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The role of banks in the new world of NFTs

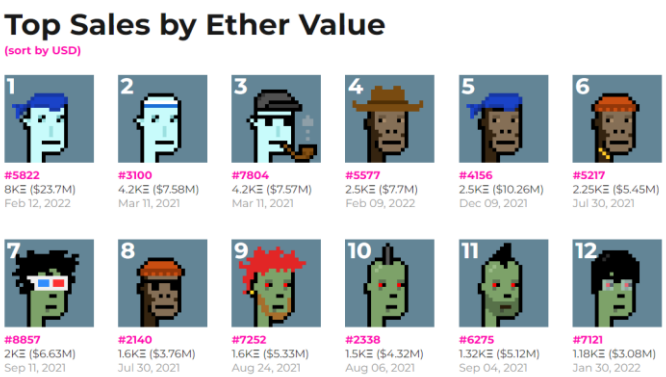
Over the past year, public interest in digital assets has exploded. This includes not only the dizzying number of different cryptocurrencies, for which prices have risen at a breathtaking pace, but also the equally broad spread of different types of digital tokens1/, and among the latter, NFTs in particular stand out for the passion that they have aroused. NFTs are most often found in the form of digital artworks of some kind, but the feverish trading in these has driven up prices and, in the process, these have caught the attention of a broader section of society, who are now wondering just what NFTs actually are.

NFT is an abbreviation of 'non-fungible token', a kind of digital asset that carries with it built-in certificates of authenticity that establish proof of ownership or confirm some other kind of right to the NFT. These can take the form of digital content, such as images, photographs, or music, or they may refer to physical assets, such as land. NFTs can thus be thought of as a digital token that confirms ownership or copyright, but unlike digital tokens, each NFT is also unique, which then means that one cannot be swopped for another (i.e., they are non-fungible) and neither can they be divided into smaller parts. NFTs can, however, be traded, and the conditions of the sale can be encoded in a smart contract2/. NFTs have their individual features recorded on a blockchain, and because this is a kind of distributed ledger technology (DLT)3/, it is possible for everyone else in the same network to inspect this data, which is then unalterable. At present, Ethereum is the preferred blockchain for the creation of NFTs, and in particular, the ERC-721 standard is used because this allows the individual data relevant to that NFT to be recorded and then to be connected with metadata (the metadata links the blockchain token to information that is held off the blockchain, or information relating to the ownership rights of physical objects). This ability then makes the Ethereum ERC-721 standard particularly suitable for use with NFTs.

One ancestor to full-blown NFTs was 'colored coins', which have been known among those interested in digital assets since the end of 2012. Colored coins were built on the Bitcoin blockchain but contained additional metadata that allowed the coin to be used to represent the value of another item, which could be a physical or a financial asset, such as stocks, bonds, or a collectible. However, colored coins were withdrawn at the start of 2018.

Slightly predating the extinction of colored coins, NFTs made their first appearance in mid-2017 via the CryptoPunks project4/. This first generation of NFTs was distributed freely, though in small numbers, and this has helped their value to increase steadily, allowing them to become both valuable and influential. This was followed by the highly popular and rapidly successful CryptoKitties project5/, which then became the first NFT venture to become widely known. The most important aspect of the CryptoKitties project was that it allowed anyone to create NFTs without the need for additional help from an administrator or a programmer, and so following this, a large number of additional NFT projects have been undertaken.

Figure 1: CryptoPunks



Source: https://www.larvalabs.com/cryptopunks/topsales

We would like to thank Khun Bunthep Tacharungreuangkij for granting us an interview and for providing such useful input and Dr. Pimnara Hirankasi for her assistance with preparing this research.

1/ See Box 1 for details.

2/ Smart contracts are programs that are embedded in blockchains and that share many of the features of regular contracts routinely agreed between buyers and sellers. However, smart contracts differ in that they are programmed to execute automatically, while they also retain other notable features of blockchain technology, that is that they are public, transparent, verifiable, distributed, and trustless.

3/ Blockchain refers to a kind of technology that is used to store information. Blockchains are decentralized (i.e., there is no overall owner or administrator of the information) and the stored data is public, with each participant in the blockchain having access to this via a peer-to-peer network that allows blockchain participants to view a shared database. Users are therefore able to inspect this public ledger, and information about who has particular rights or ownership is similarly public. Information is stored in 'blocks' that are digitally linked to one another in a chain, and this is the source of the technology's name.

4/ CryptoPunks is the most influential NFT project to date, and has provided a model for other successful NFT ventures. Cryptopunks was launched by two Canadian artists, Matt Hall and John Watkinson operating under the name Larva Labs, and involved the algorithmic creation of 10,000 unique 24×24-pixel images of men, women, monkey, zombies, and aliens (source: The Standard).

