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The non-consensus of the "metaverse" economy

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ABSTRACT

This paper attempts to clarify the main economic logic of the metaverse from an economic methodology, showing that the virtual digital economic activities of the metaverse cannot be separated from the real economy, exploring the boundary between the metaverse and the real world, and suggesting that the metaverse essentially needs to be constructed by relying on the real social structure and economic logic, and that there is no consensus with its completely decentralized concept. The increase in the realistic match or realisation of the metaverse is the result of long-term social evolution, and decentralisation is not a sufficient necessary condition for the development of the metaverse, which should be based on the central bank's digital RMB to build a metaverse financial infrastructure. This paper also discusses the current status and development path of technology applications and industrial investments for realising the metaverse. In the primary stage of the metaverse economy, infrastructure hardware and software and underlying technologies and their related applications will be prioritised for development; games and business service experience applications have more room for development, while social and other content applications are subject to personal information protection and ideological constraints and will be steadily and orderly promoted.

Keywords: reality economy; virtual digital economy; virtual-reality border; virtual digital people; central bank digital RMB

1. Introduction

2021 is the year when the topic of "metaverse" explodes. People's daily lives and work are moving more online as a result of the epidemic, the offline scene is being digitised, the number of people online and the average time spent online is increasing rapidly, the scale of online transactions is growing dramatically and the real world is expanding into the virtual world at an accelerated rate. The term "metaverse", a concept fictionalised in a novel by science fiction author Neal Stephenson 20 years ago, was revived last year by some liberal economists and echoed by investors in the gaming industry, have said they are looking into getting involved. Similar to blockchain, opinions are divided over the route and future of the metaverse. Is the metaverse a flash-in-the-pan hot topic, or is it the future of the internet, or will it even disrupt our social life? This article attempts to discuss four fundamental questions about the full necessity of decentralisation and the development path of the metaverse from the perspectives of theory, technology, industry and potential impact on society.

2. New conceptual and theoretical propositions

There is no clear and complete definition of a metaverse. The general view is that a metaverse is a virtual space. Some propose that a metaverse is a collective virtual shared space, a mega-virtual space structured on top of the logic of reality, created by the fusion of a virtually augmented physical reality and a physically persistent virtual space (including the sum of all VR, AR and the Internet)[1]. Others believe that a metaverse contains both the real world and the aforementioned virtual world, or a fusion of the real world and the virtual world with this virtual world as the main platform. The space of fusion between the real and virtual worlds. The current consensus on the virtual world of the metaverse is that it includes a social platform built on blockchain algorithms and rules, an economic system based on blockchain digital currency, and a content platform built on blockchain technology for the production of knowledge by users[2].

Some domestic experts have proposed the concept of "metaverse economy" as a subset of the digital economy, referring to all economic activities that take place in the virtual digital world, such as the creation, trading and consumption of digital products[3]. For example, the activities of gamers creating and selling virtual goods in online games. This 'metaverse economy' is a narrow concept that refers to the production, sale and consumption of native digital goods and can therefore be clearly distinguished from traditional economic activities and discussed separately.

In this paper, we refer to the economy of production, sale and consumption in fiat money in the physical world as the "real economy" and the metaverse economy in the virtual digital world as the "virtual digital economy" for convenience. From the perspective of the basic concepts of economics such as production, consumption, scarcity, cost and economic system, we discuss the follow-ing central issues concerning the metaverse economy.

2.1. Is there no "scarcity" in the metaverse economy?

The metaverse economy production function is very different from the real economy, where natural endowments such as land and population size play a negligible role, and its digital production activities are themselves primary, with the vast majority of products not coming from the processing of material means of production. The costs of production are mainly time inputs, human labour (and the energy or food required), arithmetic power and electricity. If we take as a prerequisite a system suitable for a metaverse economy, it is data, human capital, technology and financial capital that play a major role at this point. Both platforms and individuals can produce virtual digital goods, and more people can become producers in the virtual digital economy. Data itself is the means of production in the digital economy, and the fact that everyone is constantly 'producing' huge amounts of data makes it extremely easy and cheap to produce and acquire this means of production. Take the example of Roblox, a metaverse game platform where all games are created by gamers themselves. There are currently over 40 million games on Roblox, with more than 50,000 being added every day - more than all the games ever developed by any game company combined.

