THE BLOCKCHAIN ECONOMY

A PRIMER

CHRISTIAN MAYER

The Blockchain Economy - A Primer

Christian Mayer

This book is for sale at http://leanpub.com/theblockchaineconomy

This version was published on 2021-08-18

ISBN 979-8458812467

Tweet This Book!

Please help Christian Mayer by spreading the word about this book on Twitter!

The suggested tweet for this book is:

Blockchains will have at least as much economic impact in the 21st century as corporations in the 20th century. Join the Blockchain Economy!

The suggested hashtag for this book is #Blockchain.

Find out what other people are saying about the book by clicking on this link to search for this hashtag on Twitter:

#Blockchain

Also By Christian Mayer

Coffee Break Python

Coffee Break Python Slicing

Coffee Break NumPy

Coffee Break Python Workbook

Brain Games Python

The Smartest Way to Learn Python Regular Expressions

Coffee Break Python - Mastery Workout

Leaving the Rat Race with Python

Coffee Break Pandas

15 Cheat Sheet Collection in Python + Git + NumPy + ML + Mindset

Contents

SAMPLE CHAPTERS

**Original and Full Book Available on Amazon: https://www.amazon.com/dp/B09CW635YL **

https://blog.finxter.com/

Subscribe to our free email academy to learn about Blockchain technology, programming, and freelancing here: https://blog.finxter.com/subscribe/.

Introduction

The last 100 years have brought us health, wealth, and wisdom. An average worker today has more access to goods and services than a wealthy king a century ago. Life expectancy in the US was 46.3 years for men and 48.3 years for women in the year 1900. Today, US life expectancy is north of 78 years because of drastic *improvements in sanitation, housing, and education.*

Most of these goods and services that have led to this staggering increase in health, wealth, and wisdom were invented, manufactured, shipped, and distributed by our economic machine. More specifically, *corporations*. Corporations organized the invention and distribution of drugs that saved billions of lives. Corporations accelerated innovation and automation and collectively produced efficiency gains that subsequently made billions of people prosper. Corporations democratized access to the world's information – the digital revolution drove prices of information and knowledge down so that now you can become a master programmer, artist, farmer, or mechanic for free just by reading blogs and watching free videos online. The rise of corporations has not only benefited their owners (*shareholders*) – it has benefited consumers as well.

A large part of the global economy and value creation has plugged itself into the cyberspace. The UN Digital Economy Report observes that *Digital platforms are increasingly important in the world economy*. These online platforms – Google, Facebook, Amazon, Netflix – dominate their industries due to the strong forces towards centralization in the web, such as network effects, access to the best talent, and efficiencies of scale.

Today, the power of centralized entities seems to be strengthening year after year. The web has emerged as a winner-takes-all economy where large online platforms dominate and earn all the

profits in their industries. It is tough to compete against Big Tech companies because of their economies of scale and network effects that stem from their gigantic sizes serving billions of users and customers. And even the supply of monetary energy is dominated by central forces—*central banks* keep injecting lots of new money into the economy. The trend towards centralization seems to be unstoppable.

Yet, if we've learned anything from history, *decentralization* is a powerful force not to be underestimated. In 2008, a person with the pseudonym *Satoshi Nakamoto* published a whitepaper titled *Bitcoin: A Peer-to-Peer Electronic Cash System* that has introduced a new concept to the world called *Blockchain technology*. This technology offered a novel technical solution to find *distributed consensus*, the latter being the problem of reliably finding agreement in a decentralized environment where centralized forces may try to manipulate the agreement to their favor. Notably, it solves the problem of finding *consensus in a "permissionless" setting, where anyone can join and leave dynamically, and there is no a priori knowledge of the number of consensus nodes.* In this book, we use a broader definition of the word "Blockchain": a Blockchain system uses a shared database which is not controlled by a single person or party, as done in traditional databases, but by the consensus of the participants. Roughly speaking, Blockchain technology allows us to create a fully distributed and decentralized system that, from the outside, looks like a coherent whole with a majority-backed information system or infrastructure application. Like in democracies, Blockchain technology uses a voting scheme to determine the consensus of the majority. There are different such majority-based approaches. For instance, in a "proof-of-work" blockchain, the majority must perform more than 50% of the work. In a "proof-of-stake" blockchain, the majority must show that it holds more than 50% of the coins. This majority then collectively secures the information stored in the Blockchain. Think of a blockchain as a *democracy in cyberspace* – but that is designed to resist problems

that frequently occur in centralized systems such as voting fraud, trust issues, and corruption.