5/ CryptoKitties is a kind of blockchain-based game hosted on the Ethereum blockchain that involves collecting, raising and breeding digital cats. The resulting offspring all have unique characteristics, and these have thus given birth to a new class of objects within the world of cryptocollectibles (source: https://bitblockthai.com/about-cryptokitties/).

Figure 2: CryptoKitties

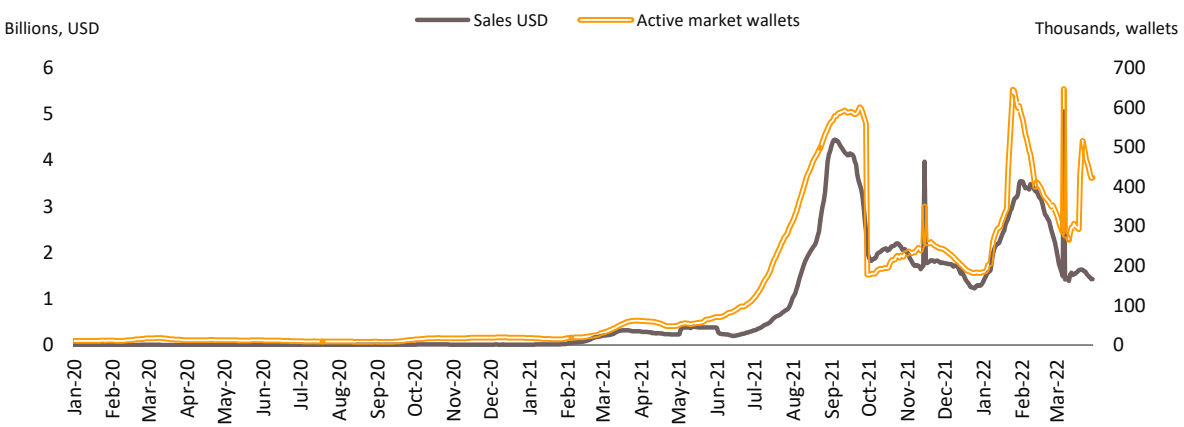


Source: MOC, CEIC, Household Socio-Economic Survey, Bloomberg, Krungsri Research

Artists around the world are turning to NFTs to create digital artworks since these are able to encode ownership data and other historical information. NFTs have the added advantage of allowing artists to add automatic royalty payment information related to the use of that artwork, too, and this surge in popularity has given rise to a growing number of platforms where NFTs can be hosted and traded, including SuperRare, Known Origin, MakersPlace, OpenSea, Wax, and Rare Art Labs.

NonFungible.com reports that as of 2021, the market for NFTs was worth over USD 15 billion, up 229-fold (22,851% to be exact) from just USD 67 million a year earlier. This astonishing surge in interest is mirrored in the 20-fold increase in NFT accounts, which went from 86,740 in 2020 to 1,976,256 just a year later.

