Blockchain-based Solutions for a Decentralized Finance
Ecosystem: A Critical Review Discussion

Masterarbeit

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vorgelegt von

Name: Groß   Vorname: Alexander

Prüfer: Prof. Dr. rer. nat. Michael H. Breitner

Betreuer: M.Sc. Oliver Werth

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1 Introduction

1.1 Motivation and Relevance

"By a continuing process of inflation, government can confiscate, secretly and unobserved, an important part of the wealth of their citizens."

(Keynes 2010)

In times of rapidly rising inflation rates and the associated decline in monetary stability, people's trust in the currencies issued by the state naturally declines. A look at the history of money shows that it has nevertheless always been very tempting for states and central banks to finance high government spending by massively expanding the money supply and thereby simultaneously getting rid of previously accumulated high government debts by causing the money to depreciate in value (Bheemaiah 2017).

Since the monetary system and state-issued currencies today are no longer backed by physical assets, but are instead entirely based on people's trust in their value, currency crises and currency reforms in the history of money are evidence that there has regularly been a complete loss of people's confidence in these currencies (Bjerg 2016; Chen 2020).

In 2008, at the height of the global financial crisis and shortly after the collapse of the U.S. investment bank Lehman Brothers, an author known to this day only by the pseudonym Satoshi Nakamoto published an eight-page long white paper with a concept for an electronic peer-to-peer payment system: Bitcoin. Using a sophisticated combination of previously existing technologies from the fields of cryptography and information technology, it was possible for the first time to create a functioning decentralized, open, tamper-proof, and thus highly secure digital network for the transfer of electronic value (Nakamoto 2008).

The core technological concept behind the Bitcoin network, which was developed by Nakamoto, is today known as blockchain technology. It is also the fundamental technological basis for a new field that has been developing rapidly in the last few years, going further than the idea of a decentralized currency or payment system: *Decentralized Finance*, or *DeFi*.

The term Decentralized Finance refers to financial applications built on decentralized, programmable blockchain platforms – primarily the second largest blockchain

Ethereum – which allow them to function without the involvement of trust-building intermediaries such as banks, exchanges, or custodians. The objective of the DeFi movement is therefore to build a decentralized financial ecosystem that can be easily accessed by anyone and use cases similar to those of traditional finance, but even new, unprecedented services as well can be offered without relying on central counterparties and trust (Qin et al. 2022; Gogel 2021).

Whether Decentralized Finance is a disruptive innovation that will drive traditional financial institutions out of the market in the coming years, or whether the interest associated with it is instead predominantly a hype that is likely to lead to heavy losses for investors and the failure of the many projects currently in development when the bubble eventually bursts, is a controversial debate in both academia and practice (Gogel 2021).

Many use cases of the traditional financial system can now be replicated based on decentralized protocols, such as lending, borrowing, or trading a wide variety of digital assets such as cryptocurrencies (Jensen et al. 2021). Furthermore, new innovative elements like smart contracts, i.e., intelligent self-executing contracts within a blockchain system, enable completely new business concepts and use cases, which contribute to the great potential of DeFi and the excitement about this new cutting-edge technology (Katona 2021; Werner et al. 2021).

Nevertheless, similar to the underlying blockchain technology, the construction of a DeFi ecosystem is still at the very beginning of its development. Many technological but also regulatory challenges have not yet been solved and could potentially hinder or even lead to a sudden end of the further development and adoption of a DeFi ecosystem and the concrete use cases and projects (Chen and Bellavitis 2019; Zetzsche et al. 2020). Moreover, states and companies are also working on solutions for their own blockchain-based digital financial applications, e.g., central bank initiated digital currencies (CBDCs), which could pose a risk to the potential of a decentralized financial ecosystem (Zetzsche et al. 2020).

However, there is no doubt that DeFi is a very innovative, interdisciplinary, and exponentially growing field at the intersection of technological and economic developments, which is ideally suited for a closer scientific examination. The increasing number of scientific studies dealing with the use and development of blockchain technology in general, but also with decentralized finance in particular, underlines the scientific interest and relevance of this subject area (Meyer et al. 2021).

