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Chapter 1: The global evolution of digital payment systems and decentralized financial infrastructures

1.1. Introduction to Digital Payment Systems

This research investigates the evolution of digital payment systems and decentralized financial infrastructures from a historical, technological, political, sociocultural, and economic angle. Digital payment systems are currently undergoing a radical market-driven transformation, as individual customers, corporations, and financial institutions alike are adopting private cryptocurrencies to retain value, transact, and keep accounting records, replace bank deposits for transactions, and provide and accept payment for goods or services. These traditional and novel use cases provide a unique and disruptive opportunity for both DeFi (Feenan et al., 2021; Brandl & Dieterich, 2023; Adisa et al., 2024) .

Digital payment systems, also known as electronic payment systems or digital cash systems, are payment systems that electronically facilitate human or machine transactions using a digital currency between parties. Digital currencies may be either fiat or non-fiat, where new money is issued either digitally by a centralized body, typically a central bank, to exist parallel to physical money. Non-fiat currencies, in contrast, are developed and governed by decentralized entities or communities on a per-protocol basis, where the properties, supply characteristics and transaction processing methods of a new digital currency are coded by creators or proposed through a community-approved signaling mechanism. Examples of current digital payment systems include: bank payment transaction services; money transfer services; credit and debit card payment networks; and financial services and banking payment systems based on digital currencies (Ozili, 2022; Wronka, 2023; Krause, 2024).

1.1.1. Background and Significance

Over the past five decades, electronic payment systems have evolved from being a niche application of electronic funds transfers, through an intermediary role between cash and card transactions, into a massive market, conducting trillions of dollars in transactions each year. Today, digital payment is an integrated part of both brick-and-mortar and online merchant offerings, acting as a tool of customer relationship management and driving merchant service revenue for traditional banks as well as specialized payment processors. Digital currencies envisioned by researchers and enthusiasts for almost 30 years and made affordable, practical and secure by the advent of low-cost and low-power computing technology are finally becoming a commercially viable payment option. Payment systems have also transcended national boundaries, enabling remittances for immigrant families from developing countries, boosting trade in goods and services as well as remittances from overseas markets for developed countries and creating new and innovative services linking fiat currencies from all around the world.

Fig 1.1: Global Evolution of Digital Payment Systems

Digital money is a significant aspect of digital transformation of social, economic and financial relations among businesses and consumers, enhancing payment systems revenues for banks and specialized payment processors, replacing legacy cash and card payments. However, the benefits of the digital transformation of payment systems are currently unevenly distributed.

1.2. Historical Overview of Payment Systems

The evolution of payment systems exhibits cyclical behavior over the centuries whereby, after periods of intense innovation and growth, periods of stagnation ensue, usually lasting several decades. Evolutionary phases are characterized by increasing standardization of payment services, development of technical infrastructures, and opening up of access to services for all participants, such that transaction costs are driven close to the marginal cost of payment processing. Typically, the banking system led the world in the development of electronic payments, while the United States led the development of automated clearing houses. The past two or three decades, however, have witnessed an unprecedented globalization in payment systems, as well as radical innovation by private sector actors, which has stimulated the current rapid evolution of payment systems and reduction in transaction costs.

Throughout the Middle Ages, the primary payment mechanism was the physical transfer of coins. Coins of known metal value and stamping, however, were the monopoly of sovereigns, with the notable exception of the manufacture of special purpose coins by temples. As commerce expanded, coinage became cumbersome; therefore, merchants began to use decrees ordering a third party to pay a specified sum as a substitute for coin. However, it was not until the development of the banking firm in the seventeenth century, which allowed for deposits of coin denominated in a unit of account, as well as the emergence of commercial paper, that the traditional medium of exchange function of money could be satisfied satisfactorily. Banks issued receipts or notes that could readily be transferred as means of payment, in place of or in addition to coins, deposit accounts could serve as a means of clearing; and negotiable debt certificates could serve as a means of deferred payment for trade transactions.

