The Study of DeFi in Virtual Community and Financial Supervision

Chian-Hsueng Chao
Department of Information
Management, National University of
Kaohsiung, Kaohsiung, Taiwan
cchao@nuk.edu.tw

I-Hsien Ting
Department of Information
Management, National University of
Kaohsiung, Kaohsiung, Taiwan
iting@nuk.edu.tw

Yi-Jun Tseng
Department of Information
Management, National University of
Kaohsiung, Kaohsiung, Taiwan
m1093310@mail.nuk.edu.tw

Bing-Wen Wang
Department of Information
Management, National University of
Kaohsiung, Kaohsiung, Taiwan
a1073321@mail.nuk.edu.tw

Shin-Hua Wang
Department of Information
Management, National University of
Kaohsiung, Kaohsiung, Taiwan
a1073323@mail.nuk.edu.tw

Yu-Qing Wang
Department of Information
Management, National University of
Kaohsiung, Kaohsiung, Taiwan

ABSTRACT

In recent years, when the world economic activity was affected by the epidemic, it was very active in the virtual world. Since Facebook announced the development of the Metaverse, its related applications and services have instantly become hot issues. Although it may take a few years for the Metaverse to become popular as a social platform today, its impact on future community development will be significant. On the other hand, since Ethereum pioneered smart contracts in the blockchain, the Ethereum Virtual Machine (EVM) can connect public nodes scattered throughout the network into a virtual machine to execute Turing-complete programs, and the issue of decentralization has gradually spread. Today, as the application of smart contracts becomes more and more extensive and innovative, such as the decentralized architecture and applications of NFT, DeFi, GameFi, DApp, DAO, DEX, its influence has gradually expanded from the virtual world to physical applications, and also has impacts on real financial applications. The recent burst of NFT and DeFi addressed this issue. There are some gaps between reality and hype, and it is a lesson just like e-commerce burst some 20 years ago. A well format regulation and supervision seem required. However, the challenge for financial supervision today is the decentralized application and anonymity. This paper discusses the innovations in communities that related to decentralized financial services in the blockchain. And the blockchain financial supervision issues that within the tolerable range of risk and impact to both virtual and real world.

CCS CONCEPTS

• **Virtual Community**; • **Blockchain**; • **Smart Contract**; • **Decentralized Finance;**; • **Distributed Ledger**; • **Decentralized Exchanges (DEX)**; • **Financial Supervision**;

KEYWORDS

Virtual Community, Blockchain, Decentralized Finance, Distributed Ledger, Smart Contract, Financial Supervision

1 INTRODUCTION

Since Facebook integrated the AR/VR R&D department into the Facebook Reality Labs (FRL) and building the "Metaverse." Metaverse-related applications and services instantly became hot issues. Issues such as, what will the Metaverse look like? How do people transit from the social network to the Metaverse? What are the impacts to the social network? In fact, the Metaverse in a broad sense is virtual reality (Virtual Reality). The Metaverse is an immersive experience that makes people feel like they are in the real world. The future development and influence of the Metaverse can be inspired by the current virtual reality services, such as games, learning, etc. that are represented by the Second Life virtual reality platform, which has thousands of virtual experience and communities (music clubs, role-playing communities, virtual cinemas, etc.) allowing people to explore and make friends in this virtual world. After several years of operation, its development has become more and more diversified.

Although it may take years or even decades for the Metaverse to become a popular application like today's community platform, it will have a significant impact on the future community development. Although the world has generally been in a sluggish economic activity due to the impact of the epidemic in recent years, it is very active in the virtual world. The virtual world is equivalent to a new type of society or community, so it also needs a new type of financial system. The financial system can be presented in different ways, such as food, clothing, housing, transportation, education, entertainment, etc. All can be recorded on the innovated blockchain services. The blockchain has been developing towards decentralization since the Satoshi Nakamoto version of the blockchain. As the applications of blockchain and smart contract becomes more

and more extensive and innovative, a variety of services, such as decentralized finance (Decentralized Finance, DeFi), decentralized exchange (Decentralized Exchange, DEX), decentralized application (Decentralized Application, DApp), and non-homogeneous Non-Fungible Token (NFT) are gradually take over our traditional financial system.

