution by U.S. scholars. Although the U.S. is one of the most developed

contexts when it comes to technology and digital assets, the topic of NFT valuation seems not to attract scholars' attention.

The next section presents the work's conclusion, addressing the RQ and developing a critical reflection on the content discussed by the three actors identified in the body of the text: academia, international entities and digital operators.

5. Discussion and conclusion

This explanatory research attempts to provide an overview of the discussed issues on NFT valuation. Addressing the RQ (*How do scholars deal with the topic of NFTs valuation?*), this work emphasizes that NFTs' valuation remains an under-explored area and is still open to new considerations.

This initial evidence emerges from the structured analysis conducted primarily on different characteristics intended to be attributed to NFTs.

5.1. Nature of NFTs and the shadows of regulatory treatment

While international entities and digital operators appear well-established in defining an NFT as an intangible asset (also due to legal issues related to ownership of these assets), academia is not completely united in this direction and defines NFTs as financial assets.

As mentioned earlier, this issue should be analyzed from the accountability perspective starting from the open questions that affect NFTs' underlying technology, namely the blockchain (Schmitz and Leoni, 2019). According to Spanò et al. (2022) the central issue in accountability lies in the blockchain's potential to create new assets that inevitably, also because of its extreme novelty, do not find a clear discipline. This lack of clarity in treatment reflects strongly on the work of the Regulator, which to date, has failed to dictate clear guidelines for companies, leaving no definitive guidance on accountability regarding different crypto-asset classes (Ramassa and Leoni, 2022). Still from a corporate perspective, the aspects related to the ownership of NFT should be considered regarding the most recent issues highlighted by the England Law Commission in the work "Digital assets, summary of consultation paper." The work set out below is a part of a more complex project that will end, according to the authority, in 2023 and is currently in the consultation phase. Undoubtedly, the conclusions that the England & Wales Law Commission's work reaches will have implications and repercussions for the

various directions discussed in the body of this research paper. In more detail, the Commission introduces the concept of a “third” category of personal property that is distinct from things in possession and things in action, which would allow for a more nuanced consideration of new, emergent and idiosyncratic objects of property rights (i.e., “data objects”). With specific emphasis on NFTs, the High Court of England and Wales recently held that there is an arguable case that NFTs are capable of attracting property rights. The Court judgement removes any uncertainty that NFTs (as tokens consisting of code) are property in and of themselves, distinct from the thing they represent (e.g., a digital artwork). This approach also appears to be confirmed by other pronouncements from different nations (such as China) whereby a marketplace was allegedly held accountable for letting a user “create tokens from a stolen artwork.” Based on the concept that possession does not correspond to ownership, the Commission proposes a parallelism between NFTs and crypto-tokens and states that the NFTs can be used to: i) grant a license to use certain intellectual property; ii) confer intellectual property rights on the holder of the NFT; iii) act as evidence of legal title to a tangible or intangible thing external to the crypto-token system such as a gold bar, a share security or a debt security; iv) embody intangible rights for which the holder of the NFT can claim performance of the obligations recorded by the NFT.

Based on this prominent interpretation, the main issues that emerged from our study are summarized below. After that, an attempt will be made to identify the future direction of the study on NFTs’ valuation.

5.2. The different approaches in NFT valuation

Starting from the classification as intangible assets (Freni et al., 2022; Treiblmaier, 2021; Patrickson, 2021; PWC, 2021), an important interconnection emerges between what international entities (CBV, 2019; EFRAG, 2020) discuss and what scholars observe in this direction. International entities analyze traditional valuation approaches starting with the International Accounting Standard Board (IASB) definitions of intangible assets (IAS38) and fair value (IFRS13) (IASB, 2014; IASB, 2011; Quagli, 2009).

In the same way, a part of academia (Trevisi et al., 2022; Wang et al., 2021) believes that to evaluate NFTs, many variables must be considered, particularly depending on which approach (cost, income or market) the evaluator intends to follow. The most important variables include costs, purchasing place, the underlying asset and the business model chosen.

Referring to costs, as stated in section 4, several factors can be considered to estimate the value, including the degree of specialization and characteristics of the blockchain adopted technology or the object's specific peculiarities (Borup et al., 2006). For instance, different blockchains may greatly impact the transaction cost. Several metaverse startups are moving from Ethereum to cheaper solutions. Recent data show about 10 different blockchains in which people can trade NFTs (Harmony, Cardano, Fantom and others, though involved in recent turbulence, such as Solana and Terra). However, Ethereum continues to represent about 97 percent of the market with a total volume in April 2022 of 19.85 trillion (source: defillama.com). At the same time, growing energy costs may affect the market, possibly pushing from a Proof of Work (PoW) to a lower energy waste Proof of Stake (PoS) solution. The PoS, by replacing miners with validators, is able to ensure the validity of transactions via committing a share of a person's cryptocurrency (namely "stake") instead of employing countless electricity units to increase computing power and solve proposed mathematical problems faster, as in PoW.