The production of digital virtual goods does feature a near-zero marginal cost, leading to an abundant supply in the market, a potentially deflationary consumer market as a buyer's market, constantly higher consumer demands for products and services, and the rapidly diminishing marginal utility of a single product, prompting producers to constantly upgrade product quality performance. This makes consumers' attention an important resource and producers need to compete for the limited attention they have. Edward Castro nova argues that people must also artificially create differentiation and scarcity in order to enhance their

experience in virtual worlds[4]. If one considers constantly upgraded software products as different products, this production itself requires scarce creativity and is also a competition for scarce attention, in other words, there is scarcity on both the supply and demand side of the metaverse economy.

2.2. What determines the price of a virtual digital good?

The price of virtual digital goods is also determined by supply and demand. However, virtual digital goods are mainly used to satisfy consumers' spiritual needs and cannot be used to address material needs such as food, clothing, housing and transport. It has been suggested that consensus determines the demand for such goods, for example, a study of over 3,000 Chinese, American and British consumers' willingness to spend on digital products found that participants were willing to pay an average of over $2,900 for a digital handbag, $9,000 for a digital artwork and no less than $76,000 for a digital home. The first digital property, 'Mars House', was sold in March for $500,000[5].

Consensus-determined prices may lead to a few products being overpriced, while a large number of the rest may be lacking in popularity. There is a lot of supporting evidence for this, for example, the AXS coin for the popular game AXIE rose from $0.9 in February 2021 to $68.2 at the end of August, a period in which the number of participants in the game increased dramatically and the game was ranked number one. In July the game generated nine times the revenue of the second ranked game. According to Roblox's prospectus, more than 99% of the more than 1.27 million Roblox game developers earn less than $1,000 in revenue. Only one in a thousand developers earned more than $10,000.

NFT as digital credentials that can be anchored to real-world objects can be mapped to a specific asset, recording the rights associated with that asset, historical transaction information, etc.

in a smart contract and generating a unique code on the corresponding blockchain that cannot be tampered with[6]. Currently, there is some acceptance of NFT as a digital collectible, and a significant bubble in the market for digitally native collectibles[7]. Beeple's NFT work Everydays: The First 5,000 Days went for nearly $70 million at auction, with some NFTs that are difficult to judge by current artistic standards reaching eye-popping and incomprehensible levels of price. 9 virtual lands from Axie Infinity were sold in June 2021 for a whopping 888.25 Ether (approximately $1.5 million. In July 2021, over 5.3 million "24×24 dots" of virtual land on Sandbox was sold for almost $880,000. The concern is that the virtual digital market will create a very disparate distribution of returns, and that such distribution mechanisms, if they replace those of the real economy, will create even greater disparities between rich and poor.

Are the transaction costs zero?

The cross-chain circulation of blockchain digital products not only requires the physical cost of building a cross-chain architecture, but if there is a lack of consensus or no consensus boundary between different blockchain communities, a unified marketplace cannot be achieved, and the transaction costs in such a case are clearly greater than zero. Even when trading in the same marketplace, the transaction costs are still much higher than zero. In the case of Bitcoin, for example, congestion in the mining system causes the average rate of transactions written to the blockchain to be higher. This situation is also present in proof-of-stake blockchain cryptocurrency systems, where it has been shown that economically sustainable blockchain networks will all incur costs[8]. There is currently no blockchain system that is simultaneously decentralised, accurate and cost-efficient[9], with issues of high cost, inefficiency and system instability arising in order to secure the first two features. The contradiction between these three may be resolved in the future.

The market costs of the virtual digital economy are not necessarily low. Due to technical sophistication and regulatory complexity, decentralised blockchain technology is still difficult to put into use in medium to high frequency trading situations, making its credit mechanism only effective on a small scale. Market consensus may not be reached between Tokens of different communities, and between Tokens and off-chain assets. There is also the possibility that governance consensus will not be reached, as in the case of crypto forks. These factors lead to the high cost of opening up virtual digital markets and establishing interoperable or unified systems for the distribution of digital products.

How do you understand the relationship between the virtual digital economy and the real economy?