Right before the popularity of NFT, DeFi already expanded its application in the virtual world. Different from the services of traditional banks, DeFi is built with open source software and an uncensorable network. The financial activity and service are based on digital currency or tokens. It is a transparent and open financial system that open to anyone, enabling people all over the world to participate in financial activities in a peer-to-peer manner. The development of DeFi almost copies the modern financial system that provides the linkage between the cryptocurrency market size and the real world financial system. And because of the decentralization, people have the ability to be free from the control of any national government and surpass the sovereign currency.

Due to the decentralized application and anonymity of the blockchain, it also brings another wave of challenges to financial supervision. The traditional financial supervision is mainly based on the control mechanism of the centralized system, focusing on money laundering prevention, combating capital terrorism, as well as customer identity confirmation, cash flow transaction monitoring, etc. To reduce the risk, the requirements for AML (Anti Money Laundering, anti-money laundering), CFT (Countering the Financing of Terrorism), and KYC (Know Your Customer) inspection programs have been strengthened, and the planning of the internal audit strategy of the financial system guided by risk-oriented concepts has been adjusted.

The supervision of blockchain finance can be regarded as an extension of financial supervision or regulatory technology, but the operation mechanism involved in the development direction of blockchain supervision is complex, especially its cross-international decentralized governance and rejection of the original centralized control system, it is bound to cause great difficulties and challenges to supervision. This research discusses the potential application and development of the innovations related to decentralized financial services in the blockchain, and develops decentralized exchanges (DEX) within the scope of risk tolerance through issues related to blockchain financial supervision.

2 LITERATURE REVIEW

2.1 Social network and Metaverse

For the social network and service, according to Fang [1], social networking service is defined as: "A new social phenomenon formed by a group of people who communicate through networks and its happening is because there were enough people in the virtual space, enough people's emotions, and long-term development of human relationships on the Internet." Social network is mainly used to establish online communities for people with the same interests and activities. Such services are often based on the use of the Internet to provide users with various way of communication and interactive channels, such as information sharing and instant messaging services. Users can build friendships with users all over the world through social networking sites. They can also use this platform to track celebrities, share any information with each other, which breaking the current boundary of space and enabling human interaction in the online world.

Since the Facebook announced the development of the Metaverse, its related applications and services have instantly become hot issues. Although it may take a few years for the Metaverse to become popular as a social platform today, its impact on future community development will be significant. The term "Metaverse" comes from a 1992 science fiction novel "Snow Crash" by American novelist Neal Stephenson [2]. Metaverse is "Meta" (meaning "transcendence") and "Verse" (derived from Universe), mainly referring to the next generation of the Internet, where users can use virtual avatars to interact, live, and use various avatars in a 3D virtual space. Metaverse, as an interactive multimedia community that relies on a huge number of users online, can benefit from the advancement of new technology of block keys, and thus build a fair, free and sustainable society [3].
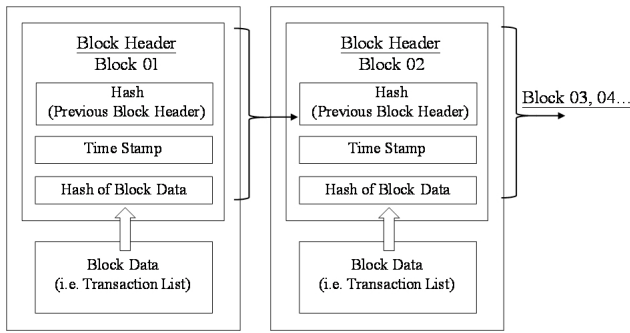
2.2 Blockchain