The marketplace represents the purchasing place where NFT producers and buyers can meet. Ad hoc platforms created by real auction houses also use them as an alternative tool to real sales. There, it is possible to find the number of transactions and their reliability influencing their purchase value. Another unavoidable variable is the underlying, physical asset to which the token is linked. The latter's value can be traced back to the former's value.

Finally, to define the correct valuation method, there is the analysis of the business model linked to the NFTs and the reason they create, share and obtain value by creating a secondary market.

The statements regarding the variables to be considered when applying different valuation approaches are also confirmed by the points highlighted by digital operators, the third category of actors involved in NFT valuation. As pointed out in section 2, according to digital operators, the determinants of NFT value are visual characteristics, previous transactions and notoriety of buyers and/or sellers. These are all characteristics found in the variables just described.

On the opposite side, a prominent part of scholars are particularly oriented to defining (and treating) NFTs as a financial asset (Bao et al., 2022; Dowling, 2022a; Dowling, 2022b; Yousuf and Yarovaya, 2022; Maouchi et al., 2021; Aharon and Demir, 2021). Their contributions are mainly oriented toward dealing with NFT valuation through quantitative approaches related to finance fundamentals. Summarizing the significance of the content covered for this category, for the valuation of these digital assets, little importance is attached to the characteristics described above. Relevance is

given to aspects related to cryptocurrencies, the liquidity present in certain blocks, and the choices of investors who see NFTs only as a trading opportunity. Based on analysis of these contributions, no utility can currently be emphasized that refers to firms that “produce” NFTs, such as start-ups in the Metaverse. These may be more useful to investors trading NFTs.

The results of this first exploratory contribution, indicate that to classify and evaluate NFTs, although their nature is not definitively clarified, it would be appropriate to focus on the function for which they are produced or acquired. With respect to that observed in the latest court guidance in both England and China, and to the NFTs potential characteristics that are being discussed (please see points i to iv above), these seem to come closest to intangible assets. This conclusion is driven from issues such as intellectual property or royalties from use, which are central topics in business-economic valuation. However, at their current state, NFTs valuation continues to be heterogeneous, dealing with different connotations of the same valuation object, thus leading it back sometimes to intangible assets, inventories or even financial investments. In this context the valuation methodologies, as conceived, become diverse, and no established guidance states what method to follow.

Such evidence is also relevant in the case of the non-financial disclosures that companies must provide to their stakeholders. Not treating the same type of assets in a unified manner means that different sets of information must be provided depending on the company’s chosen framework.

5.3. Features related to geographical area: the social dominance perspective

The results regarding analysis of the geographical origin of the contributions that are discussed in the previous section (geographical area) could be observed keeping in mind the theoretical implication of social dominance developed by Massaro (2021) about the examination of blockchain’s role in the healthcare sector. The contribution, which is linked with this paper regarding blockchain-related issues, reveals strong international collaborations in academia between the leading countries. For instance, Massaro (2021) highlighted a strong connection between the USA and UK. Social dominance theory has been previously used to find out why and how some groups of people act to maintain their power (Sidanius et al., 2004). Our research confirms a strong collaboration in conjunct outcome between scholars from different institutions (UK, Russia, China, Turkey, France, Portugal, Spain). Mixed research (C11) represents 50% of the sample analyzed. Through the

analysis, moreover, our work can confirm a material role by scholars from UK institutions. In fact, in addition to being a point of reference for combined research, scholars from the UK alone produced 25% of the contributions analyzed (C9). According to the contents discussed in the literature section, UK is confirmed as one of the most fervent regions in creating NFTs. In the light of this consideration, it can be added as described in the previous sub-section, one of the first authoritative definitions of the nature of NFTs was developed in the UK.

6. Implications

This research represents a first exploratory contribution to a broad debate that is still open. In addition, the structured analysis developed points out several theoretical and managerial implications.

From a theoretical perspective, the study contributes to literature in the valuation field, especially concerning digital assets. In addition to providing a structured overview of the different interpretations of NFTs from their nature and the different approaches followed to evaluate them, the work could contribute to literature regarding handling of the NFT for companies' non-financial disclosure. The work's managerial implication is also developed on these issues. On one hand, the current research can help practitioners to recognize the different NFT valuation approaches. On the other hand, the research can offer SMEs a valid tool to understand how to manage and account for this new kind of assets. The study can help SMEs better comprehend the nature of these assets, improving information quality to stakeholders within the non-financial disclosure. Not handling the same type of assets in a unified manner (intangible or financial asset) means that different sets of information must be provided to stakeholders depending on the company's chosen framework. A first authoritative approach should be considered regarding the contribution made by England and Wales Law Commission (2022) that introduces the notion of a "third" category of personal property for NFTs by assimilating them to crypto assets.

7. Limitations and future line of research

The main research limitations can be attributed to the topic's novelty, which makes it an interesting field to explore, but at the same time, makes it difficult to argue and compare the few previous contributions. Our work should be considered as a first exploratory work useful for drawing attention

to the main issues fostering the debate on NFT valuation. To enrich the theoretical contribution, future research will provide concrete insights into evaluating NFTs from a business perspective, observing how real firms account for these assets. In addition, a multiple case study will be developed to provide the most complete and exhaustive picture.

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