Production and consumption, on the other hand, exist in both the real world and the metaverse. One of the simplest understandings of the metaverse world, which cannot be separated from the real world, is that its energy supply must come from outside, and arithmetic power, one of the factors of production, cannot be obtained in the event of a power cut. The basic needs of human material life cannot be replaced by virtual digital products either, and are still provided by economic activities outside the metaverse, where people need to engage in transactional behaviour in the real economy. After the basic material needs of human beings have been met, spiritual needs are growing rapidly. The metaverse clearly responds to this need, and people are enthusiastic about it and have higher expectations, and part of the activities that they cannot participate in in the real world can now be engaged in, and some experiences that cannot be realised can be experienced. It can be argued that people can immerse their spiritual lives more in the metaverse through their virtual digital identities, and that a significant part of human social relationships and activities can take place in the metaverse.

However, virtual digital products satisfy spiritual needs, not physical ones, and spiritual life, however wonderfully rich, cannot rise to the level of a matter of human survival. The material life of human beings still takes place mainly outside the metaverse. For a long time, the basic requirement for human survival is to maintain a materially rich and stable real world. On this basis, the metaverse is an extension and expansion of the real world, and other technological applications will bring people more colourful satisfaction in the spiritual world and enhance their ability to perceive, explore and link with the outside world. The virtual digital world is an extension of the real physical world, a digital mapping of the real world. It should not be a "virtual world", but a place where humans can collaborate and innovate more effectively in the digital world, enhancing the equity and efficiency of the real world. It is not another parallel world, i.e. the latter may never be able to fulfil all the functions of the former, much less replace them.

The virtual digital space is not a self-contained economic environment, and no business model has yet emerged that can operate entirely independently in the virtual digital economic sphere. XR technology applications, for example, are also grounded in mapping the physical economic sphere to the virtual digital sphere, enhancing the consumer experience and facilitating consumption in the physical sphere. While virtual digital spaces do expand the range of human capabilities and enhance the experience, the profit generated from product creation and trading in virtual digital spaces is still primarily used in exchange for the satisfaction of material needs. Almost all current games that use custom gaming coins, whether using traditional or blockchain technology, cannot avoid the need to exchange them with fiat currency in order to realise their earnings. In China, such virtual earnings are subject to legal requirements and cannot be directly exchanged. The boundary between the metaverse economy and the real economy has not been phys-

ically formed, and their interplay needs further observation and research.

3. Debating the need and feasibility of complete decentralization

The practice of decentralisation in human society has a long history, but few successful examples can be found that can be replicated on a large scale. Sociologists and political philosophers have theorised about it, such as Robert Michaels' 'iron law of oligarchy' of 1911[7]. But there are also partially centralised human societies, for example, where individuals participating in a market economy are not subordinated to each other and exchange business on an equal footing, while abiding by the rules of commerce. Some experts have pointed out that the metaverse needs to replicate the logic of how society operates similarly to the real world, especially those key logics and rules of human society[8]. It is a well-known fact that human society is less decentralised, and so are its logics and rules, making it impossible for the metaverse to 'replicate' a parallel existing social structure, unless one waits for human society to transform into a highly decentralised structure, or the metaverse has to abandon its own ideal of complete 'decentralisation', whichever is the case. From a practical point of view, we have to think about the need for decentralisation and what a reasonable decentralisation might look like in order to make it feasible.

The applications of blockchain technology are divided into two categories according to whether or not Tokens are used. Blockchain can record the flow of goods and money and information by using only a shared ledger, and each node can verify each other, which can open up information "silos" and realize the information management of the whole process[9]. The reason for not using Tokens is that at this stage, blockchain plays the role of assisting and improving the efficiency of the real economy, and the value it carries and transmits comes from real world assets. The value it carries and transmits comes from re-

al-world assets. This type of application still uses the real economy system and will not be discussed further in this paper. The other type of application can be called the Token Economy or the Pass-Through Digital Economy, which builds on blockchain cryptocurrencies and uses them for value creation and incentives[10].

A more complete model of the Token economy is the ICO, which has been banned in China due to the difficulty of regulation. The main problems include: it is not yet possible to find robustly growing value-creating activities in the virtual economy that are suitable for being tied to Tokens; premature entry into exchange is prone to speculative behaviour, with supply and demand imbalances leading to irrational price fluctuations, sending the wrong market signals and limiting effectiveness as a payment instrument and incentive; Tokens need to be fungible with fiat currencies and it has not yet been possible to determine the extent of the impact on the financial and economic system, and it is currently observable that the exchange rate between Tokens and fiat currencies is highly speculative and largely determined by hedgers and speculators; the Token economy needs to be supported by a sound online and offline governance system, and the current online management technology and methods, which focus on smart contracts, formula algorithms and incentive mechanisms, are not sound, and the on-chain governance may be held by some members and cannot achieve The offline blockchain community governance is basically a gap, etc.