Figure 3: NFTs Sales and Active Market Wallets

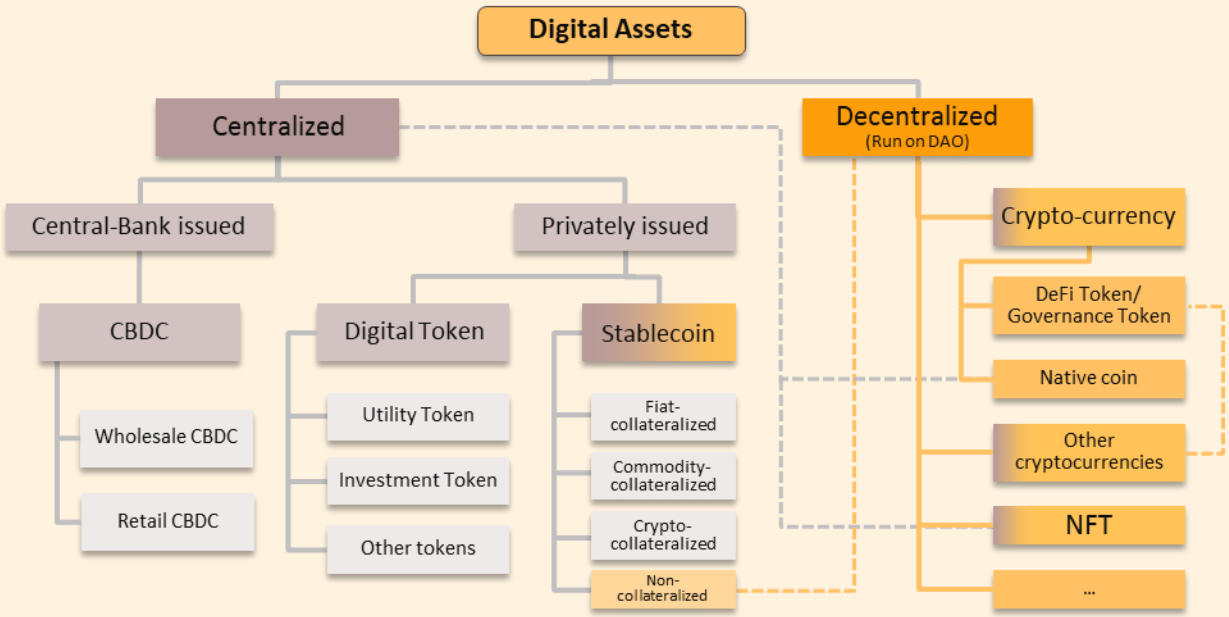


Source: NonFungible and Krungsri Research

Creating NFTs is now easier than ever and this is provoking growing interest from artists, investors, and members of the general public who are interested in exploring this new digital territory. Nevertheless, NFTs are still at the first stage of their development and those involved in their creation are still learning about these and trying to find applications for them.

Box 1: Different types of digital assets

The number of types of digital assets continues to proliferate. These can be categorized in a range of different ways, none of which is universally agreed upon as the preferred method. This research thus begins by looking at digital assets in terms of their governance, splitting the general class into the two primary groups of centralized and decentralized assets.



1. Centralized digital assets can be subdivided according to the type of issuing organization.

1.1 **Digital assets issued by central banks** are referred to as CBDCs (central bank digital currencies). CBDCs are similar to the notes and coins traditionally produced and released into the economy by central banks, but CBDCs are virtual creations and so they will be held in e-wallets or om cards. CBDSs can be divided into the two further categories of wholesale CBDCs, which are used to settle accounts between commercial banks, and retail CBDCs, which are used by the general public.

1.2 **Digital assets issued by private-sector players** can be divided into digital tokens and stablecoins.

1.2.1 **Digital tokens** are digital coins that offer certain rights or privileges to holders. These can be of two types.

- **Utility tokens** give the holder rights to claim a good, a service, or another specified item. The operation of these is similar to collecting airmiles or points on a credit card that can then be exchanged for another item or service.
- **Investment tokens** encode the rights to participate and benefit from some kind of investment project. They are thus similar to digital versions of paper equity or debt instruments.

In addition, hybrid tokens exist that combine the features of both utility and investment tokens.

1.2.2 **Stablecoins** are tokens that have a value that is tied to another asset. These fall into four groups according to the type of asset to which they are linked.

- Fiat-collateralized stablecoins are tied to a particular fiat currency, such as the dollar, the euro, or even the baht. For example, Tether (USDT) is a stablecoin that is linked to the dollar. Issuing a stablecoin requires that the issuer establish a body that is able to control the value of the stablecoin, and building the required trust in this will generally involve setting aside a considerable reserve of that currency.
- Commodity-collateralized stablecoins are secured against a commodity such as gold, oil, or land, but like fiat-collateralized stablecoins, this requires that the coin issuer is also able to guarantee that the value of the coin will be fixed against that commodity. For example, 1 Digix Gold (DGX) coin has a value equivalent to 1 gram of gold, and because the issuer is in Singapore, coin holders in Singapore are able to redeem a quantity of Digix Cold for an equivalent weight of gold.
- Crypto-collateralized stablecoins are secured against another cryptocurrency. Thus, DAI is collateralized against other cryptocurrencies, though it is structured in such a way that its value tracks that of the US dollar. These types of stablecoins may find applications on DeFi platforms[a/] and because they may be managed through decentralized autonomous organizations (DAOs)[a/], they are more decentralized than the two types of stablecoin described above.
- Non-collateralized stablecoins are not secured against another asset but instead, their value is maintained by algorithmically manipulating their supply, expanding or contracting this as necessary to keep their value stable. These are thus also sometimes called algorithmic stablecoins, an example of which is AMPL.

Box 1: Different types of digital assets (continued)

2. Decentralized digital assets are issued outside the control of a central body that has been tasked with managing their supply or value, though these are built on DAOs. Several different types of digital assets exist.

2.1 **Cryptocurrencies** are the most widely known type of digital asset. At present, there are over 1,500 cryptocurrencies being traded, and globally, over 300 million people are thought to hold some cryptocurrency. This general category of assets can be subdivided into the following groups.

2.1.1 **DeFi tokens** are designed for use on DeFi platforms, so for example, on the Aave DeFi platform, deposits and loans are made using the AAVE token. Sometimes, these are referred to as governance tokens since these may be created to provide holders with certain rights, such as assigning voting rights for changes to governance mechanisms, or to offer rewards for being a liquidity provider (LP), which in the DeFi context is similar to making deposits that can then be loaned out again. DeFi tokens are therefore similar to utility tokens.

