Nonfungible Tokens: A New Frontier

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Key Takeaways

- **Nonfungible token sales on Ethereum have surpassed $9 Billion in 2021** so far representing a 2500% increase from 2020's total sales volume.

- Elevated interest in NFTs has coincided with the overall bull market in 2021, leading to over $9 billion in sales on Ethereum so far this year. **Total sales this year are expected to achieve at least $17.7 billion by the end of the year, as new traders enter the market**.

- The success of NFT series is often measured using average and floor prices, but **median price is the least manipulatable metric**. An NFT's rareness, liquidity, and utility impact the cost of an NFT, but the final value is based on the buyer's subjective preferences.

- Digital collectibles and art dominated the market in 2021, contributing more than 90% of sales. However, we **forecast blockchain gaming to be increasingly important as the market matures**.

- **Ethereum currently processes more than 80% of sales** despite high transaction fees that are often higher than the NFT's price. However, alternative layer-one solutions, including Flow, Tezos and Wax are becoming more widespread due to lower transaction fees and energy consumption.

- Investors can store NFTs in a combination of blockchain-specific software and hardware wallets. Software wallets allow for frequent trading, while hardware wallets are more secure. **The industry standard has quickly become a combination of a non-custodial browser-wallet and hardware wallet such as connecting MetaMask to Ledger or Trezor.**

- The low liquidity of NFTs may make closing a position difficult or even impossible. complicate closing the position. However, the NFT market has been gaining liquidity from investors that have been pooling funds together in order to buy a single NFT and specialized funds that track diverse portfolios of NFT holdings. Although fractionalization of NFTs increases their liquidity, **the total value invested in the top NFT fractionalization platforms has been decreasing** steadily, which may indicate a decreasing interest from investors for this type of financial product. These products may also violate securities laws.

- The Ethereum blockchain is significantly more energy intensive than some alternatives, such as Tezos. In 2021, transactions on Tezos were more than 35,000 times more energy efficient than transactions on Ethereum. To put this into perspective, **a single transaction on Ethereum took roughly 30 kWh, which is equivalent to powering a house in the US for a whole day**. In contrast, a transaction on Tezos took 0.0016 kWh or less than the energy required to charge an Apple Tablet for 10 minutes.

Authors

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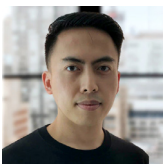
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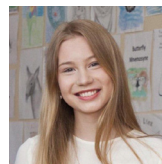
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Dear Partners, Investors and Friends,

In 2010, if someone had told you that Internet memes, digital artwork, and Twitter avatars would sell for hundreds of thousands of dollars, would you have believed them? There have been over $9 billion in NFT sales on Ethereum so far this year. According to our analysis, total NFT sales are expected to reach $17.7 billion by the end of the year, as new traders enter the market.

Cointelegraph Research proudly presents the *Nonfungible Tokens: A New Frontier* Report. To gain a deeper understanding of how nonfungible tokens (NFTs) are changing the way we own and transfer ownership of physical and digital assets, this 80+ page research report highlights the history and development of NFTs, how NFTs are stored, traded, and exchanged, how to mint an NFT and what platform to choose, how the NFT market works and how the prices are formed, how much energy is used when creating and trading NFTs, and what future awaits this emerging market.

In this report, we piece together the big picture of the NFT ecosystem and answer common questions held by asset issuers and investors. Topics such as how to find exciting new NFT projects and how NFTs are taxed in various jurisdictions are included. In addition, the report carefully curates industry expertise from the top entrepreneurs that are on the forefront of the NFT revolution. Insights from Matthew Gould, CEO and Founder of Unstoppable Domains, Yat Siu, Executive chairman and co-founder of Animoca Brands, Daniel Kim founder and CEO of NFTBank.ai, and Justin Hunter, head of product development at Pinata.Cloud are included.

All of the charts that our research team created for this report are continuously updated and available on Dune Analytics on the official dashboard for this report found at dune.xyz/panta_rhei/NFt.

Please enjoy reading Cointelegraph's eighth research report published in 2021 after the highly regarded *Polkadot: The Bedrock of the New Web* Report that came out in August. You can find all seven of our previous research papers on the Cointelegraph website.

Cointelegraph Research helps blockchain companies communicate their cutting-edge research to the world by writing, designing, and publishing professional reports. We help companies gain wider audiences by developing educational materials in the form of in-depth reports. Our team of academics and seasoned blockchain technologists can cover a diverse range of topics including tokenomics, macroeconomics, legal, tax, central bank digital currencies, decentralized finance, supply chain logistics, and venture capital.
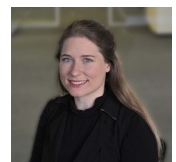
To work with Cointelegraph Research's team on creating a one-of-a-kind white labeled report or for confidential bespoke research, contact us at research@cointelegraph.com.

Sincerely
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Contents

Cointelegraph Research

Cointelegraph Research provides bespoke research reports and white-label content for organizations in the cryptocurrency industry. If your organization has a specific research question, our industry experts can find the solution. Our team's multidisciplinary knowledge of the blockchain technology and traditional finance world enable us to solve complex challenges. We leverage primary data sources to bring you actionable insights within the digital asset space.

We cover all the major sectors of the blockchain ecosystem, including layer-1 blockchains, Decentralized Finance (DeFi), mining, custody, non-fungible tokens (NFTs), private equity, and tokenomics.

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1 Introduction

Nonfungible tokens (NFT) are driving blockchains toward uncharted territory on the backs of cute kitties and pixelated punks. What may appear to be a shroud of speculation over pointless collectibles is actually the clouded horizon of fintech innovation. NFTs represent a turning point. Blockchain technology is now being used to represent assets beyond the chain. Whereas assets such as Bitcoin (BTC) are inseparable from their digital representation — i.e., the map (digital representation) is the territory (asset) — NFTs break from the chain by representing an asset stored elsewhere. Think of how a deed represents a house without actually being the physical house. This quantum jump is not just a technological innovation but a change in how blockchains are perceived. Many are still skeptical of the mental leap required to consider digital tokens as ownership over broader assets. However, this mental leap is necessary if we are to explore beyond the shroud of speculation and into the uncharted territory of NFTs.

1.1 What are NFTs?

Nonfungible tokens are a blockchain-based, programmable deed of ownership to an asset. This digital deed gives its holder the exclusive ability to use, sell and transfer the asset's ownership rights, as dictated by their private key signature.

These rights could pertain to resale, physical redemption, digital functions, financial benefits or other intangible rights. The NFT does not necessarily "contain" the asset but rather is a programmable record of ownership with an inbuilt pointer to the asset location.

Learn Fungibility

"Fungibility" refers to the interchangeability of the asset. Bitcoin, Ether (ETH) and fiat currencies are fungible because there's no difference between each unit. "Nonfungible" assets are unique and cannot be interchanged seamlessly — e.g., houses or rare art. Nonfungible tokens represent unique assets on the blockchain. "Semi-fungibility" is a relatively new term and refers to interchangeability between specific classes of assets.[1] For example, concert tickets can be interchangeable if they are for the same show and same booth or seating area. Note that these types of assets can change in fungibility over their lifetime.[2] For instance, after the semi-fungible concert ticket is used, it becomes a unique "clipped ticket" and is thereafter nonfungible.

Figure 1 / Types of Fungibility[3]

Fungible   Fungible within classes   Non-fungible
                  (semi-fungible)

Source: *OpenSea*[3]

[1] See "The Non-Fungible Token Bible: Everything you need to know about NFTs", Devin Finzer, *OpenSea*, Jan. 10, 2020
[2] See "What Is a 'Semi-Fungible' Crypto Token?" Anatol Antonovici, *Nasdaq*, Aug. 17, 2021
[3] See "The Non-Fungible Token Bible: Everything you need to know about NFTs", Devin Finzer, *OpenSea*, Jan. 10, 2020

Enjin pioneered the ERC-1155 NFT standard, coded one of the world's first NFTs, and built an ecosystem that enables developers to infuse their virtual economies and build the Metaverse.

Enjin is no stranger to NFTs. The company leapt onto the scene back in 2017, soon after which its co-founder & CTO Witek Radomski coded one of the first ever NFTs and authored ERC-1155, the now widely adopted, advanced token standard for defining NFTs on Ethereum.

Aiming to be synonymous with NFTs and gaming, Enjin has carefully crafted a holistic ecosystem of products that make interacting with blockchain easy, regardless of technical know-how.

Paired with its scalable, eco-friendly infrastructure, Enjin's ecosystem is enabling individuals and businesses everywhere to get involved with the exciting world of NFTs—and experience the joy of next-generation digital assets with tangible value and utility.

NFTs for Everyone

Enjin's raison d'être is connecting NFTs with the mainstream, while making the experience simple and fun. The company's sights are set on empowering the digital economy of tomorrow, a Metaverse of user-generated value.

NFTs of today still face significant barriers to entry, from crippling fees and usability, to inflexible smart contracts and disjointed interoperability. Efinity is Enjin's solution to these problems—an upcoming blockchain purpose-built for NFTs.

Developed as a Polkadot parachain, Efinity will support tokens from any network, serving as a cross-chain highway for the entire industry. Ultimately, Efinity aims to make NFTs as widespread and easy-to-use as smartphones of today.

Powering the Future of Gamified Experiences

Enjin's ecosystem is home to over 70 forward-thinking developers in its official Adopter Program, from open-world RPGs and augmented reality apps, to Minecraft servers and games across PC, Xbox, PlayStation, mobile, and more.

Businesses of all sizes, including leading global brands like Microsoft and Samsung, have entrusted Enjin with their NFT programs and blockchain initiatives. Since its launch in 2019, Microsoft's Azure Heroes NFT rewards program has grown into a global initiative, with over 10,000 NFT badges issued to recognize the contributions and accomplishments of the Azure technical community.

Likewise, crypto innovators like Binance, CoinMarketCap, CoinGecko, and SwissBorg are using Enjin-powered NFTs to engage and grow their audiences.

Regardless of industry, Enjin's tech stack gives projects the power to use NFTs in their products, marketing campaigns, and business strategies—no blockchain coding required.

An End-to-End Ecosystem for NFTs

Platform

Platform for minting and integrating NFTs. A robust API, SDKs, and plugins enable game and app developers to integrate blockchain with ease, using their favorite coding languages and tools.

The platform's Beam feature is a first-of-its-kind QR code service, enabling distribution of thousands of NFTs via QR. Users simply need to scan a code to instantly receive an NFT to their wallet. Scan the code on the previous page to see Beam in action!

Wallet

A secure, non-custodial mobile wallet for NFTs and cryptocurrencies. The Enjin Wallet seamlessly links up to blockchain games and apps, allowing players to use their NFTs in-game and trade them on the integrated marketplace.

Marketplace

A hub for exploring and trading NFTs, where over 3.3M items have already been sold. Enjin is also building an entirely new marketplace experience on NFT. io, slated for release in Q4 2021.

Scalable, Next-Gen Infrastructure

Efinity

A built specifically for NFTs. Efinity will support tokens from any blockchain, serving as a cross-chain network for the whole NFT space. Developed on Polkadot in partnership with Parity Technologies, Efinity is designed to solve the largest issues facing NFTs today, from scalability and speed, to usability, interoperability, and environmental impact.

JumpNet

A forever-free Ethereum scaling solution. JumpNet is a carbon-negative network offering instant, gas-free on-chain transactions for NFTs and ERC-20 tokens. It currently hosts over 20 million digital assets.

ERC-1155 Token Standard

Created by Enjin CTO Witek Radomski, ERC-1155 enables developers to deploy both fungible and non-fungible tokens in a single smart contract. Enjin's smart contracts are an implementation of ERC-1155, where each minted asset is infused with Enjin Coin (ENJ).

Symbiotic Tokens

The ENJ and EFI tokens work together in unison, each serving a core purpose within the Enjin ecosystem:

- Enjin Coin (ENJ): An NFT minting resource. Every asset minted with Enjin's platform contains ENJ, infusing it with residual value. A unique "melting" function also allows users to destroy their NFTs at any time to retrieve the ENJ value from within.

- Efinity Token (EFI): The native token of Efinity. EFI is designed to pay for transaction fees and facilitate liquidity, community rewards, and governance of the network.

Experience NFTs for yourself:
just scan to receive!

Learn NFT Properties

Ownership — NFTs are stored in blockchain wallets and can only be used by the owner of the private keys. Blockchain assets are non-custodial and one of the purest forms of property rights and digital ownership. See sections 1.4: NFT Ownership and 4.2: Storing NFTs in Wallets for more information.

Provenance — Blockchain technology allows any NFT to be traced back to its origin through the public ledger. This trait of NFTs helps to prove the authenticity of ownership and prevent fakes. Provenance is a subject of much interest in the traditional collectibles and antique market because of the need to counter forgery.

Liquidity — The digital nature of NFTs and their integration into major cryptocurrency networks like Ethereum naturally tend toward high liquidity compared to physical goods. However, compared to fungible tokens and currencies, NFTs are significantly less liquid. See section 4.3: Trading NFTs in Marketplaces for more information.

Programmability — NFTs can be integrated into digital networks to provide owners with digital benefits or revenue streams. Accordingly, an NFT can be considered a "smartdeed." Programmability is also what ensures scarcity and enables metadata, these being two critical features of NFTs. See section 2.1: NFT Ecosystem for more information.

Standardization — NFT protocols are built on open-source software such as Ethereum, a trait that introduces industry-wide standardization for these assets and their functionality. Programmability and standardization, in turn, enable ownership of digital assets across platforms and networks. See section 7.3: Beyond NFTs for more information.

Figure 2 / Fungibility Across Assets

	Fungible					Semi-fungible		Nonfungible		
	Bitcoin	Ethereum	USD	Gold	Stocks	Tickets	Merchandise	Real Estate	Antiques	NFTs
Physical	No	No	Both	Yes	No	Both	Both	Yes	Yes	No
Indestructible	Yes	Yes	No	No	No	No	No	No	No	Yes
Non-custodial	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes
Provenance	Yes	Yes	No	No	No	–	No	Yes	No	Yes
Programmable	Yes	Yes	No	No	No	No	No	No	No	Yes
Standardization	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes
Liquidity	High	High	High	High	High	Low	Low	Low	Low	Low

Source: *Cointelegraph Research*

More charts in extension to this report have been created by our research team and are available on Dune Analytics on the official dashboard for this report found at dune.xyz/panta_rhei/NFt.

History

Key Takeaways

- "Fungibility" refers to the interchangeability of the asset.

- 2017 marked the first wave of NFT popularity with collectible projects such as CryptoPunks and CryptoKitties.

- NFT sales totaled $2.5 billion in the first half of 2021, representing a 60-fold growth from mid 2018.

Bitcoin pioneer Hal Finney first mentioned an early version of NFTs in 1993. He called them "Crypto Trading Cards." In a forum discussion, Finney touched on definable scarcity, exclusive ownership and provenance. These concepts are now at the core of every NFT. This discussion occurred when trading card games were popular such as Magic: The Gathering and Pokemon Cards. The idea of NFTs wouldn't see much development until 2012 when Yoni Assia wrote about "colored bitcoins", which eventually became "colored coins".[5] Built on top of the Bitcoin blockchain, Colored Coins created semi-fungible tokens that were supposed to represent real-world assets, such as real estate, commodities and bonds.[6] Due to Bitcoin's programmability limitations, the concept did not take off.

One of the earliest NFT iterations, "Quantum" was created in 2014 by Kevin McCoy and Anil Dash and presented at the New Museum in New York City. Quantum was a unique blockchain token linked to a piece of digital artwork via Namecoin metadata. In 2015, the first Ethereum-based NFT, called Etheria, was launched at Devcon 1.[7] This is largely considered to be the first truly nonfungible token. Each token represented one of 914 virtual blocks of land, which went largely unclaimed and lay dormant until the 2021 NFT craze.[8]

The term "NFT" emerged in 2017.[9] Although little known at the time, two very significant NFT projects, CryptoPunks and CryptoKitties, were launched in 2017. This same year, the first NFT house sold through Propy.[10] This marked the first wave of NFT popularity, which synchronized with the crypto market cycle. NFTs then largely went dormant until 2019, reflecting the bearish sentiment of the market cycle. But interest was building in the background as the technology found applications. 2020 was the renaissance year for NFTs, again coming on the back of a crypto market bull cycle. Currently, in 2021, the scale of the NFT market is staggering. Sales have grown from just $41 million in 2018 to an astonishing $2.5 billion in the first half of 2021, representing a 60-fold growth in three and a half years.[11]

Figure 3 / **Number of NFT Projects on Ethereum**
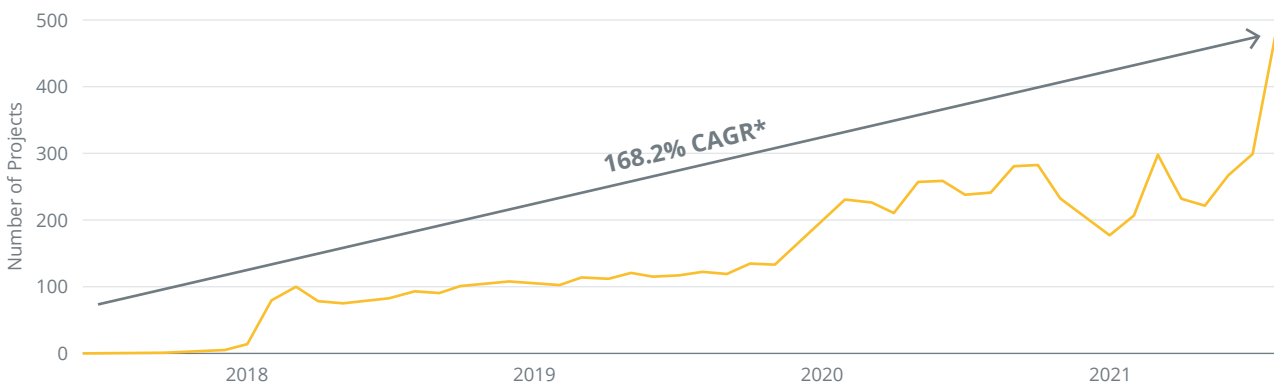
*Source: Cointelegraph Research, *CAGR calculated on data from NonFungible.com from January 1, 2018 to August 31, 2021*

4   See "Bitcoin visionary Hal Finney 'predicted' booming NFT market — in 1993", *Protos*, Feb. 15, 2021
5   See "bitcoin 2.X (aka Colored Bitcoin) – initial specs", Yoni Assia, March 27, 2012
6   Learn more about colored coins here
7   See "The history of Non-fungible tokens (NFTs)", Jürgen Alker, Medium, Sep. 29, 2021
8   See "The Cult of CryptoPunks", Lucas Matney, TechCrunch, April 8, 2021
9   See "The first NFT ever created, 'Quantum', goes under the hammer", The Economic Times, June 7, 2021
10   Learn more about Propy here
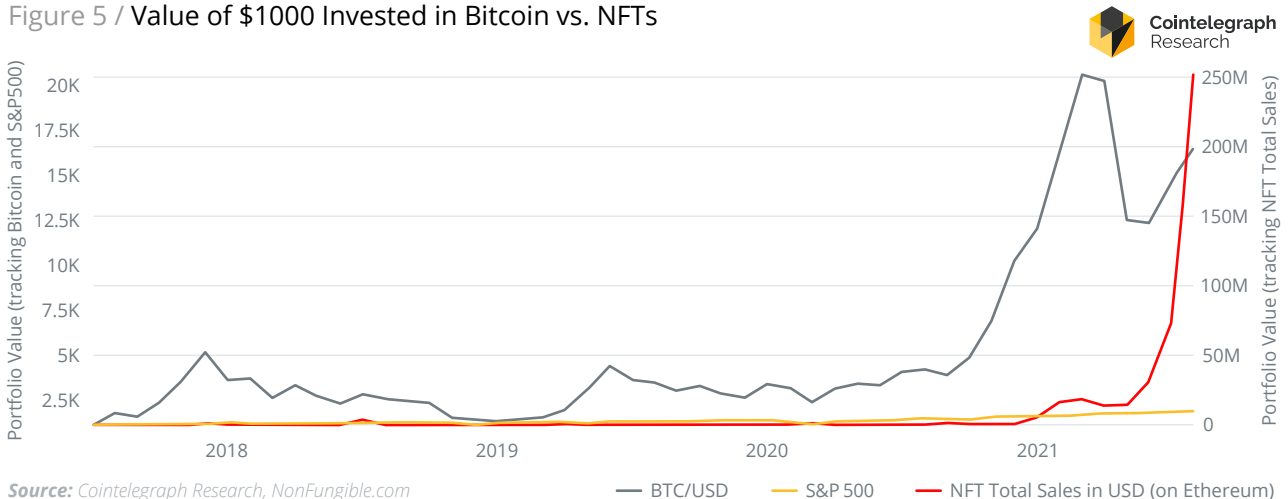11   See "NFT sales volume surges to $2.5 bln in 2021 first half", Elizabeth Howcraft, Reuters, July 6, 2021

Figure 4 / History of NFTs

1993 — Wizards of the Coast introduce trading card games, which surge in popularity.

1997 — Digital collectible card games emerge.

2008 — Bitcoin whitepaper published by Satoshi Nakamoto.

2012 — Vitalik Buterin, among others, develop Coloured Coins to make semi-fungible bitcoins.

2014 — An early tokenized artwork on Namecoin, called Quantum, is launched.

2015 — Etheria, the first true NFT based on virtual land, launches on Ethereum at Devcon 1.

Hal Finney first describes "crypto trading cards" in an online forum.

2016 — Early semi fungible projects like Pepe and Spells of Genesis.

2017 — First NFT market boom with early collectibles like CryptoKitties and CryptoPunks.

2018 — NFT interest cools down with cryptocurrency bear market.

2020 — NFT interest resurges with cryptocurrency bull market.

2021 — NFT market reaches mainstream awareness.

Beyond — Metaverse, Play to Earn and Creator Economy

Major NFT marketplaces like Opensea emerge.

Forever Rose, a fungible blockchain artwork, sells for $1m to 10 owners.

Collectibles and antiques soar in value.
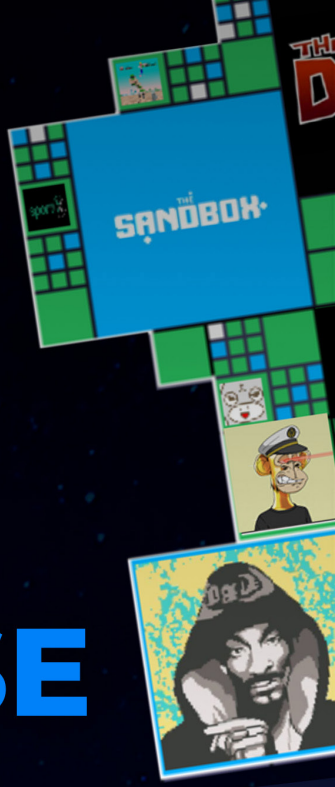
Beeple breaks records with his $69 million NFT art sale.

As shown in Figure 4, $1000 invested in Bitcoin in 2017 would have had over a 16x return giving a cumulative portfolio value of $16,500. Compare that to the staggering 125,000x return on $1000 invested in an imaginary portfolio of NFTs that bought a small fraction of all NFTs ever sold on the Ethereum blockchain. This portfolio would be worth $252 million today. However, this portfolio is not possible to make since this assumes that the $1000 was distributed evenly among the NFTs available at the start of each project such as CryptoKitties, Crypto Punks, Meebits, etc. However, some projects release NFTs month by month and not all at once, so a financial vehicle could not be built on this strategy since the NFTs only available after the launch of the financial vehicle would not have been available at the time of investment.

Figure 5 / Value of $1000 Invested in Bitcoin vs. NFTs

Source: Cointelegraph Research, NonFungible.com

BTC/USD — S&P 500 — NFT Total Sales in USD (on Ethereum)

Popular NFTs

Key Takeaways

- In 2020, all types of NFTs were equally popular. Traders purchased a similar number of collectible, art, sports and gaming NFTs.

- In contrast, collectibles and art NFTs dominated the market in 2021 with a 91% sales volume share.

- The average price of art and collectible NFTs is skewed significantly by highly valued outliers. The median price is a better metric for measuring the success of an NFT collection.

Collectibles

Collectibles are a limited set of NFT art, items or "cards" with varying attributes and scarcity. They do not necessarily provide owners with a function such as access to a sound clip or control over a special item in a game. Instead, they are valuable because of their rare attributes, traceability and social desirability. Traders can model the value of each collectible NFT based on the rareness of its attributes. Some NFT collectibles are gamified, redeemable or offer extended digital functionality.

For example, owning a Bored Apes Yacht Club NFT gives access to an exclusive Discord chat server, the Gentleman's Club. A collection of collectibles may launch through drops or packs, which give purchasers the rights to randomized, newly minted NFTs, with more expensive tiers having more desirable attributes and rarity. Creators also use generative technology to create unique algorithmic art when the tokens are minted.[12] These features replicate the gambling-style thrill of video game loot boxes or opening a pack of trading cards.

Learn Collectible Terms

NFT Drops — An announced event where investors can purchase the right to new NFTs. Investors are often charged a fee for randomized NFTs whose traits are generated when the tokens are minted. Drops can be separated into different tiers and release times, with more expensive tiers offering rarer traits.

Generative Art — A form of art that has been created with the use of an autonomous system, generally an algorithm.

Gaming

Gaming NFTs represent in-game assets, such as items and property, which have functional uses in the virtual world. Players in blockchain game economies have the opportunity to generate revenue, innovate, create, and have a true stake in the game world. Games like Axie Infinity, Alien Worlds and Gods Unchained have attracted large player bases and significant volumes. Applications are becoming increasingly sophisticated as in-game economies and "play-to-earn" monetization models mature. One example is guild DAOs, which manage a treasury of NFTs, game currencies and ownership stake across virtual worlds. These organizations sponsor players and offer them a percentage of the companies' revenue. They also host bounties and competitions, and grow communities.

Art

NFT art is generally digital content: images, music and videos. Sometimes there is a physical item accompanying the NFT, but this is not always necessary. The NFT may have some function or offer rights to the owner, such as participation in a future art piece or access to exclusive content. Art NFTs often have inbuilt royalties, which pay a percentage of all future sales back to the original artist/creator. This enables fans and collectors to support their favorite artists directly and have a true ownership stake in creative communities. NFTs are becoming a cornerstone technology in the blockchain-based creator economy, which is an emerging ecosystem of monetized content creation, distribution, patronage and a community built on blockchain technology.

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[12] See "Art Blocks: The Rise of Generative Art", Kel Eleje, Messari, Aug. 3, 2021

It is an economy that empowers creators to build their own micro-economies, with a virtuous cycle of value creation among all participants. Decentralized platforms, such as Audius for music streaming and NFTify for web stores, are emerging as major service providers in the creator economy.[13]

The Metaverse

Metaverses are networks of virtual environments where people can interact with each other, digital objects and the physical world through their avatars. While most compare metaverses to virtual reality experiences like in The Matrix, metaverses are more related to ownership of digital assets and identity across cyberspace. NFTs enable this with blockchain ownership and immutability, enabling continuity of one's avatar and digital items across platforms. With recent announcements from Facebook and Epic Games regarding their use of metaverse technology, the application is garnering much attention. Metaverse projects today aim to develop architecture, engage users with transmedia stories and build virtual world platforms.

Utility

Utility NFTs provide the owner with some functional or monetary rights, usually in a digital platform context. These range from governance rights to insurance rights, licensing, and much more. Utility NFTs overlap with enterprise use cases but are available to a general audience. Domain names are one of the most popular items in this category and attract high sales prices and substantial market volumes. These services enable users to register a domain name to their wallet, which can host a website or serve as a payment address and universal username. Insurance NFTs are offered by Yearn. finance and underwritten by Nexus Mutual, with the insurance payout tied to the NFT owner.

Sports

Blockchain technology for sports fan engagement has increased in popularity among international soccer teams, Formula 1 racing, Major League Baseball, the National Hockey League and the National Basketball Association. In 2020, fungible fan tokens, such as those on the Socios platform, allowed users to earn rewards, influence their favorite sports team, and speculate on winning teams. For example, FC Barcelona issued its token and allowed holders to influence the design of murals in the team's locker room.[14] Sports fan tokens continue to be a resounding success. Today, NFTs are used to represent sports collectibles, community participation rights and event ticketing. Many collectibles represent highlight moments from games that users can trade, similar to physical sports trading cards. NFT memorabilia is also common, with NBA team the Golden State Warriors releasing an NFT collection of championship rings and ticket stubs.[15] Some NFTs give fans the right to meet with their favorite sports stars, VIP seating at events and access to exclusive merchandise.

What are the most popular NFT categories?

The NFT market has witnessed a correction in the past few months, but prices are the least exciting thing about NFTs. We're starting to see a major shift from NFTs focused on art and digital collectibles to much broader use cases, including web domains. Major web browsers such as Brave and Opera are now resolving blockchain domain names on behalf of 500 million internet users, enabling NFTs to act as identifiers for decentralized websites. At Unstoppable Domains, we've minted more than 1 million NFTs with practical use cases. Customers can send and receive crypto from 50+ wallets to one blockchain domain name. We're focused on leveraging NFTs as a way to open the door to crypto payments for people all over the world.

