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Non-Fungible Tokens: A Research Primer and Implications for Sport Management

Bradley J. Baker, Anthony D. Pizzo, and Yiran Su

Non-fungible tokens (NFTs) have gained considerable media attention and sparked growing public interest. NFTs are unique units of data recorded on a permanent ledger or *blockchain*. NFTs are used to record ownership of both physical and digital goods. Prominent sport organizations have embraced NFTs for innovative growth opportunities such as generating revenue via novel digital products (e.g., digital collectibles). For example, the National Basketball Association (NBA) launched NBA Top Shot, an online marketplace to buy and sell digital sports highlights. Sport organizations are exploring future innovation opportunities where there is a need to reliably track and verify authenticity or ownership of digital or digitizable assets. This includes existing sport products (e.g., tickets) and novel fan engagement initiatives. To benefit from NFTs, sport managers need to reconceptualize how sport is marketed and managed in a digital domain. The purpose of this research primer is to acquaint readers with key concepts related to NFTs. Specifically, we provide an overview of NFTs, offer a review of the brief history of NFTs, conceptualize NFTs via parallels with collectibles, and address the speculative nature of the NFT market. We conclude by outlining innovative growth opportunities of NFTs for sport managers and future research directions for sport management scholars.

Keywords: NFTs, sports, technology, innovation, collectibles, blockchain, NBA Top Shot

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Introduction

Non-fungible tokens (NFTs) rose to prominence on a wave of media attention, generating more than \$44 billion in transactions in 2021 (Chainalysis, 2021). Leading the sport industry into the NFT marketplace was NBA Top Shot, a joint venture between the National Basketball Association (NBA) and Dapper Labs, a Vancouver-based start-up. NBA Top Shot takes short video highlights from NBA games and converts them into collectible clips or *moments* in the form of NFTs. NBA Top Shot recorded over \$700 million in transactions in the first half of 2021 (Nelson, 2021), leading an array of sport organizations and industry stakeholders (e.g., Major League Baseball, Golden State Warriors, and Union of European Football Associations [UEFA]) to launch NFT initiatives of their own. To date, the top price paid for an NBA Top Shot NFT is \$230,023 for a video highlight of LeBron James dunking in the series-clinching Game 6 of the 2020 NBA Finals (NBA Top Shot, n.d.). While the media focuses on these eye-popping numbers, the rapid emergence of NFTs has led to more fundamental questions, including what are NFTs, what does it mean to “own” a video highlight that is freely downloadable on the Internet, and why anyone would pay for such ownership? As more sport organizations launch NFTs, sport managers need to understand their fundamentals, dynamics, and the ensuing implications to capitalize on the innovative growth opportunities they present.

The purpose of this article is to provide a primer on NFTs and their implications for sport management. We begin by defining NFTs and other related terms. We then review the brief history of NFTs, starting with their origins in the world of art. Building on this history, we draw parallels between NFTs and other collectibles (e.g., sport trading cards) to aid in their conceptualization. We then discuss motives for NFT ownership based on signaling theory, seeking economic gain, and fear of missing out (FoMO). We conclude by outlining implications and applications of NFTs for sport managers and lay out a research agenda focusing on NFT adoption in sport.

Defining NFTs

There has been considerable hype surrounding NFTs, yet as a novel phenomenon they are surrounded by misperceptions. Formally defined, a non-fungible token is “a unique digital identifier that cannot be copied, substituted or subdivided, that is recorded in a blockchain, and that is used to certify authenticity and ownership (as of a specific digital asset and specific rights relating to it)” (Merriam-Webster,

2021).¹ To clarify and help aid conceptualization of NFTs, we break down the term non-fungible token into two component parts (non-fungible and tokens) and define each in turn. We conclude this section with brief definitions of additional terms that are commonly used in relation to NFTs (see Table 1).