The communities formed in the Token economy are not completely decentralised, but rather decentralised within the community, with economic exchanges between communities taking place through Token-to-Token exchanges. There is no limit to the number of communities in which a person can participate, but the same consensus rules do not necessarily apply between communities. Moreover, there are differences between communities, and if the size of a community falls below a certain threshold, the community will dis-

appear[3]. In this case, it cannot be denied that there may be multiple core communities with a central position and greater influence.

Objectively speaking, blockchain Tokens are more open, transparent and have clearer rights and responsibilities than fiat currencies, and can significantly reduce transaction costs within the same community and improve the efficiency of economic activities within the community, and can perform important functions such as identity verification, authorization, bookkeeping and circulation to meet the needs of the digital economy. However, the reality shows that a significant number of utility blockchain Tokens are designed with negative externalities. Security-based Tokens (STOs) are able to be incorporated into regulation and are already in experimental use in some mature financial markets in Europe and the US[11].

Blockchain Tokens are not the only credit and value vehicle that can be used to implement a distributed economic system. There are no insurmountable barriers to the introduction of centralised digital fiat currencies into the virtual digital economy. For example, the central bank digital RMB uses distributed blockchain technology at the underlying layer, but remains centralised at the application layer; not only can it carry real-world assets and perform offline exchanges, but based on the programmability of the central bank digital RMB, it can also be used to construct digital assets (such as STOs or utility pass-throughs) and enable online transactions. A central bank digital RMB with legal credit takes into account the existing financial system of the real economy, is guaranteed by sovereign credit, has the blockchain technology core required for the metaverse, and avoids the shortcomings of volatile blockchain Token prices, so there are no substantial barriers to introducing a virtual digital economy. The need to use blockchain Tokens in a metaverse is questionable when more mature alternatives exist. For the same reason, a metaverse economy does not necessarily require or can only use decentralised digital currencies. The fact is that because virtual

digital goods cannot satisfy most of humanity's material needs, people must use and pay for real-world monetary systems in order to obtain material satisfaction, and centralised platforms are still needed to undertake the exchange of Blockchain Tokens for fiat currency.

Blockchain Tokens do not have credit guarantees or reserve assets, and establishing credit simply because of mechanisms such as traceability, unmodifiability, and network-wide broadcasting may make it difficult, if not impossible, to establish trust for communities and individuals outside of the use of a particular Blockchain Token. Such scenario and premise-dependent credit mechanisms are not reliable, at which point it is either necessary to introduce off-chain trusted centralised mechanisms or require all individuals to be included in the same system constructed by the blockchain. The former suggests that individual blockchain Token communities cannot be fully decentralised; the latter is clearly not valid either, as even in a time when the internet is so accessible, there are people who do not have access to the internet and are not required to use it, let alone a blockchain network system in its very early stages.

When discussing the need for blockchain Tokens, one of the main arguments is that bookkeeping activities on the public chain are labour-intensive and time-consuming, and that Tokens are needed to incentivise people to do this work. There are two arguments to counter this assertion. One is that the cost of bookkeeping activities is related to the technology route used, and that technology with automated bookkeeping capabilities may emerge in the future to solve this problem; the other is that digital RMBs can serve the same purpose even if human resources are required to provide the service. In the existing economic system, these tasks would have been carried out by certain people. Decentralised finance (DeFi) technology can be seamlessly transferred to traditional financial firms and there is no need to replace the existing centralised financial system.

Moreover, the governance system of DeFi itself needs to be re-established, there are many basic financial scenarios that smart contracts cannot yet handle, such as debt repayment or incomplete covenants, the need to monitor the risks of DeFi operations, such as someone taking advantage of differences in product design and using multiple DeFi products to siphon off large amounts of wealth. It is unrealistic to think of using block-chain technology to completely replace existing systems and credit systems. The difficulty of setting up new systems, the need for long-term evolution and iteration to make them work properly, and the cost of doing so are incalculable.