Insight with
Matthew Gould
CEO and Founder of
Unstoppable Domains

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[13] Learn more about NFTify here
[14] See "NFTs and The Sports Industry: The Perfect Pair", Elizabeth Levine, *Hackernoon*, Aug. 6, 2021
[15] See "Warriors first pro team to launch own NFT collection", NBA, April 27, 2021

Figure 6 / Popular NFT Categories

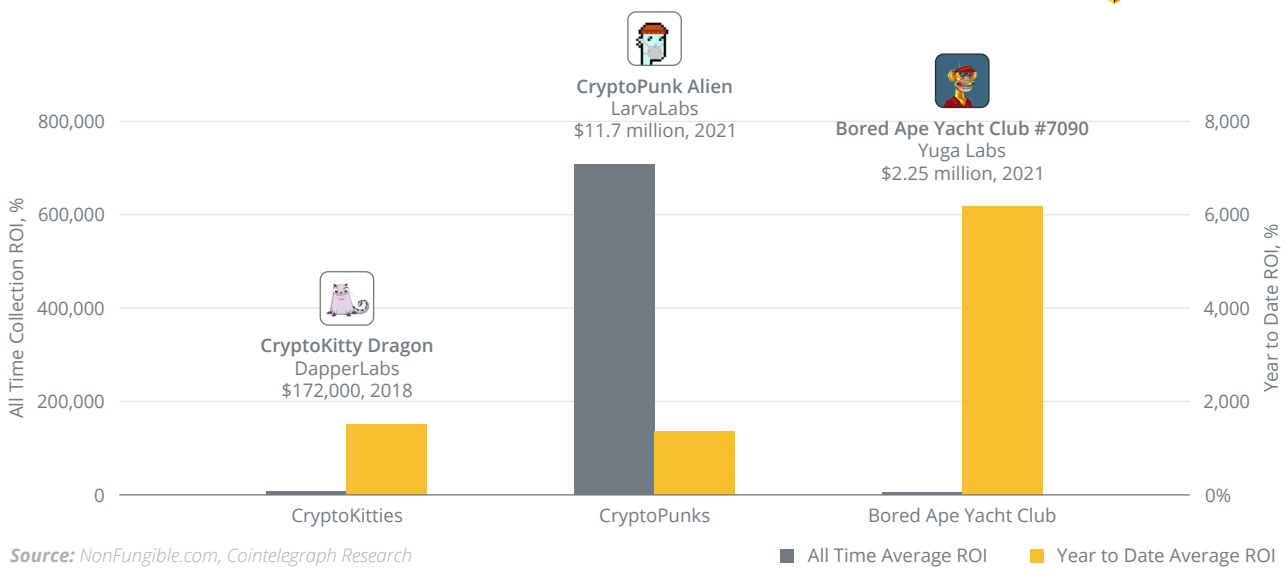| Category	Definition	Popular NFTs		Total Volume share (ETH)	
Collectibles	Collectibles are a limited set of NFT art, items, or 'cards' with varying attributes and scarcity. Collectibles are popular to trade partly due to standard attributes across a collection, enabling rarity valuation models.		**Bored Ape Yacht Club** #7090 Sotheby's $2.25 million (600 ETH) September 2021	2020	22%
			Cryptopunks CryptoPunk #7804 Opensea $7.6 million (4200 ETH) March 2021	2021	60%
Art	NFT art is generally digital content including images, music, and videos. Sometimes there is a physical item accompanying the NFT, but this is not necessary.		**3LAU** Gunky's Uprising Nifty Gateway $1.33 million March 2021	2020	22%
			Artblocks Fidenza #135 $1.53 million (437.5 ETH) September 2021	2021	31%
Metaverse	The metaverse is a network of virtual environments in which people can interact with each other, digital objects, and the physical world through their avatar. Virtual land purchases in metaverse platforms attract some of the highest valuations.		**Decentraland** Republic Realm Decentraland Market $900k (1.3m MANA) June 2021	2020	22%
			The Sandbox Summer Jam XL Estate Opensea $892k (3.64m SAND) July 2021	2021	3%
Sports	NFTs are used to represent sports collectibles, community participation rights and event ticketing. Many of the collectibles represent highlight moments from games which users can trade, similar to physical sports trading cards.		**NBA Topshot** Lebron James Dunk Topshot Marketplace $230k October 2021	2020	11%
			F1 Delta Time F1 Grand Prix De Monaco Opensea $267k (9m REVV) December 2020	2021	3%
Gaming	Gaming NFTs represent in-game assets such as items and property, which have functional uses in the virtual world. Applications are becoming increasingly sophisticated as in-game economies and 'play-to-earn' monetization models mature.		**Axie Marketplace** Genesis Estate $1.5 million February 2021	2020	20%
			Parallel Alpha "Ashes to Ashes" Opensea $1.12 million (360 ETH) August 26, 2021	2021	2%

Category	Definition	Popular NFTs	Total Volume share (ETH)	
Utility	Utility NFTs provide the owner with some functional or monetary rights, usually in a digital platform context. Domain names and insurance NFTs are two popular applications today.	**Unstoppable domains** Win.crypto Private Sale $100k March 2021	2020	3%
		yInsure 5000 ETH Cover on Curve Finance OpenSea $127k (350 ETH) September 2020	2021	1%

Source: *Cointelegraph Research*

Art and collectibles are the most popular NFT categories in 2021 and can attract phenomenally large returns. Leading collections such as CryptoPunks and Bored Ape Yacht Club (BAYC) have become iconic in the cryptocurrency culture, influencing many other collections styles and spin-offs. Although CryptoPunks have been the highest performing NFT collectible, BAYC stole the show in 2020 when they gained widespread attention. However, highly valued outliers skew the average price of NFT collections. The majority of NFTs issued do not make significant returns, and in fact, transaction fees can cost more than the initial sale price. Furthermore, NFTs trade differently from cryptocurrencies, and the last sale price does not necessarily indicate there is someone in the market willing to pay that price again. It's easy to be misled by the astronomical figures, which very few projects achieve. To learn more about safely getting into NFTs, read section 4.

Figure 7 / **Most Profitable NFT Collections (Average Return)**

Source: *NonFungible.com, Cointelegraph Research*

All Time Average ROI — Year to Date Average ROI

As shown in Figure 7, if an investor could have bought $1000 worth of a derivative that simply mimicked the average price of each of the most popular NFT collectible series, then their portfolios would have had significant gains. The ArtBlocks portfolio would be worth $87,000, BoredApeYach Club: $172,000, CryptoPunks: $645,000, and Meebits: $1500.

Figure 8 / Value of Portfolio that tracks Average Price of NFT Projects

Source: NonFungible.com, Cointelegraph Research

CryptoPunks · ArtBlocks · Bored Ape Club · Meebits
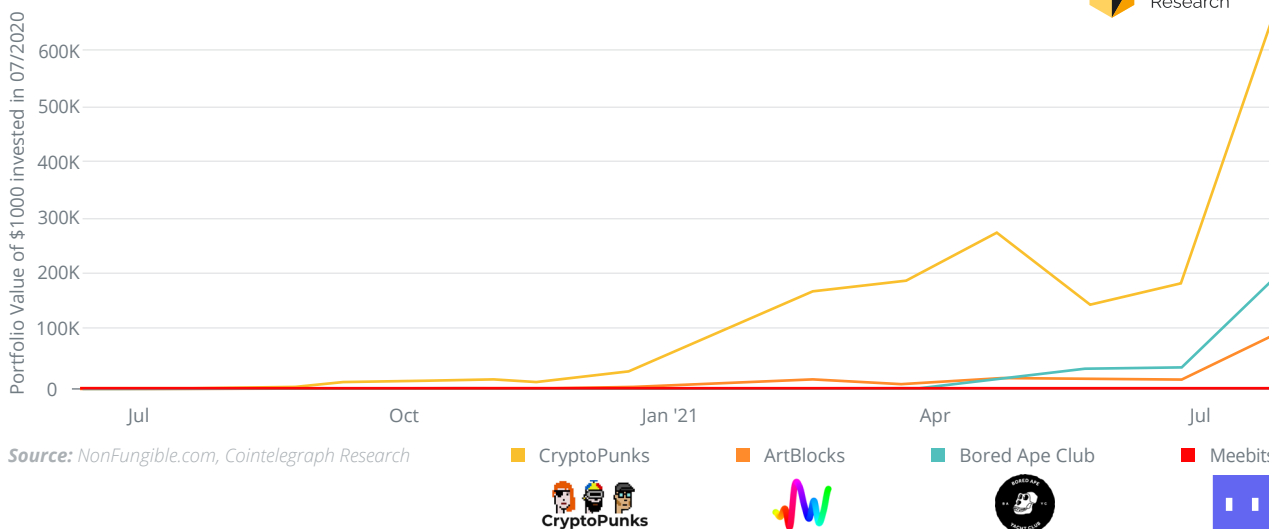
1.4 NFT Ownership

Key Takeaways

- Similar to stock picking, investors can buy individual NFTs, and similar to investing in a stock index, investors can buy exposure to a basket of NFTs. A new feature is fractional ownership, whereby many investors pool capital to buy a single NFT. However, total value locked in decentralized exchanges focusing on NFT fractions plateaued and then started steadily declining, indicating that interest in fractionalization is waning. Fractionalizing NFTs may also violate securities laws.

- The cryptographic token that represents the asset does not actually contain the asset but rather has a built-in "pointer" to where the asset is stored. The nature of how and where the asset is stored impacts an owner's ability to use their NFT.

- Enforcement of ownership rights may be through legal systems or technological systems.

There are three main ways to own NFTs, including actively managed ownership of a portfolio of unique NFTs, fractional ownership of a single NFT, and passive ownership in a basket of NFTs.

1. Active ownership	Investors can buy NFTs on marketplaces such as OpenSea or Rarrible. NFT marketplaces differ from exchanges like Binance or the New York Stock Exchange because they are bilateral, not multilateral. Instead of an order book, bilateral exchanges require a single buyer and seller to complete the transaction directly.
	NFTs are often available for purchase for a fixed fee or through an auction. English and Dutch auctions are common auction types. English auctions are offered on a fixed-price listing where the first bid equal to or greater than the fixed price wins. Otherwise, the seller can choose to take any lower price. Dutch auctions are similar, except the listed price decreases linearly to a specified end price and end date.[16]

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[16] See "How to create an NFT: A guide to creating a nonfungible token", *Cointelegraph*

2. Fractional ownership

Investors who cannot afford to spend $100,000 on an NFT can buy partial ownership. Specialized marketplaces such as Unicly and Fractional allow investors to buy small parts of NFTs called fractions or shards for less than $100.[17] Both are decentralized applications that allow users to control their own private keys. Unicly currently has $43 million locked on its decentralized exchange. The total value locked (TVL) plateaued and then started steadily declining, indicating that interest in the project is waning.

Figure 7 / **Total value locked, trading volume in USD, and transaction count on Unicly**

Liquidity
$43,642,944
22 Sep '21 12AM

Volume
$240,202
21 Sep '21
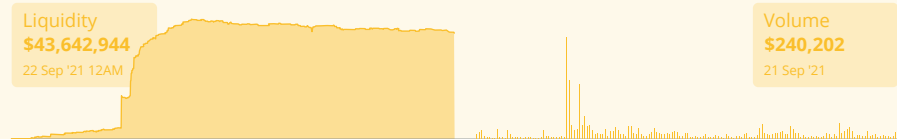
Source: Unic.ly

Alternatively, PartyBid allows investors to pool their funds and bid together in an NFT auction. Investors can find people to party with on PartyBid's discord. Recently, a group of bidders has won a Bored Ape Yacht Club NFT for $75,000 worth of Ether.[18] The NFT is governed by a smart contract that makes sure any transactions are agreed upon by the shareholders.

3. Passive ownership

Instead of buying a single NFT, investors can buy funds that provide exposure to a diversified basket of NFTs. During 2021, several centralized and decentralized NFT funds launched. Wave Financial, Three Arrows Capital and Justin Sun from Tron are all launching their own NFT. NFTX allows investors to buy decentralized funds that hold baskets of NFTs or indexes that track a collection such as CryptoPunks.[19]

Skeptics of NFTs have pointed out that digital artwork can be duplicated infinitely for minimal costs. They argue that NFTs linked to an underlying digital file aren't scarce and, therefore, aren't valuable. To answer the question, *What do I own when I own an NFT?* we must first define NFTs and ownership. NFTs are a digital deed that claims ownership to a unique asset. Ownership refers to an individual's property rights; they hold exclusive rights to the possession and use of the asset. Traditionally, property rights to an asset are embodied in a legal document referred to as a deed. However, deeds rely on a jurisdiction's ability to enforce the deed's terms. For example, in developed countries, deeds to vehicles are stored in centralized databases, which police can access to enforce ownership rights. The database or deed itself cannot directly stop someone from stealing a car; however, the network around the database does. This network includes shared databases with car ownership information, law enforcement and regulatory bodies.

For digital assets, ownership is more subtle. Files can be copied and shared and, therefore, lack the scarcity associated with physical assets. Enforcement is also difficult in cyberspace, making legal regulation less relevant. This is the core of the double-spend problem solved by Satoshi Nakamoto in the Bitcoin white paper. **For a fungible cryptocurrency, the asset and its digital representation are the same.** This means Bitcoin in a wallet cannot be copied and spent multiple times. **For nonfungible tokens, however, the underlying asset may be distinct from its tokenized representation.** While the NFT itself is digitally scarce, like Bitcoin, the underlying asset it represents may not be.

The NFT does not contain the asset but rather has a built-in "pointer" to the asset in the metadata. The nature of this pointer impacts ownership of the NFT. In many cases, the underlying asset is stored in a centralized web server, and the pointer is a URL link included in the NFT metadata. For example, a JPEG image of a cat could be the underlying asset, and the NFT could point to a website that hosts the picture of the cat. In this case, the NFT holder can hardly be considered to possess the underlying asset. The image of the cat could be altered or entirely removed by the owner of the website or data storage provider. Decentralized storage is emerging as a solution to this problem. These solutions use cryptography to store files in a way that guarantees their originality, which creates a digital scarcity similar to Bitcoin.

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[17] See "To NFT or not to NFT Part Two – Buying and Selling", Numbrs, Sept. 7, 2021
[18] Learn more about Bored Ape Yacht Club sales here
[19] See "To NFT or not to NFT Part Two – Buying and Selling", Numbrs, Sept. 7, 2021

Learn metadata

You may have heard of metadata after Edward Snowden blew the whistle on the United States National Security Agency gleaning metadata for mass surveillance on American citizens. Metadata is information that defines and describes data.[20] For example, shipping freights have a manifest that lists all the cargo with explanations, associations and relationships. Email metadata includes information such as the sender, recipient, date and subject line. Similarly, NFT metadata describes the item properties such as name, image and text description.[21] However, metadata can be used for much more, such as describing the NFT's properties in a game environment or the licensing rights of the NFT. Because storing data on blockchains is expensive, metadata is stored off-chain, with a "pointer" in the token contract.[22]

The pointer, however, can be more abstract. An NFT may represent, for example, the redemption of a commodity, like a diamond, in which case the pointer is toward a physical storage solution that a third-party custodian controls. Or, an NFT might represent the right to be featured in an artist's next piece. In this case, the pointer is toward the artist's community, backed by the artist's reputation. Generally, the pointer can be toward any platforms or services building on top of NFTs.

NFTs can offer exclusive financial benefits to the owner, such as royalties, yields or token airdrops. However, they can also provide non-financial returns such as software access or publishing rights. They can be directly redeemable, like VIP tickets to a concert or limited-edition merchandise. These functions are exclusively available to the NFT owner and controlled by their private key signature. Simply copying and pasting the image representing the NFT does not capture these ownership benefits.

The enforcement of the benefits that the NFT represents may depend on platforms, ecosystems and institutions. For example, a NFT that represents a concert ticket is only redeemable if recognized and approved by the ticket issuer. The NFT ticket itself may be valid, but the concert operators could tell security to block you at the door for any reason they see fit. Many jurisdictions do not currently recognize blockchain records to be legally valid.

However, NFTs that represent digital benefits can be tracked within a decentralized ledger and do not rely on any institution or jurisdiction for enforcement. Instead, enforcement is programmatic and trustless. Terms are executed according to network standards. Platforms and services building on NFTs must adhere to the infrastructure design and consensus of blockchain networks. These emergent rules and regulations from self-organizing systems are referred to as Lex Informatica, as distinct from legal regulation.[23] This system of regulation is analogous to the legal network that enforces traditional ownership rights over cars and houses.

Why are NFTs so hard to evaluate?

Ownership will be as important in the virtual realities of tomorrow as it is today in the real world. NFTs will provide digital property rights to billions of people. That property will include both digital and physical goods and information of all kinds, including the private data that you generate but have no control over today. With ownership rights for such assets (especially data), the populace will enjoy economic freedom. When the benefits of economic freedom become sufficiently obvious, ownership over one's data will be declared a human right, causing a shift in global policy approaches and leading to more equitable systems across all forms of reality.

That's why there's good reason to believe that the metaverse will be open and democratic. Closed data networks will become a thing of the past as decentralized networks become the foundation for all public data structures.

Insider Insight with
Yat Siu
Executive chairman and
co-founder of
Animoca Brands

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[20] Learn more about metadata from Australian Statistics Bureau here
[21] More on metadata standards here
[22] See "What Is an NFT?", Justin Hunter, Pinata, April 27, 2021
[23] More information on Lex Informatica here

UNSTOPPABLE DOMAINS

With 1.4m NFT domains sold, **Unstoppable Domains** is the leader in NFT domains. These domains are like regular domains but loaded up with superpowers.

0x40540b82...
BECH32 Address

brad.wallet
Unstoppable Domains
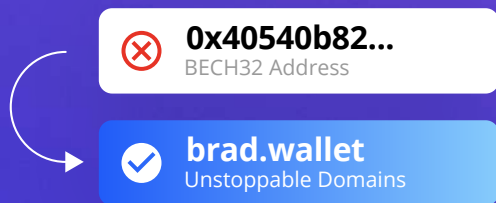
Make Crypto Payments EASY

Power up your wallet by turning complicated addresses into easily-readable names. NFT domains give you the power to send, store, and receive hundreds of crypto-currencies and NFTs with one simple domain name.

Custom NFT Galleries

Have NFTs? Create beautiful gallery-style websites in just a few clicks to display all your favorite NFTs.

Your Name on the Internet

With NFT domains, your identity is up to you. Make your domain your own with 1 of 10 extensions like .x, .crypto, .nft, and more.

No Renewal Fees Ever

Pay once and own it for life. No more losing your domain because of missed payments.

Constant Innovation

We work tirelessly to bring you the latest and greatest Web3 features and integrations.

Best in Class Support

Get the help you need, whenever you need it with our 24/7 support from real humans.

UNSTOPPABLE DOMAINS

+ 30 Leading Wallets Introduce

.Wallets Alliance

Setting a new username standard for peer-to-peer crypto payments

Figure 9 / NFT Ecosystem

NFT Infrastructure

Layer 1	ethereum · Polkadot · flow · WAX · KUSAMA · SOLANA · Tezos · COSMOS · fantom
Layer 2	polygon · iMMUTABLE · SKY MAVIS · OPTIMISM · EFINITY · NEAR
Minting	venly · BLOCKPARTY · METAPLEX · uniQue
Storage	Pinata · arweave.org · NFT STORAGE · IPFS · ESTUARY
Data Intelligence	nansen · NonFungible · CRYPTO SLAM · Evaluate · solanalysis · OTM · nft now
Portfolio Management	NFT BANK · Zapper.fi · Dapper · NFTrade
Other	UNSTOPPABLE DOMAINS · ENS · Urbit · M · POLKARARE

NFT DApps

Virtual worlds	Decentraland · SOMNIUM SPACE · SANDBOX · illuvium · TREEVERSE · NFT OASIS GENESIS PENTHOUSE · Chainmonsters · ALIEN WORLDS · R PLANET · PROSPECTORS · CRYPTOBLADES · CRYPTOMINES · THE SOLAVERSE · Afflarium · 5it.Coun1ry · THE DRAGON'S LAIR · NOVAX · TEZOTOPIA · Weapon
Games	COMETH · GODS UNCHAINED · AXIE INFINITY · ENEMY METAL · DARK COUNTRY · FARMERS WORLD · Tycoon · Kawaii islands · WOLF GAME · Polychain Monsters · polka pet world · POLKAFANTASY · AVAXTARS · Crypto Unicorns · ETERNAL · THETAN ARENA
Socials	Lazy · JPG · Universe · Pictta · RareRooms · NIFTED · UNQ CLUB · BITSPAWN · VR ALL ART · Topps · Mirror · POAP · JRNY CRYPTO
Sports	sorare · F1 DeltaTime · DeRace · TOP SHOT · UFC · Topps · Lympo · blockasset BETA
Music	SING · AUDIUS · RCRD SHP · biscuits n groovy · rocki · MELOS · BLOCKBEATS · ONEOF · bitsong · royal

NFT Marketplaces

Marketplaces	OpenSea · R · M · ZORA · Genies+ · NFT Top Expo · M · ATOMICHUB · N3 · uniQue · T · solsea · FTX US · MAGIC EDEN · 420Swap · SIMPLE MARKET · BINANCE NFT · YETI SWAP · kalao · Artion · X · HEN · objkt.com · POLKARARE · SuperRare · makersplace · N · KnownOrigin · async · AOH · VS · ethernity · BLOCKPARTY · MISA · VIVE · XENO · Kalamint BETA · DVISION · Genie · KNOWHERE
Lending	nftfi · DROPS · TribeOne · Flowty
Liquidity	nft20 · SuperFarm · BLOCTO · TETRAMEDIA · POLKARARE · FROST-FINANCE · BITGEM · NFTX
Fractionalization	PARTY BID · unic.ly · FRAKTION · Charged Particles

NFT Ecosystem & Growth

2.1 Layer-One Blockchains

Key Takeaways

- At the core of the NFT ecosystem are layer-one blockchains.
- Ethereum is the most popular NFT blockchain because it houses the largest ecosystem.
- Alternative blockchains to Ethereum are increasingly popular due to cheaper transaction fees.

The NFT digital ecosystem can be described as a stack of technologies that build on one another.[24, 25] At the core of the ecosystem are infrastructure providers, namely, layer-one blockchain solutions, such as Ethereum, Binance Smart Chain and Solana. These platforms provide the base layer blockchain, network infrastructure and protocol standards for NFTs. Layer-two solutions build on these layer-one blockchains, increasing transaction speed and decreasing transaction costs.

Learn Layers

Layer zero, layer one and layer two are terms used to describe different architectures for decentralized ledger technologies.

Layer one often refers to the underlying blockchain architecture of early blockchains, such as Bitcoin and Ethereum. Layer-one scaling solutions include:

- Dividing the validation of incoming transactions into different groups, a process referred to as sharding.
- Switching from proof-of-work (PoW) to proof-of-stake (PoS).

Layer two often refers to the applications built on top of the original blockchain. Layer-two scaling solutions include:

- State channels, such as the Lightning Network, built on top of Bitcoin.
- Nested blockchains, such as Plasma on Ethereum.

Layer zero is a term often used to describe blockchains that can connect Layer-one blockchains. For example, blockchains built on top of Polkadot can transfer assets to and from the Ethereum blockchain.[26]

Many layer-one blockchains support NFT protocols through their native programming standards. Ethereum is a popular platform for NFTs because it houses the largest ecosystem and liquidity. However, the Ethereum blockchain has expensive transaction fees, impacting user growth and presenting a bottleneck for micro-priced NFTs. For example, withdrawing Ether from Axie Infinity cost as much as $694 in August 2021, whereas withdrawing Ether from Axie typically costs a little more than $60.[27] Furthermore, Ethereum's current consensus mechanism is heavily reliant on energy use. For this reason, many artists and musicians are wary of issuing NFTs on Ethereum due to a potential backlash from their environmentally conscious fans.

[24] See "The NFT Stack: Exploring The NFT Ecosystem", Mason Nystrom, *Messari*, Aug. 10, 2021
[25] See "NFT Tech Stack", Ishanee Nagpurkar, *IOSG Ventures*, April 7, 2021
[26] See "Layer 1 vs Layer 2: What you need to know about different Blockchain Layer solutions", Petro Wallace, *The Capital*, March 1, 2020
[27] See "To NFT or not to NFT Part Two – Buying and Selling", *Numbrs*, Sept. 7, 2021

Figure 10 / NFT-enabled Blockchains

Blockchain	Symbol	Transactions per second	Average transaction fee	Marketplaces / minting services	Token standards	Popular NFTs
Ethereum		15 – 30	$15	OpenSea, Rarible	ERC-721 and ERC-1155	CryptoKitties, CryptoPunks, "Every-days: the First 5000 Days," Axie Infinity
Tezos		Up to 40	$0.00232	Hic et Nunc, Kalamint	FA2, TZIP-12	PixelPotus, Plenty, Wrap
Wax		Up to 1,200	2%	AtomicHub, Myth Market	Simple Assets	Saw, Atari, Capcom, Topps, Bratz
Binance Smart Chain		55 – 60	$0.01	Binance, BakerySwap	BEP-721	Arsenal, BakerySwap, ApeSwap, Biswap
Flow by Dapper Labs		Up to 1,000	$0.000026	Viv3	Flow NonFungible Token Standard	NBA Top Shots, UFC Digital Collectibles
Tron		2,000	$0.0000901	NFTOne	TRC-721	Lindsay Lohan, Ne-Yo, Swae Lee
EOS		2,800	$0 but some EOS coins must be put on hold	AtomicHub	dGoods	Upland, EOS Knights, Crypto Dynasty
Solana		> 50,000	$0.0015	Metaplex, Solsea	SPL Token NFT	SolanaMonkeys, SpaceMonkeys
Avalanche		Up to 4,500	$0.46	NFT Stars, Gameswap	AVAX NFT Token (X-Chain)	Bundesliga, 2021 Topps MLB Inception NFT Collection, Bazooka
Devvio		Up to 8 million	$0 but may include a minimal internal trans-action commission for preventing DoS attacks	DevvX	NFT-17	LitCraft Nysperience

Ethereum's popularity means that the most commonly used token standards include ERC-721 and ERC-1155. Similar to an ERC-20 address, an ERC-721 address has 42 hexadecimal characters derived from the last 20 bytes of the public key controlling the account with 0x appended in front. For example: 0x71C7656EC7ab88b098defB751B7401B5f6d8976F. However, unlike ERC-20 tokens, ERC-721s also have a unique "token identification number." This is because a single ERC-721 smart contract can store several different assets — hence the name, nonfungible tokens.

In contrast, a single ERC-20 contract can store only one type of asset, such as Ether or Tether (USDT). A few months after the ERC-721 standard was created in 2018, the ERC-1155 was developed by Enjin. ERC-1155 combines the ability of ERC-20s to hold fungible tokens and the ability of ERC-721s to hold nonfungible tokens.[28]

[28] Learn more about EIP-1155 token standard here

Figure 11 / ERC-1155 Combines Fungible and Nonfungible Assets

ERC-20   ERC-1155   ERC-721
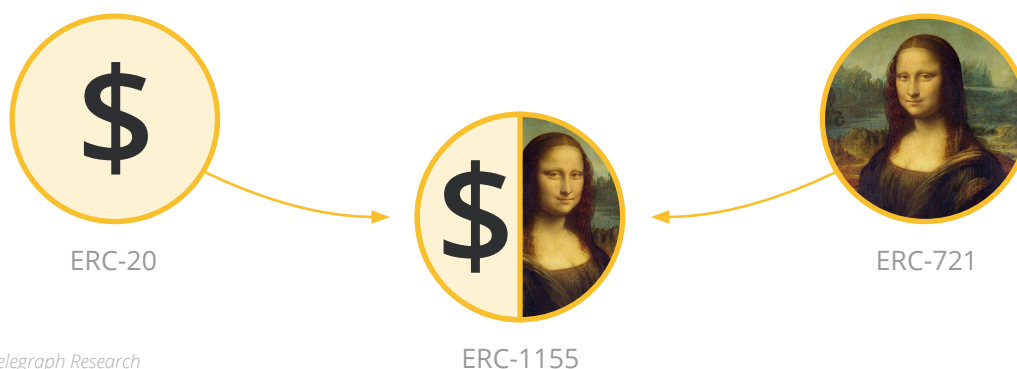
Source: *Cointelegraph Research*

Enabling both assets to be held in a single smart contract means fewer transactions bloat the Ethereum blockchain and lower transaction costs for users. Unsurprisingly, ERC-1155 has become the standard for high transaction volume applications, such as gaming, where a smart contract can execute a trade involving a fungible stablecoin such as USDT with a nonfungible in-game asset such as a sword.

Among possible and interesting alternatives, Polygon, Tezos and Flow are worth mentioning. Ethereum's high gas fees prompted the most popular NFT marketplace, OpenSea, to launch a new version on Polygon recently.[29] Similarly, Tezos' PoS consensus is both cheaper to transact on and more eco-friendly than Ethereum, making it another attractive alternative.

Tezos uses the FA2 protocol for multi-asset contracts, similar to ERC-1155.[30] In contrast to Ethereum and Tezos, Flow is an NFT-only-oriented blockchain created by Dapper Labs, the creators of CryptoKitties. This blockchain was created specifically for the NBA Top Shot NFT series, which is one of the most popular NFT series on the market. Flow aims to provide better tooling for developers and superior scalability over its competitors.[31] Flow applications are built with a simplified native language called Cadence, which is optimized for decentralized applications (DApp) and NFTs. Scalability is delivered through a PoS validator network. While Ethereum is still clearly the market leader and the space matures, major competitors will continue to emerge.

2.2 NFT Storage

Key Takeaways

- There are two separate storage topics associated with NFTs. The first is the storage of the artwork, avatar or other digital file. The second is the secure storage of the private key that holds the NFT linked to the underlying asset, which is stored in a secure location.

- NFT private keys are stored in wallets with self-custody, meaning they can be stolen or lost just like cryptocurrencies. Hardware wallets are significantly more secure than software wallets for NFT storage.

Storage solutions enable NFT issuers and owners to store their underlying NFT asset data in a secure location. Centralized storage solutions are common,

as they are cheap and scalable; on-chain storage is not natively available on Ethereum or other layer ones. As previously discussed, centralized storage brings

[29] See "To NFT or not to NFT Part Two – Buying and Selling", *Numbrs,* Sept. 7, 2021
[30] See "Introducing FA2: A Multi-Asset Interface for Tezos", *TQ Tezos,* March 6, 2020
[31] More information on Flow blockchain here

into question notions of ownership, as the underlying data can be removed or tampered with. Decentralized storage services such as IPFS and Arweave aim to solve this problem. These solutions store data immutably so that the underlying asset data cannot be tampered with. This also creates a digitally scarce original piece, which is cryptographically signed by the issuer, thereby replicating the scarcity of an artist's signature or authentic brush strokes on a canvas.

NFTs are stored in wallets with self-custody, meaning they can be stolen or lost just like cryptocurrencies. Since NFTs may have considerable monetary and even sentimental value, learning how to correctly store NFTs is crucial. Initially, NFTs will typically be stored on a software wallet such as the Ethereum-based MetaMask. For example, an Axie Infinity player can store their Axie NFTs in the browser-based software wallet called Ronin, created by Sky Mavis.[32] They can then transfer their NFTs from the Ronin wallet to MetaMask, which can store a variety of Ethereum-based fungible and nonfungible assets. One cool feature of the mobile version of MetaMask is the ability to see thumbnails of the NFTs within the app.

The benefit of software wallets is that the user is in control of their private keys. However, software wallets are recommended for use only over a short period of time, before the private keys — for the most secure option — are transferred to a cold storage hardware wallet.

However, those keys only guarantee access to the token that is stored on the blockchain. Most of the time, the assets associated with these NFTs are stored off-chain. The most-common off-chain solution is IPFS.

The most popular IPFS system for storing NFT assets and metadata is Pinata. Pinata is neither a wallet nor even a blockchain protocol. Instead, it is solely focused on ensuring the files associated with NFTs are stored safely on IPFS, giving NFT owners control over those assets while also ensuring every asset is verifiable. Pinata has over 40,000 users and 12 million files, and it is blockchain agnostic. Even Tezos-based NFTs can be stored using IPFS.[33]

As is the case with fungible digital assets such as Bitcoin, the most secure form of storage for NFTs is hardware wallets, including Ledger and Trezor.

However, unlike cryptocurrencies that are stored in cold storage for long-term capital gains, NFT users need a secure solution that allows them to frequently trade their NFTs. In light of these needs, **the industry standard for safe storage of NFTs is quickly becoming a combination of MetaMask and either Ledger or Trezor.** However, this is only for Ethereum-based NFTs. Each blockchain may have a different browser-based wallet that works with hardware wallets. For example, the Temple browser-based wallet for storing NFTs on Tezos can easily connect with the Ledger hardware wallet.

Figure 12

Viewing NFTs in the MetaMask Phone Wallet

Source: *MetaMask*

[32] Learn more on Sky Mavis Ronin wallet here
[33] Learn more about how to mint tokens via IPFS here

2.3 NFT Minting

Key Takeaways

- Minting services enable users to create NFTs without having to develop smart contracts.

- NFT marketplaces are bilateral, requiring a single buyer and seller to complete the transaction directly. Bilateral marketplaces host auctions similar to eBay where users can list their NFTs through an auction or for a fixed fee.

- NFTs have a low level of liquidity compared to fungible currencies, which trade multilaterally on exchanges.

- Web 3.0 and DeFi are the layers where NFTs interact with smart contracts to create a decentralized asset class on the blockchain.

NFT minting services are readily available through various marketplaces and issuers for a fee. Most minting services require no programming ability and only basic knowledge of blockchain technology. The most popular marketplaces include Mintable, OpenSea and Rarible.

Minting services enable users to create NFTs without having to develop smart contracts on the underlying infrastructure. These services are often offered by marketplaces, albeit generally with centralized storage. Open marketplaces enable auctions of NFTs between any participants, while curated marketplaces auction selected works, sponsor collections, and attempt to influence the development of community tastes. Services such as NFTify and Metaplex offer deployable packages that include minting and marketplace services, thus allowing anyone to create, sell, and trade NFTs on their website

Learn NFT Sales Terms

NFTs have three distinct stages over the lifecycle of their sales:

Minting price: NFT issuers may choose to mint NFTs themselves or enable users to mint NFTs for a fee. The price paid by an investor at the inception of the NFT's existence is called the mint price.

Primary sale: The first time an NFT is sold.