Non-Fungible

Fungibility refers to the equivalence and distinguishability or uniqueness of an object (or lack thereof). A fungible good (or asset) is interchangeable or replaceable with another good of the same type (Nason & Wiklund, 2018). For instance, money is the quintessential example of a fungible asset. A \$20 bill is equivalent to any other \$20 bill; they are simply two pieces of fancy paper that represent the same value (Chaim, 2021). Furthermore, a \$20 bill can be equivalently subdivided into four \$5 bills, 20 \$1 bills, or any other combination of currency that totals \$20 in value. Additional common examples of fungible goods include assets such as stocks and commodities, each of which are freely interchangeable and replaceable, thus making them fungible (Chohan, 2021).

The difference between fungible and non-fungible goods is that non-fungible goods are unique and cannot be replaced with or by something else. For example, if a friend borrows a car (a non-fungible item), the return of the original car—and not some other vehicle, even of the same make and model—is expected; by contrast, the gasoline in the car is fungible (Chohan, 2021). Each car has unique qualities that makes it distinguishable from any other. Simply put, fungible items are interchangeable and mutually substitutable, while non-fungible items are distinctive and cannot be arbitrarily swapped for another. NFTs are cryptographically unique (encoded to be distinct from any other NFT) and not interchangeable, thus making them non-fungible.

Tokens

A token is a tradable, digital representation of ownership of an asset. Tokens can be either fungible (e.g., Bitcoin, where any bitcoin is interchangeable for any other) or non-fungible (e.g., a property deed). Tokenization is the process of converting an asset (physical or virtual) into a digital representation (a token) that can be bought and sold (Aki, 2021). Tokenization allows indelible tracking

¹ As a fundraiser for the non-profit *Teach for All*, Merriam-Webster created an NFT of the definition for non-fungible token and sold it at auction for the equivalent of approximately \$60,000 (OpenSea, n.d.). Emblematic of NFTs, that someone owns Merriam-Webster's definition of the term does not in any way limit Merriam-Webster or others from using the term or definition.

of asset ownership via blockchain—a permanent cryptographic ledger system. Once a token is created—or *minted*—to represent ownership of an underlying asset, digital transfer of ownership can be enacted through transfer of the token without any need for physical exchange. Table 1 provides an overview of additional key terms associated with NFTs.

Table 1. Definition of Terms Related to Non-Fungible Tokens

Term	Definition
Block	A set of transactions recorded together as a unit on a blockchain
Blockchain	A database or ledger that stores information in cryptographic chunks (or blocks) that are linked (or chained) to all previous blocks
Cryptocurrency	A digital medium of exchange based on cryptographically encoded information, typically via blockchain
Cryptographic	Using codes or ciphers
Ethereum	A prominent blockchain network and associated software platform; A cryptocurrency recorded on the eponymous blockchain
Ledger	A record of information about transactions, typically financial
Mining	The process through which blocks are verified and are thereby added to a blockchain based on solving computation-intensive cryptographic problems
Minting	The initial process of creating a token, resulting in a tradable asset recorded on a blockchain
Non-fungible	Non-interchangeable, unique, and indivisible
Smart contract	Self-executing (or automated) contract set in computer-readable code and stored on the blockchain
Token	A tradable, digital representation of ownership of an asset recorded on a blockchain

A Brief History of NFTs

The first NFTs were created in 2014, bringing art and technology together. Their intended purpose was to help artists control and protect their creations by establishing authenticity and ownership on a blockchain (Dash, 2021). In 2017, NFTs started to gain broader attention and interest based on two projects: CryptoPunks and CryptoKitties (Dormehl, 2021). CryptoPunks is a set of procedurally generated (i.e., automated by a computer program) highly pixelated portraits that blend art with collectibles (Matney, 2021). CryptoPunks portraits were initially given away for free, with early resales ranging from \$1 to \$30 and more recently individual portraits reselling for upward of \$1 million (Locke, 2021a). CryptoKitties is a game based on purchasing, collecting, breeding,

and selling unique digital creatures inspired by cats (Serada et al., 2021). Both CryptoPunks and CryptoKitties use the Ethereum blockchain to digitally store, preserve, and authenticate ownership. CryptoPunks and CryptoKitties helped launch the digital art movement and provided a monetization model for digital content using NFTs. For instance, a high-profile example demonstrating how NFTs help artists monetize their work is *Everydays: The First 5000 Days*, a digital work of art. The piece is a virtual mosaic comprising 5,000 images by artist Beeple that sold at auction for more than \$69 million (Christie's, 2021).