The various nodes of a public chain are interconnected in a flat topology, a situation that does not exist in the real world. Moreover, the public chain itself has some current problems that are difficult to overcome, such as when the governance or market consensus on the public chain collapses, the value of its token may instantly go to zero, and the loss of digital assets or wealth formed at this time may cause a significant impact on the virtual digital society. For example, the public chain technology is still immature and there are physical performance limitations in executing transactions. Xu et al. mentioned that using a federated chain in some application scenarios can bypass these bottlenecks. Moreover, the federated chain is more similar to the organisational structure of human society, i.e. within the corresponding institutional organisation, each node can be fully reciprocal, and must be authorised to join and withdraw. The institutions form a larger coalition of stakeholders that is not simply divided into decentralised or centralised networks. They are not fully centralised, but rather a social network structure of interlinked different sub-networks, which can be linked together using only cross-chain protocols, replicating a realistic socio-economic architecture. At present, this seems to be the most realistic, least costly and least resistant way to apply blockchain technology in the Chinese social environment. We need to clarify the key components of the metaverse that are es-

sential for a smoother and smoother transition from the real world to the virtual digital world, rather than pinning everything on a decentralised process of social transformation that cannot be achieved in the short to medium term.

4. The challenges of the metaverse in social governance

With the development of XR technology, people will inevitably place part of their life scenarios in the virtual world, and the metaverse will become part of social life, with incalculable effects on culture, politics, law, ethics and morality, in addition to the economic impact discussed earlier. Interaction between the virtual digital world and the real physical world will become the norm. For example, attending virtual concerts in games, attending meetings and interacting in real time as a virtual avatar in a virtual space are already examples of reality. The metaverse values of "co-regulation, co-creation and sharing" are currently available for "sharing and co-creation", but there are no examples of applications for "co-regulation". Some advocates have cited decentralisation as a key feature of the metaverse, but have not looked closely at the extent to which decentralisation has been achieved and how the corresponding governance systems should be constructed.

The first thing that needs to be considered is governance within the metaverse. The virtual digital economy is already experiencing a great deal of disruption, a side note that suggests that the governance of the virtual digital sphere may be more complex and difficult than the challenges encountered in the real economic world. For a fully decentralised metaverse economy, distributed autonomous forms of organisation (DAOs) are the basic unit. on 1 July 2021, the first act recognising the legality of DAOs came into force in Wyoming, USA, giving legal recognition to DAOs and smart contracts. Unlike an equity-based organisation, in which individuals can participate by providing services or buying shares, a

DAO requires consensus within itself, consensus-based rules will become open-source algorithms through code, and smart contracts that meet Turing completeness requirements will automatically execute organisation-driven transactions, with no human intervention or management required throughout, and participants will automatically receive a share of the proceeds. This organisational form may be appropriate for specific activities, but there is no universality. Digitisation and decentralisation will not suddenly improve the way a system is governed and operated; the impact is likely to be gradual, with progressively fewer restrictions[12].

The governance of DAO is divided into two parts: on-chain and off-chain. On-chain governance is based on the concept of "code as law" and is characterised by anonymity, trusted networks and automatic execution of smart contracts. However, smart contracts do not currently perform all governance functions effectively. Off-chain governance relies on tools to achieve weak constraints on individuals in organisations, and is similar to real-world governance in that it requires verification of real identities, trust and reputation through integrity records, and relies on the laws and regulations of the real world to provide safeguards. Obviously, the combination of on-chain and off-chain governance in DAO itself is another aspect that shows that an absolutely decentralised virtual digital world cannot exist on its own. For example, many blockchain projects are initially developed by centralised teams and, despite their decentralised nature, over time participants may form different interest groups based on their own interests. There are different types of DAOs in different application scenarios, such as agreement, investment, grant, service, media, social and collection. At present, the general problem with DAOs is that the threshold for user participation in governance is high, the percentage of participation is low, and the decision-making power of DAOs remains in the hands of a few, with no greater degree of autonomy than that of centralised structures.

Secondly, we need to confront the problems arising from virtual digital worlds surfacing in the real world. In addition to autonomy within the metaverse, virtual digital worlds have also raised concerns at the legal and regulatory level. XR (extended reality) applications, which include VR and AR technologies, have attracted the attention of policy researchers as a fundamental way to access the metaverse, and the US introduced the VR Technology Act 2019, which proposes that the federal government should establish an advisory committee on the availability of such technologies. China, on the other hand, severely restricts the creation and trading of blockchain public chain Tokens (FT), as a 100% decentralised public chain structure will be banned from mass use for a long time, as it is completely contradictory to the existing social governance structure and economic logic and behaviour.