This book is not a technical introduction to Blockchain technology itself; there's plenty of freely accessible material on how Blockchains work. Instead, this book makes the case that ***Blockchains will have at least as much economic impact in the 21st century as corporations in the 20th century.***

In the subsequent short essays, I will give you different perspectives on the drastic potential of Blockchain technology to disrupt nearly every business or political system in existence today. Some of the ideas may appear evident to you, others may not yet. But in due time, we will see many of them implemented in the real world by practitioners, programmers, and Blockchain architects. Even better, many new ideas and applications of Blockchain technology will see the light of the day. Due to the disruptive value proposition of providing permissionless, trusted, secure, and decentralized management of information, these applications will create new blue oceans of opportunity, breaking out of the red bloody oceans of existing centralized financial infrastructures.

So, let's get started, shall we?

Bitcoin the Ultimate Asset

Bitcoin was introduced in Satoshi's Whitepaper *Bitcoin: A Peer-to-Peer Electronic Cash System.* [1] Among other things, the paper solves the *double-spent problem* – a single virtual coin cannot be spent twice by a malicious party. This problem was previously not well-addressed in a distributed environment where contributors have an economic interest in manipulating or influencing the system in their favor. However, by introducing the *proof-of-work* concept, the system became more and more secure the more it grew. Only if a majority of the network's computing power (*work*) collaborates on an attempt to hack the system for a considerable period can the monetary system Bitcoin be manipulated. Given that the combined computing power of the distributed Bitcoin network has an energy footprint larger than that of some countries, it is impractical for a single party to manipulate the network. If one party tried to manipulate the network, its other participants would quickly detect the attempt and fight back with protocol changes or increase computing efforts to gain back the majority.

Consequently, the Bitcoin network is the safest value storage network ever invented. For instance, a single motivated person could technically take your gold, real estate, paper assets, and bank assets. But the Bitcoin network cannot be destroyed by any single individual no matter how powerful –your Bitcoin always remain safely secured by the network. Consequently, if you own Bitcoin, you own one of the strongest and safest assets in the world. But what are the unique properties that make it such a great asset? In short: portability, durability, divisibility, fungibility, and scarcity. Let's explore these five properties in greater detail.

Bitcoin is ***portable***. You can keep the private key on a piece of paper or even "store" it in your head. You could transport millions of dollars worth without a vehicle or even a suitcase. Nobody would even see that you carry value—a highly desirable fact if you need to flee the country for any reason. No other asset is as portable as Bitcoin. For instance, you cannot move real estate outside the country. And it is next to impossible to transfer large sums of money without the manual involvement of a third party such as bankers asking you questions.

All commodities are hard to move because they are at a thermodynamical disadvantage: they consist of matter—in contrast to digitized assets such as Bitcoin. Moreover, transporting gold and silver is a physical and logistical nightmare. Thieves may use force to take the physical goods from you. If you need to move out of a country quickly, you can do so with Bitcoin at the speed of light. It is one of the most portable assets ever created by humanity.

We have already touched on the point that Bitcoin cannot be stolen easily. Money, gold, cash, real estate could all be taken away forcefully. But you can hold your Bitcoin in a way such that even if somebody killed you, he couldn't access them. You could hold millions worth of Bitcoin assets on a piece of paper or in your brain, and people wouldn't even know. A simple series of digits is enough to access, transfer, or take with you all the wealth saved in your whole life. Bitcoin brings genuine property rights to billions of people worldwide.

Bitcoin is ***durable***. As long as you retain the private key, a war between two or more countries cannot destroy it. It will most likely survive nuclear attacks, biological attacks, and unfriendly political environments in your home country. As long as the network consists of at least one computer, the information remains intact. In addition to the safety of your principal, your Bitcoin doesn't lose substance with time like all other physical assets, and it doesn't inflate either—only 21 million Bitcoin will ever be created. Durability is one of the main reasons for the success of Bitcoin.