In early 2021, NFTs exploded in popularity. This phenomenon was due to a confluence of factors including a lucrative market for cryptocurrency (e.g., Bitcoin, Ethereum, Dogecoin), popular culture trends, and repeated surges in speculative stock market movements. The popularity of emerging digital assets was driven by high market volatility as investors actively sought speculative assets on which to capitalize. These conditions amalgamated to boost the NFT market. In sport, Dapper Labs, developer of CryptoKitties, launched NBA Top Shot, with popularity surging in 2021 due to headline-grabbing transactions such as the LeBron James highlight. From their initial development to the media and public attention explosion in 2021, the evolution of NFTs has provided a way to monetize digital content. In particular, NFTs have been embraced by sport organizations, providing them with innovative value generation opportunities, such as digital sports collectibles, a contemporary take on traditional sport collectibles (e.g., trading cards and memorabilia).

Making Sense of NFTs: Parallels with Collectibles

One of the pressing questions regarding NFTs is *why?* Why is anyone willing to pay for an NFT and, specifically, why are people paying large sums of money to be able to claim ownership of a freely downloadable video clip or image? To remedy this paradox, the collectibles marketplace provides a salient way to make sense of NFTs. NFTs have many parallels with collectibles and are a contemporary take on an established phenomenon.

Collectibles—objects of interest of value to a collector—have traditionally spanned a wide array of physical objects such as art, cars, coins, comic books, stamps, trading cards, and wine (McIntosh & Schmeichel, 2004; Olmstead, 1991). Collectors are primarily motivated to fulfill financial or self-enhancement needs (McIntosh & Schmeichel, 2004). In particular, sports trading cards allow collectors to capture and relive legendary moments and athletes, invoking a strong sense of nostalgia (Thompson & Sen, 2011). Thus, collecting can be either a means of making an investment or as a signal demonstrating support and knowledge of an athlete, team, or sport. These motives stem from collectors'

need to maintain or enhance their social status (Burton & Jacobsen, 1999). NFTs are merely the most recent innovation in collectibles. From this perspective, owning a LeBron James NFT is simply a digital version of owning a LeBron James trading card, as both capture an iconic moment in sports history.

While NFTs such as NBA Top Shot and traditional physical collectibles, by design, share many characteristics, there are also crucial differences. For instance, with physical trading cards, players, teams, leagues, and card manufacturers do not receive money from secondary market transactions (i.e., future resale of cards). By contrast, many NFTs incorporate smart contracts that automatically return a portion of all subsequent transactions to the original creators. For example, Dapper Labs, the NBA, and players receive a portion of all peer-to-peer NBA Top Shot sales on the secondary market. A more critical difference between NFTs and physical collectibles comes from the easy reproducibility of digital items. An essential driver in the value of any collectible is scarcity (Kreuzbauer et al., 2013; Lynn & Bogert, 1996). A video clip of LeBron James can be copied without any degradation or loss in quality, something not true of physical collectibles. This leads directly to the question of how can an endlessly replicable item possibly be considered scarce and thus valuable?

Traditionally, scarcity was based on limited availability and circulation of physical assets. This is fundamentally at odds with a digital world of instant and perfect reproduction. In the digital environment, scarcity operates differently (O'Dwyer, 2020). Free circulation and reproduction of a digital asset, such as the highlight clip represented by an NBA Top Shot NFT, enhances, rather than detracts from the value of being recognized as the sole owner of the NFT. While this shift in how scarcity is measured was amplified by the rise of digitalization and digital culture, the underlying mechanism has always been present. For instance, one contributing factor to the priceless value of Vincent van Gogh's *The Starry Night* is that replications hang in countless homes and offices, making it one of the most recognizable paintings in the world (Thomson, 2008). While many people own replicas of the painting, even the most exact physical duplicate cannot replicate the intrinsic and extrinsic value of owning the original, which serves as a powerful indicator of social status.