1.2.1. Traditional Banking Systems

Traditional banking systems consist of banks as intermediaries and standardized payment processing systems. Banks act as intermediate agents between wallets by (a) verifying the money supply, i.e. deposits and withdrawals of both wallets, (b) assuring the owners of each wallet that the bank will manage it reliably, and (c) providing trust to the sellers that the buyer will settle the transaction. Traditional payment systems are standardized, due to different currencies and technical implementations across banks worldwide. Standardization is enforced by regulation to avoid rare occurrences of money laundering and terrorist financing. Money laundering is the processing of transactions involving criminal proceeds to disguise the illegal origin. The risk of transferring digital assets for money laundering is very small. One reason is that criminals usually do not want to transfer the money back to the financial system where it can be found. The digital asset may also be detected as being part of a criminal scheme. The high suspicion is

about transferring criminal proceeds from a fiat account to a digital asset account. If a transfer to a digital asset account is detected, the action is reported to networks and fiats involved in digital asset transactions are put on a blacklist.

In addition to money laundering, there are many centralized institutions governing interaction and informing trust, thus standardizing traditional payments for users. Banks hold the wallets with the money supply and determine trust for all customers. Transactions are verified before completion via a single point of failure. Clearinghouses who handle the transfer between banks fulfill this role for check transfer, larger bundles of payments, and transfers of payments for international merchant transactions. Query processors verify transfers via a single point of failure for credit cards and electronic money transfers. Blockchain for payments dissolves the institutions of banks or intermediaries in trust for foreign transactions. A network of nodes verifies transactions in a decentralized manner without a single point of failure.

1.2.2. Emergence of Electronic Payments

More as a result of the evolution of technology than of any real foresight on its part, the system of digital payments, which only reached its greatest development with the availability of credit and debit cards, began a more recent acceleration with the globalization and expansion of the Internet and interactive electronic networks. The initial phase of this stage was marked by the development of more secure systems of authentication for electronic exchanges. Without a secure means of authentication, neither buyers nor sellers could commit any resources without the certainty that such actions would be completely impervious to criminal action. Only after it was apparent that advanced electronic methods for authenticating interactions had been developed was it reasonable to expect a dramatic increase in the electronic exchanges of economic resources.

The early systems developed in this series of advancements were known as Electronic Funds Transfer systems. These systems couple the digital communications capabilities of computers with the financial operations of traditional banking organizations to enable the processing of traditional transfers of demand deposits between bank accounts. Typical of such systems are the traditional Automated Clearing House systems, which process a wide variety of periodic payments and transfers via batch processing - and real-time payments, which are now available through the clearing organization. These banks are the clearing hub for payments, enabling the transfer of funds from the senders' to the receivers' banks for ultimate credit to the beneficiaries. Such clearing operations are the fundamental processes, which must be centralized for efficient operation, employed in all check and ACH payment exchanges.

1.3. Key Technologies in Digital Payments

In recent years, the field of digital payments has seen extremely rapid and profuse growth, from innovative fintech solutions deployed by payment service providers, merchants and banks, to the revolutionary models of decentralization. In this section, we discuss the technologies underlying these hundreds of different solutions for secure, real-time payment settlement, with current adjustments and risks associated with the deployment of these different technologies at scale.