Bitcoin is ***divisible***. Unlike any other assets such as real estate, diamonds, or even paper money, you can divide the asset into multiple pieces without changing the summed value of the pieces. For example, you can break up one Bitcoin stored at one wallet into two wallets, each carrying 0.5 Bitcoin, and combine them later to 1 Bitcoin without loss except transactional costs. So, you can arbitrarily break up a single Bitcoin into many smaller units of value. The smallest unit is one-millionth of a Bitcoin, called Satoshi.

Bitcoin is ***fungible***. Fungibility is the ability of a good to be exchanged for another good of the same type. A Bitcoin carries the same value as any other Bitcoin – there's no difference in value. Fungibility is a desirable property of monetary goods—and it is one reason why gold and silver have better monetary qualities than, say, art or diamonds. Any piece of art and any diamond is unique and is valued differently by different people. Consequently, it is hard to use diamonds or art as instruments of value exchange. However, you can exchange one Bitcoin for another, and you still carry the same value. Its *fungibility* is hard-coded into the monetary Bitcoin system.

Bitcoin is ***scarce***. No more than 21 million Bitcoin may ever exist, by design. You can rely on this scarcity because it's written into the rules of the Bitcoin protocol. Most other assets such as real estate, oil, or even gold are not as scarce—rising prices usually lead to a higher production volume because of the higher incentive. For example, as the oil price rises, alternative ways to extract oil at higher costs, such as fracking, became profitable. As we extract more oil, supply increases, and consequently, prices reduce. Most other asset classes and commodities have this self-regulating pricing mechanism making them an inferior investment compared to Bitcoin – at least when considering only the supply side. Not many assets are truly scarce. However, Bitcoin cannot be reproduced no matter how much demand exists.

In fact, higher Bitcoin prices tend to *increase* demand even more, not reduce it. For instance, some large organizations or large state

treasuries cannot invest in Bitcoin because it is still too small and thinly traded in relation to their sizes. At the point of writing, Bitcoin's market capitalization is still less than a percent of that of large asset classes such as stocks and bonds. But as the market capitalization of Bitcoin grows, it creates the opportunity for larger and larger institutions to take a position. Bitcoin's total addressable market *increases* with increasing prices. Also, higher adoption will attract more participants into the network for economic and psychological reasons as trust in the asset begins to increase—a phenomenon known as the *Lindy effect*. Finally, the more participants the network has, the more secure it becomes against manipulation. So, the value proposition strengthens with a price increase.

An asset is a *store of value*. Bitcoin is the perfect store of value because there cannot be any dilution. It is decentralized and secure, scarce, portable, and fungible. No other asset ever invented can offer the same value proposition. For example, the value of gold dilutes over time as the gold supply expands. Bonds are promises of future cash flow—and they are heavily diluted as more and more of those promises accrue. Stocks are ownership interests in companies - and a small group of persons such as the CEO can decide how much of those ownership interests exist, so their value can be diluted. Real estate is a dilutive asset class too as more and more houses are built. There are billions of houses in the world, and more are produced every year. Even land as an asset class is dilutive because the vertical space allows for infinite expansion.

Bitcoin, on the other hand, exists in limited quantities forever – 21 million. Every day, Bitcoin get lost and will never be recovered as, for example, Bitcoin holders lose their private keys or even die without preparing to transfer the private keys to their heirs. While most other assets are inflated with more and more of the same, Bitcoin becomes more scarce over time.

Let's assume a world where the demand for all assets remains the same over time. In this world, the value of Bitcoin will rise against stocks, bonds, fiat cash, real estate, and most other commodities.

Theoretically, it rises at the rate of the inflation of the other assets. But the demand for Bitcoin is snowballing due to many factors – currently, the Bitcoin market capitalization is significantly lower than the market capitalization of all other assets. As Bitcoin offers such unique inflation protection, more and more investors move from traditional assets into the relatively small Bitcoin market, resulting in price increases that are even larger than the inflation rate. However, even when we reach a steady state in terms of adoption growth, the increase of the world population and the inflation of other assets are likely to keep driving Bitcoin prices.