1.2 Objective and Research Questions

The objective of this paper is to analyze the potential of decentralized financial services based on blockchain technology and, consequently, a decentralized financial ecosystem in general.

In this context, the history of today's existing centralized financial system, the need for decentralized systems, as well as the technological foundations of blockchain and related technologies will also be covered in order to comprehensively discuss and evaluate the potential of a decentralized ecosystem for the financial sector.

The purpose is to provide a scientific contribution to the understanding of this still very young research area of decentralized finance. In addition, implications and recommendations for science and practice are developed, which are intended to support interested stakeholders in deriving suitable recommendations for actions and policies.

Two concrete research questions derive from the objective, which will be answered within the scope of the thesis:

1. *How is the decentralized financial ecosystem designed and what are the concrete use cases in the context of DeFi?*

2. *What is the potential of a decentralized financial ecosystem in the future based on these DeFi use cases?*

To provide a profound answer to the two research questions, some additional but fundamental questions on the topic of Decentralized Finance will also be answered from

a) an *economic perspective*, i.e., the history, characteristics and functioning of money, centralized (financial) systems and central banks;

b) a *technological perspective*, i.e., the functioning, essential components and characteristics of blockchain technology and related supportive technologies

1.3   Structure

The thesis is consequently divided into the following six chapters, whose corresponding contents are briefly summarized:

Chapter 1 – Introduction: in the first chapter of the thesis, a brief introduction to the main topic was given and the main objective and related research questions were presented, before a brief overview of the structure of the thesis is provided.

Chapter 2 – Theoretical Background: In order to create a sufficient basic understanding for the following chapters, the second chapter first provides a brief definition of decentralized finance and then explains the economic and technological basics regarding the financial system and blockchain technology.

Chapter 3 – A Decentralized Finance Ecosystem: This chapter first introduces the applied research methodology, a critical review discussion. Subsequently, a brief introduction to the focus topic of decentralized finance will be given before answering the *first research question* on the design and use cases of a decentralized finance ecosystem.

Chapter 4 – DeFi SWOT Matrix and Critical Discussion: In chapter four, the advantages and disadvantages as well as the chances and risks of decentralized finance are first presented in the form of a SWOT matrix and the advantages and disadvantages are briefly explained. Based on this, the *second research question* about the potential of a decentralized finance ecosystem is then addressed by confronting, discussing, and evaluating the advantages and disadvantages as well as the chances and risks of the various DeFi applications and concepts. The findings from this discussion are then deployed further in the form of implications and an outlook.

Chapter 5 – Limitations and Recommendations: Following the critical discussion, the limitations of this study and potential directions for further research are highlighted in chapter five.

Chapter 6 – Conclusion: In the last chapter of this thesis, the essential findings from the previous chapters are summarized and concluded.

6   Conclusion

The focus of this thesis is the analysis and discussion of the emerging research area of blockchain-based decentralized financial applications and the potential for a respective decentralized financial ecosystem. For this purpose, two specific research questions were addressed and answered by conducting a literature-based analysis and a critical discussion. In order to create a basic understanding of money and the financial system on the one hand, and the technical aspects of blockchain technology on which decentralized finance is built on the other, the economic and technological basics were first explained before answering the concrete research questions.

From an economic perspective, the long history of money is marked by the fact that it has changed over time as humanity has invented new, more suitable forms of money. While most of the characteristics of today's (often digital) fiat money, such as easier divisibility, transportability, or storage, are an improvement over previous forms of money, it is neither naturally scarce nor backed by other physical goods, and thus carries the crucial risk that it can theoretically be replicated indefinitely. The expansion of the money supply by central banks and the resulting decline in the value of currencies in the past, as well as in the present, validates this risk and distrust of central institutions controlling the money supply. A potential solution to this problem was first presented in 2008 at the height of the global financial crisis: a decentralized, electronic peer-to-peer cash system.

From a technological perspective, the introduced concept, which we today call blockchain technology, offers several advantages over existing centralized systems. By using and combining cryptographic mechanisms such as hash functions, asymmetric private/public key pairs and consensus mechanisms, it is possible to store transaction histories and thus ownership of digital goods within a decentralized network in a digital, transparent, and tamper-proof way without a central intermediary. However, the price for decentralization and independence from authorities is limited speed and scalability, increased costs, e.g., for consensus building, increased complexity and, at least today, less usability than with solutions offered by traditional centralized platforms.