2.1.2 **Native coins** are the coins issued from or tied to a parent blockchain. Thus, Bitcoin, the oldest cryptocurrency, is the native coin for the Bitcoin blockchain, and Ether (ETH) is the native coin for the Ethereum blockchain. Ethereum provides the basis for many DeFi platforms, including Aave, and each DeFi platform uses its own DeFi token, so it could be said that native coins and DeFi tokens bear the same relationship to one another as department stores do to the smaller shops that they house.

2.1.3 **Other cryptocurrencies** are gaining ground since although mainstream cryptocurrencies such as Bitcoin are a kind of digital gold, some developers believe that these could be developed further. Because these provide an alternative to the cryptocurrencies that are currently popular, they are called altcoins (from alternative coins).

2.2 **NFTs**, or non-fungible tokens, encode ownership information or data relating to other rights, and these are often linked in particular to digital artworks. Because each NFT is unique, they cannot be substituted for or with another token, and unlike cryptocurrencies and other types of digital tokens, they cannot be subdivided.

2.3 **Other types of digital token** include memecoins, such as Doge Coin or Shiba-inu Coin. In the future, a large number of other types of digital coins are likely to be created.

a/ For more information, please see the research paper "Traditional Banking and DeFi: What Role will be Left for Banks if the Financial System is Disintermediated?"

NFT characteristics

Different types of NFT display a wide range of different characteristics, but the most significant of these can be gathered under the following five headings[6/].

1. **Uniqueness:** Unlike other tokens or digital assets, NFTs have unique qualities, and when NFTs are issued, it is possible to clearly specify the number that will be created, with identifiable differences between each token.
2. **Rarity:** The limited supply or rarity of NFTs may have several explanations. (i) Artificial rarity occurs through a deliberate decision to restrict the supply or issuance of an NFT. For example, Larva Labs, the creator of the Cryptopunks NFTs, decided that of the 10,000 NFTs that it would issue, just 1.75% would feature a 'punk' wearing a mask. (ii) Numerical rarity is similar to artificial rarity but may be more obvious since a numerical limit is set on the number of NFTs to be issued. An example of this would be a musician who issued a new song as an NFT, of which only 100 signed and password-protected copies were created. (iii) Historical rarity can occur when historical circumstances or the history of a token work to underscore that NFT's rarity. Thus, the Cryptopunks NFTs are valuable and sought after since they are widely recognized as the first NFT. In addition, because the blockchain records the complete ownership data of individual NFTs, those that have been owned by famous individuals may acquire historical rarity and so become more in demand.
3. **Ownership:** NFTs carry their own proof of ownership, as well as encoding their full history. This generally includes data on when the NFT was created, who created it, who the current owner is, and what changes of ownership have occurred since it was first issued. Most NFTs that are created now guarantee only ownership rights, and unless it is otherwise specified, the copyright usually remains with the original creator.
4. **Immutability:** This quality is an extension of properties of the blockchain on which the NFTs are created, i.e., it is impossible to unilaterally alter the data on the blockchain. This then helps to build transparency and trust.

6/ EU Blockchain Observatory and Forum

5. **Programmability:** This is a characteristic of NFTs that marks them out from real-world assets. Because NFTs allow for complex agreements to be encoded into smart contracts that are bundled with the NFT, as long as the conditions can be specified and coded, there is no limit to what these can cover, and so changes of ownership of the NFT can involve complex procedures. Thus, an artist might specify that a 10% royalty fee has to be paid every time a particular NFT changes hands. This ability is also allowing NFTs to be trialed as collateral for loans made on DeFi platforms.

What is the source of NFTs' value?

Although at present, there are no laws that directly regulate or support the market for NFTs and most NFTs only offer ownership rights that do not include copyright, the NFT market has exploded in value and investors are rushing to enter this space. The main determinants of NFT value are thus summarized below.

- **Passion for or an appreciation of the value of the artist's work**: Value might derive from the status of a world-famous artist, or for support provided to a particularly admired artist, singer, or sportsperson.
- **Benefits that derive from holding an NFT:** For example, ownership of an NFT might grant the owner the right to additional goods or services, further benefits or returns as a share of any future income generated by the asset, extra benefits deriving directly from that asset, or other specified rights.
- **The social status of NFTs:** Owning NFTs may make the owner feel that they are young, progressive. modern, adventurous, entrepreneurial, and that they are a member of the wealthy investor class.
- **Community building:** Individuals with a shared interest or who belong to the same community will try to support the continuation of that community, and so the value of NFTs has steadily increased with the size of the NFT community and its support for NFTs.
- **Speculation and buying for future sale:** Because NFTs are unique and limited in supply, they attract the interest of investors looking to sell on for a profit.

Creating and trading NFTs

When creating an NFT, it is possible to encode within it a wide range of property rights that relate to that particular asset, but because digital artworks[7/] have attracted the most interest in the market for NFTs, the following section will focus on how these are created and traded.