Leaving all of those advantages aside, Bitcoin has a counterbalancing effect on the governments in the world. No single government controls the Bitcoin network as a global decentralized network of computing energy. Michael Saylor calls Bitcoin a *Bank in Cyberspace*. As the government inflates assets and prints more money, more and more people will deposit their assets into Bitcoin that is immune against those inflating forces. Consequently, prices of the deflating Bitcoin asset increase relative to prices of the inflating fiat currencies. Thus, governments lost their monopoly on monetary control. To stay competitive and avoid losing market share in the global market of value storage systems, they may have to cut back on inflation.

All assets are in constant competition against each other, and the existence of a perfect asset like Bitcoin threatens the power of central banks. The fact that people flock to crypto-assets such as Bitcoin may deprive governments of their most potent tool to finance their operation: inflation. Governments issue debt to pay for their operations. Inflation allowed them to "pay off" their debt without direct taxation. They soon may need to do openly what is now being done in the shadows—creating fresh money without needing to tax their citizens explicitly. Many Bitcoiners believe that this will lead to a more open, transparent, and fair political conversation between governments and the citizens they represent. Bitcoin will hopefully lead to an open conversation about the

economic society we want to live in.

#
Decentralized Finance –Killer App of Blockchain Technology?

The proliferation of Blockchain technology has led many critics to point out the lack of useful "killer apps"—so convincing and valuable that you wouldn't want to miss Blockchain technology just for the sake of those applications. These applications could quickly catapult Blockchain technology to billions of users. Killer apps led to the rapid adoption of the web or mobile phones. For example, Uber is one killer app for smartphones—it increased the utility of smartphones and, thereby, Uber and smartphones are in a symbiotic relationship where one's success benefits the other's. Another example is Amazon that used the web to create the *Everything-Store*, and, by doing so, increased the utility of the web. Both killer apps have had massive synergy effects where the infrastructure (web, smartphones) enabled the app (Amazon, Uber), and the app in turn fostered the proliferation of the infrastructure.

So what is the killer app for Blockchain infrastructure that can help it grow to billions of people by providing a service that is so useful, it cannot be ignored?

Well, the killer app of Blockchain technology may just be *decentralized finance*.

What is decentralized finance?

Decentralized finance (DeFi) provides a new backbone to the financial system based on code rather than individual human decision making.

Every financial system is build on top of money. But instead of fiat money that is controlled by centralized institutions such as banks, exchanges, and governments, DeFi builds on top of Blockchain-enabled crypto-assets such as Bitcoin and Ethereum.

Most finance is currently centralized (CeFi). It provides us with all the services of today's financial system. CeFi has a massive value

proposition because it enables you to participate in the growth of specific businesses through stocks, store value by investing in broad market indices such as exchange-traded funds (ETFs), create a predictable income stream for retirement through lending, or borrowing money to buy a house or a business without your own capital.

CeFi has problems—many of them originate from centralization. For example, centralized brokers charge high trading fees that make them rich and the traders poor. Moreover, central bankers and government employees decide over the fate of billions by controlling the fiat money supply—humans make biased, irrational, or even corrupt decisions whether they are aware of it or not. For instance, centralized institutions tend to take on too much risk as they become too big to fail. *"Heads you lose, tails I win"* – the downside risk is often socialized whereas the upside is "taxed" by the financial gatekeepers.

Decentralized finance, however, provides hope. It offers a way out that keeps the positives of the CeFi financial system while mitigating the negative effects of centralization. Within DeFi you'll find centralized institutions as well such as exchanges, lending and borrowing platforms, or quick, easy, and scalable payment solutions. But DeFi can do some things that cannot be done with CeFi due to the decentralized infrastructure. We'll dive into many of those applications in the remaining chapter.

The potential market for decentralized finance is significant. Today's bond and stock markets hold hundreds of trillions of USD in *monetary energy*. Much of it is currently being moved from centralized banks to digitized, decentralized Blockchains as they reduce costs by removing intermediaries, provide highly specialized and programmable financial products, and offer higher levels of infrastructure trust and security.