Secondary sale: Any sale after the primary sale.

Sales volume: The sum of the primary, secondary and minting sales.

Royalties: A percentage cut taken on secondary sales and paid to the issuer.

Web 3.0 and decentralized finance (DeFi) are the layers where the "smart" of a smart deed bears fruit. The programmability and standardization of NFTs enable them to integrate into digital platforms for extended functionality. For this reason, the DeFi layer of NFTs is emerging as a highly lucrative and deeply liquid market, with fractionalized NFTs, hybrid NFTs and NFT-backed loans all becoming popular. Web 3.0 broadly refers to an evolution of internet infrastructure to permissionless blockchains with open protocols and native digital ownership.[34, 35] DApps are built on Web 3.0 technology, integrating NFTs into web apps, games, platforms, enterprise and more. Beyond Web 3.0, we see sophisticated economic ecosystems forming around NFTs and blockchain technology evolving into new concepts, such as metaverses, creator economies and play-to-earn. To read more about this, see Sections 7.2 and 7.3.

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[34] More about the Web3 Foundation here
[35] See "What is Web 3.0 and Why Should You Care?", Diana Chen, *Unstoppable Domains*, April 2, 2021

Pinata

Pinata is your home for NFT Media

Pinata is the first multimedia hub for NFT creators, builders, and artists in the decentralized world of web 3. Pinata's vision to foster a sense of place for every creator on the internet that is uniquely theirs has been the company's goal since 2018. Building the largest pinning service on IPFS, Pinata gives users the ability to upload, manage, and share their content whenever, wherever and, with whomever they want.

Company stats

💡 Established in 2018, launched at ETHBerlin Hackathon

📌 Over 22 million files pinned

😎 More than 40,000 customers

🚀 Files stored on Pinata received more than 600 million views in August 2021 alone

Some of our customers

Protocol Labs   sorare   YUGALABS   Autograph

Learn More

www.pinata.cloud

Market Activity

■ Ethereum holds approximately 80% of 2021 NFT sales volumes, but only houses 37% of total NFT traders.

■ Alternative layer-one blockchains to Ethereum are increasing in popularity due to cheaper transaction fees.

■ New buyers on secondary markets are largely driving NFT volumes in 2021.

Following their emergence in 2015, market activity for NFTs has been developing slowly. There is no consistent market data for NFTs prior to 2017, as major marketplaces were not yet established. In mid-2017, daily sales were still consistently under $1,000, dominated by early collections on Ethereum, such as CryptoPunks and Curio Cards.[36] In November 2017, CryptoKitties ignited the first major wave of NFT hype,[37] fueled by the concurrent bull market mania.[38] NFT sales exploded in Q4 2017 and reached $4 million in monthly sales in December. However, throughout 2018, market activity fell significantly as interest waned and the cryptocurrency bear market reduced purchasing power. Primary sales dropped to all time lows in late 2019, when very few NFTs were being created and volumes were dominated by existing collections in circulation.

Figure 13 / NFT Sales on Ethereum in USD

Source: *NonFungible.com, Cointelegraph Research*
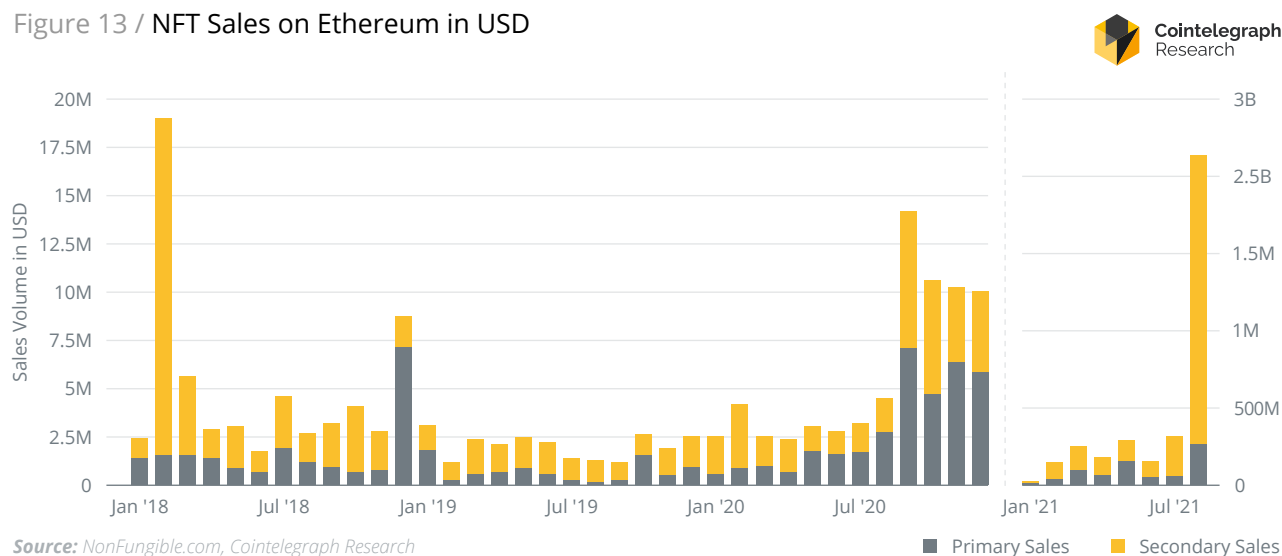
Market activity remained relatively dormant until Q2 2020 when an unprecedented resurgence began brewing. As the overall cryptocurrency market rallied, speculative interest turned back toward NFTs. Although the now classic collectibles from 2017 led the resurgence (CryptoPunks in particular), new projects and form factors emerged. In Q4 2020, as Bitcoin made headlines, the ludicrous valuation of NFTs began to reach mainstream attention. In the first half of 2021, NFT sales on Ethereum totalled over $1.3 billion.

The rich, famous and influential began collecting or issuing NFTs in 2021, with monthly sales volume in May reaching $360 million. Shortly thereafter, a deep downturn in the cryptomarkets briefly ended the NFT euphoria, causing daily volumes to drop significantly — up to 90% from their highest levels according to data from NonFungible.com.[39] Also, according to data from NonFungible.com, **by July, NFTs rebounded and once again reached record-breaking highs, astonishingly attaining $2.6 billion in total volume in August on Ethereum alone**.

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[36] More information on NFT market history and trends here

[37] Learn more about CryptoKitties trades history here

[38] See "CryptoKitties Transaction Network Analysis: The Rise and Fall of the First Blockchain Game Mania", Xin-Jian Jiang and Xiao Fan Liu, *Frontier*, March 3, 2021

[39] See "NFT sales down 90% since market peak", Greg Thomson, *Cointelegraph*, June 3, 2021

Figure 14 /

NFT Average Monthly Transaction Size (Volume vs. Sales) over time on Ethereum
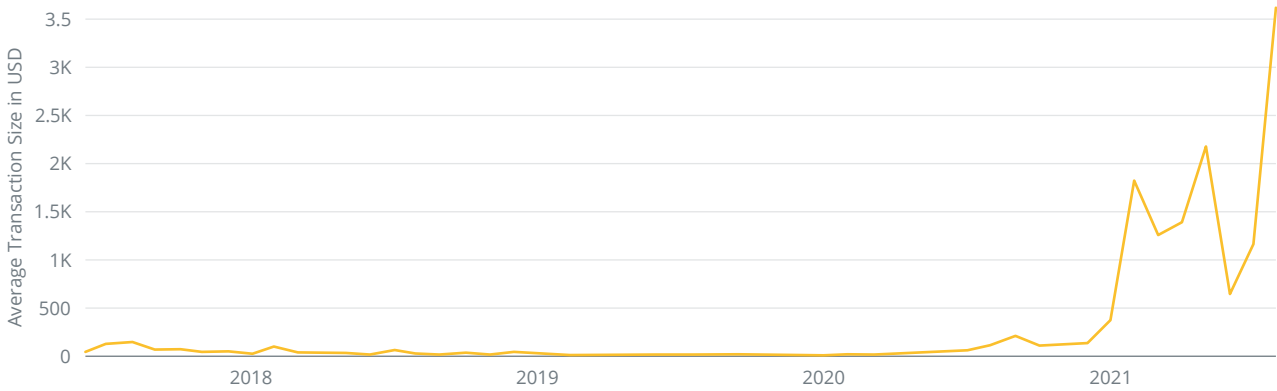
Cointelegraph Research

While Ethereum continues to dominate NFT market activity, there is interest growing in alternative layer-one blockchains due to their cheaper transaction fees and faster block times. According to data from DappRadar.com, Ethereum holds approximately 80% of NFT sales volumes in 2021, but only 37% of total NFT traders. This is a reflection of the higher average NFT valuations on Ethereum due to the large transaction fees. Flow and Wax both hold a large share of total traders, 32% and 25%, respectively, but with significantly less volume. Their cheaper transaction fees enable more regular-, lower-priced NFT transactions and reflect their use cases for high-volume applications such as games.

Figure 15 /

Total NFT Volume and Traders by Blockchain 2021 YTD (January to August)
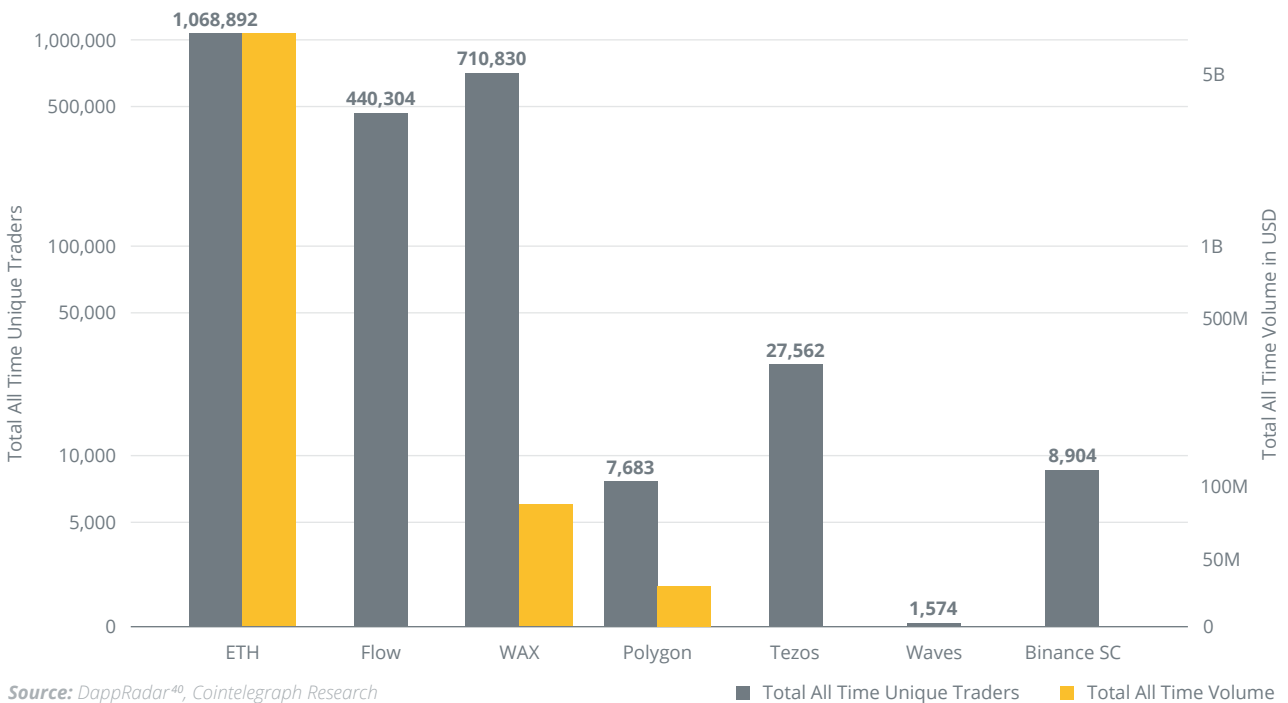
Cointelegraph Research

A breakdown of transactions by popular NFT categories, discussed in section 1.3, reveals that early sales were dominated by collectibles such as CryptoKitties and CryptoPunks. In late 2019, the gaming NFT category surged in transaction count, as player bases expanded on games, such as F1 Delta

[40] DappRadar data reports significantly different numbers to NonFungible.com. DappRadar estimates total ETH sales for 2021 to be $7.6 billion rather than NonFungible.com's $4.6 billion.

Time, Gods Unchained and Decentraland. In mid 2020, the number of transactions for sports and metaverse NFT projects began climbing as these platforms increased in popularity. Around the same time, art NFTs also drew increased attention, peaking in January 2021 with Beeple's record-breaking sales. Although the overall share of transactions for collectibles has decreased, they still dominate total sales volume and leading projects by a significant margin. The art category follows behind collectibles in sales volumes, reflecting the similarly high valuations in the art and collectibles categories.

Figure 16 / **NFT Monthly Sales Count by Category**

Source: NonFungible.com, Cointelegraph Research ■ DeFi ■ Game ■ Sports ■ Art ■ Utillity ■ Metaverse ■ Collectible
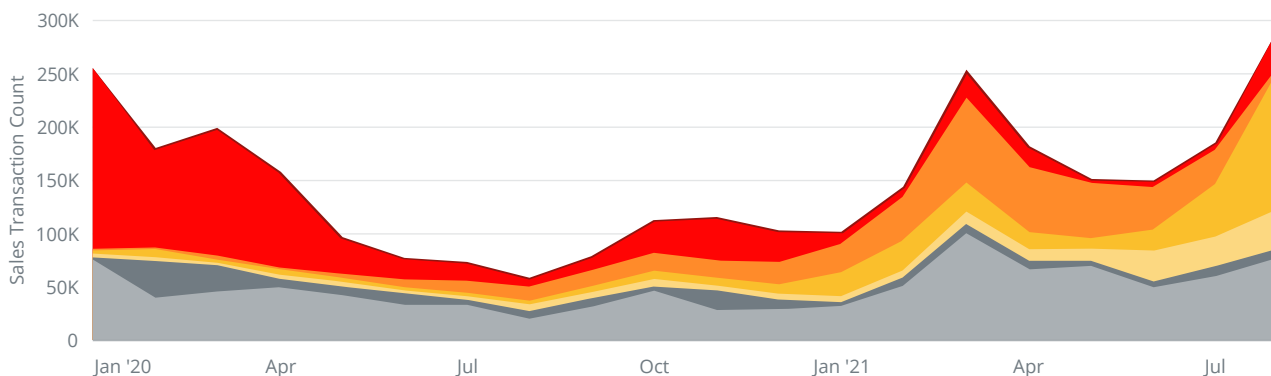
Figure 17 / **NFT Monthly Sales Volume in USD by Category**

Source: NonFungible.com, Cointelegraph Research ■ DeFi ■ Game ■ Sports ■ Art ■ Utillity ■ Metaverse ■ Collectible
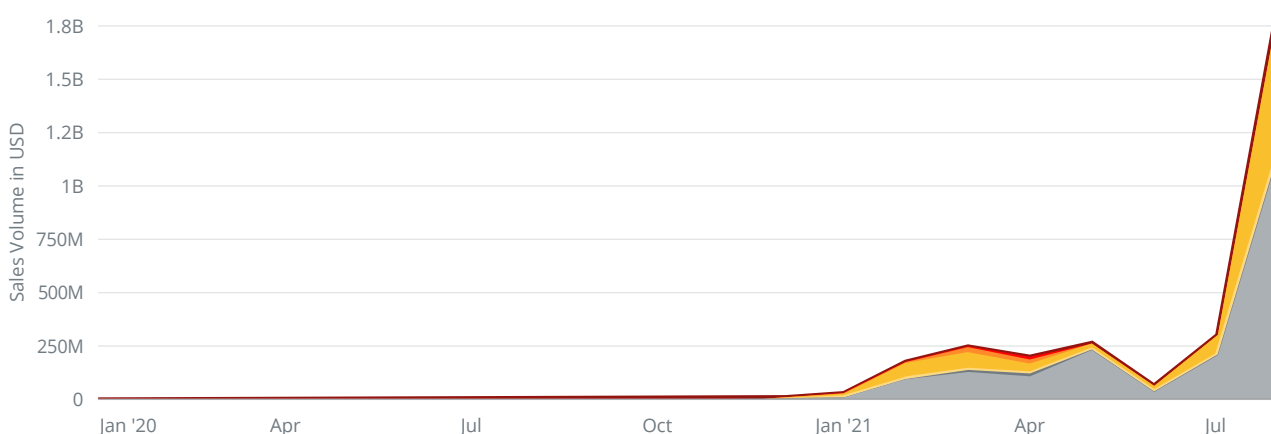
Figure 18 / **Top 5 NFT Projects (by Total Sales Volume since 07/2020)**

Source: NonFungible.com, Cointelegraph Research

— Cryptopunks — Artblock — Boredapeclub — Meebits
■ Cryptopunks (RHS) ■ Artblock (RHS) ■ Boredapeclub (RHS) ■ Meebits (RHS)
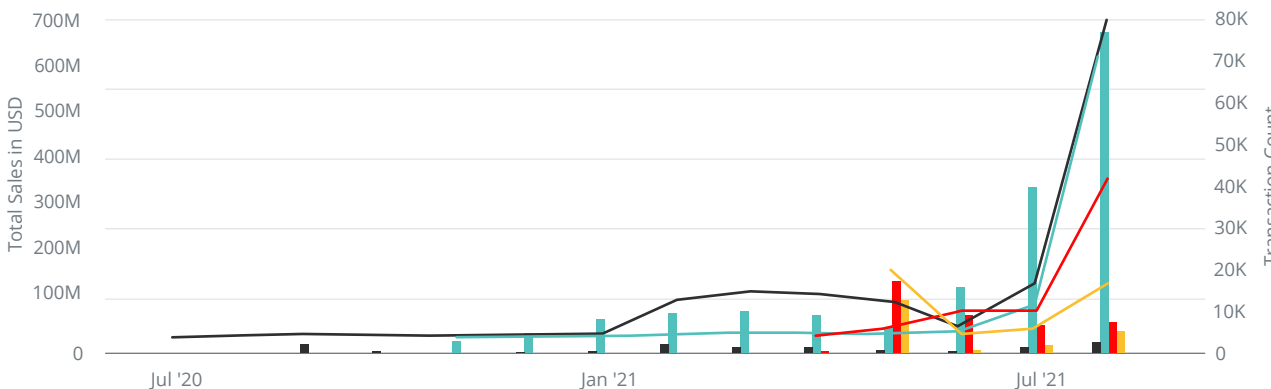
Marketplaces facilitate NFT sales and auctions. Many of these marketplaces operate as DApps, meaning users retain full custody of their funds and NFTs but may incur gas costs for trading. Sale volumes of top marketplaces have seen spectacular growth with the NFT market, led by Ethereum DApps OpenSea and Rarible. However, the growth of these platforms has been limited by high transaction fees on Ethereum,

and competitor marketplaces on alternative, cheaper blockchains are garnering more of the market share. Hic et Nunc on Tezos and SCV.finance on Binance Smart Chain are two examples of such rapidly growing competitors. Figure 13 demonstrates how the Tezos blockchain enables a higher volume of NFT transactions compared to its Ethereum-based counterparts.

Figure 19 / **Top NFT Marketplace Volume and Transaction Count (per Month)**

Source: DappRadar, Cointelegraph Research
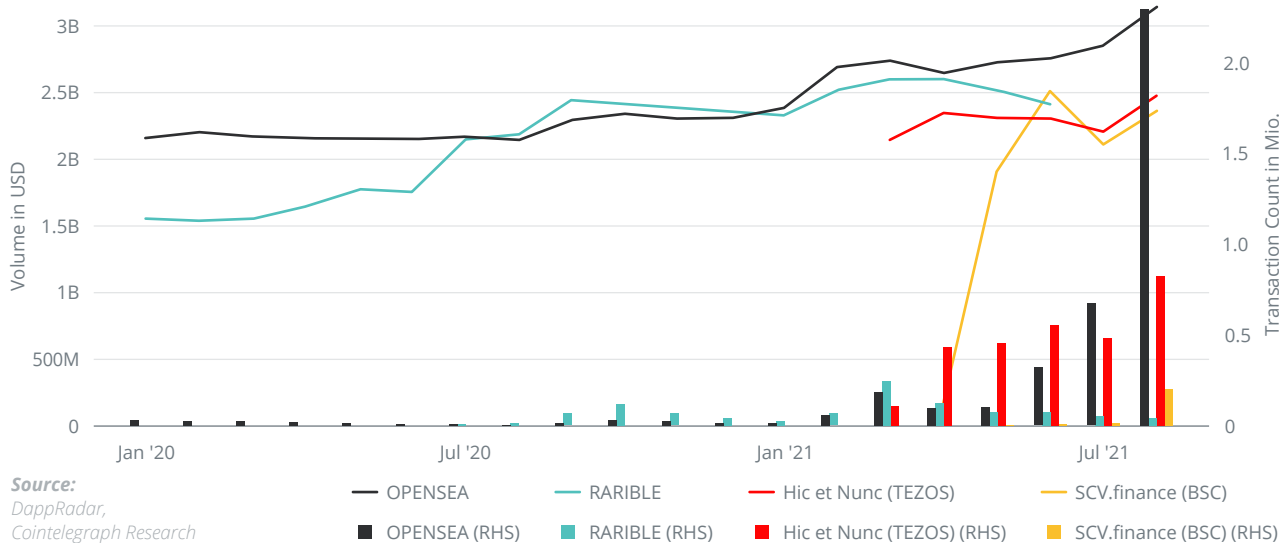
NFTs are stored in cryptocurrency wallets, which are visible on the blockchain along with all transactions. Many wallets are dormant, having been abandoned or whose keys have been lost, whereas active wallets have recent transactions. One wallet may own multiple NFTs, so the following figures demonstrate unique buying wallets over time on the Ethereum blockchain. Besides the number of transactions and the volume of traded NFTs in U.S. dollars, market activity also has to be evaluated in the context of the Ethereum ecosystem. As any transaction of NFTs involves Ethereum wallets, more market activity will likely be correlated with an increase in the number

of active wallets on the Ethereum blockchain. To get a proxy of NFT market activity that goes beyond simply a general increase of activity in the Ethereum ecosystem, we can look at unique addresses that purchase NFTs relative to all active wallets on the blockchain. As depicted in Figure 5, NFT activity in the first half of 2021 surpassed previous peaks and skyrocketed to unprecedented heights. With the share of unique NFT buyers relative to all Ethereum wallets increasing, one can argue that the importance of NFTs has not only been driven by the USD price of ETH but by the growing number of active market participants. Participation in NFTs on Ethereum is clearly on the rise.

Figure 20 / Ethereum Price and Unique NFT Buyers Relationship[41]

Source: *CoinMetrics, NonFungible.com, Cointelegraph Research*

— Price USD — Unique NFT Buying Wallets as Share of Active Wallets
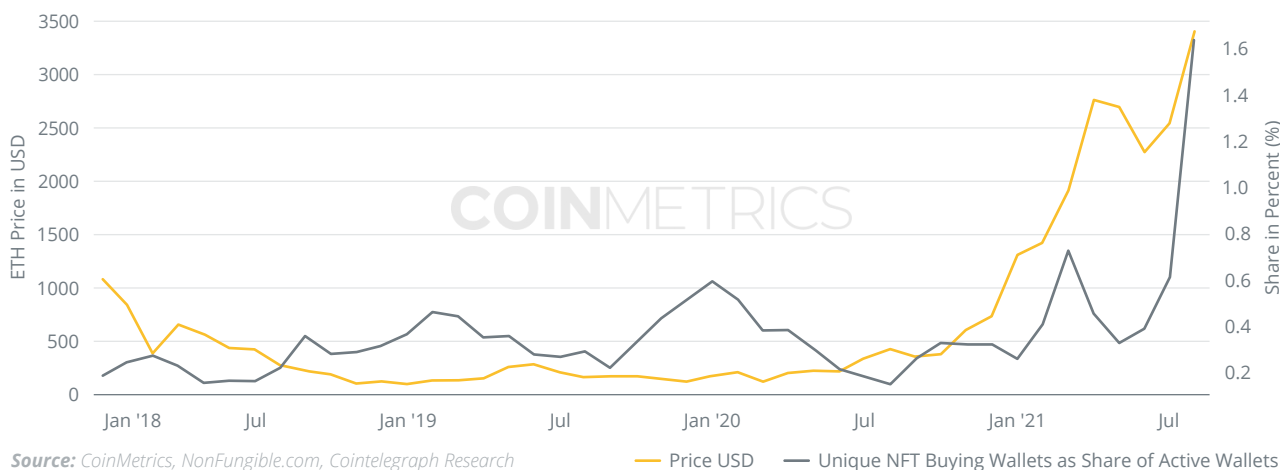
In absolute terms, the number of unique NFT buyers has increased substantially this year. Unique wallet addresses that bought NFT assets in the first half of the year spiked to more than 4,000 in one day, a figure that continues to grow and passed 8,000 in August.

Figure 21 / Unique NFT Buyers on Ethereum

Source: *NonFungible.com, Cointelegraph Research*

■ Primary ■ Secondary
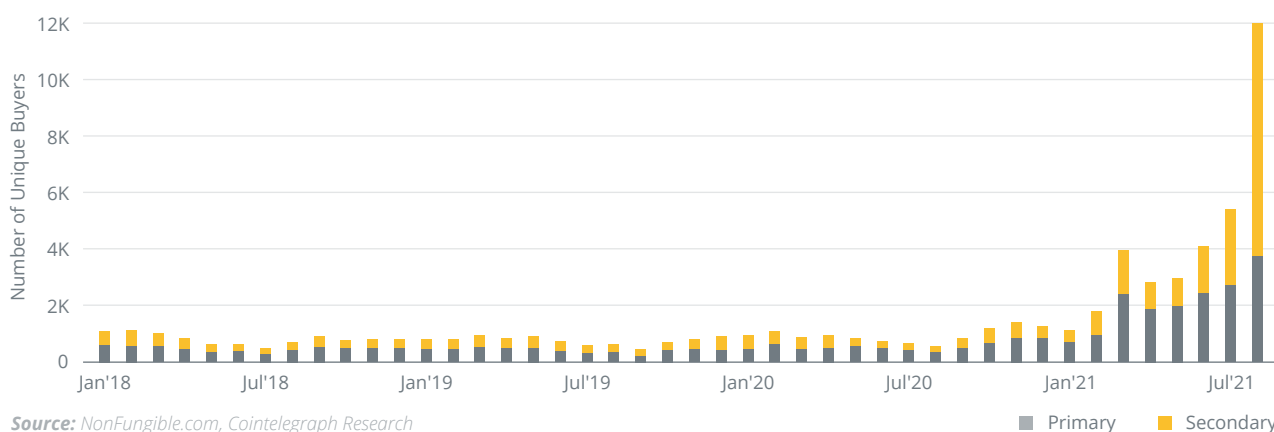
Figure 22 / Unique NFT Sellers on Ethereum

Source: *NonFungible.com, Cointelegraph Research*

■ Primary ■ Secondary
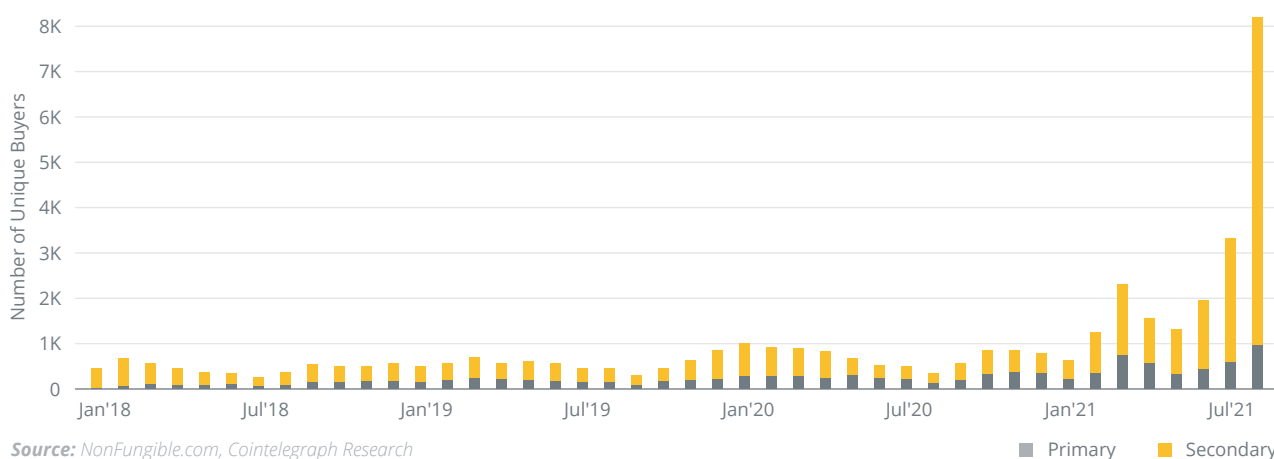
[41] *Ethereum Price* on last day of month, *Share of Unique NFT Buyers* as monthly average

Unique NFT buyers increased significantly in August, with participation in secondary market transactions leading the charge. This demonstrates that the resurgence of NFTs in the second half of 2021 was driven by secondary market sales rather than new NFTs entering the market. Figure 18 reflects this increase in secondary market sales through marketplaces, particularly OpenSea on Ethereum, but recently alternative blockchains, too.

There is some evidence that, despite the NFT hype, the distribution of sales and revenue across the market is unequal. One study sampling a weeks worth of NFT data[42] found that the majority of primary sales were for under $300, with 34% under $100. **When selling NFTs for less than $100, the price paid to host an auction, as well as the gas fees, could cost more than the NFT itself.** This analysis also found that over 85% of NFTs sell fewer than three times, calling into question the efficacy of secondary market royalties as a means of ongoing artist revenue and further demonstrating the low liquidity of NFTs.

Learn NFT Liquidity

There isn't a market for "Mona Lisa" paintings because there is only one "Mona Lisa." Similarly, NFTs have a low level of liquidity compared to fungible currencies for multiple reasons. One reason is that collectors often wish to keep their NFTs rather than trade them on speculative markets. Another reason is that NFTs are traded bilaterally on marketplaces, with a small pool of potential participants for each sale. For example, a sports card NFT of a specific player might only be in demand by a subgroup of collectors. Furthermore, not every NFT is a perfect substitution for another NFT. If, for example, little Mikey wants a 1988 Michael Jordan NFT for his birthday but gets a 2014 Lebron James instead, little Mikey might not be very happy. Due to the difficulty of comparing different NFTs being offered by sellers and the low number of bids being made by buyers, there is a low number of total transactions. This low turnover makes it more difficult to determine each NFT's value.

For fungible assets, such as stocks and shares, liquidity can be measured by dividing the total number of shares traded during a particular period (such as a month) by the average number of shares outstanding for the same period. The higher the share turnover, the more liquid a company's shares are. But how would you go about measuring the liquidity of a unique nonfungible asset?

For markets with low transaction volumes per item such as real estate or collectibles, the two main types of liquidity measures include "**time on the market**" and "**level of transaction activity**."[43] For example, real estate liquidity can be measured by the average time between a home being listed and when it is sold. In NFT terms, this would be "average time between when the NFT was listed on a secondary market and when it sold."

The second type of liquidity measure calculates the level of transaction activity. For example, NonFungible. com measures NFT liquidity by the percentage of the total supply of a specific type of asset that has been traded on secondary markets. This can be calculated by dividing the volume of unique assets that have been traded on the secondary market by the total supply available for each type of asset.

A study using SuperRare market data shows the distribution of sales volume using a Lorenz curve model, as shown in Figure 19 below.[44] The diagonal line represents perfect equality of volume among sellers. The Lorenz curve for NFTs shows, in contrast, an approximate Pareto principle distribution: 75% of the sales volume is associated with the richest 25% of sellers.