1. Minting NFTs: NFTs begin their life when an artist or creator records a graphic or other digital artwork and then uploads this image or artwork together with all relevant accompanying information to a hosting service[8/] so that the images and data can be further processed. This could be a centralized storage service, such as the Amazon S3 service, a distributed storage service, such as IPFS (Inter Planetary File System), or possibly an NFT marketplace, which in some cases also offer data storage services. Having been uploaded, the NFT is minted and any accompanying rights or obligations are encoded with it. Artists may create their own NFTs or, if they lack the expertise necessary to convert a digital artwork into a blockchain-hosted NFT, this can be done by an agent or seller, who will then mint the NFT and include it in NFT marketplace catalogues.

2. Trading NFTs: When a buyer is interested in an NFT, purchases are relatively straightforward. Prices may be fixed or they may be set by auction, and in NFT marketplaces, these follow one of two models.

1) 'English auctions' are organized such that prices start from the lowest price that the seller of a particular NFT will accept. The bid prices are then steadily raised by the auctioneer until they reach the highest price that anyone will bid on. NFT marketplaces that use English auctions include OpenSea, Foundation and SuperRare. This style of auction is favored because it is so easy to understand and to follow.

2) 'Dutch auctions' take the reverse path, beginning with a very high price. The seller will then steadily reduce the sale price until a buyer agrees to the proposed price; the first person to accept a price is then the winning bid. Axie is one NFT marketplace that uses this method.

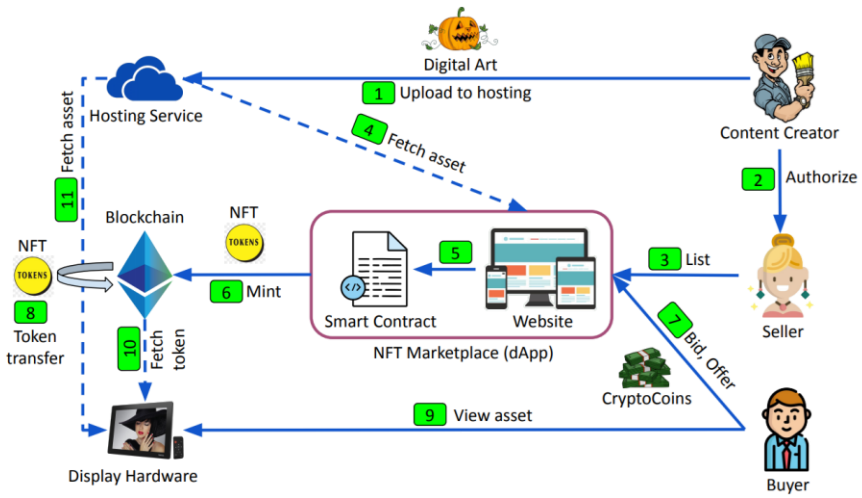
7/ Das, Dipanjan & Bose, Priyanka & Ruaro, Nicola & Kruegel, Christopher & Vigna, Giovanni. (2021). Understanding Security Issues in the NFT Ecosystem

8/ Hosting services provide online data storage capabilities that make the data accessible to others, who can access it, download it, or otherwise interact with it. Generally, users will build a website first and then upload this to the hosting service provider (source: https://blog.phalconhost.com/what-is-hosting/).

In either case, when a sale price is confirmed, the seller will transfer ownership of the NFT from the seller's to the buyer's account.

In addition to the method used to set sale prices, NFT marketplaces also vary the conditions that they impose on either side of the market, and buyers and sellers will need to consider these carefully before making a decision. For example, some marketplaces may store information about bids on a blockchain or in internal systems, they may have different rules about withdrawing bids, and they may operate differently with regard to how quickly they transfer ownership of NFTs after a sale has been completed.

Figure 4: NFTs ecosystem



Source: Das, Dipanjan & Bose, Priyanka & Ruaro, Nicola & Kruegel, Christopher & Vigna, Giovanni. (2021). Understanding Security Issues in the NFT Ecosystem.

Box 2: How do NFT Marketplaces differ from General e-Commerce Platforms?

There are five principal ways[b/] in which NFT marketplaces differ from general e-commerce platforms such as Amazon, eBay, or in the Thai context, Shopee and Lazada.

1. Decentralization: Trading or transferring ownership of NFTs has to take place on a blockchain for proof of ownership to be recorded, and one of the most important features of the blockchain is that it is centralized and no single authority has permission to alter or change this information. This makes the data stable, secure and transparent.

2. Crypto payments: Buying and selling NFTs is completed using cryptocurrencies.

3. Trustless trading: Buying and selling NFTs occurs without the need for an intermediary to manage the processing of payments or the transfer of ownership.