The origin of blockchain technology can be dated back to 1997 when Haber and Stornetta proposed the earliest cryptographically secure chain block in order to design a system that cannot be tampered with [4]. However, the original chain block still needs a trusted third party to sign. In 2008, Satoshi Nakamoto published a paper titled "Bitcoin: A Peer-to-Peer Electronic Cash System" and subsequently launched the Bitcoin financial system [5]. Blockchain is based on cryptography, mathematics, algorithm mechanism, which is also a decentralized distributed database. According to the definition of blockchain based on the basic protocol of Satoshi Nakamoto's "Bitcoin Blockchain," records are formed with timestamps, multi-party accounting. The notarization with confirmation every ten minutes, and the ledger is recorded every ten minutes.

It is a "block", and then each legal block is connected into a chain to form a distributed, unanimously agreed ledger database, which is called a "Blockchain" (Figure 1). Blockchain has the characteristics of decentralization, distributed ledger, consensus algorithm, which is not easy to tamper, and difficult to counterfeit [6]. It can provide a safe, immutable, transparent and effective record transaction, and the data exchange mode without the intervention or assistance of a third party. With its sharing characteristics, all information can be published in the network environment, and resources can be shared with related stakeholder. If it is private information, it can be encrypted with the public key and the private key to decrypt each other's information, showing a very high level of performance and information transparency [7].

The core technology of blockchain operation is briefly described as follows:

- The link of the block chain: The block chain consists of a chain of blocks, each block header and block body (including transaction data) two parts. The block header contains the hash value of the block and the nonce used to calculate mining.
- Consensus mechanism: There are two major consensus mechanism, such as POW (Proof of Work), which is mining mechanism similar to Bitcoin. The computing power competition of distributed nodes to ensure data consistency,

Figure 1: Typical Structure of Blockchain

consensus and security. The other one is POS (Proof of Stake), which is about to replace POW. The system calculates the equity according to the coin age (the product of the number of coins owned by the node and the time of possession), and the node with the highest equity but not the highest computing power will obtain the "bookkeeping right." There are other decentralized consensus algorithms such as PBFT that are depended on types of blockchian.

- Smart Contract Mechanism: The technology of automatic verification and automatic execution of contracts on the blockchain. The decentralized ledger, openness, decentralization, encryption technology, smart contracts [8], and high-efficiency characteristics of clearing of blockchain are applied in financial services, and any item can be used by this technology And "programmable (Programmable)".

2.3 Ethereum and Smart Contract

Smart Contract as first proposed by Nick Szabo [9], who hoped to create a contract constructed by multiple agreements, including agreements that allow all parties to perform these agreements, eliminating "inanimate paper contracts". He believes that the digital revolution is accelerating changes in the connections between people, and provides a way to use these connections to form new institutions or application services. However, it did not resonate widely at the beginning. Perhaps the technology was not mature enough to realize this structure at that time.

Due to the success of Bitcoin, the application of blockchain in a tamper-proof decentralized ledger has attracted great attention [10]. Therefore, in 2013, Vitalik Buterin [11] and others added the smart contract function to the original blockchain protocol and proposed a decentralized platform called Ethereum. The so called Ethereum Virtual Machine (EVM) can be dispersed in the whole chain, and the nodes are connected as a virtual machine. Once the smart contract is deployed on the chain, it will be automatically executed according to the pre-defined rules.

Ethereum consists of numerous interrelated projects that are used to create applications distributed on Ethereum. It cannot be tampered with, so it is regarded as having legal attributes in itself. Smart contracts can handle all kinds of logic, make full use of the Ethereum blockchain, and promote the development of Ethereum into the most extensive blockchain platform. Ether (ETH) is the native cryptocurrency of Ethereum and is the transactional token

that facilitates operations on the Ethereum network. If users want to transfer money, trade, or create new applications on the Ethereum platform, smart contracts enable nodes on the blockchain to interact under the contract framework. Smart contracts can be automatically executed according to the agreement, allowing different types of decentralized applications (DApp) to run on the blockchain in the form of smart contracts, such as blockchain games.