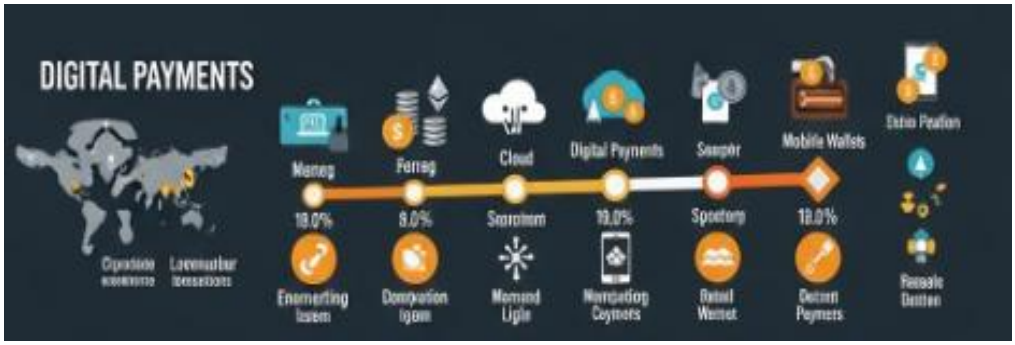

Fig 1.2: Digital Payments

A blockchain is a type of distribution ledger technology, or DLT. A DLT is a ledger that is available to many parties. It is distributed, meaning that multiple copies of the same ledger are stored on multiple computers or nodes in a network. The DLT is maintained collectively, meaning that, unlike traditional databases in which a single computer or organization controls the database and manages the process of writing and maintaining data, the process of writing data to the ledger and the process of organizing and managing the data are distributed in different ways. In a fully decentralized blockchain network, no nodes are trusted exclusively to complete these tasks. Instead, the network uses mechanisms of consensus among all the nodes that ensure "honest" behavior in completing these tasks. This process is often called "reaching consensus," and can take many forms. It is also called "triple-entry bookkeeping" because it involves the cooperation of multiple parties.

Many developments have made blockchains much more useful than just payment systems, and it is true that they provide many technologies and primitives underlying a vast array of decentralized applications in health care, finance, identity and security, supply chains, and more. Here, though, we will concentrate on the bits and pieces common to all cryptocurrency protocols because this is the context in which we need to understand the discussion of policy issues related to innovation in cryptocurrencies and cryptocurrency markets. In particular, most cryptographic tokens that are the basis of these decentralized applications are initially created as currencies or brought into the protocol in transactions.

1.3.1. Blockchain Technology

Blockchains are the technology underlying DeFi and they all work on the same principles initiated by Bitcoin's blockchain and the creation of the original cryptocurrency. Although Bitcoin was a pioneering blockchain, it was never meant to function like a "financial" blockchain but was rather built to function as a distributed public ledger to ensure that all users of the network come to the same consensus of transactions, thus preventing double spend fraud. An individual can become a member of the network by running a copy of the ledger/transaction history of the Bitcoin blockchain on its computer which is constantly updated as miners on the network discover new blocks of transactions. The incentive for running a Bitcoin node is so that a user can listen, verify, and independently confirm via their own simplified copy of the Bitcoin ledger, that no two transactions are attempting to transfer funds from the same address. Although this incentive is primarily for the assurance of security that your funds will not be involved in a double spend fraud, it is a service that Bitcoin nodes provide to the entire network. This was collectively a revolutionary technology that not only ensured that the Bitcoin network was decentralized, secure, and permissionless but also that all users of the network ran nodes independently instead of having the network depend on a centralized backbone of private firms that could collude or be hacked.

The critical innovation accomplished by blockchain technology is that of removing trust in a third party who manages assets while instead, providing a public ledger system that is cryptographically-coded to remove the possibility of transaction fraud while simultaneously allowing all community network participants to verify and confirm transaction accuracy. In addition to removing the possibilities of double-spending, blockchain technology also relies on digital signatures and public key encryption to function, which allows users to independently verify that the identified account has authorized a transaction. Blockchains also reduce the cost of transaction verification and audits because the public accessed ledger records them permanently, thus providing a lower-cost transaction audit trail for users and regulators alike. Each country could develop Central Bank Digital Currencies that could issue government-backed electronic currency coins that could incorporate this public blockchain technology structure, record transactions transparently, and allow for transaction verification by the users and the Central Bank regulators.

1.3.2. Cryptography in Transactions

Cryptography enables two parties to transact anonymously without a trusted third party by assuring that only the intended receiver can decrypt the contents of the transaction. An essential building block of this system is asymmetric encryption. The basic principle of asymmetric encryption is that it enables a user to generate a public and private key.

The user makes the public key widely available but keeps the private key secret. If some information is encrypted with the public key, only the corresponding private key can decrypt it. Similarly, information that is encrypted with the private key can only be decrypted with the public key. By this mechanism, the user can ensure that information that only the intended receiver can read and verify the identity of the sender.

The basic commercial idea that is enabled by asymmetric encryption is the concept of digital signatures. Digital signature technology has enabled the creation of non-repudiation services. A digital signature is a means for the recipient of a transaction to validate the identity of the sender. Digital signatures enable an auditor to verify or refute each party's claims. A digital signature consists of a hash, generated by applying a one-way hash function to the contents of the transaction and encrypting the hash with the sender's private key. Encrypted in this way, only the sender's public key can decrypt the transaction hash. Digital signatures provide evidence of the transaction activity. The ability to create, verify the signature, and provide a proof of signature verification to a trusted third party is the key to the non-repudiation service.