4. Atomic swaps: Payments and transfers of ownership will take place simultaneously, even if the cryptocurrency being used as a payment for the NFT is on another blockchain. This then allows transfers to take place in the absence of a middleman that might otherwise be needed to secure against the risk of one side of the transaction not being completed.

5. Token minting: NFTs have to be created either before or at the moment of being traded so sellers cannot create an NFT after it has been sold. This is a direct consequence of the nature of trustless trading and atomic swaps, which are not possible if the NFT being sold does not yet exist.

b/ Das, Dipanjan & Bose, Priyanka & Ruaro, Nicola & Kruegel, Christopher & Vigna, Giovanni. (2021). Understanding Security Issues in the NFT Ecosystem.

Using NFTs

NFTs have found a variety of roles in different industries, some examples of which are given below.

Digital art: NFT platforms have helped to create a space within which artists may connect with buyers and so they now do not need to rent their own sales space or rely on galleries organizing exhibitions of their work. This has then had the additional benefit of reducing the cost of marketing to collectors, though these developments have been especially important during the pandemic, when governments severely curtailed travel in countries around the world. NFTs also give artists a way to benefit more fairly from the sale of their works since NFTs can carry and enforce smart contracts that ensure that a proportion of the sale price is returned to them every time the work is resold. Thus, artists are now able to earn royalties in addition to the initial sale price, which had previously been their only source of income from the sale of an artwork. Examples of recent sales of NFTs are 'Everydays: The First 5000 Days' by the artist Beeple, which went for a 2021 record of USD 69.35 million, while in Thailand, the current record sale price for an NFT is held by 'The Invitation' by Nahathai Naothaworn, or IPUTSA, which sold for 11 ETH, or around THB 1.5 million[9/].

In-game assets: The gaming industry has enjoyed high rates of growth that have lifted its market value to beyond USD 100 million, and the emergence of NFTs will help to further add to the appeal of gaming. NFTs allow gamers to generate income from their activities (so-called play-to-earn) by linking gaming assets, which might be objects in the gaming environment or character skills, with NFTs that allow for proof-of-ownership. Gamers are then able to trade these NFTs with others, as is the case with Cryptokitties, Axie Infinity, Aavegotchi, Splinterlands and LiteBringer.

Content ownership: Content creators are able to generate income through NFT versions of songs, or music or other videos, or to use NFTs to make use of their copyright over previously created works. NFTs may be issued that enforce fractional ownership rules regarding that particular artwork, so if that artwork generates additional income, the NFT owner will receive a portion of this as specified. For example, Rocki, a platform for music NFTs built on the Binance Smart Chain, sells songs and accompanying copyright ownership to record labels and collectors, which will be shared with the creator[10/]. In Thailand, the well-known singer Tik Shiro has auctioned his song 'Love Doesn't Change' as an NFT.

Fashion: Brands exist as concepts that individuals use to express a particular image, identity, social standing, or other admired feature. The appeal of brands is unlikely to change, and in the future, as the virtual and real worlds become increasingly integrated and hard to distinguish, the desire to express individual identities in the digital space through brands will become ever more important for companies looking to expand their customer base and to take control of this new environment. At present, both mass-market and high-end brands, including Gucci, Louis Vuitton, Burberry, Coach, Dolce & Gabbana, Gap, Balenciaga, Adidas, and Nike, are establishing a presence in NFT markets. Brands are also finding other applications for NFTs in recording and checking the history of goods by using blockchains to track these from raw materials, through retail outlets, and into secondhand markets, and leading brands such as Bulgari, Cartier, Hublot, Louis Vuitton, and Prada are already participating in the Aura Blockchain platform[11/].

Ticketing: Tickets for admission to events such as concerts could be issued as NFTs. This would then allow them to be kept as souvenirs or collectibles.

Certificates: Because NFTs are built on blockchains, they are transparent, open and immutable, which makes them suitable for use as a means of recording different types of certification. Hoseo University in South Korea and Dhurakij Bundit University in Thailand have therefore both begun issuing degree certificates as NFTs.

Virtual assets: NFTs are beginning to be used to record ownership of virtual assets, for example, to record ownership of domain names (e.g., via the Ethereum Name Service and Unstoppable Domains) and so permit the owner to trade these. Within the metaverse[12/], where activities may straddle the virtual and real worlds, NFTs are widely used to establish ownership of metaverse-based assets, including for example to record ownership of virtual land on the Decentraland, The Sandbox and Cryptovoxels platforms.

Real-world assets: In addition to ownership of virtual assets, NFTs can also be used to establish ownership of real-world assets through the creation of a 'digital twin', or a digital representation of a real-world object. NFTs may thus act as the middleman linking property rights in the virtual and the real worlds, and this will then allow for the seamless trading of real-world assets in virtual environments. An example of this is OpenLaw, which has established a platform for trading real estate but which uses NFTs and the ERC-721 standard to encode ownership information. Adidas also offers virtual trainers for sale as NFTs but bundles with these rights that entitle the owner to a pair of real trainers at no extra cost.