By answering the first research question, it was possible to identify and analyze the design of the decentralized financial ecosystem and the specific DeFi use cases.

The results revealed that the decentralized financial ecosystem is built on an infrastructure of different layers that stack on top of each other, each with different functions within the ecosystem. Key building blocks of this system are the fundamental blockchains, such as Ethereum, on which all other layers, platforms and applications

are built in a modular approach. On the asset layer, digital assets can be issued on the blockchain platforms through tokenization, which can take on different functions such as currencies, non-fungible assets or even representations of physical objects and serve as a lubricant within the ecosystem and between the different platforms and applications.

Through the use of smart contracts, dApps and DAOs, financial applications can interact autonomously and interoperable with other applications, creating entirely new application scenarios. The most widespread and frequently used DeFi use cases to date are currently digital value storage, asset tokenization (primarily in the form of cryptocurrencies, stablecoins, or NFTs), decentralized lending and borrowing, trading via decentralized exchanges, and the use of decentralized derivatives and oracles. In addition, other use cases such as decentralized insurance, automated asset managers, wallet platforms, and many other smaller use cases are also under development, but were not explored further in this thesis. In the future, however, as the DeFi space continues to be developed and adopted, more use cases will be added to this space, some of which may not even be foreseeable to be integrated into the ecosystem one day at this point.

By answering the second research question in the context of the DeFi SWOT Matrix and a critical discussion, the potential of the Decentralized Financial Ecosystem was analyzed, discussed, and evaluated.

In summary, the results and discussion showed that DeFi has great potential to become an established, open ecosystem for financial applications as an alternative to the traditional financial system in the long term due to the multiple technological advantages of blockchain technology and the innovative applications that are currently being built on top of it. In particular, its accessibility, interoperability, automation capabilities, and high rate of adoption suggest that the DeFi ecosystem will continue to grow and add value in the near future. In particular to those who have had no or only very limited access to the services of the traditional financial system to date, DeFi can provide a great opportunity.

At the same time, however, the development is still at a very early stage and the potential is countered by numerous challenges and risks. The current enthusiasm and hype around DeFi and blockchain solutions in general could also end very quickly if, for example, regulatory restrictions would massively limit the usage and further adoption or even completely ban it on a wide scale. In addition to regulatory risk, there are also a number of technological risks that currently limit the potential for mass adoption and use of DeFi applications. These include, for example, the risk of error-prone or even intentionally incorrectly programmed platforms, applications, or smart

contracts. Due to the high automation capabilities and immutability of the transactions executed, errors in the protocols can very quickly lead to massive problems. In addition, the limited scalability and low usability of most truly decentralized applications is still a reason, at least at the current time, why further adoption is still severely limited.

Overall, it can be summarized that DeFi definitely has the potential to contribute to a more open, digital, inclusive, and connected financial world in the future. The technological and regulatory challenges that are currently still hindering DeFi could be resolved if the appropriate measures and frameworks are found and the relevant stakeholders manage to make technology-open decisions in favor of the systems that can provide the greatest value to people in the long term, while effectively preventing misconduct and fraud without banning entire aspects of the system. Whether the impact of blockchain technology, and DeFi in particular, can ultimately match the comparisons to the spread of the Internet, or at least this is more hype, will only become clear over the course of the next few years. It is highly unlikely that a decentralized financial system will replace the entire traditional financial system in the foreseeable future.

However, DeFi at least has the potential to offer a counterweight and an alternative to centrally controlled systems and the existing financial institutions and applications, and thus putting pressure on traditional players to continuously improve their services and adapt them to changing conditions. Especially in combination with other technological developments such as the Internet of Things, Artificial Intelligence or an increasing automation of industry and society, extremely exciting use cases for blockchain and DeFi solutions will arise in the next few years through the combination of these technologies. This provides the potential to completely change our current understanding of money and finance, especially in the context of technological progress and a highly digitalized, automated, and connected world.