DeFi comes with some unique advantages compared to CeFi. Let's dive into some of those next.

Fees: Decentralized exchanges and not-for-profit intermediaries in DeFi don't need to charge high fees as they don't necessarily need to make a profit. Their operations are performed entirely in code using *programmable money*—many intermediaries are implemented by code that runs on the Blockchain infrastructure.

The current overhead costs of the banking industry is around 3% per year compared to the assets they hold, as a global average . Before Blockchain, this friction was necessary to provide the modern financial system and trust on which the capitalistic economy can stand on. Blockchain technology has the power to disrupt parts of the expensive and labor-intensive banking system with scalable code, offering an even higher level of trust and predictability. With the invention of Blockchain technology, the overhead costs has the potential to decrease significantly, perheaps to 1% or less.

Single Point of Failure: CeFi is based on centralized institutions such as banks or governments. Many of them are too big to fail—they're often rescued and bailed out by tax payers to prevent financial chain reactions. But centralization injects fragility into any system—if a centralized institution is hacked, physically attacked, corrupted, or partially taken over by malicious parties, a collapse of the whole system becomes more likely. In computer science, this is called a *single point of failure*—and it must be avoided at all costs if the system must keep working under extreme conditions. Because extreme conditions happen all the time in the economy. DeFi technologies such as Bitcoin can be designed in a way that they don't have a single point of failure.

Globalization: The world is divided into roughly 200 countries which results in friction when value or information travels across national boundaries. Money must be converted back and forth into different currencies, each time losing a small percentage of its value. However, a given Blockchain such as Bitcoin is usually distributed among computers all around the world. Blockchains create their own worldwide network that can be used as a backbone for value exchange. Moreover, DeFi provides us with a global

financial system that works even if a government doesn't want to give its citizens access to stable financial energy by inflating its own currency. By means of DeFi, every world citizen with a smartphone will have access to the same powerful financial tools that were previously available only to high-net-worth individuals.

Safety: Decentralized finance gets rid of some risk factors due to centralization. The financial industry is all about value, risk, and return, the increased safety, reliability, and trust. Most centralized finance applications will still exist—but with DeFi, they can now provide more value, are more secure, or are enriched with functionality that was previously unavailable such as the increased availability of capital markets in space and time: decentralized finance brings financial services to billions of people. And as DeFi runs on decentralized Blockchain technology, the infrastructure is available 24/7 safely, reliably, and without needing to trust a single institution or even country. Disrupting money, the backbone of capitalism, will unlock massive first- and second-order consequences to people, companies, and governments that embrace it.

Technically, decentralized finance was created using *smart contracts* and decentralized applications (*DApps*) on the Ethereum Blockchain. Let's quickly examine both concepts, smart contracts and DApps, next:

What are smart contracts?

One of the pioneers in the development of Blockchain technology, Nick Szabo, defined smart contracts as *"set[s] of promises, specified in digital form, including protocols within which the parties perform on these promise"*. Roughly speaking, a smart contract is a rule-based program that uses computer code to describe when and if a contractual obligation is fulfilled and what to do in that case.

Contracts are at the heart of economic exchange—each time you purchase a good such as a cup of tea, you express your intent to buy, agree on a price, pay it with money or debt and get the good. Contracts also facilitate the collaboration of corporations or even

governments. If multiple governments agree on a certain course of action, such as reducing carbon emission, they usually enter into a mutual contract to make sure the course of action is actually implemented by all parties.

Smart contracts are written in code. You can express every condition in the contract that can be expressed by a modern computer—computer scientists would use the term "Turing complete" to characterize that the programming language with which you can express smart contracts, e.g., in the Ethereum Blockchain, is theoretically as expressive as any other programming language such as Python, C++, or Java. The goal of smart contracts is to mitigate the need for trusted intermediaries, arbitrators, or enforcers. For example, a future Blockchain may automatically oversee and manage the provision of much-hated speed tickets, freeing the police and the legal system from handling a massive number of low-risk, low-stake legal cases, and thereby reducing the workload and costs of the judicial systems in modern societies. But the main use of smart contracts are likely to come from DeFi and DApps.

What are DApps?