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[42] See "Most artists are not making money off NFTs and here are some graphs to prove it", Kimberly Parker, April 19, 2021

[43] See "Which Factors Determine Liquidity Across US Metropolitan Office Markets?", Steven Devaney, Pat McAllister, Anupam Nanda, *University of Reading*, 2015

[44] See "The Inconvenient Truth About Secondary Markets, Part II", Massimo Franceschet and Sparrow Read, *DADA.art*, Dec. 14, 2020

Figure 23 / Lorenz curve for NFT Sellers

Figure 24 / Shares of volume for NFT artists and collectors

Artist Share   Collector Share

This study also shows that collectors are taking a larger share of NFT artists' volumes in the secondary markets. This means that artists creating NFTs are owning a smaller proportion of the transactions associated with artwork, with collectors increasing their share of revenue volumes. Beginning in January 2020, artists' share dropped from a previously consistent 90% down to 75% in July of the same year. Assuming this trend continues, along with a royalty rate of 20%, the study predicts that collectors' share will overtake artists' share in late 2022.

Global Awareness

Key Takeaways

▪ The majority of NFT users in 2021 are cryptocurrency natives.

▪ NFT games and collectibles are reaching global audiences.

▪ Respondents in developing nations are more likely to use NFTs for financial gain compared to developed nations.

NFTs are often touted as a blockchain application that appeals to the mainstream. Despite many celebrities, music artists and corporations hyping NFTs, a recent survey found that the majority of NFT users are cryptocurrency natives. In November 2020, Crypto.com's survey on 30,000 international respondents indicated that 53% of participants had not heard of NFTs. Of those who had heard of NFTs, nearly 60% had never used them, with the full breakdown shown in Figure 25 below. Of those who had used NFTs, 74% also used DeFi.[45] This indicates that the majority of NFT users are cryptocurrency natives.

Another U.S. survey from July 2021 suggests that NFT awareness is lower than previously measured. The results found that 66% of respondents had not heard of NFTs, and only approximately 2% of Americans have purchased or sold NFTs.[46] These surveys were conducted largely on crypto-native users, meaning the results could be upward biased. Yet clearly, NFTs are rapidly spreading across the globe. Respondents in developing nations were more likely to use NFTs for financial gain compared to developed nations, who were more interested in the technology. Projects such as Axie Infinity, Sorare and NBA Top Shot are showing the potential penetration of NFTs into a wider audience. Axie Infinity is seeing massive popularity in the Philippines,[47] NFT marketplaces are spreading throughout India,[48] and sports fan collectibles are reaching broad audiences.

Figure 25 / NFT Survey: Main Reasons to Use NFTs

Source: Crypto.com, Cointelegraph Research

Developed nations ▪ Emergent markets
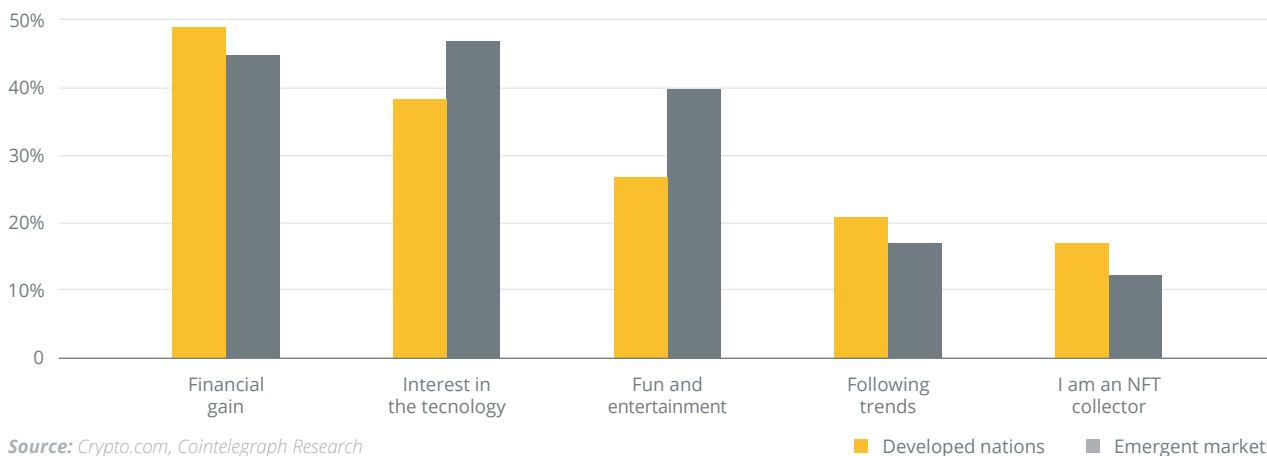
[45] See "Non-Fungible Token Survey: The Next Trend in Cryptocurrencies?", Kendrick Lau, *Crypto.com*, November 2020

[46] See "NFTs: Awareness, Familiarity, And Ownership", *Security.org*, June 3, 2021

[47] See "People in the Philippines are earning cryptocurrency during the pandemic by playing a video game", Christian Nunley, *CNBC*, June 27, 2021

[48] See "India's NFT space is growing almost as fast as cryptocurrencies did", India Bureau, *Business Insider*, Aug. 2, 2021

Figure 26 / NFT Survey: Usage of NFTs

Figure 26 / NFT Survey: Usage of NFTs

Category	Value
I have never used NFTs	~57%
I have used NFTs once or twice before but no	~19%
I use NFTs once every few months	~9%
I use NFTs a feve times a month	~5%
I use NFTs ones a month	~4%
I use NFTs daily	~3%
I use NFTs a few times a week	~3%
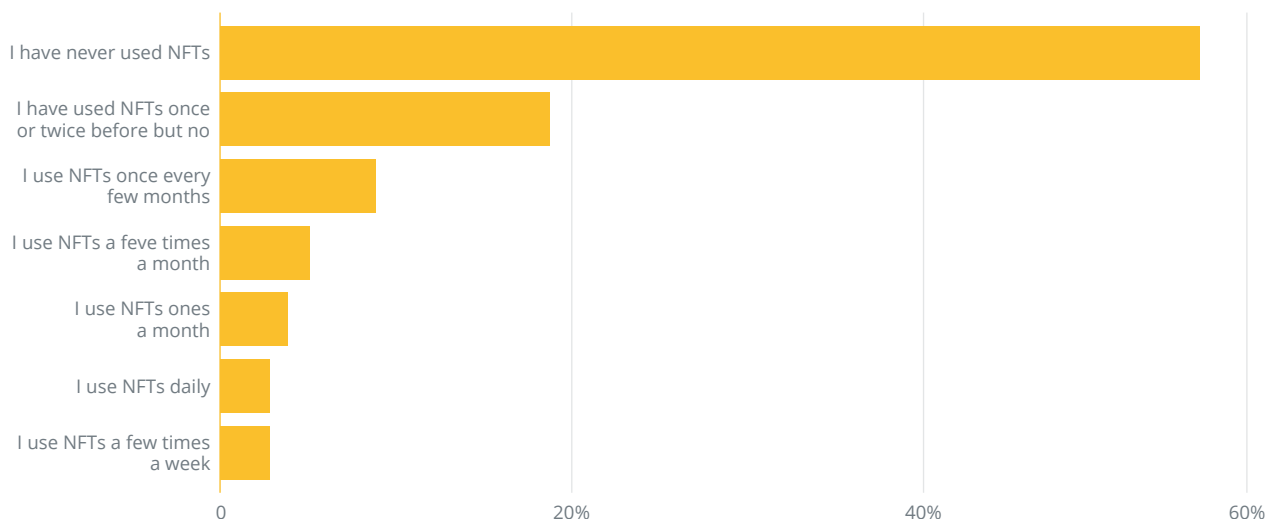
Source: *Crypto.com, Cointelegraph Research*

The growing global awareness is immediately obvious from search ratings of the term "NFT." As seen in Figure 26 below, search requests started to rise in January 2021 and soared throughout the rest of the first quarter. Searches then decreased substantially in May and June, reflecting the overall pullback in the crypto and NFT markets. However, interest quickly renewed in August as the market rebounded and Bitcoin recovered.

Figure 27 / Weekly NFT Google Search Trend
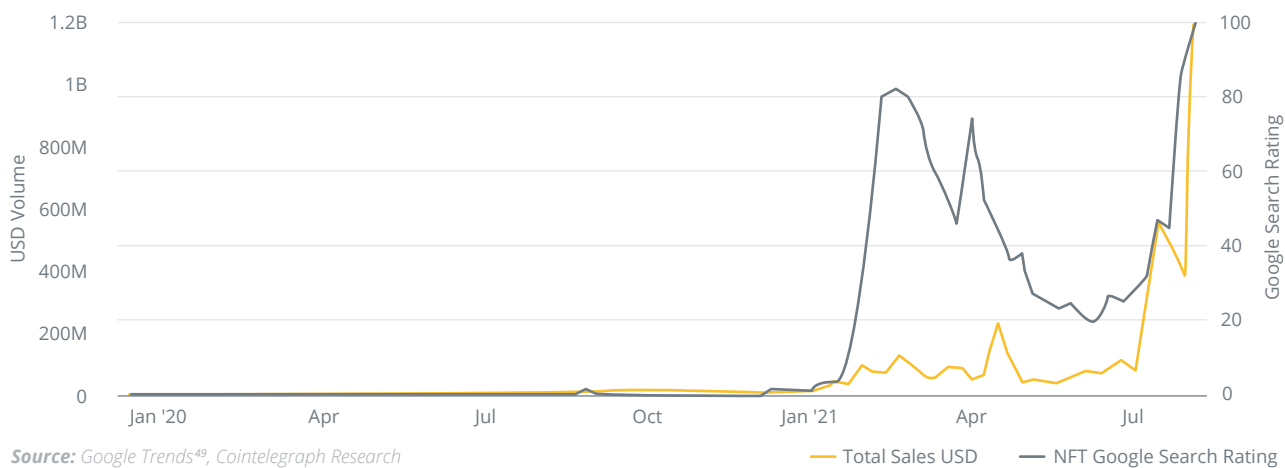
Source: *Google Trends[49], Cointelegraph Research*   — Total Sales USD — NFT Google Search Rating

[49] Google Trends assigns a value of 100 to the date with the highest search volume within the selected time period. Thus, all values are relative to this peak of interest.

Mintable is a next-generation non-fungible token (NFT) marketplace built on the Ethereum & Zilliqa (and soon, Ripple) blockchain. Launched in 2018, Mintable has pushed the NFT industry forward by being the first to design gasless minting, batch minting and royalties, empowering artists and creators to monetize their work via NFTs. Mintable's gas-free minting option allows the everyday person to get involved with NFTs without any prior knowledge in coding or upfront cost of minting an asset — a great way for everyone to get into crypto.

Why Mintable?

Gasless minting
No more high up-front costs of minting NFTs and the risk associated with it before selling and generating revenue

Purchase NFTs with credit cards
Anyone can buy your NFTs just like buying groceries off Amazon. No longer is NFTs just available to those who hold crypto

ART
Crypto Renaiss
Ξ0.150000
STYLEWISH

ART
MonaelonMUSK
Current Bid
Ξ0.208736
RYUZAKIL123

COLLECTIBLES
Bored ape Player
Ξ0.001092
SRINIVASAN7   👁 513
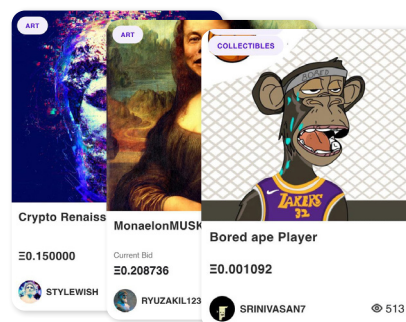
Pro Services
Advertising tool that allows creators to push their NFTs to the entire Mintable community via social media, emailers or press releases

Sellers University
Empowering the NFT creator economy. Learn how to market, promote and eventually sell your NFTs while building a brand and community

NFT Authenticity Verification Feature
Removing barriers associated with a lack of trust and transparency are a requisite for making the NFT marketspace truly accessible to everyone

To date, Mintable has worked with brands, celebrities, and artists looking to kickstart their NFT journey. Most notably, Mintable worked with NFL Jacksonville Jaguars quarterback Trevor Lawrence whose NFT collection sold on the platform for over US$400,000, leading streetwear fashion brand BAPE, and American business broadcaster CNBC which raised US$100,000 for charity via a Mintable NFT auction.

Mintable's goal is to democratise access to NFTs and make it available to a larger audience, both creators and collectors. That mission drives the team forward to focus their efforts on developing features that remove obstacles that are hindering the majority of the masses from getting involved in NFTs, accelerating the realization of a future where NFT technology truly becomes mainstream.

For more information, visit **www.mintable.app**

3 Business Breakthrough

3.1 Venture Capital Interest

Key Takeaways

🔖 Dapper Labs reached $357 million in total funding in 2021.

🔖 Venture capitalists have shown the biggest interest in NFT marketplaces and service providers.

Venture capitalists have also begun taking notice of the brewing NFT activity. Prior to the $100-million mega deal landed by OpenSea in July of this year, other marketplaces were also striking sizable funding of their own. NBA Top Shot operator Dapper Labs still holds the highest funded value with $357 million, secured on March 30 from a group of notable investors, including Andreessen Horowitz, Union Square Ventures, Will Smith, Michael Jordan, Kevin Durant and Spencer Dinwiddie.[50] Avatar startup Genies also landed big in May with $65 million in funding led by venture capitalist Mary Meeker's firm Bond.[51]

Figure 28 / Largest NFT VC Deals

Dapper 🇨🇦	OpenSea 🇺🇸	GENIES 🇺🇸	ONEOF 🇺🇸	sorare 🇫🇷	animoca BRANDS 🇨🇳
$305M In 2021	**$123M** In 2021	**N/A** In 2021	**$63M** In 2020	**$62M** In 2020	**$216.3M** In 2021
$357.5M Total	**$127.2M** Total	**$103.9M** Total	**$63M** Total	**$66.4M** Total	**$245.4M** Total

Dapper Labs is a consumer-focused Flow blockchain product made for fun and games and supports digital collectibles. Dapper Labs uses the power of play to deliver blockchain-based experiences and digital collectibles that are made for you and ready for the real world.

Notable Investors: Coatue, Andreessen Horowitz, The Chernin Group, Will Smith, Shawn Mendes, 2 Chainz
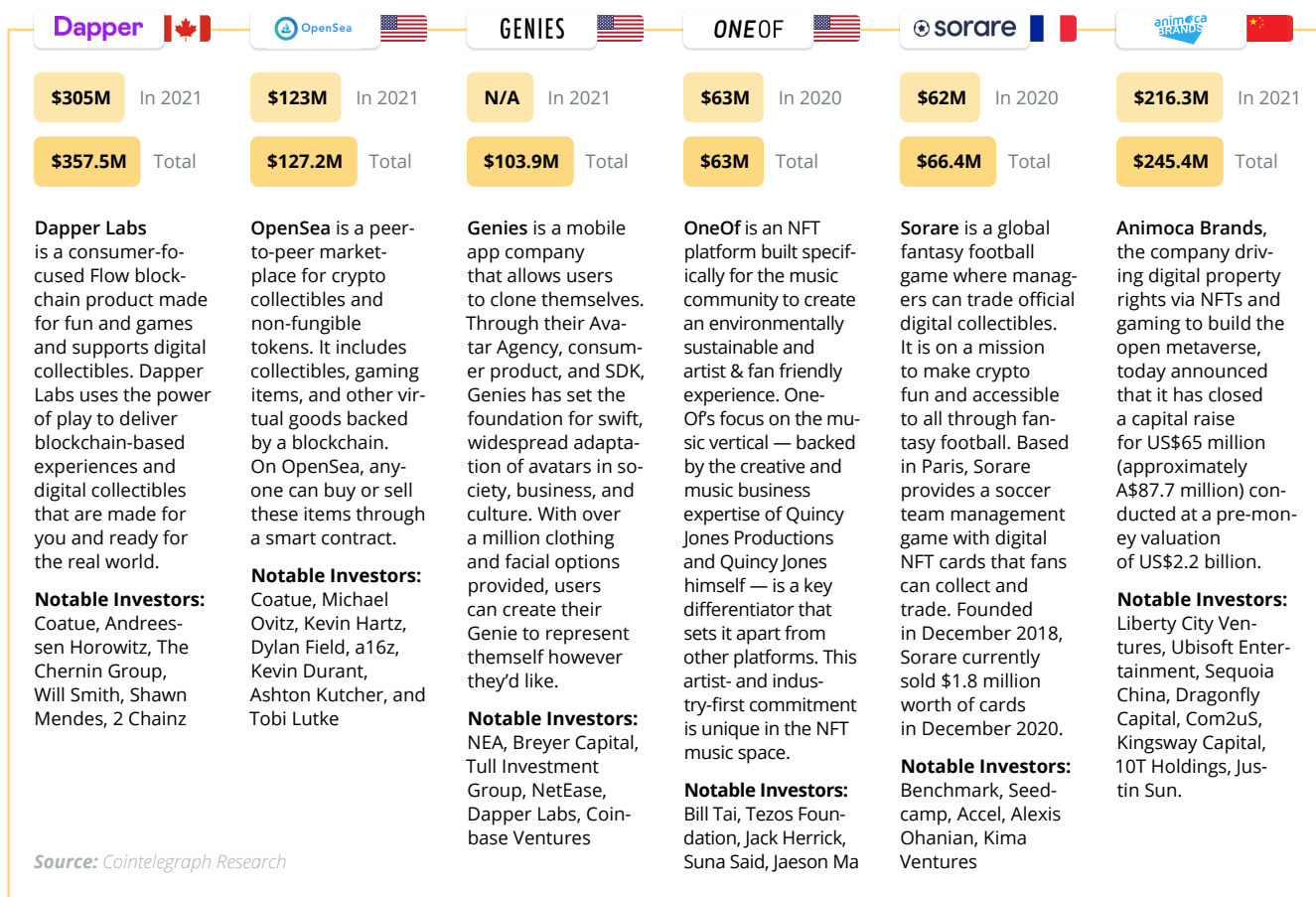
OpenSea is a peer-to-peer marketplace for crypto collectibles and non-fungible tokens. It includes collectibles, gaming items, and other virtual goods backed by a blockchain. On OpenSea, anyone can buy or sell these items through a smart contract.

Notable Investors: Coatue, Michael Ovitz, Kevin Hartz, Dylan Field, a16z, Kevin Durant, Ashton Kutcher, and Tobi Lutke

Genies is a mobile app company that allows users to clone themselves. Through their Avatar Agency, consumer product, and SDK, Genies has set the foundation for swift, widespread adaptation of avatars in society, business, and culture. With over a million clothing and facial options provided, users can create their Genie to represent themself however they'd like.

Notable Investors: NEA, Breyer Capital, Tull Investment Group, NetEase, Dapper Labs, Coinbase Ventures

OneOf is an NFT platform built specifically for the music community to create an environmentally sustainable and artist & fan friendly experience. OneOf's focus on the music vertical — backed by the creative and music business expertise of Quincy Jones Productions and Quincy Jones himself — is a key differentiator that sets it apart from other platforms. This artist- and industry-first commitment is unique in the NFT music space.

Notable Investors: Bill Tai, Tezos Foundation, Jack Herrick, Suna Said, Jaeson Ma

Sorare is a global fantasy football game where managers can trade official digital collectibles. It is on a mission to make crypto fun and accessible to all through fantasy football. Based in Paris, Sorare provides a soccer team management game with digital NFT cards that fans can collect and trade. Founded in December 2018, Sorare currently sold $1.8 million worth of cards in December 2020.

Notable Investors: Benchmark, Seedcamp, Accel, Alexis Ohanian, Kima Ventures

Animoca Brands, the company driving digital property rights via NFTs and gaming to build the open metaverse, today announced that it has closed a capital raise for US$65 million (approximately A$87.7 million) conducted at a pre-money valuation of US$2.2 billion.

Notable Investors: Liberty City Ventures, Ubisoft Entertainment, Sequoia China, Dragonfly Capital, Com2uS, Kingsway Capital, 10T Holdings, Justin Sun.

Source: Cointelegraph Research

[50] Learn more about investors in NFTs here

[51] See "Avatar startup Genies scores $65 million in funding round led by Mary Meeker's Bond", Lucas Matney, *TechCrunch*, May 3, 2021

NFTs, BRANDS, PROPERTY RIGHTS

building the open metaverse

Animoca Brands is one of the dominant forces in the world of NFTs and the emerging open metaverse. The company and its various subsidiaries deliver original games as well as games officially licensed by popular global brands such as Marvel, WWE, Power Rangers, MotoGP™, The Walking Dead, Formula E, and Snoop Dogg. Animoca Brands is also an investor in more than 100 of the leading NFT-related projects, helping to foster the advancement of the entire industry and adoption into the mainstream.

Mission

To deliver digital property rights to the world's gamers and Internet users, thereby creating a new asset class, play-to-earn economies, and a more equitable digital framework contributing to the building of the open metaverse.

Subsidiaries

THE SANDBOX · BLOWFISH · Lympo · Pixowl · TicBits
quidd · HELIX · nWay · Bondly · GAMEE

Major Projects

REVV MOTORSPORT · REVV RACING · MotoGP IGNITION · F1 DeltaTime · HIGH VOLTAGE · Arc8 by GAMEE
THE SANDBOX · PHANTOM GALAXIES · launchpad LUNA · UNDEFEATED · POWER RANGERS LEGACY WARS · CRAZY DEFENSE HEROES

Major titles in alpha / development

REVV Racing
(public alpha version)

Play-to-earn title in the **REVV** token metaverse of racing games, part of an ambitious plan to develop blockchain-based games with the quality and feel of traditional video games. Cars are NFTs and play sessions are registered on blockchain — but the game looks and plays like the 3D car racing games familiar to gamers all over the world.

Read More

revvracing.com

Phantom Galaxies
(coming soon)

Science fiction shared-world online third-person action RPG with stunning visuals and fast-paced action. When it launches in 2022, it will be a fully fleshed game featuring blockchain systems and NFTs to enable real player-driven governance and game asset ownership. Features a gripping story campaign of survival and dominance in a hostile galaxy, human and alien factions, thrilling space battles, atmospheric planetary missions, and good old-fashioned mecha rampages.

Read More

phantomgalaxies.com

NOT YOUR TYPICAL BLOCKCHAIN GAMES...

Enterprise Use Case

Key Takeaways

🔖 Real estate, licensing and event management are established NFT enterprise use cases in 2021.

🔖 In August 2021, Alibaba launched an NFT marketplace for intellectual property licensing.

Beyond the hype of collectibles and digital art, NFT technology is seeing a rise in enterprise, venture capital and institutional interest. Popular incarnations of NFTs today do not fully leverage the potential value of smartdeed technology and, for this reason, will not drive industry growth long term. Similar to cryptocurrencies, there are many enterprise applications that bring value through disintermediation, network effects and trustless coordination. NFT technology enables enterprises to create digitally valuable assets that are programmable, unique and liquid. This means innovative digital functions and sophisticated monetization frameworks can be baked into the tokens. Issuers imbue their NFTs with value from an enterprise or industry ecosystem; this value is then exclusively available to NFT holders. This exclusive value is also liquid, as the NFT can be exchanged with near-instant settlement using blockchain technology.

Figure 29 / Enterprise use case

Application	Example
Supply Chain NFTs can be used to digitally represent a physical asset in a supply chain. This representation contains trustless provenance, immutable product data and, combined with the Internet of Things (IoT) technology, forms a digital twin model. This is proving to be valuable in supply chains where products cross many jurisdictions and participants. Trustless and efficient interactions between parties is crucial when it comes to profit margins in the supply chain industry.	MarketsN from KoineArth[52] is a platform that was developed to enable corporations to digitize and attach immutable data to documents and goods in the form of NFTs. KOINEARTH [markets]N
Real Estate Property sales through financial institutions is an arduous, bureaucratic process. This is partially due to widespread deed fraud and the necessary mitigating security measures. NFTs offer immutable proof of ownership with built-in provenance and near instant transferability settlement. This technology can expedite the property sales process, introduce liquidity, and reduce the potential for deed fraud.	Propy was the first company to list an apartment using NFT technology in 2017.[53] This apartment was bought by TechCrunch CEO Michael Arrington, who went on to sell the apartment for $90,000 on Propy in 2021. PROPY

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[52] See "KoineArth launches marketsN, one of the world's first enterprise-grade NFT platforms", PrNewswire, *Finanzen.at*, May 12, 2021
[53] Learn more about Propy NFT here

Application	Example

E-commerce

E-commerce goods can be represented or accompanied by NFTs with digital functionality. This includes authenticity verification, provenance and loyalty benefits. Not only does this reduce fraud, it opens up new avenues of consumer engagement. Luxury goods, limited edition items, commodities and collaborative products are commonly found in this category.

4k.com is a leader in physical NFT sales with regular auctions for watches, shoes, tech and other luxury goods. In 2019, Nike created a system that used NFTs to represent sneakers, enabling buyers to "breed" new variants by digitally crossing designs.[54]

Intellectual Property and Licensing

Tokenized intellectual property is easier to exchange, track and issue compared to traditional forms. All intellectual property owners, their license periods and conditions are visible on the blockchain. Through this immutable ledger and trustless provenance, violations and fraud are easily identifiable. Tokenized intellectual property may lead to an open market for venture capitalists to buy patent rights from startups and innovators.

IBM collaborated with IPwe to develop the infrastructure for representing patents in the form of NFTs and keeping the records on a distributed ledger.[55] Alibaba has recently announced its NFT marketplace for intellectual property licensing, which has numerous products listed.[56]

Qualifications and Credentials

Qualifications fraud, theft and forgery have long plagued the education industry.[57] The advent of online learning has only made it even more difficult to prevent fraud. NFTs on a blockchain ledger can represent an immutable list of certified holders, allowing employers or educational institutions to check against the ledger and easily spot qualification fraud. As online education grows due to the COVID-19 pandemic, NFTs can help create new industry standards for digital certification.

Educational platform BlockDegree[58] issues certificates that can be minted as NFTs. The marketplace for such tokens is currently running an alpha-test on the company's website.

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[54] See "NFTs, explained", Mitchell Clark, *The Verge*, Aug. 18, 2021
[55] See "IPwe and IBM Seek to Transform Corporate Patents With Next Generation NFTs Using IBM Blockchain", Anthony Colucci and Brian Berman, *IBM*, April 20, 2021
[56] See "Alibaba launches NFT marketplace for copyright trading", Brian Quarmby, *Cointelegraph*, Aug. 17, 2021
[57] See "An Introduction To Qualification Fraud", *Fraud Advisory Panel*, January 2020
[58] More about Block Degree here

Application	Example

Identity Management

NFTs can represent an individual's unique digital identity, which is immutably stored on-chain. This reduces identity fraud and enables exclusive digital functionality for the identity owner. On a blockchain, identity is tied to a wallet, but for many applications, this wallet must link to a person's identity. NFT identity management synergises with intellectual property, qualification and software licensing enterprise applications.

Nasdaq-floated WISeKey has announced a strategic partnership with CasperLabs and filed patents to integrate NFT technology into its digital identification solutions.[59] Similarly, SmartAxiom is developing enterprise NFT solutions for digital asset ownership and identity.[60]

Insurance

NFTs can give rights to financial benefits to the holder, including insurance. NFT insurance rights can be sold on secondary markets unlike legacy implementations. Insurance issuers benefit from the immutable transaction history, reduced fraud and programmable features. Insurance seekers benefit from reduced bureaucracy, decreased premiums and increased liquidity in secondary markets.

NFT insurance is offered by Yearn. finance's yInsure products, underwritten by Nexus Mutual.[61] YInsure NFTs give the holder the right to claim covered funds in the case of hacks or technical exploitation across various DApp and Web 3.0 platforms.

Event Management

Event management and particularly ticketing[62] are upcoming enterprise applications of NFTs. NFTs enable new forms of customer engagement, improved digital ticketing and additional revenue streams. Blockchain-based ticketing reduces ticket fraud and enables a native secondary market. Not only does this disempower black-market ticket sales, fraud and scalping but it also enables transaction fee revenue. Tickets as nonfungible or semifungible tokens are tradable assets that may be considered collectible[63] and can increase in value over time. NFT tickets also open up opportunities for customer engagement, such as collecting and combining tickets for redeemable prizes. This extends to loyalty benefits, lottery-style giveaways and broader gamification.

NFT event management is spreading quickly in the industry with ticketing projects such as Blocktix[64] and Bam[65] leading the charge. Kred[66] is offering a white label solution for artists that includes event management, ticketing, a marketplace and NFT minting services.

Source: *Cointelegraph Research*

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[59] Learn more about The WISeKey Blockchain here

[60] More information on SmartAxiom NFT solution here

[61] See "A Mixture of DeFi, Insurance and NFT Mining?", *Dapp.com*, Oct. 9, 2020

[62] See "How Can NFT Ticketing Disrupt The Ticketing Industry?", Akash Takyar, *LeewayHertz*

[63] See "eBay's 2021 "State of Trading Cards" Report Spotlights Collecting Trends and Industry Predictions", *eBay*, Feb. 11, 2021

[64] Learn more about Blocktix here

[65] More info on Bam ticketing solution here

[66] More about NFT Kred platform here

ONEOF

OneOf is an NFT platform built specifically for the music community to create an environmentally sustainable and artist & fan friendly experience. OneOf's focus on the music vertical - backed by the creative and music business expertise of Quincy Jones Productions and Quincy Jones himself — is a key differentiator that sets it apart from other platforms. This artist- and industry-first commitment is unique in the NFT music space.

Doja Cat, H.E.R., Quincy Jones, Whitney Houston, TLC, Charlie Puth, Jacob Collier, G-Eazy, AURORA, The Kid LAROI, Alesso and many more will all release NFTs in the form of collectible music, art, and experiences on the OneOf platform, which will launch to the public **in August 2021**.

OneOf's Emerging Artist Spotlight program reinforces this commitment to the democratization of music and NFTs. While OneOf's first drops are with major name artists, it's commitment to artists - and ultimately, the value of creativity for artists and fans alike - is a key thread that runs through the project as a whole. This "levelling of the playing field" in the music space resonates with the high level motives behind blockchain in general.

> "Blockchain has the ability to democratize ownership and bring economic empowerment to both artists and fans. We are building a technology company with an artist-first ethos and eco-conscious mission to help introduce hundreds of millions of non-crypto native users to blockchain through easy and exciting use cases such as NFTs."
>
> *— Lin Dai, CEO and Co-founder of OneOf*

OneOf builds industry leading Music NFT platform on Tezos, the energy efficient, self-evolving blockchain. OneOf was made with a mission of environmental sustainability, using over 2 million times less energy than most other NFT platforms. Unlike Ethereum minting costs, which can be upwards of $150 per NFT, crucial to OneOf's accessibility is their guaranteed $0 minting fee, made possible by the low transaction costs on the Tezos blockchain. This enables artists to release an NFT at any value of their choosing without having to pay a fee first. This way, artists can release both headline-making "OneOf One" collectibles, but also hundreds or thousands of NFTs priced at $5, or even free if they choose. Deeply committed to a sustainable blockchain future, OneOf will also donate a percentage of its platform revenue from every sale to either a charity of the artist's choice, or an environmental cause partner.

"OneOf is lowering the friction to a more engaging relationship between artists and their communities by leveraging modern technologies," says Bill Tai, one of the earliest investors in Zoom, Dapper Labs, Canva, Wish.com, Treasure Data and more. "By using Blockchain, meaningful experiences - previously not easy to deliver, can be unlocked on OneOf."

Details of OneOf's platform were first revealed in May, with coverage ranging from Rolling Stone, Variety, Billboard, Forbes, Los Angeles Business Journal and Uproxx to Engadget and Bloomberg.

In May 2021 OneOf completed a $63 million seed round from prominent tech and music industry veterans including famed VC and environmental activist Bill Tai, Suna Said of Nima Capital, participated by ESG fund Sangha Capital, seasoned tech investor Jack Herrick, Tezos Foundation, Jaeson Ma, founder of East West Ventures and co-founder of 88rising, and others.