2.4 Decentralized Finance (DeFi)

Decentralized finance, DeFi is an innovation brought about by smart contracts. In fact, before the year of NFT in 2021, DeFi already expanded its application in the virtual world. Decentralized Finance (DeFi), a peer-to-peer financial model that utilizes blockchain-based smart contracts to ensure its integrity and security [12]. Different from the financial services of traditional banks, DeFi is built on open source software and an uncensorable network. All the financial activity and service are based on digital currency or tokens. Having built a transparent and open financial system, DeFi is open to anyone, enabling people around the world to participate in financial activities in a peer-to-peer manner. Decentralized finance offers financial instruments without relying on intermediaries such as brokerages, exchanges, or banks by using smart contracts on a blockchain.

With the development of DeFi, it can be said that it has almost copied the modern financial systems, and then accelerated the linkage between the expansion of cryptocurrency and the financial system in the real world. With decentralization, people have the ability to go beyond the control of any national government and surpass the sovereign currency and financial systems. The decentralized exchanges (abbreviated DEXs) as alternative payment ecosystems with new protocols for financial transactions emerged within the framework of decentralized finance, which is part of blockchain technology and FinTech.

2.5 Financial Supervision

As mentioned above, different from the financial services of traditional banks, DeFi is a transparent and open financial system that opens to anyone, enabling people around the world to participate in financial activities in a peer-to-peer manner. And because DeFi has almost copied the modern financial system, the potential impact not only on the existing financial system, but also challenging the national government and the sovereign currency. Therefore, related regulatory issues are becoming the primary initiatives to many countries.

The traditional supervision method is more focused on single-point inspection. After the incident, relevant review and verification are carried out, and the acquisition data is relatively static. However, with the rise of online services and the diversified development of online financial products, the cost of legal compliance has also increased. Financial institutions are currently seeking solutions to reduce labor costs and improve efficiency through emerging technologies.

The current financial supervision adopts Regulatory Technology (RegTech), which is the combination of Regulation and Technology. It refers to the requirement of using information technology more efficiently assist financial institutions and activities in complying

Table 1: DeFi Service and Protocol

DeFi Service Stack	Services
Aggregation Layer	Banking services or crypto wallets
Application Layer	Lending or trading of cryptocurrencies
Protocol Layer	Decentralized exchanges, debt markets, derivatives and on-chain asset management, etc.
Asset Layer	Composition of all assets issued above the settlement layer
Settlement Layer	Blockchain and its protocols to tokenize assets or real estate

with regulations. Callen-Naviglia [13] believes that RegTech needs to go hand in hand with FinTech financial innovation services to assist operators in real-time legal compliance and enable competent authorities to improve the efficiency of financial supervision and inspection to achieve the purpose of active supervision.

In response to the development of emerging financial technology (Fintech) and myriad of innovated financial applications, such as Defi, the existing laws and regulations have been unable to monitor financial transactions in real time. Cryptocurrency only exists digitally that usually has no central issuing or regulating authority but instead uses a decentralized system to record transactions and manage the issuance of new units. The blockchain can be used for transaction supervision and identification, risk prediction, and real-time monitoring. It can enhance the efficiency and effectiveness of financial supervision, and help financial institutions to reduce the labor cost of legal compliance [14].