9/ https://thestandard.co/5-highest-earn-nft-thai-artworks/

10/ https://siamblockchain.com/2022/02/11/top-7-nft-use-cases/

11/ https://zipmex.com/th/learn/fashion-in-nft

12/ The metaverse is a three-dimensional environment that seamlessly joins the real and the virtual worlds and that is accessed via internet. This provides a setting within which people can live out their lives, spending their time working, resting, consuming media, gaming, socializing with others, and engaging in joint activities much as they would in the real world. The metaverse is entered by wearing a VR headset that is connected to the internet.

Obstacles on the path to widespread adoption of NFTs

Money laundering: At present, most NFT platforms enforce know-your-customer (KYC) rules only cursorily, or even largely ignore these. Thus, on the OpenSea platform, customer identities are checked only to the extent that they have an Ethereum wallet, and when gaining access to the platform to sell NFTs and to be paid in a cryptocurrency, revealing further personal details is not necessary. Moreover, because these transactions take place on the blockchain, buyers and sellers are anonymous to one another, it is not possible to know the origins of the money being used to fund the sale, and it is equally impossible to assess whether or not the price of the asset being sold is a fair reflection of its real value. Beyond this, at present, legal systems do not extend explicitly into NFT markets and regulatory bodies in many countries thus fear that the trade in NFTs is being used for money laundering. It is therefore likely that in the future, buyers and sellers of NFTs will need to perform basic KYC procedures before sales can be completed. This may involve revealing the real names of those on either side of the trade, establishing the source of the funds used to pay for the NFT, and supplying other supporting documentation, even if this runs against the decentralized sprit of the NFT market.

Security concerns: As soon as NFTs began to attract more widespread interest, fears about safety started to mount. These worries extended over problems with confirming actual ownership of the NFT, credit card information being stolen when purchasing an NFT, ownership of NFTs being switched back after the sale had been completed, stealing NFTs, copying NFTs, and using assets without the owner's permission when minting NFTs (e.g., copyright infringement). Finding ways to reduce fears around all of these issues will thus be an important step on the road to opening the market for NFTs to a broader section of the public. There are several approaches that could help with this. (i) Problems with identity theft could be reduced by enforcing the use of two-factor authentication (as used in commercial banks' online applications) when accessing accounts or trading an NFT. (ii) Worries about fake NFTs could be reduced by using a middleman to inspect and confirm the authenticity of NFTs when they enter the system or in the period between selling an NFT and completing the transfer of funds and ownership (i.e., enforcing an after-sale cooling-off period during which checks could be made). However, at present, the world of digital assets and especially the area of cryptocurrencies is outside the scope of official regulators, and so operators of NFT marketplaces will need to take it upon themselves to try to enforce these kinds of standards and to ensure that their customers' data and assets remain secure when they are on their platform.

The difficulty of enforcing real-world linkages: In many ways, NFTs perform the same kind of function as do land title deeds or other types of certificates of ownership, but in the real world, title deeds and ownership certificates are not the asset owned; they are simply accepted as proof that the owner named on them benefits from all the accompanying rights that come with ownership of that asset. However, as described above, although some NFTs are used in this way to assign ownership of real-world assets such as land or other goods to the owner of that NFT, at present, most NFTs have no legal status, and holding ownership through an NFT is not legally sanctioned. Rather, this is simply an agreement between buyer and seller to treat these agreements as though they were legal, without this being the case. It is therefore difficult to enforce NFT-assigned property rights through a court. In addition, international trading of NFTs adds to these difficulties since the law varies from one country to the next, and at present the international agreements that would need to be in place to make the international trade via NFTs secure is still only at the stage of being researched and developed. It is also true that it remains difficult to check ownership of NFTs, even when operating within a single NFT marketplace, and so buyers' security is at least partially dependent on the safety and stability of these platforms.

Inaccessibility: Most NFT marketplaces insist that users wishing to buy or sell NFTs must have a cryptocurrency wallet, while to make informed choices about what features to include with their NFTs, artists or others looking to create these need to have at least a basic understanding of blockchain technology and to be able to decide questions such as which blockchain to use, which standard to employ, how to write their contract, and what currency they would like to be paid in. Because of this, participants in the market for NFTs tend to be restricted to those with experience and knowledge about cryptocurrencies and the use of DApps (decentralized applications). As such, the market is currently concentrated among 'early adopters' and particular groups with shared goals. By contrast, much of the population either does not understand the benefits that come from owning NFTs or does not trust them. To counter this and to attract a greater number of customers, owners of NFT marketplaces are trying to improve the user experience by making their platforms more user-friendly. Nifty Gateway is therefore allowing the purchase of NFTs with credit cards, and OpenSea has extended this to allow payments to be made with debit cards, credit cards, and Apple Pay.