This summer, OneOf was also selected as the preferred NFT partner of the *Right Here, Right Now Global Climate Alliance*, which works with global partner United Nations Human Rights to advocate for urgent action to protect the rights of people around the world suffering from the devastating effects of climate change.

OneOf was co-founded by tech entrepreneur **Lin Dai**, digital media executive **Joshua James**, and music industry veteran **Adam Fell**, in partnership with **Quincy Jones** and **Quincy Jones Productions**:

Lin Dai   Joshua James   Adam Fell

4 Creating NFTs

4.1 Seven Steps to Minting Artwork

Key Takeaways

- Anyone can design and create NFTs via minting services and marketplaces.
- The layer-one blockchain and transaction costs are a significant consideration for NFT minting.

Do you want to create an NFT? Anyone can. NFTs can be created just for fun, for research purposes, or in order to sell to others. **Anything that can be uploaded digitally can be turned into an NFT.** This includes a JPEG file, a scanned copy of a Rolex certificate of authenticity or a PDF file.

The online shopping website Shopify recently launched a way to create NFTs without touching blockchain technology. Therefore, if content creators wish to skip the following steps and just stick to what they do best, Shopify would be the way to go.

Step 1: Choose a Blockchain
Each blockchain has its own NFT ecosystem, which includes token standards, compatible wallets and marketplaces. For example, NFTs created on Binance Smart Chain generally cannot be sold on a marketplace built on Ethereum. This means that creators will need to do some research on which blockchain ecosystem will best serve their project. Major considerations include liquidity, minting services and transaction costs.

> ### Learn Printable NFT Series
>
> This is when many NFTs are created at once in a series. An example is the series of 10,000 unique NFTs created by Enjin in collaboration with Cointelegraph for this report.

Step 2: Set up a wallet
The next step in NFT creation is to set up an Ethereum wallet such as MetaMask, a Coinbase Wallet or a Trust Wallet. All non-custodial software and hardware Ethereum wallets support NFTs; however, custodial exchange accounts may not unless explicitly stated. In the case of Ethereum, creators will also need to buy between $70 and $100 of ETH to pay for minting fees on the blockchain. This can be reduced with layer-two solutions such as Polygon, which is supported on OpenSea. Other NFT-supported blockchains such as Tezos have lower NFT minting fees. A popular NFT-enabled wallet on Tezos is Temple.

Step 3: Design your NFT
To turn a physical work of art into an NFT, the creator

must upload a photo of the artwork or a recording of a performance in order to create a digital file. The physical artwork along with the digital NFT that gets recorded on the blockchain can then be sold online. Since NFTs are programmable, their design and functionality can become arbitrarily sophisticated. Many minting services offer options for enhancing NFTs, such as unlockable content or attributes for collectibles.

Step 4: Mint your NFT
To record the content on a blockchain or to "mint" the NFT, the creator must connect their wallet to the marketplace of their choice. The marketplace will prompt the creator to upload a file representing ownership of the NFT. Once the NFT is minted, no changes to the original file can be made; therefore,

the content's title and description must be accurate. The final steps include signing the NFT and approving the gas fee. Keep in mind that the transaction that records the NFT on the blockchain will take some time. How much time depends on how much the creator paid in gas fees. Once the NFT is minted, the creator can see the NFT in their wallet and also via blockchain explorers.

Marketplaces such as Mintable and OpenSea have a "**gasless**" option, which means you can mint an NFT without any transaction occurring on the blockchain and, therefore, without paying Ethereum gas fees. The way this works is that Mintable attaches the creation of the NFT to the first transaction associated with the NFT. In other words, the NFT is created in the same transaction that occurs when the NFT is sent to the eventual buyer's wallet. This way, the content creator can push the transaction fee associated with creation onto the buyer of the NFT. Allowing the buyer to pay

for the gas fees thus enables any artist to create content without facing a financial barrier to entry.

For content creators who would like to directly mint their NFT on the Ethereum blockchain without relying on a buyer to pay for the gas fees, the normal Ethereum gas fees will apply. Regardless of which marketplace is used, gas fees for minting will be automatically sent from the marketplace to the MetaMask wallet. Ethereum gas fees for minting an NFT can be hundreds of dollars, depending on the congestion on the Ethereum network. This behooves creators to check the gas fee on a site like ethgasstation.com or ethereumprice.org/gas prior to minting.

In addition to Ethereum gas fees, marketplaces charge fees when NFTs are sold. As shown in Figure 29, Mintable charges 2.5% on normal NFTs, 5% on gasless NFTs and 10% on printable series NFTs.

Figure 30 / NFT Marketplace Fees

| Platform	Main Login	Credit / Debit Card	Unlockable / Hidden Content	Content Storage	Split Payments & Royalties	Utility / Gov Token	Initial Sale Fee (platform)	Secondary Sale Fee (platform)	Networks
OpenSea (Open)	Wallet	Yes	Yes	Centralized	No	No	2.50%	2.50%	Ethereum, Polygon
R (Open)	Wallet	No	Yes	IPFS	No	Yes (RARI)	2.50%	2.50%	Ethereum
M (Open)	Email	No	Yes	Centralized	No	Yes (MINT)	2.5% / 5% (Gasless)	2.5% / 5% (Gasless)	Ethereum, Zilliqa
Cargo (Open)	Email	No	Yes	Centralized	Yes	Yes (GEM)	2.50%	2.5% / 5% (Gasless)	Ethereum, xDAI, Polygon
(Open)	Wallet	Yes	Yes	Arweave	Yes (only Near)	No	2%	2%	Ethereum, Near
ZORA (Open)	Wallet	No	No	IPFS	No	No	0%	0%	Ethereum
SuperRare (Curated)	Wallet	No	No	IPFS	No	No	15%	0% (+3% buyer fee)	Ethereum
makersplace (Curated)	Email	Yes	No	IPFS	No	No	15%	2.50%	Ethereum
KnownOrigin. (Curated)	Wallet	No	No	IPFS	Yes	No	15%	3%	Ethereum
N (Curated)	Email	Yes	No	IPFS	No	No	5%	5% (+30 cents credit card processing fee)	Ethereum
(Curated)	Wallet	No	No	IPFS	No	No	15%	0% (via Open Sea)	Ethereum
async. (Curated)	Wallet	Yes	No	IPFS / Centralized	No	No	1% – 30%	1%	Ethereum

Source: Cointelegraph Research

Step 5: "Drop" the work
Next, the creator announces to their followers and fans that they intend to auction their creation on the blockchain. This is the PR part of a creator's campaign, and having social media followers, fans and a way to connect with them could make or break the success of the auction.

Step 6: Auction the NFT
To actually auction the NFT, the creator must connect the wallet that owns the NFT to whatever marketplace they wish to auction it on. This doesn't have to be through the same service the NFT was minted on, but it must be on the same blockchain. The NFT can be put up for auction or for a fixed price sale. Once a bid on the creation is accepted by the creator, it gets recorded on the immutable and public blockchain.

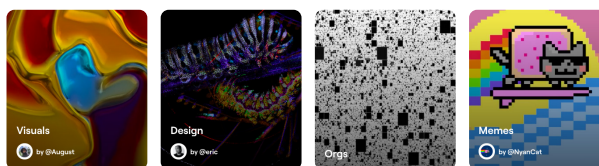Figure 31 / The Two Main Ways Content Creators Can Sell Their NFT
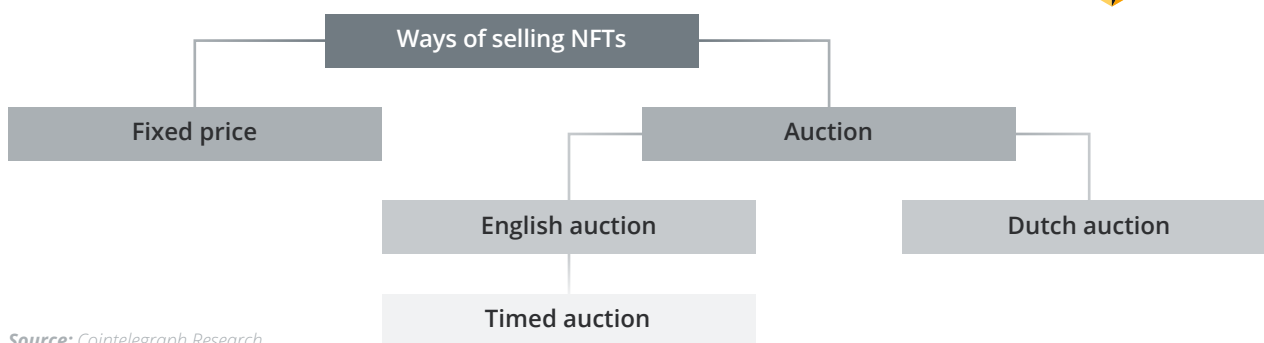
Source: *Cointelegraph Research*

Learn NFT Auctions

WORLDS

Explore new worlds curated by the Foundation creative community

Foundation is an art minting platform on the Ethereum blockchain that allows artists to auction off their content to buyers. Every interaction with auctions (placing bids, winning, claiming NFTs, etc.) is recorded on the Ethereum blockchain. All of the artworks on Foundation can be bid on and purchased with ETH. Creators get paid in ETH, too.

The way the auctions work is that creators set a starting price for the auction, and buyers must place bids at or above this price. Reserve prices are made public on Foundation. After the first bid is placed on an artwork at or above the reserve price, a 24-hour countdown for the auction starts. The auction comes to an end when the countdown has run out of time. Foundation auctions have 15-minute extensions that gamify collections and encourage participation from collectors. If a bid is placed within the last 15 minutes of an auction, the countdown will reset back by 15 minutes. The addition of 15-minute extensions gives time for each buyer to have a final opportunity to place a bid and for the artwork to find its true market value. Time extensions can go on indefinitely until no other bids are placed within the last 15 minutes of an auction.

Since launching in February 2021, more than 20,000 creators have joined the community at Foundation and have collectively earned 24,525.26 ETH (~$57 million) overall. Foundation has supported thousands of artists, including Chris Torres and his massively successful sale of the viral internet meme "Nyan Cat," Nadya Tolokonnikova of Pussy Riot, M.I.A., Shawna X, Yung Jake, Aphex Twin, Zach Lieberman, Devendra Banhart, Viktoria Modesta, The Tor Project, Serwah Attafuah and Edward Snowden.
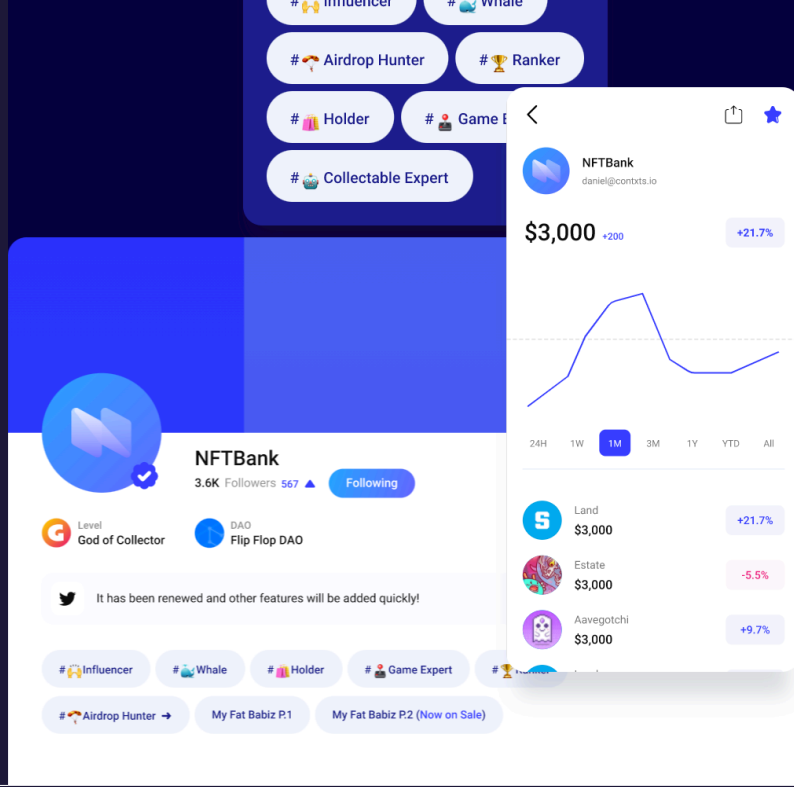
Step 7: Accounting
Lastly, buyers and sellers of NFTs should keep records of their purchases and sales. Taxes may be due on any capital gains from selling an NFT for more than what was paid.

NFT Valuations made easy

NFTBank is the all-in-one solution to easily and insightfully manage NFT investment portfolios. Leveraging its advanced valuation engine, NFTBank directly tackles NFT investments' inherent problem of illiquidity, complexity (lending, fractional investments), and price discovery and delivers key insights in the most user-centric view. NFTBank has been undergoing tremendous growth. Seeing their Asset Under Tracking (AUT) grow 480x within the last year, NFTBank is on their path to become the most trusted solution for NFT investment.

While NFTs have been one of the hottest topics in 2021, many are lost in how to assess an NFT's value, making them hesitant to jump onto lucrative NFT investment opportunities. Leveraging the methodologies of existing financial products may be inappropriate to evaluate the value of NFT products due to the essential difference in liquidity and cash flow. Specific NFT valuation methods like latest sold price or floor price may also be unreliable. In addition, traditional statistical models can also be inadequate for NFTs.

NFTBank solves this problem with its unique valuation engine that proved 80 – 90% accuracy; it assesses different characteristics such as collectibles and game items and turns them into summaries of insight that is easily digestible and actionable. This unlocks the opportunity for investors to discover new investment opportunities — both at the project level & individual item level.

With NFTBank, managing your NFT investment portfolio becomes easy. From an at-glance understanding of your assets and investment performance to tax-filing, NFTBank has got them covered. Join the top investors on their favorite tool, NFTBank.
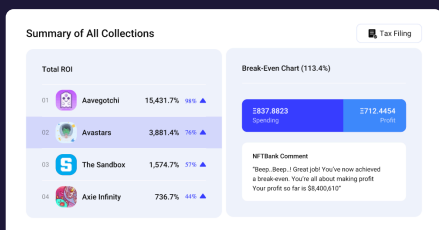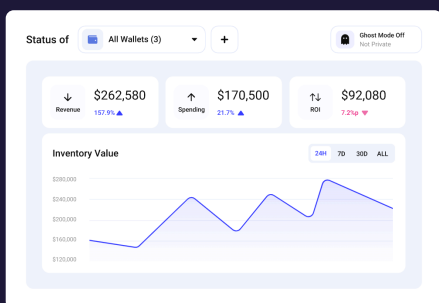
Portfolio Management
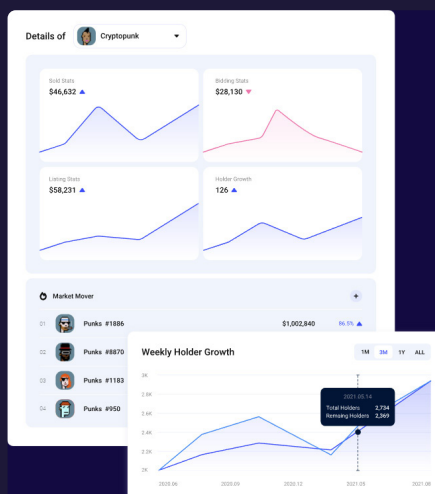
Investment Discovery: Project

Investment Discovery: Item

Portfolio Management Solution for General Investors and Play-to-Earn Gamers

Play to Earn has been the star of the show in bringing NFTs to the mainstream. It not only drove more adoption of NFTs, but far beyond that, it has also been driving the economy in the Philippines by giving millions of jobless an opportunity to earn money through gaming.

However, as both the users and their NFTs increase, there lies a challenge for those users to easily manage them. **Oftentimes, each user holds hundreds of NFTs, distributed across numerous wal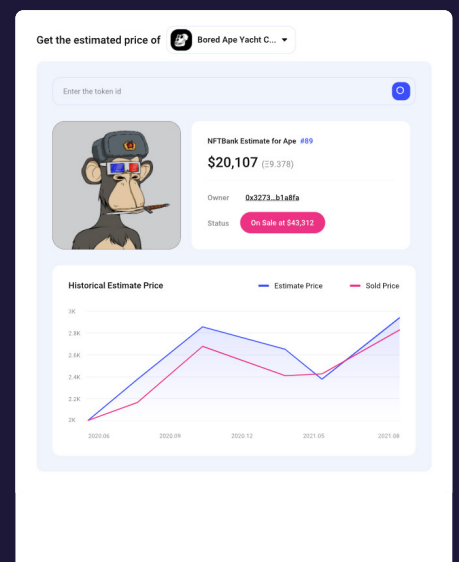lets for varying purposes.** In this condition, not only are they not able to understand whether they are maximizing the value of their NFTs in games they participate in, but also they lack a clear picture of what they have and where they are across their wallets.

NFTBank is the solution to this management problem as well. **NFTbank aggregates users' distributed wallets to form a holistic view of the users' NFT collection and denotes each with an estimated value.** This opens the eyes of the NFT holders to make better decisions that are well informed by data.

NFTBank is already widely used by Axie Infinity players who participate in what's called 'scholarships' (ref). Scholarship managers lend out their Axies for scholars, or the gamers, to use and earn money, sharing the profit. Scholarship managers are in dire need of a simple solution to manage scholars, their performance, and the associated profits.

Using NFTBank, Scholarship managers can easily see their Axie inventory, accumulated profits, as well as individual scholars' performance. As one can see from the screenshot of one of the prominent scholarships being managed on the platform, an increasing number of users are leveraging such tools to disrupt the existing ways of making money and grow their wealth to another level.
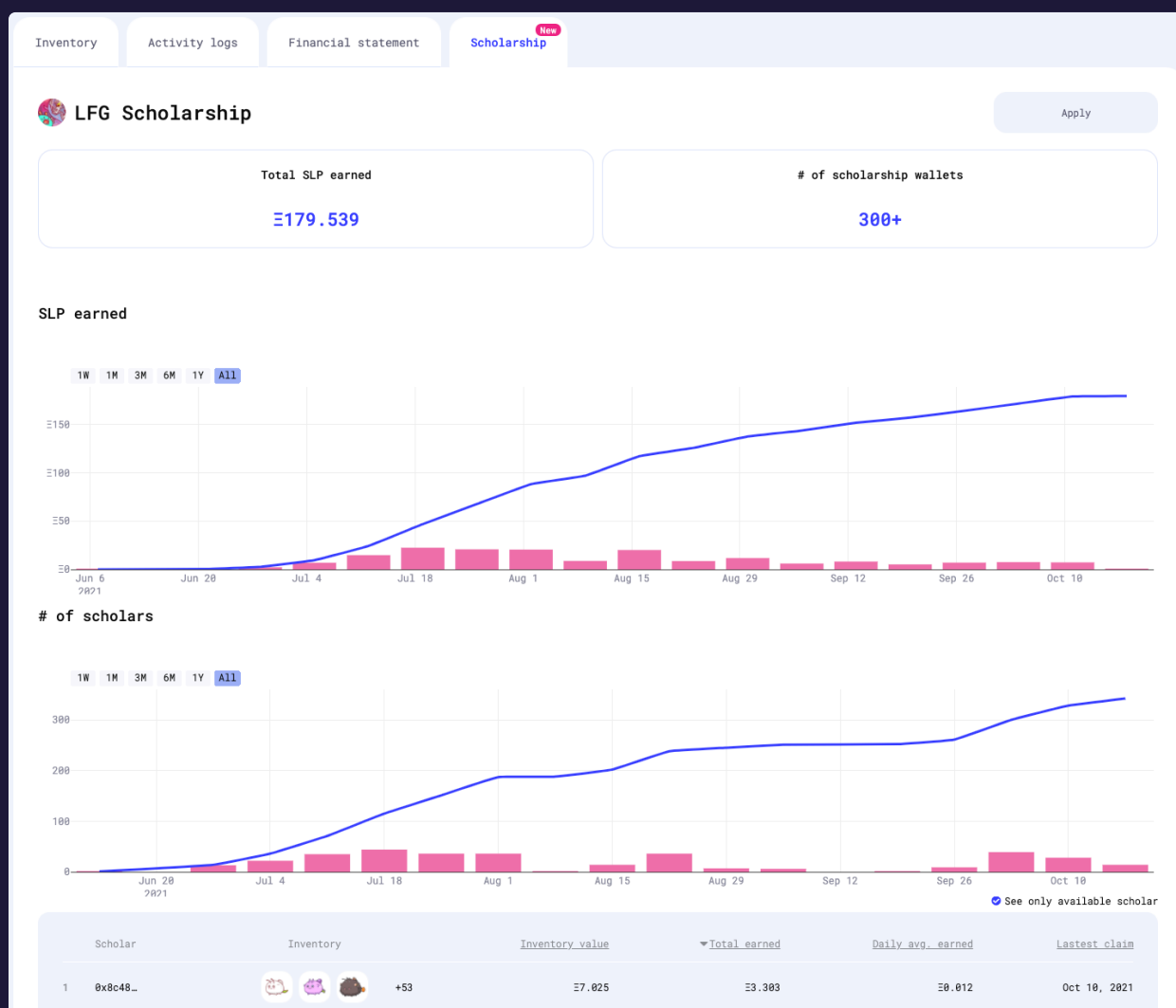
The ways of building wealth are drastically evolving. NFTBank is at the forefront of this movement to support the growing needs in the new paradigm of wealth management.

Check out NFTBank now to try it yourself

www.nftbank.ai

5 Pricing and Valuation

5.1 Pricing Mechanisms

Key Takeaways

- The very first time an NFT can receive a valuation is during inception, also known as minting. Many NFTs are never minted by collectors, and of those, primary sales listings may not find a buyer.

- The primary sale of an NFT refers to the first time it's sold. Secondary sales of a NFT are any sale thereafter.

- Floor price, median price and average price are used to evaluate collections of NFTs. Average price can be upwardly biased due to a few sales of very expensive NFTs. Therefore, median price is a better indicator of a collection's overall price.

Nonfungible tokens are priced differently to their fungible counterparts like Bitcoin and Ether. Pricing models for NFTs vary depending on their category, design and financial rights. For example, collectible NFTs can be valued based on the rarity of their attributes within a collection, and income generating NFTs can be valued with a discounted future cash flow model. There is also a social, community and network value to NFTs, which makes it a challenge when assigning a price. With bilateral marketplace trades and limited collection sizes, liquidity is much lower in NFTs than fungible tokens[67], leading to less accurate price discovery. Liquidity and price discovery are inherently related, as accurate and real-time price discovery enables a liquid NFT derivatives market. Furthermore, the NFT market is still in early stages and, therefore, likely to contain regular pricing inefficiencies, which was reported by a recent analysis of Decentraland LAND prices.[68]

Why are NFTs so hard to evaluate?

Two main factors make this an extremely challenging feat: low transaction volume and extreme price change. Let's take CryptoPunks, the NFT project considered most prestigious, as an example. Of the 10,000 Punks that are out there, only 5,878 of them have any transaction record. Since the collection's launch on June 23, 2017, to Oct. 4, 2021, there have been only 18,777 recorded sales. Even the Punks that switched hands two times or more, the average time between the sales is 117 days, and the max is 1,549 days. In addition to such low transaction volume, the price change is extreme — and we're not even considering the rarest items that have never been available on the market.

Insider Insight with
Daniel Kim
founder and CEO of
NFTBank.ai

The very first time an NFT can receive a valuation is during its inception, also known as minting. Creators don't necessarily have to mint NFTs themselves but can enable investors to mint under a variety of conditions. This could be for a fee, which is referred to as the minting price. However, this price does not represent the NFT's value on the market. In order for this price to represent its value on the market, an investor would need to pay the minting fee and create the NFT. Many NFTs are never minted by collectors, and of those that are, primary sales listings may not find a buyer.

[67] See "Which Factors Determine Liquidity Across US Metropolitan Office Markets?", Steven Devaney, Pat McAllister, Anupam Nanda, *University of Reading*, 2015
[68] See "Fertile LAND: Pricing non-fungible tokens", Michael Dowling, *ScienceDirect*, April 29, 2021

Collectibles and video game items are often offered through drops or packs where users pay a fee for rights to randomized newly minted NFTs. These generally have randomized characteristics, with higher scarcity at more expensive tiers. Another example of minting price is Ethereum Name Space[69], which charges $5 per year to mint an unclaimed domain name. Investors may get minting rights for free under a variety of conditions, such as being a premium subscriber to a content creator, as was the case for popular cryptocurrency YouTuber Benjamin Cowen[70]. In this case, there is no minting price. Another example of minting conditions could be through a game, such as Axie Infinity, which allows users to breed their in-game pets into newly minted NFTs with crossed properties. Crossed properties means that the offspring of the cross-bred Axies will have properties from both parents. Investors may want to get into projects by participating in minting events to get the earliest and potentially cheapest NFT price before being available on marketplaces.

The primary sale of an NFT refers to the first time it's sold. This could be through an auction house, marketplace or private deal. Secondary sales of a NFT are any sale thereafter. Many marketplaces offer secondary sales royalties for the original NFT creator where a set percentage of all sales is collected. A common metric used to price NFTs on secondary markets is what NFT traders refer to as the "floor price": the lowest open sale price of an NFT within a collection. For example, after Visa paid $150,000 for a CryptoPunk NFT representing a 24 × 24 pixel JPG in August 2021, the floor price rose 280% to $425,000.[71] NFT marketplace OpenSea shows the floor price for each collection in its description. Another common secondary market metric is average price, which refers to the average of the total executed sales prices for a collection. However, average price is considered an unreliable metric for estimating a collection's value since a few sales of very expensive NFTs can skew the data. For this reason, Canadian concept artist and Medium blogger Kimberly Parker suggests that median price is a better reflection of how much people are really paying for NFTs on the market.[72]

Learn Pricing Terms

Floor price: The lowest open sale price of an NFT within a collection. Dutch auctions are not included in floor price calculations.

Median price: To calculate the median price of all NFT primary sales for a specific collection, the sales' prices are listed in order from lowest to highest. The median is the sales price exactly in the middle.

Average price: The average executed sale price of NFTs within a collection, often considered misleading due to skewing from highly priced outliers.

Beyond direct sales there are other pricing mechanisms in the NFT market. Derivative products such as indices, loans or fractional NFTs are emerging based on DeFi technology. These NFT products not only introduce further liquidity to the NFT market but enable implied pricing models. To fractionalize an NFT, participants deposit their NFT into a pool and receive fungible tokens in return, which can be redeemed for a random NFT in the pool at any time.[73] For example, based on a pool of 10 Cryptopunks and a circulating supply of 1 million fractionalised tokens worth $1, the Cryptopunks are priced at $100k each. These fractional

tokens trade on exchanges multilaterally, and therefore produce more regular pricing compared to auctions. One shortcoming with fractionalisation is that it may skew toward the cheapest NFTs in a collection. Investors are unlikely to pool a significantly more expensive NFT with other less valued NFTs, as they may lose money on redemption of a random NFT from the pool. Furthermore, for this implied valuation to be realised, the entire supply of fractional tokens would have to be purchased and redeemed for the underlying NFTs. This would ultimately change the implied price given by the fractional pool.

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[69] Learn more about Ethereum Name Service here

[70] More information about Into the Cryptoverse V2 can be found here

[71] See "To NFT or not to NFT — 400x returns or tulip mania", *Numbrs*, Sept. 2, 2021

[72] See "Most artists are not making money off NFTs and here are some graphs to prove it", Kimberly Parker, April 19, 2021

[73] See "Hot or Not, for NFTs", Nick Emmons, *Upshot.io*, Dec. 23, 2020

Appraisals are a pricing mechanism common in the traditional art and real estate industry, where experts value an asset based on their knowledge. Peer prediction appraisal networks aggregate and incentivise honest community inputs, which is distributed via data oracles. Upshot gamifies community input by letting users appraise NFTs side-by-side, estimating and ordering their value.[74] To appraise NFTs, users are required to have a stake in Upshot, which can be slashed if they act maliciously. These appraisals are aggregated across the platform to deliver real-time price feeds for NFTs. The benefit of peer prediction appraisals is that they measure subjective value of NFTs as perceived by the market.[75]

Without real-time, accurate price feeds the NFT market will struggle to introduce further liquidity to an inherently illiquid asset. For example NFT indices, synthetic NFTs and NFT loans all require real-time pricing to operate. Asset indices track the price of a set of assets, such as the S&P 500 tracking the price of the top 500 largest companies. Similarly, a synthetic asset tracks the price of a single asset, without actually containing the asset. These fungible derivatives require real-time price feeds to trade on exchanges. Similarly, loan underwriters are unable to accurately price NFTs to manage loan risk and size. NFT backed loans are emerging on platforms like NFTfi.com, Cream Finance and Etna Network. But due to pricing limitations these are often undercollateralized loans,[76] meaning the NFT isn't specifically valued in the underwriting process. As more accurate price discovery and valuations emerge, these defi derivatives are expected to grow, and further improve pricing mechanisms themselves.

Learn Market Terms

A derivative is an investment that allows investors to bet on the future price of an underlying asset.

A pool is when investors combine their money together to create a large account of capital that can be used to bid on NFT auctions.

A data oracle is a smart contract that pulls data from an external source to a blockchain. The source can be data on another blockchain or non-blockchain-based data.

Indexing is the process of tracking a wide basket of NFT prices instead of just purchasing one NFT in a portfolio. Indexes can give different weights to the NFTs in the basket, such as equal weighting, proportional weighting based on market capitalization or trading volume.

5.2 NFT Valuation Model

Key Takeaways

- The scarcity, liquidity, utility and hedonic properties of the NFT imbue it with value.
- Collectibles are popular to trade because of the defined rarity of their traits.
- Historically, investors who purchased NFTs at the time of minting have accrued the highest returns.

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[74] See "How Does UpshotOne Work?", Nick Emmons, *Upshot.io*, Sept. 23, 2020
[75] See "Appraisal games and the NFT liquidity problem", Jake Brukhman, *CoinFund*, Jan. 26, 2021
[76] See "PleasrDAO Uses NFTs as Collateral for $3.5 Million Loan", Will Gotsegen, Decrypt, July 16, 2021

Scarcity is a major underlying cause for value, similar to the total supply of a fungible token. NFT creators programmatically adjust the supply of NFTs to impact rarity; for example, minting 1,000 base collectibles and only 10 gold tier collectibles. In other words, if all variables are held constant except rareness (ceteris paribus), scarcer NFTs are priced higher. This forms the basis of valuation models for collectible NFTs based on statistical rarity of attributes.

Liquidity attracts premiums from investors. Blockchain-based collectibles offer a higher liquidity value compared to "off-chain" collectibles. Investors may value NFTs issued on Ethereum higher, considering their ease of sale and volumes. Similarly, projects with high derivative liquidity, such as fractionalized or loaned NFTs, may be valued higher.[77]

Utility of the NFT describes its functional and financial value.

○ The NFT holder has rights to a functional good, service or asset. For example, software access via NFT licensing, intellectual property rights or insurance coverage.

○ The NFT holder has rights to future cash flows, which can be valued according to discounted cash flow models. Examples include resale royalties, digital real estate and yield bearing NFTs.

Hedonic value pertains to the experience an NFT brings to the owner.

○ Perceived sociocultural value such as relation to an artist, group, event or cultural niche. This also includes social benefits of owning an NFT — e.g., accessing exclusive digital communities, identifying with a group or receiving respect and praise.

○ A personal, sentimental or aesthetic tie between the purchaser and NFT.

○ This hedonic value can simply be the enjoyment of hunting rare items or completing a collection.