3 ANALYSIS AND RESULT

3.1 Decentralized Finance Application

DeFi is made up of some orderly financial protocols, and the backbone of all DeFi protocols and applications is smart contracts. The current DeFi protocols include stablecoins, assets, transactions, lending, derivatives, etc. These protocols can be freely combined to replicate actual financial activities, so they are also called "DeFi Lego". Its bottom-up structure is described as follows (Table 1):

- Settlement Layer: This is the bottom layer of the DeFi protocol or called Layer 0, which consists of the blockchain and its native protocol, such as Bitcoin (BTC) on the Bitcoin blockchain and (ETH) on the Ethereum blockchain. It allows the network to securely store ownership information and ensure that any state changes adhere to its combination of rules. The settlement layer can tokenize owned assets or real estate, such as real estate tokens, which represent ownership of a piece of land.
- Asset Layer: It consists of all assets issued on the settlement layer. This includes native protocol assets as well as any additional assets (often referred to as tokens) issued on that blockchain.
- Protocol Layer: Provides standards for specific use cases such as decentralized exchanges, debt markets, derivatives,

and on-chain asset management. These standards are usually used as a set of smart contracts that any user (or DeFi application) can communicate with each other, that is, multiple application practices can use it to build services or applications at the same time. This layer provides DeFi with flexibility and a high degree of interaction. operability.
- Application Layer: The application layer creates user applications that connect to the needs of each protocol, and is where services are provided to consumers, such as lending or cryptocurrency exchange.
- Aggregation Layer: This layer is an extension of the application layer, created by the aggregator to connect to multiple applications and protocols to a user-centric platform. Allowing users to perform other complex tasks by connecting to multiple protocols simultaneously, banking services or crypto wallets are also common examples of aggregation layers.

In the DeFi development, there were decentralized stablecoins (such as MakerDAO). After the success and the establishment of market scale, people began to build a larger-scale financial system that followed by circulation, lending and construction of derivatives, and the decentralized transaction protocol was also born. The decentralized trading protocol, which is often referred to as DEX (decentralized exchange), is a decentralized virtual asset trading platform built on the blockchain that based on smart contracts. For the virtual communities, both parties can use any type of value, such as between assets or between various virtual currencies, which is similar to real-world asset currency and asset trading activities.

The Automated Market Maker (AMM) protocol turns traditional order book transactions into transaction pools (Liquidity Pool, LP). AMM can be used to trade a wide variety of assets, including stocks, bonds, commodities, and even cryptocurrencies. All those who want to trade can complete the transaction without an order from the counterparty, which can greatly increase the transaction efficiency. Indeed, AMMs is a simple mathematic formula. Take the cryptocurrencies transaction as an example:

$$X * Y = K$$

X: Number of Token A in the pool
Y: Number of Token B in the pool
K: Constant Product

The meaning of this formula is that every time a liquidity provider deposits an asset, the product of the two asset quantities is calculated and kept constant. This also means that when the supply of token X increases, the supply of token Y must decrease, and vice versa. As the price moves larger and larger, the ends approach infinity. When a user is swapping tokens, they are depositing tokens into the pool to remove a market rate amount of the other token, as shown in Figure 2. The effective price for the swap is determined by the ratio of tokens in the pool.

The Price Oracles are very important part of DeFi. Oracles are the bridge and link between off-chain (i.e. real world) services and on-chain (blockchain) protocols. Oracles can retrieve off-chain data and publish this data in DeFi, and the main use of Oracles is related to the settlement of lending protocols. In addition, stablecoins in DeFi include USDC, USDT, GUSD, BitUSD, and BitCNY ensure that all stablecoins can be converted into U.S. dollar fiat currency 1:1, which
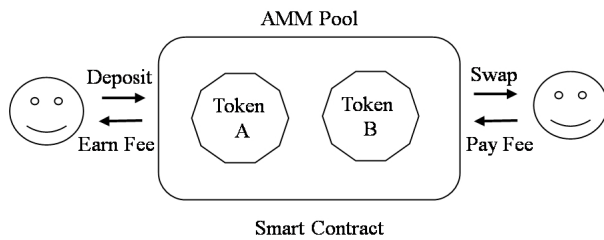
Figure 2: The Automated Market Maker (AMM) and Smart Contract

is anchoring stablecoins and fiat currencies. Among the stablecoins, there is USDC, which is issued by the Center Alliance, a joint venture jointly established by the exchange Coinbase and Goldman Sachs' Circle. Every month, an accounting service company checks and discloses information to let users know that there is a sufficient amount of USD guarantee.