Asymmetric encryption is also used to construct secure channels through which to establish persistent symmetric session keys that will permit fast, private communication between two parties. A symmetric session key must be agreed upon before symmetric message encryption can begin. A symmetric key is generated through the exchange of public keys or by any asymmetric key exchange protocol that utilizes public key encryption.

1.4. Types of Digital Payment Systems

Users and merchants can not communicate directly, because they do not have a direct relationship, and instead need an intermediary, who manages the whole process for them. The system accomplishes its task in two main ways, which can be combined: through a trustful relationship over the years and the use of risk assessment criteria or through the management of chargebacks by the intermediary. The money transfer process is characterized by information exchange, balance and money flow, in a personal context as well as in a commercial context. In these transactions exist two different agents: sender/receiver and payer/payee. Personal use transactions are between individuals and commercial transactions are between individuals and merchants. Payment systems can fundamentally be distinguished into those only authorized by the payee and those authorized by the payer. The first groups concern the systems used for bill payments like telephone, gas, electricity, etc. The second one is represented by the vast majority of existing systems, since they encompass all personal and commercial transactions, both completely free and those in which there are previous agreements. The kinds of payment

systems can also be distinguished between the different types of payment instruments holders can use to transfer money to merchants or receivers.

The kinds of payment systems are linked to the types of payment instruments holders use in order to transfer money to merchants and receivers. Payment instruments are anything that people can use to carry out transactions. In the last couple of decades, as e-commerce has developed, notarization instruments used to complete a transaction are increasingly relying on different types of digital payment systems. For tax assessments, the differences between funds transfer systems rely on the complementary use of paper instruments like checks and drafts. A first classification shows three categories of traditional payment systems: credit and debit card and stored-value systems, which can only be used by centralized operators, e-wallets and mobile apps, which can be managed either by centralized or decentralized operators.

1.4.1. Credit and Debit Card Systems

In any survey of recent digital payment developments, credit and debit card systems would have to be front and center. Although cards were first invented in the early 20th century, it was not until the 1960s that payments card networks began to establish themselves as critical facilitating institutions in consumer credit markets. Credit and debit cards incrementally displaced cash and check payments, enabling consumers to make larger, higher frequency, and lower friction purchases, while also affording a new set of services to banks and payment processors. Card processors developed more efficient ways to facilitate transaction approval requests and clear and settle transactions. Networks coordinated card issuance by banks, merchant acceptance, and transaction messaging to facilitate the ever more embedded role cards would play in contemporary commerce.

Consumers are assured of seeing their facially pictured primary credit and debit cards, as well as cards providing benefits such as airline loyalty points or cash back. When not in physical form, these cards have become digital payment wallets, with payment options available on devices like smartwatches. Cards are displayed on phones as stored card numbers encrypted with a device number and unique cryptogram for card-not-present transactions. Card tokens are stored as encrypted credit account numbers, allowing contactless transactions at most automated teller machines and at stores with incompatible terminals for cards using older magnetic stripe technology. Using stored enciphered card data minimizes the delay involved in keying a 16-digit number.

1.4.2. E-Wallets and Mobile Apps

Umbrella accounts that pool and manage funds through many different payment accounts have also gained immense popularity and growth in recent years. Highly flexible in their capabilities, e-wallets allow users to link to bank accounts, credit cards, and debit cards to facilitate P2P and merchant payments, cash withdrawals, and more. The four major functionalities of these payment apps include P2P transfer of funds, acting as a merchant POS, offering bill payment systems, and allowing the loading and storage of funds. Examples of apps that permeate many different payment arenas and propel digital payments for bill payments, P2P payments, online donations, mobile commerce, and even public transport and vending machines are widely recognized.

As movement towards account-based payments continues to increase, e-wallets have gained prominence around the world, mainly due to heightened consumer demand for convenience, security, and marketplace integration. E-wallets bridge the gap with the essential infrastructures by allowing institutions to develop an easier payment experience for customers, leading to more value and innovation.