Utility and hedonic valuation factors are limited by their lack of qualitative measures and mutual exclusivity. The line between hedonic and functional values can be blurred, depending on the context. Fungible currency tokens are valued primarily by scarcity, utility and liquidity, readily measurable as circulating supply and transaction volume. Only a few notable "memecoins" are held for their hedonic value, namely Dogecoin (DOGE), Shiba Inu (SHIB) and, arguably, social tokens, too. Conversely, the highest-valued NFTs today rely largely on their hedonic appeal, mimetics and social value, which are synergistic with network effects.[78]

This pricing model must be considered in regards to the overall network context of the NFT. **Like fungible tokens, NFTs are the quantified embodiment of network effects. In a digital landscape, utility means little in isolation. Similarly, hedonic value means little without a social component. Innovators aim to increase the network effect of their NFT ecosystem to find new forms of functional and hedonic value.** Network effects are key in determining the long-term valuation of NFTs. Few NFTs ascend to the realm of Beeple or CryptoPunks, just like most art isn't Banksy and most collectibles aren't valued like vintage baseball cards. These examples rely heavily on their surrounding social and cultural networks, which necessarily have a digital component in today's context. Relying solely on scarcity and hedonic value is a characteristic of physical collectibles and is only a subset of the potential value programmable digital assets offer.[79]

Collectibles are perhaps the easiest and most practical NFT to value, which is a driving factor in their trading popularity. Collectibles are often generated from a set of underlying base attributes distributed across the collection. For example, in the CryptoPunks collection, there are up to seven attributes per Punk, including a beanie, sunglasses, pigtails, a beard, etc.[80] Each of these attributes appears only a set number of times across the collection of 10,000 CryptoPunks. The rarity and, therefore, value of a CryptoPunk is determined by how often its traits appear across the set.[81]

The rarity of several example CryptoPunks based on their three attributes is below.

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[77] See "How to value CryptoPunks", *DappRadar*, Jan. 20, 2021
[78] See "On Reflexivity & Imitation", *Deribit Insights,* Nov. 3, 2020
[79] See "NFT Value Capture Equation", *Coopahtroopa*, Feb. 18, 2021
[80] More about CryptoPunks types here
[81] See "Ranking Rarity: Understanding Rarity Calculation Methods", *Rarity.tools,* May 16, 2021

Figure 32 / CryptoPunk Rarity Measures

	Attribute 1 Punk Type	Attribute 2 Rarity	Attribute 3 Rarity	Average Rarity	Statistical Rarity	Rarity Score	Last sale price
Punk 2683	Male 6039 / 10,000 = 0.6039	Peaked spike 303 / 10,000 = 0.0303	Front Beard Dark 260 / 10,000 = 0.0260	0.31	0.0048	43.42	$276,474
Punk 4893	Female 3840 / 10,000 = 0.3840	Regular shades 527 / 10,000) = 0.0527	Wild blonde 144 / 10,000 = 0.0144	0.15	0.00029	91.02	$432,676
Punk 5217	Ape 24 / 10,000 = 0.0024	Knitted cap 419 / 10,000 = 0.0419	Gold chain 169 / 10,000 = 0.0169	0.0204	0.0000017	499.7	$5.45 million

Source: Cointelegraph Research

In this simple example, each attribute is given a rarity measure that is combined into an overall rarity for the CryptoPunk. The average rarity is a basic measure that averages across the attributes of the CryptoPunk. Statistical rarity is the product of each rarity measure, and the rarity score is the sum of inverse rarity measures. **For example in Figure 31, Punk 2683's price of $276K is roughly half that of Punk 4893's price. Punk 2683's attributes also give a rarity score that is roughly that of Punk 4893's. This is not a coincidence. The rarer a collectible is, the higher its price should be holding all variables constant (Ceteris Paribus).** Each of these has its own pros and cons, but the rarity score is used by platforms such as Rarity Tools.[82] The general efficacy of these models is apparent when compared to the last sale price, all of which occurred in mid 2021.

These models have two main limitations. Firstly, it assumes that attributes are valuable solely based on their scarcity, but scarcity is a heuristic measure at best. Some attributes may be more desirable to collectors aesthetically, and certain combinations of attributes may synergize. This is where peer prediction and crowd-sourced intelligence provides an advantage in measuring subjective value. Secondly, not all collectible attributes can be reduced as readily as CryptoPunks. For example, projects using generative art to produce more complex collectible attributes and designs, such as Art Blocks, are harder to model than projects with fewer possible combinations of attributes.[83]

How to Find Underpriced Collectible NFTs

Historically, investors who purchased the NFT at the time of minting have accrued the highest returns. In order to find new NFT projects, investors can subscribe to newsletters, follow Twitter influencers, and receive tips in Discord and Telegram communities.[84] There are also online calculators for measuring the rareness of NFTs. Numbrs.com has created a great list of resources for NFT collectors.

Newsletters:

- Bankless. Written by guest poster William M. Peaster, the NFT newsletter published by Bankless provides thorough research on upcoming NFTs. The Bankless newsletter has over 90,000 subscribers.
- NFT Review. Written by Bruno Škvorc of RMRK fame. This is published weekly with a slight KSM focus. Bruno is also the technical educator for the Web3 Foundation.

[82] See "Ranking Rarity: Understanding Rarity Calculation Methods", Rarity.tools, May 16, 2021
[83] See "All uniqueness is not equal", Adam Chekroud, 2021
[84] See "To NFT or not to NFT — 400x returns or tulip mania", Numbrs, Sept. 2, 2021

○ NFT Valuations. Written by University of Nicosia Institute For the Future. NFT Valuations focuses on the top NFTs. Unlike the two previous Substack newsletters, this is a blog.

Twitter:

○ Zeneca 33. This account has timely NFT content and a great newsletter on Substack as well.

○ Gary Vaynerchuck. An investor in Twitter and Coinbase, Gary Vaynerchuck is the CEO of Vayner Media and creator of VeeFriends. He is big into NFTs and hot on the beat of upcoming projects.

○ Seedphrase. Danny from Seedphase is another big NFT account with good retweets and information about projects before they go mainstream.

○ NBA Top Shot. This Twitter account provides information on NBA Top Shot pack drops for collectors interested in basketball.

Tools:

NFTBank   Rarity Tools   Upshot   DappRadar   NonFungible

When analyzing a collectible NFT, key metrics include:

1. The number of users in the Discord and/or Telegram group for that NFT.
2. The number of Twitter followers.
3. Growth over time in the number of Discord/Telegram users and Twitter followers. If the Discord is dead or the Telegram is full of bots, that is a big red flag. Instead, promising NFT collections are marked by enthusiastic communities that are garnering new members on a daily basis.
4. Are there any benefits that the NFT unlocks, such as exclusive content or chat rooms?

Once an investor has found an NFT collection they like, the next step is to choose an NFT within that collection. Important questions to ask before making a decision:

1. What traits are trending or popular at the moment?
2. What characteristics are more valuable or scarcer than others?[85]

When you have a clear picture of what to look for, look at sales prices to get an idea of what you can expect to pay. Check Discord for what others have paid for similar tokens.

| 5.3 | # NFT and Crypto Correlation |

Key Takeaways

🔖 Historically, NFT resurgences have been correlated with the overall cryptocurrency market cycle.

🔖 Distinct, uncorrelated markets may be emerging in the NFT space.

Historically, NFT resurgences have been correlated with the overall cryptocurrency market cycle. The first wave of NFT popularity emerged following the 2017 bull market with early projects such as CryptoKitties.
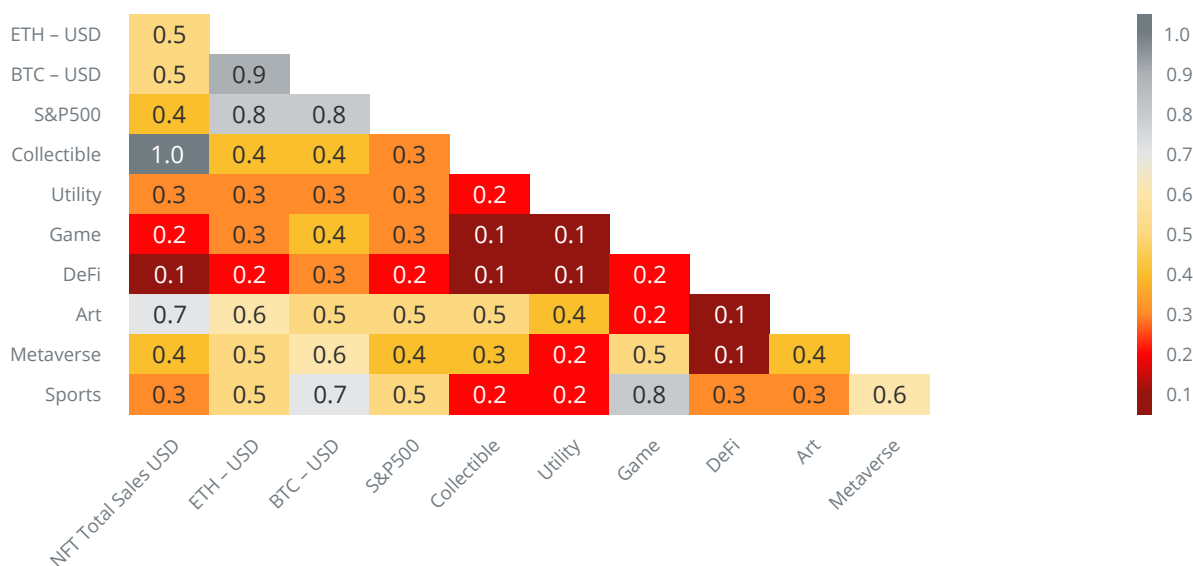
Today's resurgence of NFTs comes on the back of the current bull market. This is expected as cryptocurrency investors look for more opportunities with their increased purchasing power. The heatmap below shows

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[85] See "Ranking Rarity: Understanding Rarity Calculation Methods", *Rarity.tools*, May 16, 2021

that total NFT sales have a fair correlation of 0.5 with Ether and Bitcoin, with a slightly lower read for the S&P 500 at 0.4. Across different categories of NFTs, both collectibles and art sales have the strongest correlation to total NFT sales, demonstrating their dominance. DeFi and utility NFTs show the lowest correlation across the board, suggesting these categories may be forming a distinct market in themselves.

Figure 33 /

Correlation Heatmap between NFT Sales Volume, Crypto Prices, and Sales by NFT Categories

	NFT Total Sales USD	ETH – USD	BTC – USD	S&P500	Collectible	Utility	Game	DeFi	Art	Metaverse
ETH – USD	0.5									
BTC – USD	0.5	0.9								
S&P500	0.4	0.8	0.8							
Collectible	1.0	0.4	0.4	0.3						
Utility	0.3	0.3	0.3	0.3	0.2					
Game	0.2	0.3	0.4	0.3	0.1	0.1				
DeFi	0.1	0.2	0.3	0.2	0.1	0.1	0.2			
Art	0.7	0.6	0.5	0.5	0.5	0.4	0.2	0.1		
Metaverse	0.4	0.5	0.6	0.4	0.3	0.2	0.5	0.1	0.4	
Sports	0.3	0.5	0.7	0.5	0.2	0.2	0.8	0.3	0.3	0.6

Source: *Cointelegraph Research*

Studies on the correlation of NFT sales and the broader cryptocurrency market report mixed results. One study shows low volatility transmission between NFTs and the broader cryptocurrency market, as well as low transmissions among different NFTs.[86] The authors suggest this may be due to multiple markets existing within the NFT ecosystem. The report also notes some co-movement between NFTs and the cryptocurrency market, implying similar underlying factors move both. Another study shows cryptocurrency volatility transmits to NFTs, with a stronger correlation to Bitcoin than Ether.[87] The author compares the current NFT market to the early initial coin offering (ICO) market from 2017, which saw increased volume with price shocks to Bitcoin.

5.4

Covid–19's Impact on NFT Pricing

Key Takeaways

- NFTs show a mild-to-fair correlation with major traditional indexes such as the S&P 500.

- Heightened NFT activity may be fuelled by a period of loose fiscal policy.

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[86] See "Is non-fungible token pricing driven by cryptocurrencies?", Michael Dowling, *ScienceDirect*, April 29, 2021
[87] See "The non-fungible token (NFT) market and its relationship with Bitcoin and Ethereum", Lennart Arte, *Blockchain Research Lab*, June 8, 2021

In 2020, several nations unleashed stimulus packages in response to the COVID-19 pandemic. The level of stimulus is historically unprecedented, with 11 nations deploying at least an equivalent to 10% share of their gross domestic product.[88] The U.S. extended its round of coronavirus relief in March 2021 with an additional $1.9 trillion, including a new stimulus check worth $1,400 to eligible individuals.[89] The rapid expansion of the monetary supply has not yet caused an equally significant impact on the consumer price index[90], but rather, asset prices have soared, including cryptocurrencies, equities, properties, commodities, and NFTs. The collectibles and antiques market is no exception[91], with trading cards and vintage memorabilia making record valuations in 2021. NFT prices are definitely inflated due to the monetary stimulus, a dramatic increase in online auctions[92] due to the pandemic, as well as a demand from investors to fly to "safe" tangible assets during times of uncertainty.[93]

How did Covid-19 Impact the NFT Market?

There's no doubt that the pandemic accelerated digital trends — from the shift to remote work to NFT adoption and volatile crypto prices. More specifically, digital property has dramatically increased in popularity. People want to take ownership via NFT use cases, such as trading cards, domain names and digital currencies. In the past 18 months or so since the pandemic started, crypto's trajectory has permanently shifted upward as people have become more educated and comfortable using and engaging with digital technology, and now there's no looking back.

Insider Insight with
Matthew Gould
CEO and Founder of
Unstoppable Domains

One of the main doubts raised about this heightened NFT activity is that it's merely a consequence of a period of loose fiscal policy. Retail investors with stimulus liquidity are more equipped than ever to speculate in 2021[94] with the maturation of cryptocurrencies and free trading platforms like Robinhood. Similarly, the increased purchasing power of asset holders and low interest rates are pushing risk appetite up, further increasing speculative volatility. On the other hand, some investors believe that digitally scarce NFTs offer unique value and speculative opportunities. Distinguishing speculation and stimulus impacts from the underlying economic value is a challenge for quantitative analysts and hedge funds. However, as stimulus and fiat currency debasement continue, assets are expected to rise further.

While there is no direct link between coronavirus relief and NFT pricing, there is an overall correlation between the cryptocurrency market and major traditional indexes. This is primarily due to broader adoption from traditional institutions and investment firms. Combined with a correlation between major cryptocurrencies and NFTs, there is an implied relation between stimulus and NFTs. While it appears that stimulus could have impacted NFT valuations, it's difficult to distinguish this effect from the overall crypto market cycle and maturation of the market. In the long term, the NFT market will approach its economic value as speculation and stimulus effects wane. Projects that rely mostly on hedonic value and social desirability for their valuations will underperform compared to those with strong network effects, fintech applications and functionality.

[88] Learn more about COVID-19 stimulus by various countries here

[89] More details on COVID-19 policies here

[90] See "Central Banks' Monetary Policy in the Face of the COVID-19 Economic Crisis: Monetary Stimulus and the Emergence of CBDCs", Javier Jorge-Vázquez and Ricardo Francisco Reier Forradellas, *Sustainability*, 2021

[91] See "Salzberg on the Effects of the Corona Crisis on the Collectible Industry", Mark Salzberg, May 7, 2020

[92] See "Global Collectibles Industry", Alexandra I., *Wonder*, Sept. 6, 2020

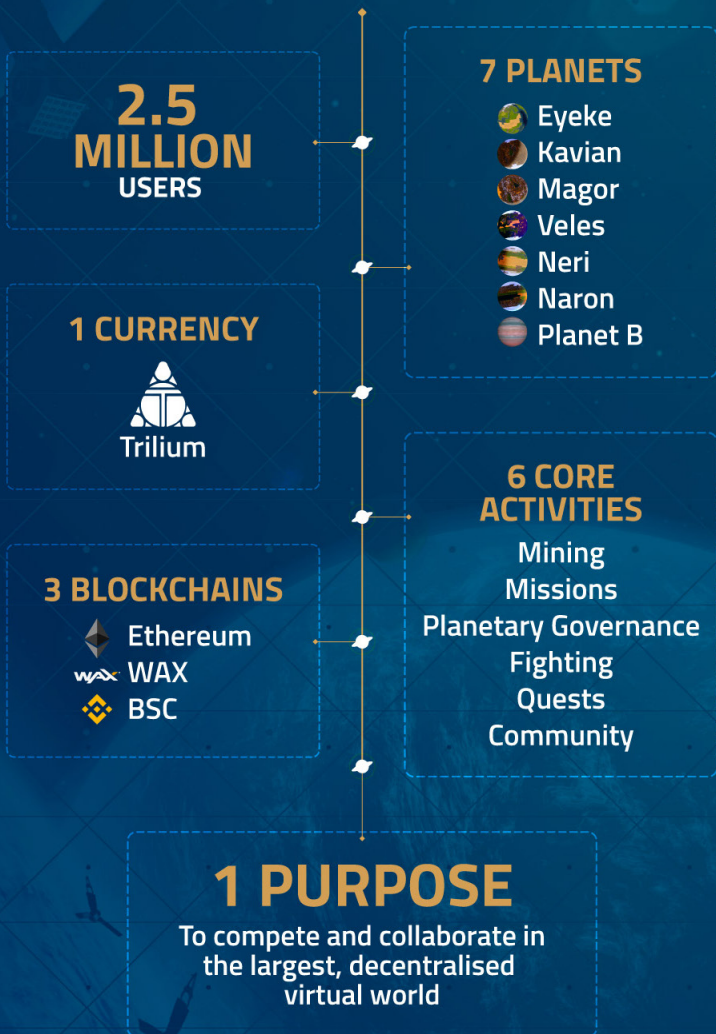[93] See "Collectibles: An integral part of wealth", *Credit Suisse and Deloitte*, October 2020

[94] See "Uncovering Retail Trading in Bitcoin: The Impact of COVID-19 Stimulus Checks", Peter Zimmerman and Anantha Divakaruni, *Federal Reserve Bank of Cleveland*, July 19, 2021

ALIEN WORLDS™

Alien Worlds is the most popular blockchain game in the world[1] with more than 3.3 million players signing up since its launch in December 2020. It is a futuristic game of shared values for people leaving earth in 2055 to build a metaverse around teamwork and collaboration. A play-to-earn social economy based around NFTs (Non-Fungible Tokens), Alien Worlds allows users to buy and sell the digital assets they acquire and earn an income from their activity.

ALIEN WORLDS™

1 METAVERSE

2.5 MILLION USERS

1 CURRENCY
Trilium

3 BLOCKCHAINS
- Ethereum
- WAX
- BSC

7 PLANETS
- Eyeke
- Kavian
- Magor
- Veles
- Neri
- Naron
- Planet B

6 CORE ACTIVITIES
Mining
Missions
Planetary Governance
Fighting
Quests
Community

1 PURPOSE
To compete and collaborate in the largest, decentralised virtual world

alienworlds.io

Users can explore seven planets in the Alien Worlds Metaverse across Ethereum, WAX and BSC blockchains. They earn the in-game currency Trilium and NFTs by mining digital assets, fighting other players and earning rent from land that they acquire. Each planet is a Decentralised Autonomous Organisation (DAO) and users can use Trilium to play a role in the governance of their chosen planet.

The development team at Dacoco established this complex metaverse with the goal of bringing many aspects of real life to the digital world where we spend so much time each day. They found inspiration in early DAO projects and wanted to combine the creation of decentralised worlds with NFTs, unique digital assets whose authenticity and ownership are tracked on a blockchain. By doing so, the team was able to secure digital ownership of virtual assets and establish the principle of play-to-earn: the basis for a virtual economy enabling users of Alien Worlds to earn and use NFTs within the game, with a low carbon footprint[2].

A receptive audience was quickly found for this decentralised model which enhances community ownership and participation, while enabling players to interact directly without the need to rely on fee-charging or data-hoarding middlemen. This contrasts with centralised companies that are trying to claim the metaverse as a 'walled-garden' and a home for their VR products.

In just a few months, Alien Worlds has become an environment that stimulates economic competition and co-operation among players, encouraging people to come together and form collaborative units in order to compete with other groups - just as they do in real life.

Inspired by Alien Worlds NFTs and Trilium (TLM) tokens, Explorers in the Metaverse have created events and experiences to attract and engage others. Miners are often rewarded by landowners in the communities they have created, such as Kinderminers, the Alien Army and the Cabal. Brands, such as the UltraRare collection of Horrors characters, have extended their NFT collections to mining events, increasing their collectibility. Some Explorers have taken to storytelling, with the Rusty Montains community rewarding fellow Miners who stop by to tell stories of their travels.
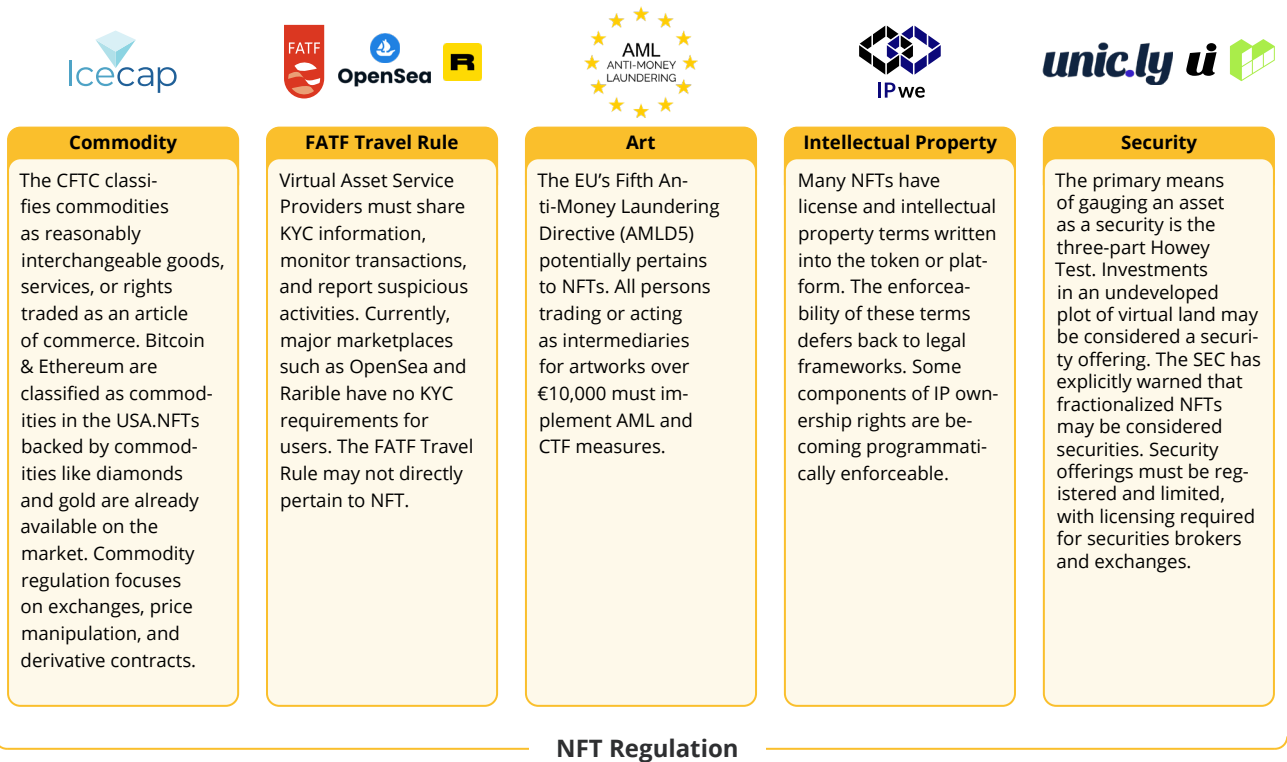
[1] DappRadar.com
[2] On.wax.io/co2

6 Challenges

6.1 Regulatory Challenges

Key Takeaways

- There is no explicit regulation from any jurisdiction regarding NFTs.
- It is unclear whether NFTs fall within the bounds of emerging cryptocurrency regulation across jurisdictions.
- NFTs may be considered a commodity, security, intellectual property or other classification.

Figure 34 / NFT Regulation

Commodity	FATF Travel Rule	Art	Intellectual Property	Security
The CFTC classifies commodities as reasonably interchangeable goods, services, or rights traded as an article of commerce. Bitcoin & Ethereum are classified as commodities in the USA.NFTs backed by commodities like diamonds and gold are already available on the market. Commodity regulation focuses on exchanges, price manipulation, and derivative contracts.	Virtual Asset Service Providers must share KYC information, monitor transactions, and report suspicious activities. Currently, major marketplaces such as OpenSea and Rarible have no KYC requirements for users. The FATF Travel Rule may not directly pertain to NFT.	The EU's Fifth Anti-Money Laundering Directive (AMLD5) potentially pertains to NFTs. All persons trading or acting as intermediaries for artworks over €10,000 must implement AML and CTF measures.	Many NFTs have license and intellectual property terms written into the token or platform. The enforceability of these terms defers back to legal frameworks. Some components of IP ownership rights are becoming programmatically enforceable.	The primary means of gauging an asset as a security is the three-part Howey Test. Investments in an undeveloped plot of virtual land may be considered a security offering. The SEC has explicitly warned that fractionalized NFTs may be considered securities. Security offerings must be registered and limited, with licensing required for securities brokers and exchanges.

NFT Regulation

Source: Cointelegraph Research

Similar to the fungible token landscape, there is no single type of regulation covering all NFTs. An NFT is essentially a digital deed, granting the holder ownership rights to various assets, functions and financial benefits. It is still unclear whether NFTs fall within the bounds of current or emerging cryptocurrency regulation across jurisdictions. In the clearest cases, the underlying asset of an NFT may explicitly be a security, commodity or intellectual property. Globally, there is a push toward cryptocurrency regulatory frameworks, with the Financial Action Task Force "Travel Rule" heavily influencing implementation. In this analysis, we apply the current state of regulation to the emerging asset class of NFTs.

FATF Travel Rule

The Financial Action Task Force (FATF) is an intergovernmental organization that impacts 200 jurisdictions globally. The FATF issues non-binding policy recommendations to counter money laundering and terrorism financing, with a 2019 release[95] pertaining to "Virtual Asset Service Providers" (VASP) under the "Travel Rule." The recommendation requires that affiliated member countries develop local policy frameworks that regulate VASPs. The policy frameworks are influenced from the American Bank Secrecy Act (BSA) and require VASPs to share Know Your Customer (KYC) information, monitor transactions, and report suspicious activities. Currently, major marketplaces such as OpenSea and Rarible have no KYC requirements for users. Marketplaces may be subject to money laundering, wash trading and price manipulation issues due to anonymity and loose regulation. While the FATF Travel Rule and subsequent policies do not address NFTs directly, it is likely that marketplaces in particular will encounter regulation.

In the European Union, the Markets in Cryptoassets Regulation (MiCA) has recently been proposed, largely influenced by FATF recommendations. NFTs are not mentioned specifically in the proposal and do not match directly with the proposal's three classifications of digital assets. The MiCA classification under which NFTs most likely fall is utility tokens, which are defined broadly as a catch-all class.[96] For any classification under MiCA, NFT issuers and service providers must be registered as crypto-asset providers (CASP) to operate in the EU, and all such CASPs are required to comply with Anti-Money Laundering (AML) and Counter-Terrorist Financing (CTF) regulations. In addition, the EU's Fifth Anti-Money Laundering Directive (AMLD5) potentially pertains to NFT artworks.[97] This regulation requires all persons trading or acting as intermediaries for artworks over 10,000 euros to implement certain AML and CTF measures, including recording of documentation, due diligence and the reporting of suspicious activity.

In the U.S., NFT regulation is unclear at the state or federal levels. Under U.S. law, an NFT could be considered a commodity, security or intellectual property.

NFTs as Commodities

Commodities are defined under U.S. law as reasonably interchangeable goods, services or rights traded as an article of commerce, which also includes currencies and interest rates. Of particular interest is the notion of fungibility as it pertains to reasonably interchangeable goods. The U.S. Commodity Futures Trading Commission (CFTC) has explicitly stated that cryptocurrencies like BTC and ETH are commodities.[98] NFTs may endow exclusive ownership to some commodity, a capacity already available for diamonds[99] or gold[100], and these would likely be classified accordingly. Nevertheless, whether the commodity classification extends beyond these physical cases to more abstract digital assets is yet to be determined. The CFTC focuses its regulation on commodity exchanges, price manipulation and derivative contracts rather than the underlying asset or issuers.

NFTs as Securities

The primary means of gauging an asset as a security is the three-part Howey Test, which stipulates that a security is "an investment of money, in a common enterprise, with the expectation of profit to be derived from efforts of others."[101] The last component of the Howey Test is where many cryptocurrencies find exemption on the basis of their decentralized networks and governance. This may apply as well to NFTs, which are similarly decentralized. Furthermore, static NFTs such as collectibles and artwork do not have any ongoing enterprise and development and may, therefore, be considered exempt as well.[102] On the other hand, NFTs that give the owner rights to some future asset — say a virtual plot of land in a game

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[95] More on FATF regulation rules here

[96] See "REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Markets in Crypto-assets, and amending Directive", *European Commission*, Sept. 24, 2020

[97] See "Regulatory Approaches to Nonfungible Tokens in the EU and UK", Pascal Bine, Elizabeth Robertson, Simon Toms, Sidne Koenigsberg, Nadine Kari, Abigail B. Reeves, Gregory Vianesi, *Skadden*, June 15, 2021

[98] Learn more on CFTC regulations of digital assets here

[99] More information on Icecap can be found here

[100] See "You can now buy gold-backed NFTs with the mining carbon footprint offset", Samuel Haig, *Cointelegraph*, May 26, 2021

[101] Learn more about SEC position regarding digital assets here

[102] See "Anatomy of an NFT", Andrew James Lom, Rachael Browndorf, James Larkin Smith, *Norton Rose Fulbright*, April 2021

that is in development — might be considered securities. Additionally, some NFT derivatives may also be considered securities — in particular, fractional NFTs, which have been explicitly questioned by U.S. Securities and Exchange Commission Commissioner Hester Peirce.[103] NFTs are also being used as components of "baskets" of assets that include fungible tokens (see section 7.3), which may themselves be considered securities. If it turns out that NFTs are to be considered a security, the Securities Act of 1933 and Security Exchange Act of 1934 will be applied, entailing registered and limited offerings. What's more, only licensed exchanges and brokers will be able to trade these NFTs, and all markets will be strictly monitored and regulated (with restrictions on short sales, insider trading, speculative trading, etc.).