NFTs represent a reconceptualization of scarcity in an era of digitalization, allowing digital content to be simultaneously both scarce and abundant (Chaim, 2021). NFTs that represent famous and viral content capture cultural significance (Chaim, 2021), thereby monetizing said significance and enhancing its value. As a result, the more ubiquitous the digital content, the higher its value. The abundance of digital replicas only further enhances the value of NFTs. In short, NFTs represent the future of digital collectibles, with value based less on owning

an asset that no one else has (e.g., *The Starry Night*) and more from owning the asset that everyone else has (Wark, 2017). NFTs also play a key role in signaling social status and standing within a sport community that prioritizes *true* fandom and insider knowledge (Decrop & Derbaix, 2010).

NFTs: Ownership and Signaling

The buzz around NFTs drives an economic motive based on the allure of possibly sizable financial returns as speculators anticipate opportunity to sell at a higher price (Sharma, 2021). For example, Dapper Labs, the firm that operates NBA Top Shot, orchestrates releases (or “drops”) priced such that the going rate for the NFTs on the secondary market substantially exceeds the list price. Thus, any buyer could immediately resell for a profit, driving a frenzy of oversubscribed demand for each new drop. While this suggests that moments are underpriced, by creating artificial scarcity and leaving money on the table, Dapper Labs stimulates demand and ensures a robust secondary market (Mardon & Belk, 2018).

In line with the proposition that the financial value of NFTs is grounded in certified scarcity, consumers’ possession of an NFT further signals their social status. Signaling theory suggests that a signaler (e.g., person, product, or company) possesses underlying qualities that the receiver interprets through the signal (Spence, 1973) and the more costly a signal is, the more reliable it will be (Connelly et al., 2011). In the NFT context, costly signals (e.g., NFT ownership) indicate unobservable traits (e.g., the owner’s socioeconomic status, level of sport fandom, and technology savviness) that are correlated with social status. This motivation is well-established in the literature examining why people collect (e.g., Belk, 1988; Dimson & Spaenjers, 2014; McIntosh & Schmeichel, 2004). Consistent with more established forms of collecting including art, stamps, coins, and sports memorabilia, NFT ownership is a status symbol in a new dynamic of social status based on possessing the “right kind of knowledge” (Eckhardt & Bardhi, 2020, p.89)

Seeking status as an insider to the latest trends also stimulates fear of missing out (FoMO), a sentiment driven by a sense of scarcity. FoMO is the pervasive concern that others may be having rewarding experiences from which one is absent (Przybylski et al., 2013). If sport fans feel pressure to keep up with their peers, friends, or families, they experience higher levels of FoMO, leading to fad chasing (Larkin & Fink, 2016), such as NFT investment. With the NFT buzz, sports fans may get swept up in the hype and make irrational investment decisions that undermine their relationships with teams and athletes they follow.

Sport NFTs: What's Next?

Sport organizations are already looking beyond digital collectibles such as NBA Top Shot. Any context in which there is a need to reliably track and verify authenticity or ownership, particularly of digital or digitizable assets, is a potential application for NFTs. This includes existing sport products, such as tickets, as well as fractionalized team ownership and innovative ways to enhance fan engagement and recognize ardent supporters. NFTs unlock additional value when there is a need for a secondary market (i.e., assets that benefit from additional transactions beyond the initial sale) or where residual royalties for the original creator are desirable (e.g., allowing creators to retain a financial interest in their creations). For example, NFTs can leverage smart contracts designed to automatically return a portion of each sale to the original creator, supporting participation in the full economic lifespan of the asset (Shah, 2021). This enhances equity and restores balance between individual creators and organizations, providing creators greater control over their content.

Tickets as NFTs solve multiple concerns with traditional tickets, including verifying authenticity, reducing barriers for resale when a ticketholder cannot attend a game, and allowing markets to price tickets dynamically. One example of this trend is that the Dallas Mavericks have announced that they are exploring options to sell tickets to home games as NFTs (Locke, 2021b). NFTs further support smart contracts that open opportunity for teams to bundle benefits beyond game attendance into a more attractive ticket package and generate residual revenue for the team from ticket resale.