The metaverse is likely to be rife with problems of technological addiction, discrimination, harassment and violence, which will inevitably spill over into the real world as well. Western experts currently focus more on concerns about privacy, personal data security, deep falsification of faked real-life activities, mental health and addiction, especially the physical and mental health of children[13]. The metaverse may also bring about some new social problems. For example, the highly immersive experience of metaverse may have a negative impact on youth development and may become an addictive "digital drug", allowing some adults to be immersed for long periods of time in a metaverse that creates an idealised atmosphere of life, and their cognition and behaviour may be disconnected from people in the real world[14]. Human beings will never be able to live in a virtual world. The addiction in the virtual digital space will eventually be awakened by a hungry gut, but may have already caused irreparable impact and damage to the real world.

The virtual digital world will become a second space for human existence and will offer people a new life in another dimension, giving them a

virtual identity and creating a dual social relationship that is very different from the real world. In the grey area of the virtual-reality border, issues such as rules, order, law, power structures, governance systems, distribution logics, organisational forms and confusion between reality and reality will also arise. The virtual digital person is an avatar of the real person in the metaverse, and in creating a digital person, all the data of the real person is needed to achieve a full replication, and the protection of personal data and privacy is a difficult problem to solve. The discontent and hatred caused by the strong contrast between the virtual digital world and the real world, as well as the impact on people's marriage, fertility, interpersonal relationships, psycho-spiritual health, production and consumption, are challenges that will come to the fore as the metaverse develops.

5. Metaverse related technology applications and industry investment prospects

Technologically speaking, the metaverse consists of three levels: basic, core and application.

The metaverse infrastructure, core technologies and their applications are currently dominating the metaverse investment boom[15]. The value chain of the metaverse market, as defined by Jon Radoff, consists of seven components[16], of which five, such as direct user engagement experiences, discovery platforms, spatial computing, human-computer interaction and infrastructure, are primarily related to the availability of technology, while two components, the creator economy and decentralisation, are closely related to social structure and content management.

For the availability of relevant technologies, reference can be made to the emerging technology maturity curves published annually by Gartner, Inc. The graph below shows Gartner's "Hype Cycle for Emerging Technologies 2021" (**Figure 1**). As can be seen from the curve, the general pattern of emerging technology development is to move quickly from the nascent stage to the technology mania stage (expectation inflation), followed by the bursting of the hype bubble into the trough, and then a steady climb to recovery before reaching the level of mature adoption.
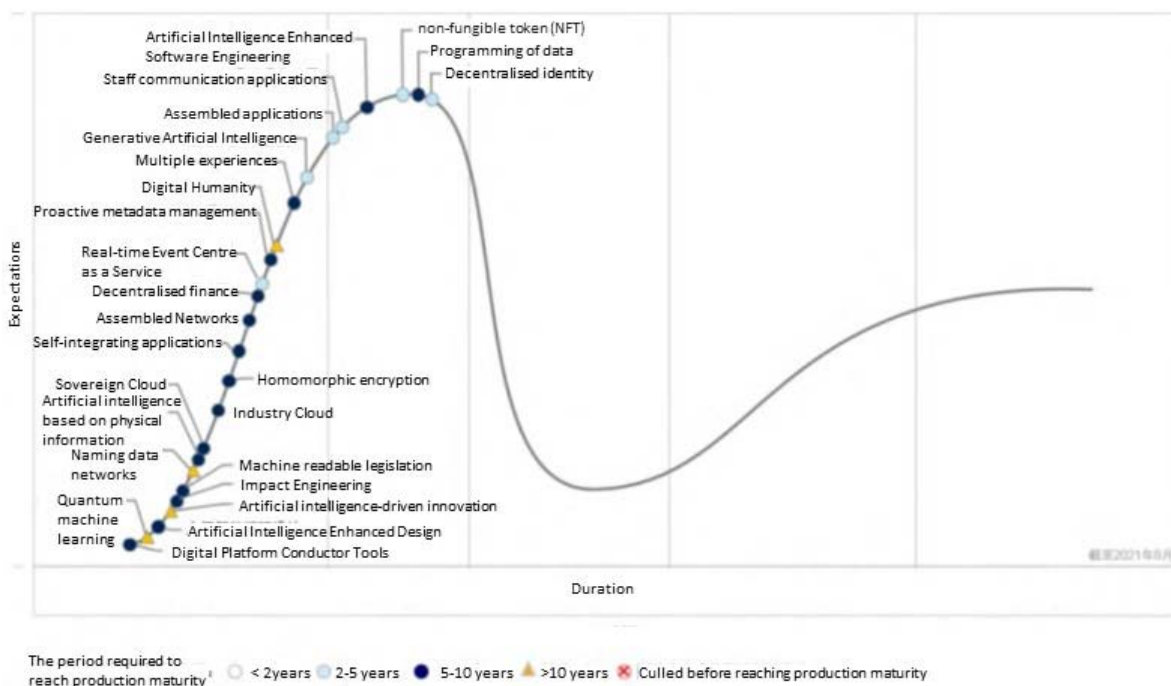

Figure 1. Emerging technology maturity curve 2021.