NFTs as Intellectual Properties

NFTs may represent ownership of some artwork or patent, a fact which naturally brings up questions pertaining to the intangible rights associated with intellectual property (IP). Indeed, many NFTs have license and intellectual property terms written into the token or platform[104, 105], with the purchaser "signing" their agreement upon the sale. However, the enforceability of these terms defers back to legal frameworks, as NFTs do not necessarily prevent replication or commercialization of the underlying asset. Nonetheless, as a more sophisticated Web 3.0 environment develops around NFTs, some components of IP ownership rights are becoming programmatically enforceable. That is, platforms built on top of NFT technology may enforce the transferrable scope of rights, such as use, copy, display, monetization and modification in their ecosystem. This trustless programmatic enforcement of intangible rights, which can then be transferred or traded digitally, is a unique and high-value feature of NFTs compared to traditional ownership rights. In sum, all issuers are advised to ensure they have their legal intellectual property rights in order before issuing NFTs.[106]

[103] See "The SEC's 'Crypto Mom' Hester Peirce says selling fractionalized NFTs could be illegal", Sophie Kiderlin, *Insider*, March 26, 2021

[104] More information on NFT licensing here

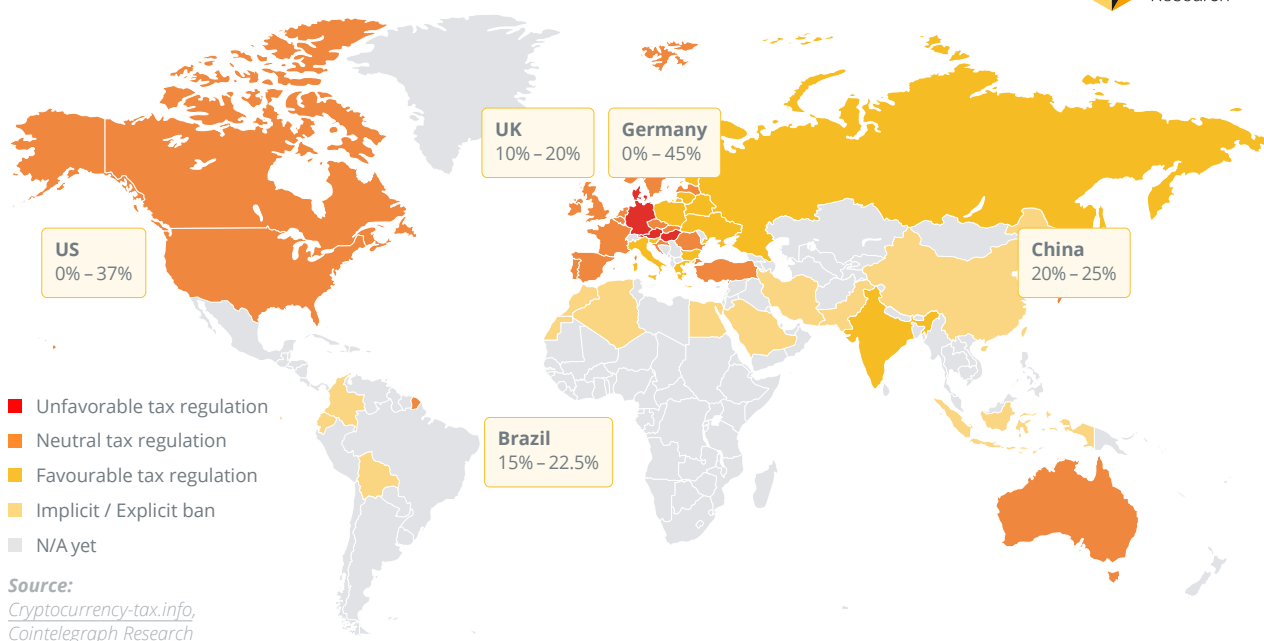[105] See "NFTs: A Legal Guide for Creators and Collectors", Amy Madison Luo, CoinDesk, March 11, 2021

[106] See "THE COMING BLOCKCHAIN REVOLUTION IN CONSUMPTION OF DIGITAL ART AND MUSIC: THE THINKING LAWYER'S GUIDE TO NON-FUNGIBLE TOKENS (NFTS)", Daniel S. Nuñez Cohen, Clifford C. Histed, Stephen M. Humenik, Jeremy M. McLaughlin, Anthony R.G. Nolan, Judith Rinearson, Mark H. Wittow, Daniel-Charles V. Wolf, Jonathan M. Miner, *K&L Gates*, March 25, 2021

Taxing NFTs

Key Takeaways

⬛ Clear NFT guidelines by tax authorities are yet to be announced.

⬛ Jurisdictions have varied cryptocurrency classifications, some as property, others as currency, making them subject to different tax laws.

⬛ Minting, transferring, and exchanging NFTs may all be considered taxable events.

Figure 35 / Crypto Tax Map

CoIntelegraph Research

UK
10% – 20%

Germany
0% – 45%

China
20% – 25%

US
0% – 37%

Brazil
15% – 22.5%

🟥 Unfavorable tax regulation
🟧 Neutral tax regulation
🟨 Favourable tax regulation
🟨 Implicit / Explicit ban
⬜ N/A yet

Source:
Cryptocurrency-tax.info,
Cointelegraph Research

In the US, there are 2 types of capital gain taxes - short-term and long-term. Long-term capital gains tax refers to assets held for over a year. The rate is progressive and based on an individual's tax bracket. The rate ranges from 0%, 15% or 20% for most assets. In contrast, the short-term capital gains tax is higher ranging from from 10% up to 37% (10%, 12%, 22%, 24%, 32%, 35% or 37%) depending on the individual's tax bracket. A person's tax bracket is determined by how much they earn.

In the UK, the capital gains tax on NFTs ranges from 10% to 20% depending on the individual's tax bracket like in the US. Residential properties have higher capital gains taxes in the UK than other assets like cryptocurrencies.

In Brazil, the capital gains tax depends on the amount of the gain. The basic rate is 15%; however, it is raised

to 17.5% when the gain is more than BRL 5 million and could reach 22.5% if the capital gain exceeds BRL 30 million. Day trade transactions are also subject to a special tax rate of 20%.

In China, the capital gains tax rate is 20% for individuals and 25% for corporations.

Tax authorities are still deliberating as to how to approach NFTs. While clear guidelines by tax authorities are yet to be announced, one should be aware of possible pitfalls and keep track of individual transactions. Additionally, as in the treatment of cryptocurrencies, there are differences across jurisdictions. While some jurisdictions treat cryptocurrencies as property, others treat them as currency, making them subject to different tax laws. Irrespective of the exact treatment, one should analyze the taxability of NFTs by looking at the events

involved in their lifecycle. Therefore, the discussion should take the minting process as its starting point. The process of minting does not necessarily involve the transaction of value from an owner to a buyer, so minting could be treated as a non-taxable event.[107] However, subsequent transactions, which shift ownership from the seller to a buyer and possibly involve an increase in value, can be argued to be a taxable event. Assuming that NFTs are treated as a capital asset, any increase in value will be subject to capital gains tax. The final taxable value will be based on price changes of the NFT's in the investor's home country's fiat currency, rather than priced in the cryptocurrency used to buy the NFT.

As NFTs have a broad spectrum of applications, one might also argue for differential treatment of privately owned NFTs in the areas of collectible art and business-owned intellectual property rights. While the former (collectible art) could be treated as a capital asset, the latter could be seen as an inventory (intellectual property rights).[108]

6.3 Drawbacks and Risks

Key Takeaways

- The NFT market is a highly volatile, illiquid, nascent market that carries significant risks for investors.
- Blockchains and other technologies underlying NFTs are at risk of malfunction, exploitation or hacks.
- Techniques such as wash trading and shill bidding are used to mislead investors.

Speculation Risks

The NFT market is a highly volatile, illiquid, nascent market riddled with pricing inefficiencies and unregulated transactions, and it often appears to be driven by speculative mania more so than by value. Participation in NFT creation, trading or service provision, therefore, carries all the speculative risk associated with early-stage financial technology, and due diligence is required to avoid monetary losses and legal penalties. Price manipulation from insider trading, influencers and other deceptive practises are common.[109] Beeple's $69-million NFT, for example, is arguably overvalued due to price manipulation from the purchaser MetaKovan, who purchased a large number of Beeple's works prior to this record-breaking auction. Shortly thereafter, MetaKovan launched the B.20 fund, which included fractionalized Beeple NFTs.[110]

Technology Risks

Blockchains are still an emerging technology with many underlying risks of malfunction, hacks and exploits. Protocols such as Ethereum have been extensively developed over many years, with market exposure stress-testing the technology, but even recently, exploits have still occurred.[111] In general, larger projects have more proof of stability than obscure and speculative technology. Similarly, while alternative chains such as Dapper Labs and Flow have a record of extensive use over many years, a slew of new chains are emerging that carry a higher relative technological risk. Beyond NFT infrastructure, the ecosystem stack itself poses technological risks. Platforms built on top of layer-one and layer-two scaling solutions and emerging ERC token protocols do not necessarily have the same level of testing as the underlying reliable blockchain. Marketplaces,

[107] See "Tax consequences of nonfungible tokens (NFTs)", Walter Effross, Leonard Goodman, Anthony Pochesci and Jay A. Soled, *Journal of Accountancy*, June 24, 2021
[108] See "THE UNCHARTED TERRITORY OF TAXING NON-FUNGIBLE TOKENS (NFTS)", Joyce Beebe, *Baker Institute*, June 8, 2021
[109] See "OpenSea collector 'pulls the rug' on NFTs to highlight arbitrary value", Turner Wright, *Cointelegraph*, March 9, 2021
[110] See "Floor is Rising Ep 4 — Price Manipulation in NFTs, What is it and How is it done", *The Reading Ape*, July 21, 2021
[111] See "Bug in Ethereum client leads to split — EVM-compatible chains at risk", Turner Wright, *Cointelegraph*, Aug. 27, 2021

DApps, storage solutions and DeFi smart contracts all carry technological risk. One strategy for mitigating this risk is to choose the largest, longest-running and most reputable infrastructure providers when dealing with NFTs. Insurance options, centralized or decentralized, may prove to be another viable strategy for mitigating inherent technological risk.

Origination Problem and Fraud

The origination problem is the issue of fraudulent NFT creation and monetization, often by the imitation of an established creator. The pseudonymous cryptocurrency market and lack of legal regulation leaves plenty of opportunity for malicious actors, with little consequence. This could involve downloading an artist's digital works and reselling them as NFTs, or tokenizing an influencer's tweets and auctioning them off as NFTs without the influencer's knowledge.[112]

Wash Trading

High fees on NFT marketplaces discourage wash trading; however, the data provider NonFungible.com still believes wash trading occurs in the market. Wash trading is the creation of inflated trading volumes and price growth that occurs when asset owners trade between accounts that only they own. On some marketplaces, the vendors' number of trades and total volume are related to their reputation, providing a direct incentive to wash trade. Investors risk being misled by these trades and overpaying for NFTs or purchasing from fraudulent vendors. Wash trading is a significant drawback for NFT marketplaces, which struggle to identify and prevent illegitimate purchases in the anonymous crypto landscape.

Shill Bidding

Shill bidding is the artificial inflation of prices from colluding bidders who do not intend to actually win the auction. This could be collusion with the marketplace or with the NFT vendor directly. Shill bidding is a well-documented form of price manipulation for auctions outside the NFT market,[113] and the pseudonymous nature of cryptocurrency makes it even easier with NFTs.

<table>
<tr><td>**6.4**</td><td># Energy Consumption</td></tr>
</table>

Key Takeaways

- Blockchain energy consumption is a highly debated topic, which has been rekindled amid the resurgence of NFTs.

- The Ethereum blockchain is significantly more energy intensive than some alternatives, such as Tezos.

- For 2021, transactions on Tezos are more than 35,000 times more energy efficient than transactions on Ethereum. To put this into perspective, a single transaction on Ethereum took roughly 30 kWh, which is equivalent to powering a house in the US for a whole day. In contrast, a transaction on Tezos took 0.0016 kWh or less than the energy required to charge an Apple Tablet for 10 minutes.

NFTs have been subject to an intense debate regarding their energy consumption and environmental impact. Earlier this year, the Ethereum-based NFT marketplace SuperRare[114] fought claims regarding Ethereum's energy consumption made from Medium blogger Memo Akten[115] and emission estimation website Carbon.fyi. Carbon.fyi[116] estimates the energy cost of each transaction by multiplying the Ethereum gas consumed by an emissions factor based on Ethereum's hash rate. This implies that

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[112] See "Artists report discovering their work is being stolen and sold as NFTs", James Purtill, *ABC Science*, March 15, 2021
[113] See "eBay Restricts Trading Card Giant PWCC for "Shill Bidding", Brett Pickert, *Boardroom*, Aug. 17, 2021
[114] See "No, CryptoArtists Aren't Harming the Planet", *SuperRare*, March 3, 2021
[115] See "The Unreasonable Ecological Cost of #CryptoArt (Part 2)", Memo Akten, Dec. 31, 2020
[116] Learn more about NFT emission estimation resource here

complex transactions and smart contracts that require more gas have a higher carbon footprint. This also implies that NFTs shared on PoS blockchains have a lower carbon footprint than NFTs shared on PoW blockchains since the former do not have a hash rate. However, SuperRare argues that more computationally intensive transactions such as minting NFTs do cause more energy consumption in the Ethereum network. So, who is right and who is wrong?

When addressing the issue of energy consumption, first of all, one needs to distinguish transaction costs and the costs of maintaining the network. That is, the simple fact that nodes need to run for the network to exist is responsible for a large amount of energy consumption. Each additional transaction then adds to energy usage but only marginally affects the overall energy consumption. Also, it is important to keep in mind that there are layer - two solutions built on Ethereum such as Polygon that allow the NFT ecosystem to benefit from Ethereum's maturity, adoption, utilization, and network effect without paying high transaction fees.

Abstaining from the inherently messy calculation of a blockchain transaction's carbon footprint, we want to focus here on the energy consumption that is associated with the transaction of NFTs. With this in mind, two ways of evaluating energy consumption can be identified. One relates to the measurement of gas spent for each transaction. It can be argued that gas on Ethereum is an accurate measure of the processing costs for each block and transaction. Inferring energy usage from gas fees, therefore, provides a baseline for the determination of NFT energy consumption.

However, as this first approach would only allow for the calculation of energy usage by NFTs running on the Ethereum blockchain, we will need to focus instead on the energy consumption of just a single transaction to be able to compare the purchase of an NFT within Ethereum versus the Tezos ecosystem. While this approach has the drawbacks

mentioned above — i.e., the fact that the network would likely consume a similar amount of energy without this individual transaction — it still allows us to get some idea of the energy usage that different blockchains entail. Naturally, a PoW system such as Ethereum will be more energy-intensive than a PoS blockchain such as Tezos.

In our baseline version, we will refrain from including the transactions for minting and simply ask how much energy is associated with the purchase of an NFT.

For Ethereum, we calculate the energy consumption as follows:

To estimate energy consumption per transaction, we need to divide the amount of energy used by the network within a given time period by the number of transactions in that same time period. In line with other studies on the topic, we annualize energy consumption and the number of transactions at each point in time. Thus, our estimate for each day tells us how much energy the blockchain would consume in a year, assuming that input values for our calculation remain the same.

$$kWh \ per \ Transaction = \frac{Total \ Energy \ Usage \ of \ Network}{Number \ of \ Transactions}$$

To calculate the total energy consumption for a given day, we multiply the daily total hash rate of the network by a measure of hardware efficiency. For example, on Aug. 1, 2021, Ethereum's hash rate was 537.3 terahashes per second, and we assume a hardware efficiency factor of 1,800 joules per gigahash.[117] Therefore, the network's annualized energy consumption was estimated to be 16.5 terawatt-hours.

Finally, we divide this number by the daily number of transactions to arrive at our estimate for the energy consumption per transaction.[118] Our estimates can be seen as rather conservative, as we assume a quick uptake of newly available, more efficient equipment by miners.[119]

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[117] This factor is subject to assumptions about uptake of the latest available hardware and replacement of older hardware.

[118] Data on the total hash rate and number of transactions is taken from CoinMetrics; data for energy efficiency is based on hardware data taken here.
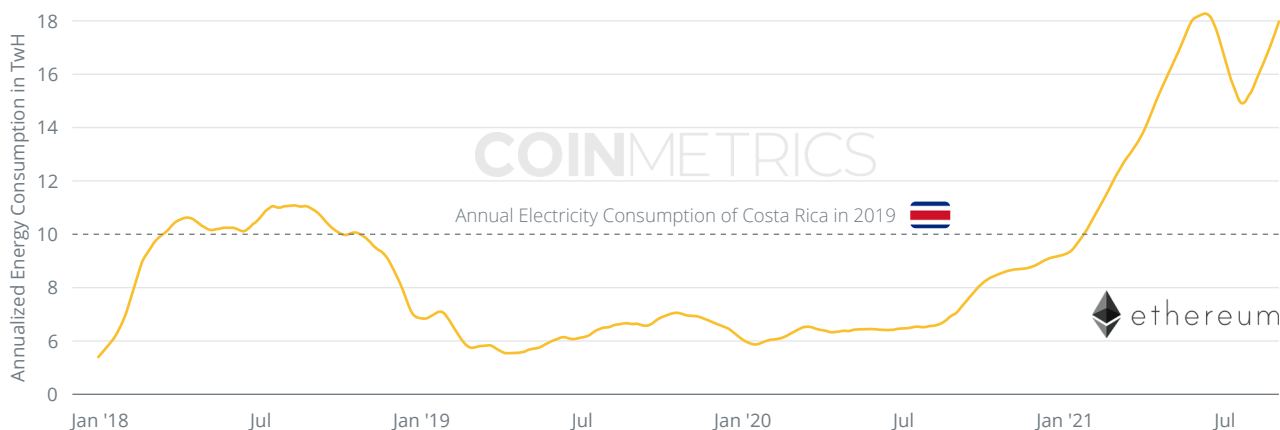
[119] Further estimates for Ethereum can be found here.

Figure 36 / Hash Rate on the Ethereum Blockchain (30-day moving average)

Source: CoinMetrics, Cointelegraph Research

Figure 37 / Ethereum Network Energy Consumption (30-day moving average)

Source: CoinMetrics, Cointelegraph Research

The Ethereum network is currently using more than Costa Rica does during an entire year. To put this into perspective, a single transaction on Ethereum took roughly 30 kWh, which is equivalent to powering a house in the US for a whole day. 100 Ethereum transactions is equivalent to driving approximately 390 kms in a Tesla Model 3. In contrast, a transaction on Tezos took 0.0016 kWh or less than the energy required to charge an Apple Tablet for 10 minutes. 100 Tezos transactions are equivalent to driving 10 kms in a Tesla Model 3. The energy use of the entire Tezos network is approximately equivalent to two households in the US for the whole year.

Figure 38 /
Ethereum Energy Consumption per Transaction (30-day moving average)

Daily Electricity Consumption of Average US Household in 2020
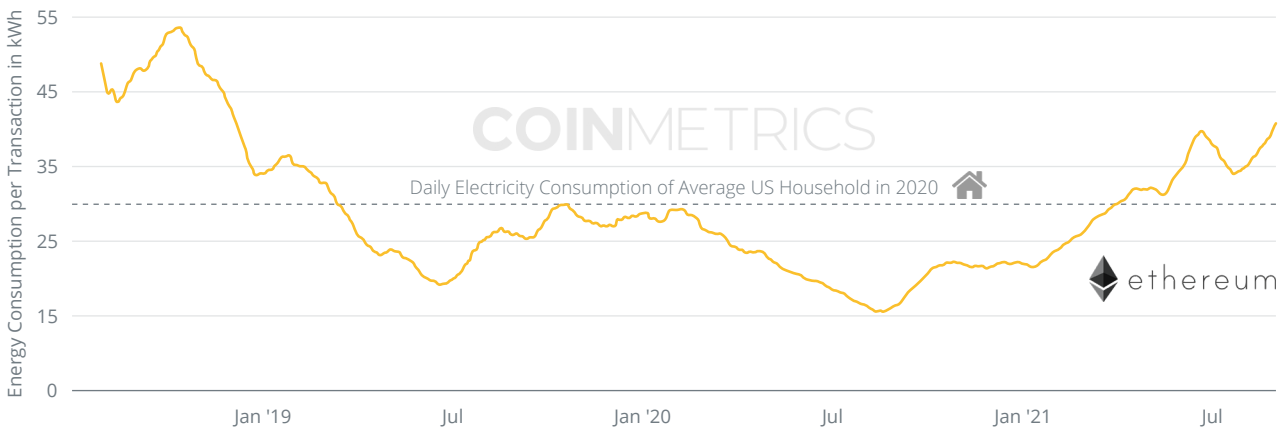
Source: CoinMetrics, Cointelegraph Research

For Tezos, we followed a slightly different strategy, as energy consumption in a PoS network does not depend on the hash rate. We calculate the total energy consumption by multiplying the number of active delegates, that is, the number of active bakers, by the total energy consumption of a baker.[120]

Figure 39 / Tezos Energy Consumption (30-day moving average)

Annual Electricity Consumption of Two Average US Households in 2020
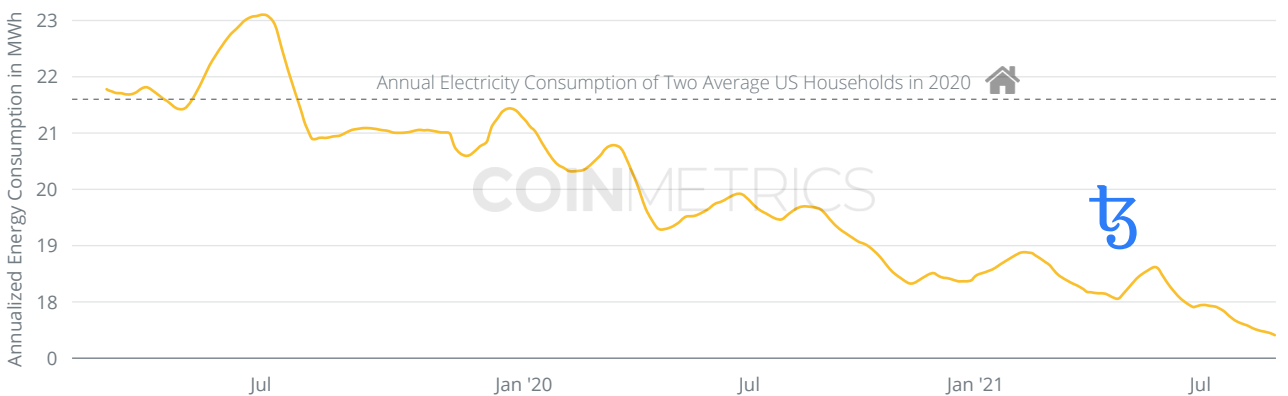
Source: CoinMetrics, Cointelegraph Research

Figure 40 / Tezos Energy Consumption per Transaction (30-day moving average)

Electricity Consumption of Charging a Tablet for 10 Minutes
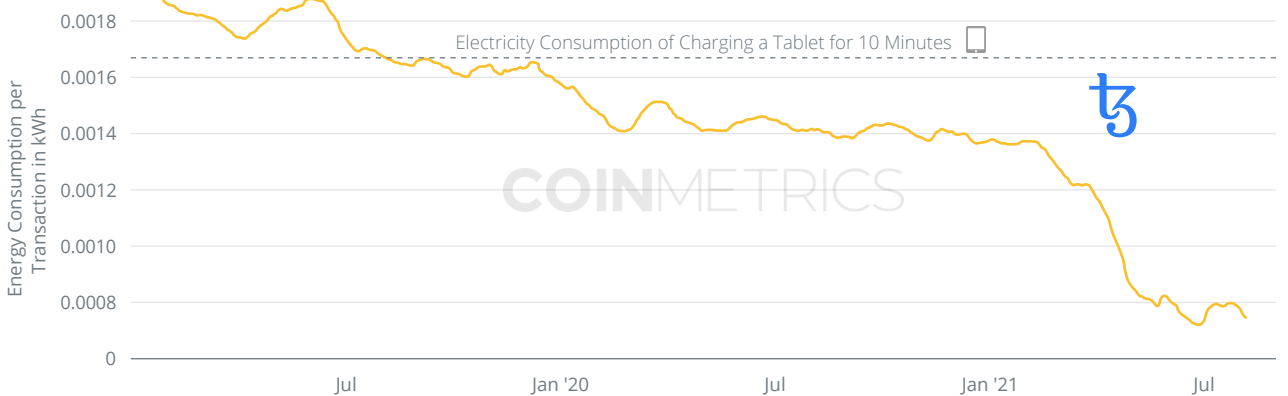
Source: CoinMetrics, Cointelegraph Research

[120] Estimates for energy consumption of Tezos bakers can be found here.

Learn Metric: Energy Cost per Transaction

A proof-of-work (PoW) blockchain network depends on a large number of individual miners contributing to the network's hash power. Thus, the energy consumption of Ethereum, for example, is not directly related to the number of transactions. Each transaction only contributes marginally to the total energy consumed. However, comparing energy consumption across blockchain networks calls for a metric that can be readily calculated independent of a network's specific features. Energy cost per transaction is such a metric. As the total energy consumption of a network is a function of the overall usage, energy consumption needs to be scaled by a metric that captures how extensively a network is used. Thus, we divide total energy consumption by the number of transactions that a network performs within a day.
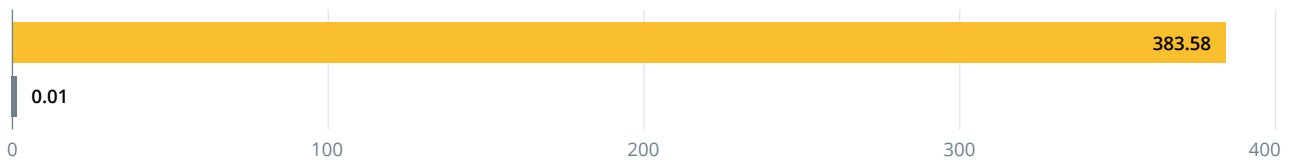
Figure 41 /

Energy Consumption of Network (in MWh, Average of 2021)

Cointelegraph Research

Energy Consumption per Transaction (in KWh, Average of 2021)
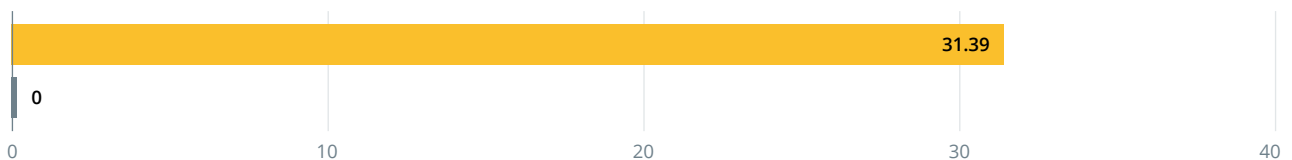
Tesla Model 3 (2021) Kilometer Equivalent of Hundred Transactions with Avg. 2021 Energy Consumption

Source: Cointelegraph Research

ETH   Tezos

Again, our estimates vary from previous studies, a fact which can be attributed to the time series nature of our analysis as well as slightly different underlying assumptions regarding hardware efficiency. Nonetheless, our results support previous findings on the vastly different energy consumption of PoW vs. PoS blockchains.[121] **For 2021, we find that transactions on Tezos are more than 35,000 times more energy-efficient than transactions on Ethereum.** This means that creating an NFT on Tezos is roughly equivalent to using a hair dryer for two seconds, while creating an NFT on Ethereum amounts to using it for more than 20 hours. However, many PoW blockchains have layer two solutions for faster transactions that require less energy consumption. For example, REVV Racing and

Arc8 by Animoca Brands are on Polygon built on top of Ethereum.

Despite coming closer to an agreed-upon method for estimating the energy cost of a blockchain transaction, there is still no single universally accepted method for estimating the carbon footprint of energy consumption.[122] Therefore, the precise harm done to the environment by PoW blockchains is impossible to calculate. However, one point we can conclude is that Ethereum's move toward a PoS algorithm will likely lead to a substantial decrease in energy usage per transaction. In the meantime, layer two use on Ethereum provides both the publisher and the users the benefits of the Ethereum network but with massively reduced gas fees and environmental impact.

[121] See "The Energy Consumption of Blockchain Technology: Beyond Myth", Johannes Sedlmeir, Hans Ulrich Buhl, Gilbert Fridgen and Robert Keller, *Springer*, June 19, 2020 and more information on differences between PoW and PoS network energy consumption here
[122] See "The Complicated Relationship Between Ethereum-based NFTs and the Environment", Alexandra Rubio and Wei Dai, 2021

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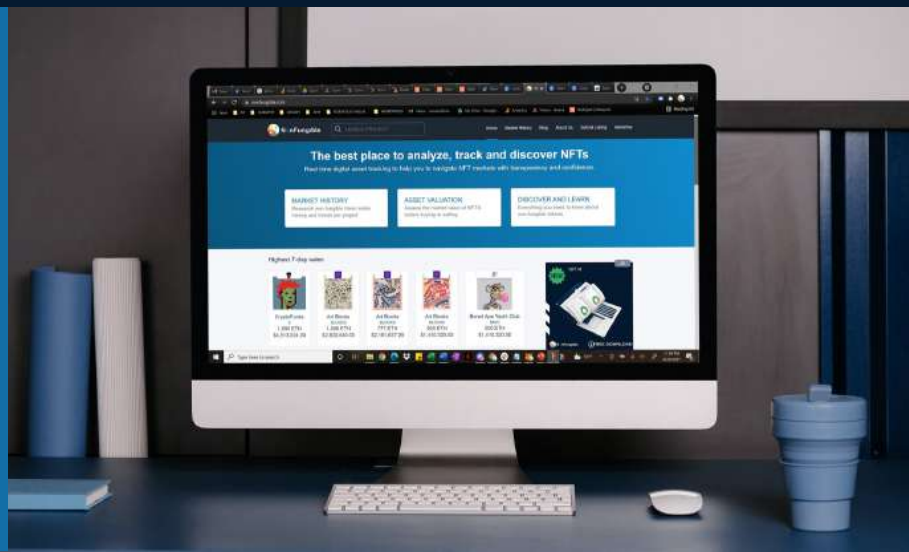
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The Future of NFTs
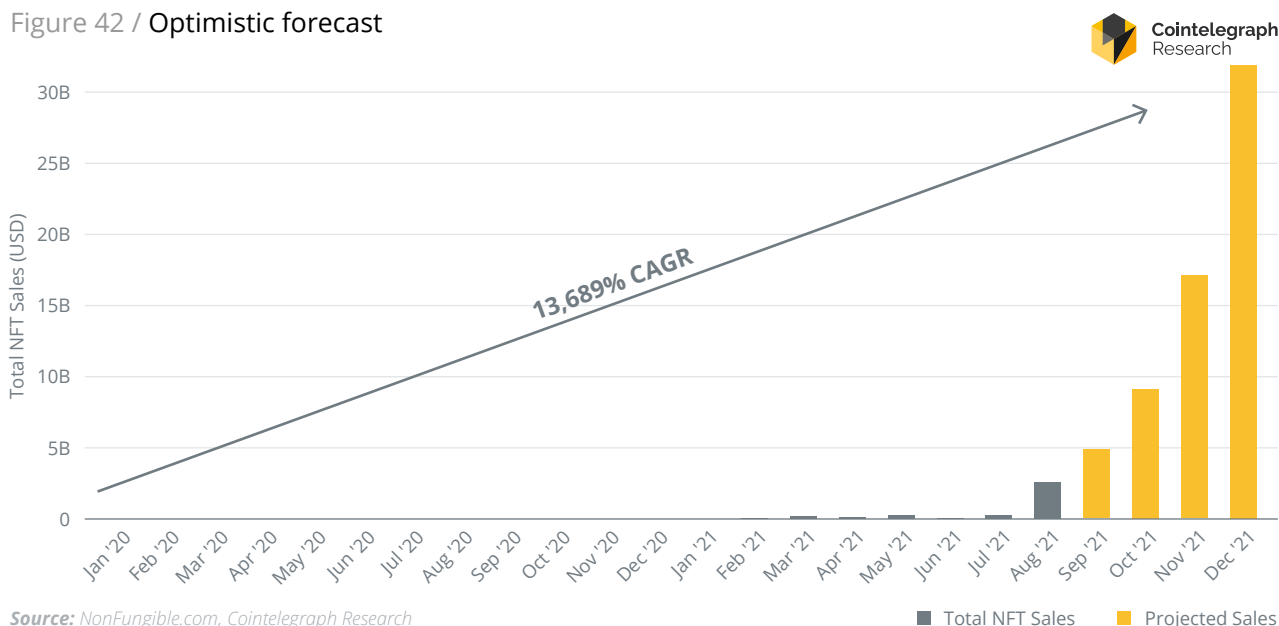
7.1 NFT Market–Projected Growth

Key Takeaways

- A conservative estimate projects total NFT sales volume for 2021 at $17.7 billion, with an optimistic forecast estimating $67 billion.

- The total volume of art and collectible NFT sales in 2021 so far is equivalent to 23% of all online art, collectibles and antiques sales in 2020.

- The gaming and sporting categories of NFTs reflect a significantly smaller portion of their counterpart industries, 1.5% and 0.18%, respectively.