With the development and application of blockchain DeFi, its financial simulation and decentralized anonymity will inevitably bring greater challenges in supervision policy. Because DeFi, DEX, are technologies based on blockchain, the blockchain supervision is the concept of chain governance.

3.2 Financial Supervision and Distributed Ledger

For blockchain supervision, the international community has established specialized blockchain institutions, such as the EU blockchain observatory and forum, the World Bank blockchain laboratory, and the International Monetary Fund's Fintech Senior Advisory Group. Various international organizations are also stepping up research on blockchain technology and cryptocurrencies for globalization regulation of decentralized finance.

The financial supervision of the United States is mainly promoted by the United States Securities and Exchange Commission (SEC), Commodity Futures Trading Commission (CFTC) and other agencies. In 2018, the U.S. SEC and CFTC issued a "Joint Statement on Measures against Virtual Currency", which mentioned that whether it is a violation of laws and regulations carried out in the name of virtual currency, tokens or other names, the SEC and CFTC must conduct penetration analysis to determine its business substance and take regulatory measures in accordance with the law [15]. In February of the same year, the CFTC announced the establishment of a virtual currency committee and a blockchain committee at the virtual currency and blockchain regulatory discussion meeting. The former focuses on the virtual currency industry, while the latter strengthens the application of blockchain technology in the financial field. In addition, the "Token Safe Harbor Proposal" proposed by U.S. SEC Commissioner Hester Peirce advocates that DeFi projects need a sufficient buffer period in the process of growth, so that new teams and business models can pass through the central The process of moving towards a decentralized community is limited by regulations.

In Japan, the Ministry of Economy Trade and Industry (METI) has been discussing the potential impact of blockchain technology

on Japan's domestic financial industry. Therefore, starting in 2015, Japan has regulated blockchain-related businesses and services in accordance with existing financial laws or regulations, which will depend on the legal characteristics of the tokens minted on the blockchain or the nature of such services. For example, Japan Financial Services Agency (FSA) launched "Fintech Testing Hub" in September 2017. As part of this initiative, the FSA established on a case-by-case basis to help fintech companies and financial institutions identify and resolve potential legal issues and risks associated with new fintech initiatives. Japan also set up a cross-government one-stop service desk to oversee the sandbox program. There are some other supervisions, for example, the amendment to the PSA (Platform Security Architecture) requires that digital currency exchanges must be registered with the FSA to operate. This process may take up to six months, and more strict cybersecurity and AML/CFT are proposed for both processes.

On February 1, 2018, the European Commission established the European Blockchain Observatory and Forum, which consists of two working groups, namely the Blockchain Policy Framework Working Group and the Multi-Scenario Case Working Group. The former focuses on solving cross-regional and cross-industry blockchain regulatory policy issues, and actively seeks the optimal framework for blockchain regulation [16]. The latter focuses on the applications of blockchain in social public sector institutions such as identification, healthcare, energy, etc. On the EU side, the European Commission attaches great importance to blockchain standards, especially the activities of ISO, the International Telecommunication Union Telecommunication Standardization Sector (ITU-T), IEEE and other standard organizations. It plans to convert relevant international standard results into EU standards. Over the years, ISO/TC 307 has accelerated the research on key standards such as reference architecture, smart contracts, security and privacy, and interoperability. Among them, technical committees such as ISO/TC 68 and ISO/TC 46 (Information and Documentation Technical Committee) are also conducting research on blockchain-related standards. The specifications related to ISO and blockchain are as follows in Table 2. In general, the application of blockchain is developing towards the normalization of active supervision and effective prevention of financial risks. In terms of digital currency regulation, many countries and regions have begun to implement a regulatory sandbox system. The regulatory sandbox initially was from UK that provided a safe environment in which fintech companies can test their innovative products, services and business models. Today, the regulatory sandbox model is also applicable to controlling financial innovation risks including blockchain.