According to the six core technologies of the metaverse identified by experts, the technological

development curve shows that video games, network computing and artificial intelligence tech-

nologies are more mature and have formed a certain scale of industry. Blockchain technology, Internet of Things technology and human-computer interaction technology, on the other hand, are poorly developed. After experiencing initial hype, blockchain technology is now in the stage of adjusting its direction and restarting; Internet of Things technology is subject to multiple bottlenecks such as operating systems, communication protocols and interconnection, and the ecology is still simple, with a large gap from large-scale applications; interaction technology relies on breakthroughs in VR/AR hardware and product iterations, and with the support of 5G The development of interaction technology is dependent on the breakthrough of VR/AR hardware and product iteration, and has started to accelerate with the support of 5G system.

Digital human technologies are still in their infancy, with decentralised technologies and applications and NFT nearing the middle and top of the first wave of hype and soon to fall into a bubble bursting through[17]. From an investment perspective, these segments should be avoided for the time being. Therefore, technologies at this stage may take another 5-10 years, or even more than 10 years, to develop and mature. In addition to the long incubation period, investments may suffer large losses if the technology route is chosen incorrectly.

In terms of industrial development sequence, the development of metaverse depends on the improvement of infrastructure, XR interaction devices, network construction as well as AI algorithms, engines and NFT etc. Virtual reality technology and digital twin technology can bridge the virtual and real worlds. The development of XR technology is to realise the real-time realistic nature of the metaverse, where VR/AR/MR technology can break through the two-dimensional space limitation of the Internet and realise a full-media three-dimensional space experience, improving human-computer interaction, freshness of identity transformation and live immersion through the deep involvement of multiple senses, which is technically used to break the virtual-reality technology to break the virtual-reality boundary. As 5G addresses the limitations of traffic, broadband and responsiveness that previous hardware could not break through, the most promising technology and industry sectors for investment in the short to medium term are mainly based on 5G and XR technology in R&D, education, business services and experiences, gaming, virtual office, social, film and entertainment, and tourism.

Digital twin technology based on big data artificial intelligence and on top of the Internet of Things is another rapidly developing area. Industrial applications such as the digital factory, which is the replacement of an entire physical factory with a network of digital models, can be used for comprehensive planning, continuous evaluation and optimised enhancement of manufacturing plants. The civilian side can be used to simulate the digital world, where people can observe and control physical objects from a distance simply by sitting at home, and also perform experiments that cannot be done in the real world. For example, beer brewing company AB InBev, which has more than 200 brewing plants and 150,000 employees worldwide, has built corresponding digital factories (digital twins) for all of its plants using digital twin, MR and AI technologies. Information on production, sales, supply chain, energy and safety are constantly flowing and interacting between the plant and the digital twin. With wearable devices, staff in this factory can move through the digital factory, check and operate various machines, receive real-time information flow feedback and make decisions at any time.

Digital assets issued on the blockchain have characteristics such as clear ownership, transparent quantities, timestamps on transfer, and distributed storage resulting in the inability to erase traces. Some industry analysts believe that homogenised tokens such as Bitcoin will play the role of real-life currency and NFT, as a non-homogenised token, will play the role of real-world assets such

as houses, vehicles and jewellery. However, as virtual digital assets, their market value formation process, which cannot be intervened or regulated due to their complete decentralisation, may form bubbles more easily and quickly. Typical applications in this area include homogenised passwords in blockchain cryptocurrencies such as Bitcoin, as well as non-homogenised passwords (NFT), which have emerged rapidly in the last two years, see **Figure 2**. The top three application areas of