A decentralized app or DApp is an application that runs on a decentralized infrastructure such as a Blockchain as opposed to a centralized infrastructure such as a company's private servers. Examples of decentralized apps are Ethereum-based freelancing platforms, games, non-fungible tokens, or (DeFI) lending and borrowing platforms. Because DApps run on a decentralized infrastructure, many of the infrastructure advantages such as no single point of failure, increased trust, security, and high availability also apply to DApps. Running a DApp is much more expensive than running a centralized app on a cloud server because memory and computing power are very scarce on a Blockchain. Consequently, DApps are mainly used for a small subset of highly specialized and security-focused applications such as decentralized finance—where the unlocked value overshadows the monetary costs of running the DApp. For many common-day use cases such as watching an

entertainment video, using a DApp wouldn't be a good use of scarce Blockchain resources.

Let's dive into the most common DeFi applications developed so far. New applications emerge daily so this is merely a snapshot in time.

Stablecoins. A stablecoin is a crypto-asset with a price that is pegged to another asset. Frequently, a stablecoin tracks the price of fiat currencies such as USD, EUR, CNY. This is useful for traders who want to trade in and out of a certain cryptocurrency and need a safe-haven asset with low volatility so that they can wait for a more favorable purchase price of a volatile crypto-asset. But there are many more use cases of stablecoins. For example, a snowballing number of Bitcoin and Ethereum holders lend their assets against regular payments of stablecoins to be used to purchase goods in the "real world" where cryptocurrencies may not yet be accepted as payment devices. But as the adoption of crypto assets increases, fewer people will find it necessary to even trade out of crypto and into fiat currency.

Payment. Money is a store of value, a unit of account, and a medium of exchange (payment). More than 90 trillion USD exchanges hands every year in the global economy. Currently, the centralized financial industry provides most of the monetary energy used for payments. However, the share of payments handled by decentralized finance and crypto assets proliferates. Most of the disadvantages such as the high overhead for decentralization are currently being mitigated by using a layered financial architecture and new technological innovations. For example, Bitcoin payments are relatively expensive—but new "Layer 2" solutions on top of Bitcoin, such as *Bitcoin Lightning*, enable fast and scalable payment solutions without significantly reducing the security model for relatively small purchases of, say, coffee, clothes, or even cars. Decentralized finance builds layer upon layer of an emerging global payment network offering fast and cheap payments. But in contrast to the layered solution around centralized "fiat" money,

the layered DeFi industry evolves around a decentralized backbone with unique monetary properties.

Borrowing and lending platforms. The global bond market size is north of $100 trillion. This is the global debt outstanding. Clearly, borrowing and lending have become integral parts of the global economy. States borrow money to fund infrastructure projects. Companies borrow money to fund their operations. Individuals borrow money to buy homes for themselves and their families. On the other side of these transactions are the lenders and capital owners who get paid a rent on their capital for taking the risk of capital loss and for forfeiting consumption of their capital for a given period.

DeFi has emerged as an alternative way to orchestrate borrowing and lending without the need of a centralized entity such as banks or central banks. DeFi cuts out the middlemen and provides unique safety and reliability service agreements. Many decentralized platforms for borrowing and lending already exist where, for example, Ether holders lend their assets to borrowers and get paid rent for it. Some of these platforms are completely decentralized, so if you're a lender you can be sure to not getting screwed over by a single untrustworthy entity. If you're a borrower, you can be sure that you'll get the same deal as any other participant in the market, no matter how rich they may be. Decentralized finance and programmable money provide a degree of security and reliability that cannot be matched by centralized finance.

Decentralized exchanges. Part of DeFi are decentralized exchanges where people can exchange crypto assets against each other, as well as crypto assets against fiat currencies. Providing liquidity, i.e., being able to quickly transfer any asset into any other asset, is an important function of the financial industry. At the time of writing, centralized exchanges seldomly provide their service 24 hours per day and seven days per week. However, decentralized exchanges that run on top of Blockchains such as Ethereum are always available and cannot be shut down by

any central authority. With the help of decentralized exchanges allowing you to trade decentralized assets into a wide range of other asset classes, you can now excert complete control of your asset.