3.3 The Challenge of DeFi

The recent market reaction of DeFi has been sluggish, and the related discussions have become much less popular than last year. Many people hold skeptical about the future development and application of DeFi. The recent fall of DeFi due to the overhype of the blockchain innovation that without knowing the true value of it. On the other hand, the DeFi is aiming at revolutionized the existing financial system. However, it is over simplified the connection/relations between virtual and physical world that short in

Table 2: The ISO Blockchain Standards

Standards	Title	Formulate Organization
ISO/TR 23455:2019	Overview of and interactions between smart contracts in blockchain and distributed ledger technology systems	ISO/TC 307
ISO/TR 23642	Overview of smart contract security good practice and issues	ISO/TC 307
ISO/TR 23246	Overview of identity management using blockchain and distributed ledger technologies	ISO/TC 307
ISO 23257	Reference architecture	ISO/TC 307
ISO/TS 23259	Legally binding smart contracts	ISO/TC 307
ISO/TS 23635	Guidelines for governance	ISO/TC 307
ISO/TR 6039	Identifiers of subjects and objects for the design of blockchain system	ISO/TC 307
ISO/TR 6277	Data flow model for blockchain and DLT use cases	ISO/TC 307
ISO 24374	Information technology security techniques –DLT and blockchain for financial services	ISO/TC 68
ISO/TR 24332	Information and documentation application of blockchain technology to records management-Issues and considerations	ISO/TC 46

Note: TR: Technical Report; TS: Technical Specifications

translating cryptocurrency, stablecoin, and fiat currency, and therefore, many prospective investors/speculators can take advantage form the imperfect innovated model. In the long run, the DeFi is still promising in many different ways. In the coming G20 summit in 2022 October, Finance Ministers will propose Cryptocurrency regulations. It is hope to lay a solid foundation for the DeFi financial supervision and development within the tolerable range of risk and impact to both virtual and real world.

4   CONCLUSIONS

The speed of the evolution of blockchain and a series of innovative applications seems to exceed the speed of research and development of regulatory systems in many countries. Blockchain applications are impacting the traditional financial system in many countries due to the global connectivity of virtual community. Among them, the Decentralized Finance (DeFi) has the greatest potential impact. The traditional financial system has been formed through consensus in the long history of mankind. However, unlike the services and solutions of ordinary banks, DeFi is built on open source software and uncensorable networks. Behaviors and services are open to anyone enabling people all over the world to participate in financial activities in a peer-to-peer decentralized manner. People are free from the control of any national government, and the anchoring of the currency will eventually cause an impact on the real financial system.

Decentralized finance has not been stress tested by long or widespread use. It is over simplified the connection/relations between virtual and physical world that short in translating cryptocurrency,

stablecoin, and fiat currency, and therefore, many prospective investors/speculators can take advantage form the imperfect innovated model. Therefore, many countries are taking a serious look into the systems.

The traditional financial supervision is based on the control mechanism of the centralized system, focusing on money laundering prevention and control. Due to the highly decentralized nature of DeFi based on the blockchain, regulators are bound to be unable to apply the centralized management model of traditional supervision. For joint supervision of greater integration, especially the European Union, the European Commission attaches great importance to blockchain standards, especially ISO, IEEE and other standard organizations. In the end, the results might translate into EU standards.

In the long run, the DeFi is still promising in many different ways. The lesson learnt from DeFi burst may lay a solid foundation for future Metaverse applications. The application of the blockchain database in Metaverse community will be regarded as an important business opportunity. Using more aspects to do big data analysis can increase the prediction accuracy. The related applications of blockchain, such as cryptocurrencies and NFTs, must be an important foundation for advancing the Metaverse. Therefore, in the supervision of blockchain, countries, such as Europe and the United States may continue to pay attention to standards such as ISO, so as to allow traditional centralized and innovative decentralized financial applications work in parallel under a sound regulatory system.

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