the NFT market in 2020 are virtual worlds, art and gaming, with market shares of 25%, 24% and 23% respectively. 2021 Q2, the share of the NFT trading market is rapidly increasing to 66% for collectibles, 14% for art and 7%[18] for sports. Risks to NFT investments may arise from the emergence of significant price bubbles in the market and large price fluctuations caused by market speculation. speculation triggered by significant price fluctuations.
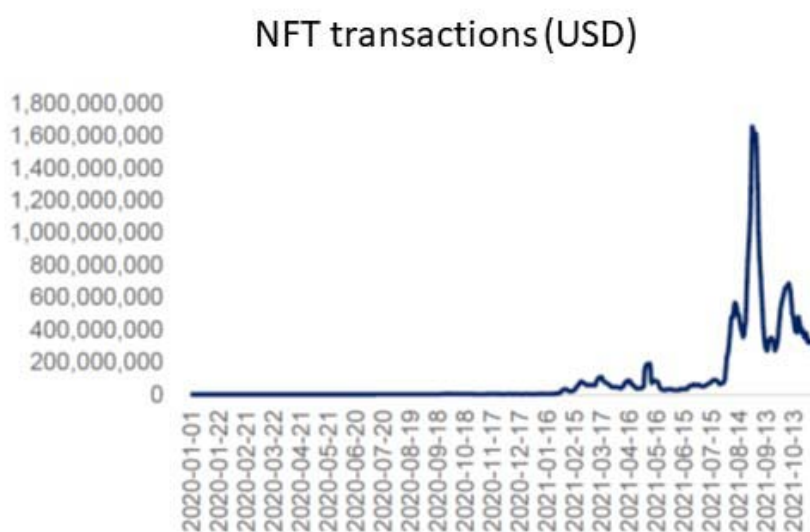

Figure 2. NFT transaction.
Source: Guoxin Securities Institute

Metaverse gaming and social are the fastest growing segments in the application layer. The incentive system for user-produced content (UGC) based on gaming communities is more mature and the technical barriers to content creation are being lowered, for example, players can make and combine their own props for re-creation using components provided by Roblox. The development of metaverse social networking applications is related to the protection of personal information and may require steady progress. Currently only very elementary applications, such as public bounty, live gifts, band wagoning and online income have all become common ways to cash in from the virtual world. When the country's first hyper-realistic digital person, AAYAYI, debuted on Little Red Book, AAYAYI's first post had nearly 3 million readers and nearly 40,000 fans overnight, breaking the history of real-life KOL trend com-

munities and getting brands such as Guerlain and Burberry. The amount of followers rose by nearly 40,000 overnight, breaking the history of the real-life KOL trend community and receiving recognition from brands such as Guerlain and Burberry.

Overall, it seems that there are many development opportunities in the underlying technology and infrastructure hardware and software of the metaverse. Currently, the main investments are in XR hardware and software, digital people (virtual anchors, virtual idols, personal avatars, etc.), UGC technology and platforms; applications that are promising for faster development are games and commercial service experience categories, such as tourism, advertising and exhibition, design and planning, XR+ games, tourism, advertising, etc. The metaverse industry is still far from reaching the ideal state of full industrial coverage and ecological openness, economic self-reliance and in-

teroperability between reality and reality, and there are some ambiguous areas to be determined at the technical, legal and ethical levels.

6. Policy recommendations

Synthesizing the previous discussion, the following recommendations are made for the development of a metaverse that meets China's sociopolitical and economic constraints:

Both structures have their merits: Strengthening decentralisation at the base layer (data and technology) in order to establish a system environment that is more transparent, stable, easy to monitor for risk prevention and risk isolation than centralisation, while promoting the application of coalition chain blockchain technology at the application layer to replicate the social-ecological structure and human code of conduct of real society in virtual space on the basis of making full use of the good governance structure provided by the base layer. It should not aim at 100% decentralisation, but should be fully prudent and objective in judging the realistic match or degree of realisation (breadth) of the metaverse to reach the target, and need not over-pursuit the degree of decentralisation, which will be a long social evolution and the technology should serve the process.

Decentralised technology is not limited to blockchain, and blockchain technology itself is constantly evolving and iterating, with the potential for existing bottlenecks to be gradually resolved through better technology. The technological advancement driven by the metaverse has a strong spill over effect, and is a huge boost to enhance China's innovation and technology level and capability. In terms of commercial investment, in addition to the maturity of technological development in the choice of technology route, investment institutions should also focus on the policy risks related to technology ethics, especially in terms of content design and data privacy protection.

Conflict of interest

The authors declare no conflict of interest.

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