The nascent NFT market has a lot of potential overhead room to grow, particularly if enterprise and institutional interest continues. As discussed in Section 5, the valuation of NFTs is correlated to the overall cryptocurrency market, which is likely to dictate short-term industry growth. The cryptocurrency market and NFT market experienced a bull run in 2016 and 2017 that lasted approximately 1.5 years until early 2018. Considering that cryptocurrencies and NFTs have seen a general uptrend since the middle of 2019, market have stage in the hype cycle, it is fair to be skeptical at the ludicrous valuation prices of popular NFTs today, but this does not diminish the economic value of the technology.

As fractionalization, funds, yield and derivatives emerge, the NFT market is likely to continue its strong growth and reach new heights. According to NonFungible.com, total NFT sales from Jan. 1 to Sept. 15, 2021, totalled $4.54 billion, with $2.6 billion contributed in August alone. Projecting an exponential regression on average monthly sales to the end of 2021 yields a forecasted total sales volume of $17.7 billion, a relatively conservative estimate. For a more optimistic forecast, we can take the average monthly sales growth rate from January 2020 to today and project that for the rest of 2021. This results in an average monthly growth rate of 185%, totaling to $67 billion projected in NFT sales in 2021.
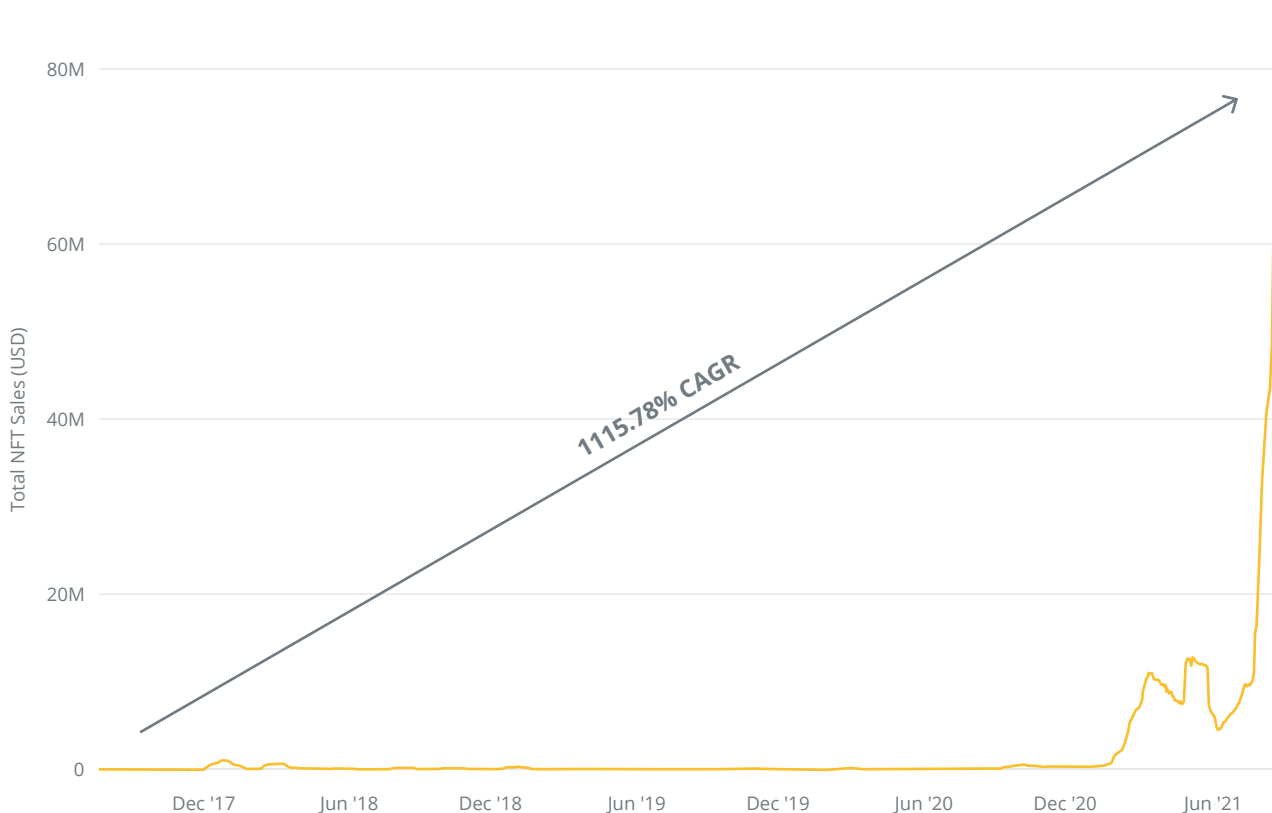
Figure 42 / Optimistic forecast

Source: NonFungible.com, Cointelegraph Research

Figure 43 /
Conservative Forecast of NFT Sales During the Next Year (Rolling 30-day Average)

Cointelegraph
Research

Source: Cointelegraph Research, NonFungible.com

The NFT market crosses over with many industries. Currently, art and gaming are two of the largest sectors with direct traditional counterparts. The number of transactions in the traditional global art market was estimated by Statista to be 31.4 million in 2020,[123] with an estimated total volume of $50 billion according to a 2020 report from Art Basel.[124] These volumes are actually down 22% from 2019 due to the COVID-19 pandemic. Accordingly, online art sales doubled over 2020 to $12.4 billion, jumping from a 9% to 25% share of the market.

According to our calculations at Cointelegraph Research using data from NonFungible.com, **NFT transactions on Ethereum involving art and collectibles totaled around 800,000 from January to August 2021, with a total volume of $2.93 billion**.[125] Therefore, the NFT art and collectibles market makes for an equivalent of 23.6% of the online global art and collectibles market value, but only 2.5% of transactions. This demonstrates how NFT art and collectibles are priced significantly higher than their traditional counterparts and could readily be considered overvalued. However, the rise in online art sales due to the COVID-19 pandemic may help NFTs retain their share of the market.

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[123] More information on art market statistics and facts can be found here
[124] See "The Art Market 2021 reveals market shifts during a year of exceptional challenges with extraordinary growth of online sales", *Art Basel and UBS*, March 16, 2021
[125] More NFT data and statistics here

Figure 44 / NFT Markets Compared to Industry Counterparts

Cointelegraph Research
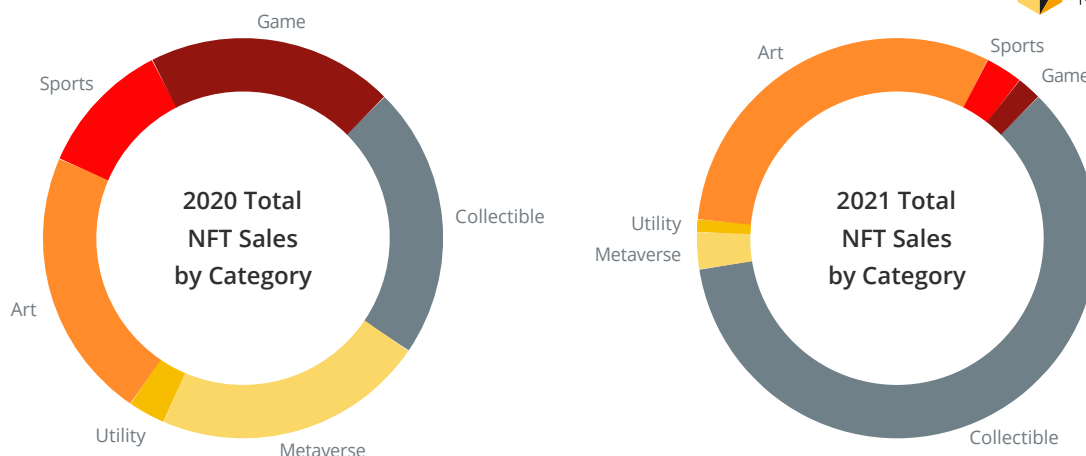
Source: Statista, Cointelegraph Research

The total video game industry market revenue was estimated to be $159 billion in 2020 according to Newzoo data reported by WePC.[126] Of this revenue, 85% is generated from free-to-play games through in-game purchases. The play-to-earn economy and game-based NFTs are a rapidly growing segment, which purports to be the evolution of game monetization.

According to our calculations at Cointelegraph Research using data from DappRadar.com, **Game-based NFTs have totaled $1.93 billion across multiple blockchains in 2021 so far, making up only 1.5% of the equivalent total free-to-play gaming revenue in 2020**. This NFT application is significantly less overvalued than art and collectibles. The gaming market has continued to grow in 2021, fuelled by the COVID-19 pandemic and is forecast to have reached $258 billion by 2025.[127] If gaming NFTs can take an equivalent market share of 5% of free-to-play transaction volumes, **then it will see $11 billion of volume in 2025**.

The sports market is another rapidly growing segment in NFTs, with further potential in penetrating its traditional counterpart. The global sports market is reported to be valued at $458 billion in 2020, down 15.4% from 2019 due to the COVID-19 pandemic.[128] This industry is rapidly digitizing with esports, virtual reality technology and online ticketing driving growth in 2020, making the industry ripe for NFT applications.

Sports NFTs totaled $83 million of volume in 2021 so far on the Ethereum blockchain, an equivalent of only 0.18% of the total sports market value. The sports market is projected to have grown to $600 billion by 2025, and if sport NFTs capture just 1% of this market share, we can expect to see $6 billion in volume. Similar to the gaming sector, this market is expected to grow significantly as the world recovers from the pandemic and offers more reasonable entry valuations compared to art and collectibles.

[126–127]More video gaming industry statistics and data can be found here
[128]More sports market data here

NFT Fintech Development

Key Takeaways

- ▣ DeFi technology is developing new features and markets for NFTs.
- ▣ Scalability, referring to transaction time and cost, is a major technical bottleneck for NFTs.
- ▣ NFT DeFi is enabling more accurate forms of pricing through peer prediction networks and derivatives.

Speculators get ahead of themselves, particularly in the cryptocurrency market. Today's wave of NFT interest echoes the ICOs from 2017. This time was marked by highly speculative crypto project launches that largely crumbled in the bear market and from regulatory scrutiny. Attracting liquidity to early-stage projects required expensive deals with monopolistic exchanges and well-connected whales. However, in 2020, ICOs returned in a much more sophisticated form. In just three years, DeFi networks developed an ecosystem for early-stage venture capital and liquidity bootstrapping. Launchpads, initial decentralized exchange offerings (IDOs) and slot auctions are just a few examples. NFTs will evolve in a similar manner, with many innovators today pushing this technology in new directions. The three main improvement paths include scalability, interoperability and protocol development.

1. Scalability is needed to reduce transaction time and costs, as well as enabling data to be stored on-chain cheaply. This is a limitation of layer-one blockchains and, in particular, Ethereum, which is known to have high transaction fees (see Figure 9). Competitors such as Binance Smart Chain, Tezos and Flow offer layer-one blockchains with lower transaction fees and faster block times. Layer-two solutions aim to build scalability on top of layer-one protocols, with projects such as Immutable X[129] and Loopring[130] developing on Ethereum. Improved scalability will enable microtransaction NFTs, more sophisticated NFT-related smart contracts, and storing data on-chain.

2. Today, different blockchains are largely isolated from one another, hence the need for interoperability. This is being developed by layer-zero solutions, such as Polkadot, Pylon developed Cosmos[131], and Harmony[132], to enable ownership among networks, taking the industry one step closer to truly universal assets. This is a critical component of metaverses, where digital assets and identity are continuous across platforms.

3. Protocol development is another avenue where NFTs can evolve. As new standards are created, novel applications can be built into NFTs. For example, the evolution of ERC-721 to ERC-1155 enabled the creation of smart contracts that can manage mixed assets such as fungible, non-fungible, and semi-fungible tokens.[133] Another example is the royalty feature of many NFTs, which is not a standard protocol but siloed across marketplaces. A recent Ethereum Improvement Proposal, EIP-2981, aims to address this issue with a standardized royalty implementation.[134]

4. DeFi technology applied to NFTs is a fintech frontier in the industry. One emerging application is the fractionalization of NFTs through fungible ERC-20 tokens, as discussed in Section 5.1. Charged Finance and Solv Protocol are taking this further by enabling users to deposit tokens into an NFT, complete with time locks and definable yield. This turns an NFT into a basket of goods with yield rights for the owner. The emergence of accurate NFT pricing feeds through peer prediction and derivatives opens the gateway to synthetic and indexed NFTs where an asset is created to track against the price of NFTs without containing them.[135]

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[129] Learn more about Immutable X here
[130] See "Loopring Now Supports NFTs on L2", Daniel Wang, *Loopring*, Aug. 24, 2021
[131] Learn more about Pylon here
[132] More information about Harmony here
[133] More information on the EIP-1155 standard here
[134] See "Exploring the NFT Royalty Standard (EIP-2981)", Blaine Malone, *Gemini*, Aug. 30, 2021
[135] See "150 Minutes of NFTs with Jake Brukhman", Tom Shaughnessy and Jake Brukhman, *Delphi Digital*, Aug. 25, 2021

5. These technical and financial developments of blockchain networks are forming an open internet standard with inbuilt digital ownership, referred to as Web 3.0. Digital ownership in a sophisticated Web 3.0 environment enables novel and innovative NFT applications that extend beyond the finance sector.

Beyond NFTs

Metaverses

Metaverses are networks of cyber spaces in which people can interact with one another, digital objects and the real world through their avatar. While definitions of metaverses vary, they orbit around technologies, including virtual reality, augmented reality, Web 3.0[136], IoT, digital twins and blockchain. While most think of metaverses as a singular, fully immersive virtual reality world, similar to *Ready Player One*, this is perhaps only the headline interpretation. A metaverse refers to the infrastructure that enables interoperability across cyberspace[137], continuity of one's online identity or "avatar," as well as continuity of digital objects and ownership.[138] Blockchain technology enables the continuity or digital universality of asset ownership and identity.[139] In the noise of cyberspace, blockchains are a beacon of immutable truth enabling trustless coordination.

Of course, immersion is another important factor in metaverses[140] but, again, perhaps not in *The Matrix* style of VR simulation that first comes to mind. In today's digital media context, immersion extends beyond one mode of consumption and across mediums. This is exemplified through the popularity of transmedia storytelling, such as the Marvel Cinematic Universe and the Pokemon franchise. Both offer entryways to their story universes through movies, shows, games, books, comics and other canon material. **Metaverses are transmedia for cyber spaces and economic reality.** A cyberspace could be a browser website, mobile app, video game, chat room or a virtual reality environment. The specific medium is not as important as the continuity of your digital identity and continuity of ownership — embodiments of your transmedia story.

Now that blockchain technology has established ownership in cyberspace, an economically meaningful structure is emerging for cybersocieties to build on. Facebook and Epic Games have both announced their leading products are shifting to metaverse platforms, with Facebook rebranding their parent company as Meta.[141] Perhaps in the future, we will see independent digital societies emerge, coordinated via smart contracts and decentralized autonomous organizations (DAO), with the same scale of relevance as Fortune 500 companies and governments.

[136] See "The Value Chain of the Open Metaverse", Packy McCormick, *Not Boring*, Jan. 25, 2021
[137] See "Introducing The Open Metaverse OS Paper", Jamie Burke, *Outlier Ventures*, February 2021
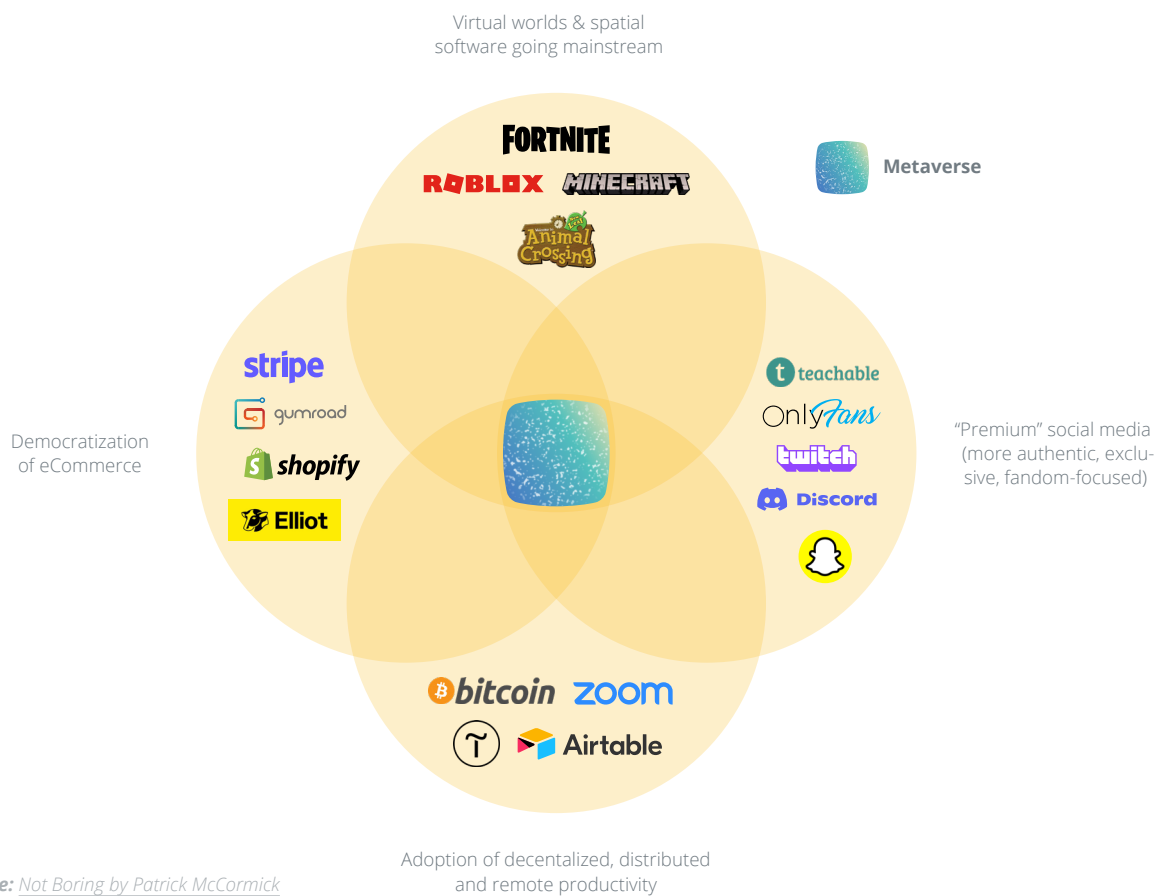[138] See "Step through the MetaPortal", *MetaPortal*, May 5, 2021
[139] See "Escaping the Gilded Cage: User Created Content and Building the Metaverse", Cory Ondrejka, *New York Law School*, January 2005
[140] See "What Is the Metaverse?", Brian Caulfield, *Nvidia*, Aug. 10, 2021
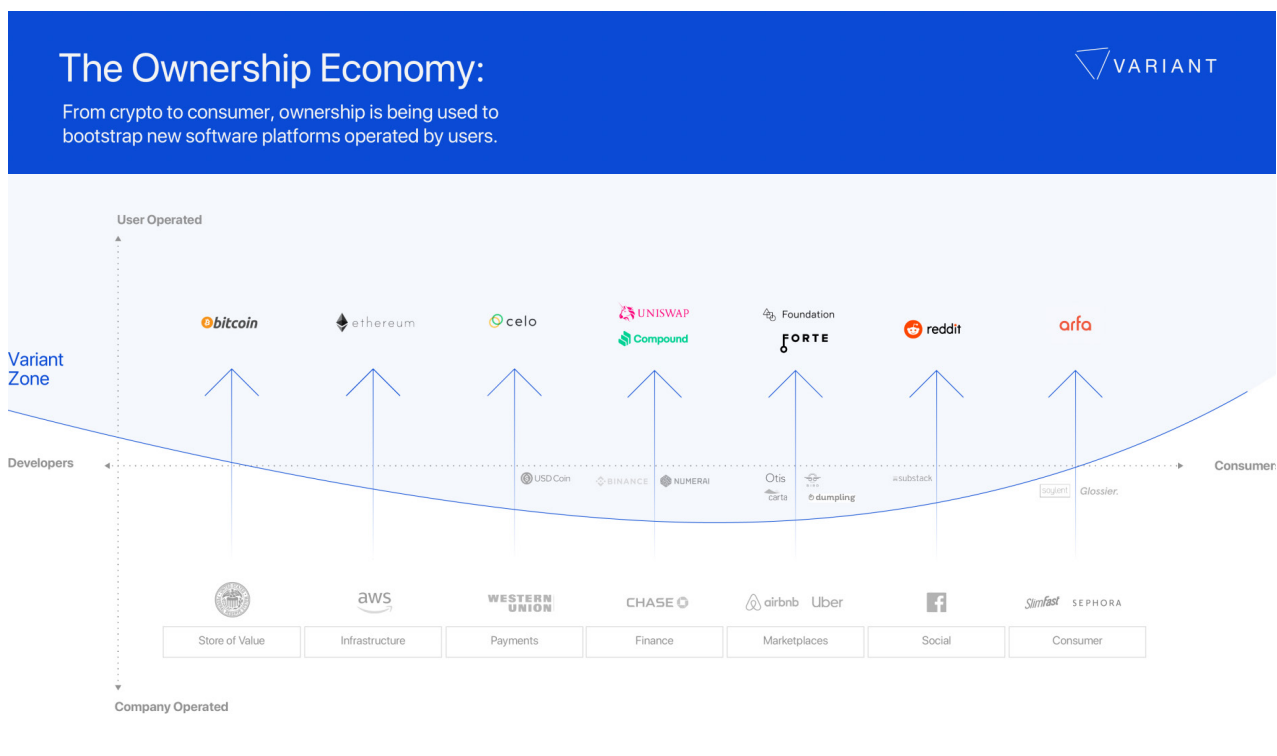[141] See "MARK IN THE METAVERSE", Casey Newton, *The Verge*, July 22, 2021

Figure 45 /

Metaverses Combine Gaming, Communication, Social Media and E-commerce

Virtual worlds & spatial
software going mainstream

Metaverse

Democratization
of eCommerce

"Premium" social media
(more authentic, exclu-
sive, fandom-focused)

Adoption of decentralized, distributed
and remote productivity

Source: _Not Boring by Patrick McCormick_

Figure 46 / The Ownership Economy

The Ownership Economy:
From crypto to consumer, ownership is being used to
bootstrap new software platforms operated by users.

VARIANT

Source: _The Variant_

Play-to-earn

Video game-based NFTs are proving to be one of the most readily applicable industries. The major leap being that in-game items, property and virtual objects now can be owned, given exclusive functions and monetized.[142] Play-to-earn is at the crossroads of gaming, Web 3.0 and DeFi, which includes various crypto technologies, such as NFTs, yield farming, fungible currencies and DAOs. The history of video game monetization began with pay-to-play models in the form of depositing quarters in an arcade machine or buying a boxed game cartridge. The next major form of monetization is free-to-play, or the dreaded pay-to-win model, focused on in-game microtransactions and popularized largely by mobile game designs. Play-to-earn is purported to be the next generation of video game monetization.

With monetized in-game assets, sophisticated economies have been emerging in and across video game worlds. Players in these economies have the opportunity to generate revenue, innovate, create, and have a true stake in the game world.

AG and DarkForestCapital wrote in a recent Substake post, *The Memetic Power of Play-to-Earn,*

" Play-to-earn fundamentally changes the distribution of economic power among different stakeholders in the gaming ecosystem. Specifically, it puts more influence into the hands of the gamers who, arguably, make a game valuable in the first place. In traditional gaming, players spend their time (effort) and sometimes capital in exchange for entertainment. However, with play-to-earn based games, the effort becomes monetizable and can be easily converted into an ownership stake."[143]

An interesting phenomenon emerging from play-to-earn models are guild DAOs and scholarships.[144] In their simplest form, scholarships fund players by leasing them in-game items, teammates and mentorship in return for a cut of revenue generated. This has grown into guild DAOs, such as Yield Guild, which manages a treasury of NFTs, game tokens and other assets through decentralized governance. Guild DAOs coordinate scholarships, bounties, esports teams, community events and other functions in the play-to-earn economy. Considering reports of the unbanked earning a livable income from play-to-earn games such as Axie Infinity[145], working in a metaverse doesn't seem so far-fetched anymore.[146]

Creator Economy

Today, the internet is dominated by platforms that largely rely on people's content, such as Google, YouTube, Wikipedia and various social media — yet very few profits are distributed to content creators. While there has been an emergence of crowdfunding and peer-to-peer platforms, these are ultimately limited by intermediaries and infrastructure. The creator economy is an emerging ecosystem of monetized content creation, distribution, patronage and community built on blockchain and Web 3.0 technology. Fungible social tokens emerged in 2020, often used as means for creators to raise capital, reward community members, and manage

[142] See "Axie Infinity, Yield Guild Games & the play-to-earn economy", *Coinbase*, Sept. 1, 2021
[143] See "The Memetic Power of Play-to-Earn", *MetaPortal*, June 21, 2021
[144] See "Beyond In-Game Assets: Blockchain Gaming, DAOs, Guilds, and Ragequitting", Garrison Breckenridge, *Magazine*, June 28, 2020
[145] See "A Play-to-Earn Account Beats a Bank Account", Beryl Li, *CoinDesk*, July 30, 2021
[146] See "Yield Guild Games: The Metaverse Recruitment Agency", *Accelerated Capital*, April 16, 2021

community governance.[147] Many creators tokenized themselves and launched their community through ICOs. Platforms like Collab.Land then allow creators to coordinate their community of token holders.[148]

NFTs enable digital artists to directly monetize their content by issuing and selling them on open marketplaces. In tokenizing and selling content to a community, the holders, fans, collectors and curators have a stake in the creator. This is empowering creators to build their own micro-economies, with a virtuous cycle of value creation among all participants.[149] Curation DAOs are an emerging phenomenon where decentralized marketplaces coordinate with their community to form value around a particular style, sponsor artists, and influence taste-making in the market.[150] Audius is the leading platform for Web 3.0 music streaming, enabling artists to earn a larger share of streaming revenue, release NFT collectibles and build communities.[151] Outside of Ethereum, there are deployable platforms such as OneOf[152], Metaplex[153] and Raydium[154] for creators to easily build a marketplace, web store and other infrastructure.

[147] Learn more about Llama here

[148] See "Social Tokens: Year in Review", Cooper Turley, *Forefront and Seedclub*, 2020

[149] See "Social tokens and the future of media", Joon Ian Wong, *The Block*, Jan. 17, 2021

[150] See "NFT Value Capture Equation", *Coopahtroopa*, Feb. 18, 2021

[151] See "Building the Investable Layer of Music, by 3LAU", Justin Blau, *The Defiant*, Jan. 19, 2021

[152] Learn more about OneOf here

[153] More information about Metaplex here

[154] See "Introducing DropZone", *Raydium*, Sept. 8, 2021

Nansen is a blockchain analytics platform where crypto investors can discover new investment opportunities, perform due diligence, and defend their positions by analyzing on-chain data by having access to the most extensive wallet labeling coverage on the Ethereum blockchain.

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Perform Due Diligence

Make informed investment decisions before you invest in a new crypto project or token.
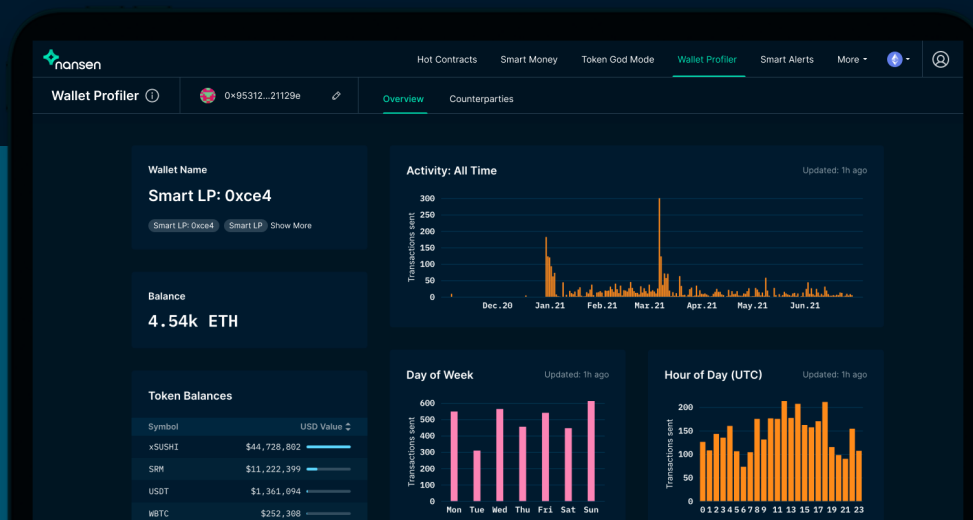
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Closing Thoughts

The NonFungible token movement is bridging digital keys and assets together. An NFT serves as a digital pointer ("deed") to the asset. Nonfungible tokens are blockchain-based deeds, giving a holder ownership rights to an asset, much like the house ownership deed proves the ownership of a house.

Digital collectibles and art dominated the market in 2021, contributing more than 90% of sales. Nevertheless, new uses of NFTs are emerging in supply chains, event management, and verification of qualifications. DeFi is also perceived as a potential way for further NFT market development.

Although the dependence of NFTs on the cryptocurrency market is still unclear, elevated interest in NFTs coincided with the overall bull market, **leading to $2.6 billion in Ethereum sales in August 2021 alone**. **Total sales this year are expected to achieve at least $17.7 billion by the end of the year as new traders boost secondary market activity.**

Meanwhile, NFT marketplaces that require only a single buyer and a seller to complete the transaction, have been attracting the interest of venture capital firms. For example, Dapper Labs, the creators of the basketball collectible series NBA Top Shot, raised a staggering $357 million in 2021.

Marketplaces and minting services allow for NFT creation without smart contract development. NFTs are first evaluated during minting and are then traded on the market. **The success of NFT series is often measured using average and floor prices, but median price is the least manipulatable metric.** An NFT's rareness, liquidity, and utility impact the cost of an NFT, but the final value is based on the buyer's subjective preferences.

Importantly, layer-one blockchains form the basis of an NFT ecosystem. **Ethereum currently processes more than 80% of sales despite high transaction fees that are often higher than the NFT's price.** However, alternative layer-one solutions, including Flow, Tezos and Wax are becoming more widespread due to lower transaction fees and energy consumption.

Investors can store NFTs in a combination of blockchain-specific software and hardware wallets. Software wallets allow for frequent trading, while hardware wallets are more secure. **The industry standard has quickly become a combination of a non-custodial browser-wallet and hardware wallet** such as connecting MetaMask to Ledger or Trezor.

The low liquidity of NFTs may make closing a position difficult or even impossible. complicate closing the position. However, the NFT market has been gaining liquidity from investors that have been pooling funds together in order to buy a single NFT and specialized funds that track diverse portfolios of NFT holdings. Although fractionalization of NFTs increases their liquidity, **the total value invested in the top NFT fractionalization platforms has been decreasing steadily**, which may indicate a decreasing interest from investors for this type of financial product. These products may also violate securities laws.

The lack of explicit jurisdictional regulations and taxation policies makes the future uncertain. NFTs may be considered to be a commodity, security, or intellectual property. The taxation depends on the residence country of the investor (and citizenship status for Americans). **In most countries, NFTs are subject to capital gains taxes.** Outside of taxes, NFTs carry inherent risks including the inherent risks associated with encryption and blockchain technology such as loss of private keys and 51% attacks, amongst others. Multiple reports have also pointed to the high degree of market manipulation that exists in the NFT market. NFTs are non-interchangeable and are not as liquid as cryptocurrencies, yet they are as volatile as cryptocurrencies. Thus, NFTs can be considered to be even riskier than cryptocurrencies. Therefore, investors should carefully consider the advantages and disadvantages of NFTs prior to trading.

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