Wrapped assets. A relatively novel approach to allow interoperability between different Blockchains is the idea to wrap assets. For example, you can wrap Bitcoin into a token on the Ethereum Blockchain. You can then trade the wrapped token on Ethereum, use it for payments or even lend it to another user for a certain time to earn interest. At any time you can trade the wrapped Bitcoin back to a real Bitcoin. This has several advantages. First, one Blockchain can now access the liquidity provided by another Blockchain. Second, you can move value from one Blockchain to another without losing the exposure to your original asset. For example, if you own BTC but you need to be able to quickly purchase goods from a vendor who only accepts ETH, you can use wrapped BTC. If the BTC price rises, your wrapped BTC will rise in value too.

Derivatives and tokenized assets. Like CeFi, decentralized finance provides more and more derivative instruments such as futures and options. If you're a vendor, you can hedge your risks using these instruments much like a farmer who wants to protect against falling crop prices. Over time, the number of derivative instruments provided by DeFi will increase. A current trend is to tokenize many non-financial assets as well such as art, real estate, startup ideas, and even the future reach of, say, Elon Musk, in a social network like Twitter. With tokenized assets and derivatives, decentralized finance is already in the process of matching, in the future even exceeding, the possibilities offered by centralized finance.

Yield farming, liquidity mining, and initial coin offerings. The potential use cases of decentralized finance are massive. Some emerging DeFi concepts include *yield farming*, i.e., earning new crypto assets with your old crypto assets using smart contracts,

liquidity mining, i.e., providing crypto assets to liquidity pools and earning new crypto assets in the process, and *initial coin offerings* (ICOs), i.e., funding new ventures and startup ideas by launching a token that represents ownership in the startup. For example, the crypto exchange Binance has funded its big launch with an ICO of their BNB token. As the Binance exchange grew, they purchased back the token to increase its scarcity—and the increased adoption of BNB has lead to a stark price increase making many of the early investors into the ICO rich. However, the lack of regulation also means that many fraudulent ICOs happened—so the investor must be extra careful when investing into an ICO!

It is likely that these applications of decentralized finance are only the tip of the iceberg. The DeFi industry is young and grows rapidly. New applications emerge almost every day and many of the future blockbuster ideas have not yet been invented.

But where does the growth come from? Is it robust? As for the adoption of Bitcoin, the DeFi industry growth has many facets. First of all, there are strong network effects on several levels.

Developer networks emerge such as for Ethereum where developers create apps, documentation, and success stories attract more developers who develop even more successful apps and better documentation. This compounds utility and, ultimately, adoption of DeFi.

Then there's the *Lindy effect*—the expected lifespan of a technology is proportional to its current age. The more DeFi ages, the more trustworthy it becomes which increases its chances to survive and increase its lifespan even further due to the Lindy effect. Every day DeFi survives, it becomes stronger and its expected lifespan increases. And with the current growth numbers of double or even triple digit percentage points per year, it seems unlikely that DeFi is going away anytime soon.

Composability and building blocks. When thinking about the future name for what later became *decentralized finance* or *DeFi*,

Ethereum developer Blake Henderson proposed the name *"Lattice network - enabling the financial revolution by weaving together open protocols"*. Composability has been front and center when the concept of DeFi has been created by the early Ethereum developers. The idea is simple but powerful: DeFi provides a means to create open interfaces so that one DeFi app can build upon one or more other DeFi apps. For example, an entrepreneur may create a "personal finance DeFi app" that makes use of three DeFi apps for insurance, investments, and borrowing, respectively. The open protocols of many DeFi applications enable architectural thinking to plug together more high-level apps from lower-level apps. It's Lego—or better yet: Minecraft—for the financial industry.

Raw financial incentive systems exist as any person invested in scarce digital assets benefits from increasing adoption through price increases. Naturally, millions of Bitcoiners start talking—or writing—about Bitcoin and attracts more and more people into it until the adoption curve slows down over time.

All these effects and more feed into each other to grow the industry. Many industry experts today believe that this will lead to an explosion of the DeFi industry that will take over large parts of centralized finance to create democratization of the financial industry much like the Internet has democratized the content creator economy.