Transferable membership or ownership stakes in sport teams or clubs is another potential application for NFTs in sport. Club Necaxa, in Mexico's Liga MX, has announced plans to sell a 1% stake in the club as an NFT (Tarmy, 2021). While this initial NFT sale is primarily designed to generate publicity and attract attention from young, tech-savvy individuals, the club is also considering ways to bundle small minority ownership stakes and premium access for fans through NFTs in the future (Tarmy, 2021).

An intermediate step between membership and ownership, fan tokens are fungible tokens that provide fans access and a means of providing input into club decision-making (e.g., uniform design or selection, player honors). Blockchain firm Chiliz has partnered with high-profile clubs including F.C. Barcelona, A.C. Milan, Paris Saint-Germain F.C., and Juventus F.C. to launch fan tokens, generating millions of dollars in revenue (Evans, 2021). Teams can also distribute tokens to their local community or fan groups to acknowledge and reward support (Shah, 2021). While the decision-making enabled by fan tokens may (currently) be limited to relatively trivial matters, such tokens also represent an

innovative approach to increasing fan engagement and support, key objectives for professional sport organizations (Yoshida et al., 2014).

NFTs allow athletes to monetize their brand, including their name, image, and likeness (NIL). Athletes' brands are often tied to their league and team (Su et al., 2020). With NFTs, athletes are empowered to leverage their personal brand and popularity by creating unique images and special fan experiences that eliminate intermediaries (Atienza, 2021). Collegiate athletes, who lack traditional means of profiting from their athletic performance and talent, seek to monetize their popularity through attracting an engaged audience (Kunkel et al., 2021). With collegiate athletes becoming increasingly popular on social media platforms such as Instagram and TikTok, athletes can sell their digital NIL content—independent from their college and university—to their social media followers. Smart contracts further help college athletes benefit from secondary market transactions as their fanbases grow in size and value. For instance, the Pacific-12 Conference (Pac-12), an American collegiate athletic conference, partnered with technology firms Veritone and RECUR to create NFTs based on selected highlights from Pac-12 moments (Coffey, 2021). The sale—and resale—of these NFTs, powered by smart contracts, is mutually beneficial to university athletics departments and athletes.

Finally, sport organizations and athletes can use NFTs to promote social responsibility. Non-profit charities can access new funding sources through the sale of NFTs, diversifying their revenue streams. For example, in a recent partnership, Shaquille O'Neal and Notables teamed up to sell NFTs featuring O'Neal's image. With his special edition NFT, O'Neal raised \$2 million for his charity foundation, which helps underprivileged youth across the United States (Jones, 2021). NFT displays can be integrated into social media platforms, allowing users to show off the items they invested in on their profiles and thus signaling affiliation and leveraging associations with the organization and NFT content. The symbolic value of NFTs and team identity can drive fans to purchase NFTs themed to their teams' social causes.

Future Research Directions

Adoption of NFTs by both sport organizations and sport consumers is a crucial part of unlocking their potential use. In the future, scholars should investigate the readiness of both sport organizations and consumers toward innovation around NFTs using theoretical models such as the Technology Acceptance Model (TAM; Davis et al., 1989), Unified Theory of Acceptance and Use of Technology Model (UTAUT; Venkatesh et al., 2003), Diffusion of Innovations theory (Rogers, 2010), or Bass (1969) Diffusion Model. These models can also inform

the development and deployment of NFTs by identifying barriers to adoption and accelerating user acceptance. Due to inherent uncertainty with innovation, many sport organizations are hesitant to commit to NFTs despite their potential. These theories provide ways to explain the processes through which people accept technological innovation, explain resistance to innovation, and guide development of strategies to promote the integration and adoption of NFTs.

One of the primary current uses of NFTs in sport is as a form of digital collectible. Collectors obtain hedonic benefits from the collection process, generating attachment to collected objects and viewing these items as part of their self-identity (Belk, 1998). Yet, NFTs are both highly collectible and frequently resold to new owners. There is a lack of understanding of the processes through which collectors discard items and collectibles leave collections (Lee et al., 2021). Understanding when NFT owners are interested in selling an NFT, versus those who intend to maintain ownership for a long period of time (i.e., hold on for dear life, or HODL in NFT vernacular), and how ownership intention interacts with established constructs in sport management (e.g., team identification or attachment to an athlete) could be a fruitful research area with implications beyond the immediate context.