Krungsri Research view: How should the banking sector approach the NFT ecosystem?

Compared to the markets for cryptocurrencies or indeed for other asset classes, the market for NFTs is currently limited in scope, but its rapid expansion and the wide range of potential uses for NFTs indicates that this will not always be the case, and so close attention should be paid to this area. Krungsri Research believes that banks can follow a number of different routes to enter this space.

Brand awareness: Banks could participate in the market for NFTs to improve their branding and to indicate that that bank understands the technology and is a member of the NFT community. At first, this might take the form of supporting the market for digital artists or in-game assets since these are areas where NFTs are finding applications most rapidly. Banks could also buy NFTs directly, fund or participate in activities related to the NFT community, or join with partners to build a network connected to the NFT ecosystem. These types of activity will help to develop brand awareness and build the bank's image as youthful and tech-forward. However, it should be noted that the biggest gains from this strategy will likely go to the bank that gains first-mover advantage.

Enhancement of operational efficiency: An alternative route would be for banks to increase their own operational efficiency by exploiting the special characteristics of NFTs to encode ownership information in a way that is transparent and trustworthy and to include within themselves smart contracts. For example, NFTs could be used when buying a house or car with a loan, and these could be set up so that ownership would automatically transfer to the buyer from the lender as soon as all payments had been completed. In addition, if a bank customer wished to transfer the loan from one bank to another, this could be done without the need to void the first contract and then create a second. Instead, the NFT-based loan could be traded between the two banks, with the loan conditions being adjusted as necessary. Nevertheless, getting to a point when NFTs can be used in this way will take some time since the requisite infrastructure will need to be built, industry standards need to be agreed, and the regulatory and legal framework needed to support this kind of business will need to be put in place.

Supporting the introduction of new products and services: Banks may also respond to a wide range of consumer needs by designing new products and services that are based on NFTs.

- **Establishing an NFT fund:** Banks could underwrite NFT investment funds. As well as helping their clients invest in the NFT market without their needing to hold their own NFTs directly, this would also help to stimulate the market for NFTs and related industries.
- **Using NFTs as collateral:** Once the market for NFTs has matured sufficiently that the price volatility of at least some types of NFT has settled down, or financial tools have emerged to better manage this risk, NFTs may become one option when considering the collateral to be used to secure a loan.
- **Provider of financial services**: There are many types of financial services associated with the sale of NFTs that could be provided by commercial banks. This could include supplying payment gateways for NFT marketplaces, which because it would allow buyers to pay for their purchases with credit cards, would likely make the whole process much easier. In the future, the trading of high-value NFTs is likely to attract the attention of the authorities, and buyers will need to comply with anti-money laundering/countering the financing of terrorism legislation that requires them to disclose the sources of their income. In this case, banks would be well placed to provide services to facilitate this process. When NFTs are auctioned, banks could also confirm the ability of bidders to finance their purchases in real-time, thus obviating the need to cancel auctions after a winning bid has been made but the funds to pay for this are not forthcoming.
- **Providing NFT custodian services for the storage and management of returns arising from clients' NFTs:** Banks could act as custodians for their clients' NFTs, and for NFTs that represent real-world property rights, banks could offer additional services to look after those assets, too. Banks have an advantage in this area since they are already trusted to look after clients' other personal assets, such as money on deposit or objects kept in bank safety deposit boxes, and this would pave the way for banks to offer these additional services managing and looking after other assets. Both buyers and sellers of NFTs would likely trust banks not to alter the asset or to allow it to drop in value. Assets that would tend to need these kinds of custodian services would be high-value goods that were more difficult to look after or that the owners did not need to have physical access to. Examples might include precious stones, wine, collectible cards, religious objects, books, or other types of collectible or valuable items.

- **Establishing an NFT marketplace:** Banks could set up an NFT marketplace, either by themselves or by partnering with another player. This would help them: (i) generate income from the fees charged for carrying out business on the platform; (ii) gain access to customers interested in NFTs, to whom the bank could then try to sell other goods and services; (iii) harvest data on consumer behavior; and (iv) increase the channels through which the bank is able to reach their clients. However, this might be a tricky route to take, and it may be difficult to attract users to the platform and to encourage the development of relationships within it.

Although NFTs remain a new and somewhat exotic asset class that has yet to find a clear role within the banking sector, players in the financial sector should nevertheless pay attention to this corner of the technological world because NFTs may well open another door into the new continent of digital assets. And as long as they are providing financial services in an environment that is undergoing such unprecedented technological change, stepping into this new territory will remain crucially important for players in the financial sector.

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