While NFTs are inherently non-fungible and cryptographically unique, they also typically come in sets that share common characteristics. For example, the highest-priced transaction for an NBA Top Shot moment is a LeBron James dunk; yet there are 79 versions of this same video clip (each with a unique serial number and minted as a distinct NFT). The record price was set for serial number 23, matching LeBron James's jersey number with the Los Angeles Lakers (NBA Top Shot, n.d.). Transactions from NBA Top Shot indicate that collectors place a price premium on NFTs with serial numbers that are lower (i.e., single digit serial numbers are valued more highly than double digit or triple digit numbers), match a player's jersey number, or are "perfect" (e.g., serial number 1000/1000; Klingman, 2021). Another way in which NFTs of the same moment differ is in their transaction and ownership history, which is perfectly preserved on the blockchain. From the fine art world, ownership history—referred to as provenance from the French word *provenir*—can impact future prices, with value adhering from previous celebrity ownership or display in prominent galleries and museums (Findlay, 2012). As an emerging phenomenon, much remains unknown about what aspects of traditional collecting translate into the new, digital medium of NFTs. With perfect authentication and transaction records, how will ownership histories impact NFT values? A better understanding of the characteristics that explain heterogeneous pricing of near-identical NFTs within the same collection could offer insight into psychology and how people value symbolic goods.

NFTs offer unique brand experiences that appeal to consumers, driving brand awareness, increasing brand-consumer interaction, and stimulating consumer engagement (Patel, 2021). Innovation around NFTs promises better consumption experience as consumer interactions with both firms and other consumers can be tracked, recorded, and rewarded transparently. At the same time, consumers are increasingly concerned with personal privacy and the use firms make of their personally identifying information (PII; Chua et al., 2021). NFTs and related technological innovations such as blockchains promise anonymity and pseudonymity (Khalilov & Levi, 2018). This suggests novel research directions exploring how customer relationships are created and strengthened using brand-related NFTs (Treiblmarier, 2021).

Finally, much remains to be determined about the structure of the NFT marketplace. While NFTs are lauded as providing opportunity for access and distributed participation (Disparte, 2021), the network properties of NFT ownership suggest highly concentrated small-world structures dominate (Barabasi, 2021). That is, a relatively small number of individuals control a disproportionate share of all NFTs. Further investigation of the social networks around NFTs could provide insight into how such networks evolve over time and the extent to which NFTs may reproduce structural inequalities present in other environments. This is further related to stakeholder theory and agency theory, addressing the issue of identifying key players within this new digital ecosystem (Wilson et al., 2021). Critical Theory approaches to examining how NFTs are conceptualized and implemented by both the sport industry and consumers could help guide theorizing and practice in ways that make the sport community better for all stakeholders and the society.

Conclusion

NFTs represent an emergent phenomenon with both established applications and future potential in the sport industry. The purpose of this primer is to provide an introduction and establish a groundwork for understanding key concepts related to NFTs for sport academicians and practitioners. The hype surrounding sport NFTs mirrors consumers' intrinsic and extrinsic motivations for buying sport collectibles. NFTs provide sport organizations innovative ways to monetize their intellectual property, particularly digital content, and capitalize on new growth opportunities. Furthermore, associated technologies (e.g., smart contracts) provide athletes with opportunities to leverage their personal brand. While the psychological aspects of collecting are not novel, NFTs parallel the broader digitization of the sport industry and represent a reconceptualization of scarcity triggered by the expanding field of blockchain technology. Therefore, NFTs

open new avenues for monetizing digital content in the sport industry. Sport managers must gain familiarity with the core principles of NFTs to appropriately innovate in this emerging space. NFTs open new realms in collectibles, ticketing, ownership, and fan engagement. We call on sport managers and sport scholars to engage with this new technology and proactively shape NFT-related innovation to enhance equitable outcomes for all sport industry stakeholders, including athletes, sports consumers, teams, and leagues, as well as to promote greater social good. This primer lays a foundation supporting research investigating the NFT phenomenon and guiding managerial practice.

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