1.5. Decentralized Financial Infrastructures

The emergence of Bitcoin gave rise to new financial infrastructures that functioned without relying on central trusted parties. In these decentralized infrastructures, trading and settlement occurs in peer-to-peer networks and is secured by cryptographic algorithms and distributed ledgers, rather than traditional institutions and databases.

However, while Bitcoin's blockchain was initially limited to being the settlement layer of a closed currency system, the success of Ethereum proved the idea of a general-purpose smart contract-based blockchain capable of handling a host of different applications, such as different fungible and non-fungible asset tokens, more generalized financial agreements and contracts involving complex sequences of conditional events, and decentralized applications that utilize decentralized oracles for external data retrieval and user interface modules. Decentralized Financial (DeFi) technologies and services allow people to create and utilize fungible tokens and non-fungible tokens denominated in both fiat and crypto anchor currencies, launch and participate in liquidity and capital incentive pools, borrow, lend, and leverage asset positions, trade, swap, and permute asset token representations, and liquidate collateral agreements such as mortgages or collateralized debt positions, engage in gaming, publicity, social network.

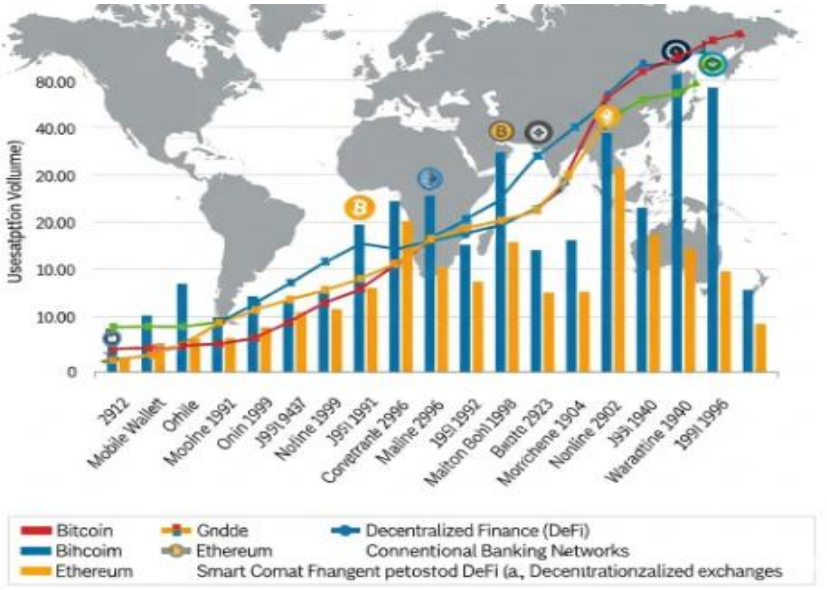

Fig : Evolution of Digital Payment Systems and Decentralized Financial Infrastructures

1.5.1. Defining Decentralized Finance (DeFi)

The growing use of blockchain and cryptocurrency technologies and projects has led to more advanced financial solutions than those offered by established institutions. These solutions, implemented via smart contracts, ensure trust in blockchain technology and facilitate peer-to-peer exchanges of value. The term decentralized finance, or DeFi for short, applies to this new approach to cultural and financial services. DeFi encompasses complex systems that give users access to almost any financial or custodial service. The solutions implemented to date include decentralized exchanges, non-fungible tokens, decentralized autonomous organizations, and more. All these systems, which have grown and evolved over the last few years, are based on the use of blockchain technology to promote direct exchanges of value between users.

Many decentralized protocols, however, focus only on one or a few focused aspects of personal finance. One example would be a protocol that primarily facilitates the activity of decentralized lending. Many of these projects likewise have seen new implementations built on top that broaden the scope of DeFi and experiment with improved and transformative personal finance services for large numbers of people. For example, one service uses a lending protocol as a backend to manage automated treasury services and liquidity searches for its users. Such services are enhanced and complemented by specialized smart contracts. Other DeFi players operating in parallel

are decentralized futures markets. Another significant feature of DeFi is, of course, the crucial utility of a major network, as well as that of compatible networks, where a wide range of DeFi protocols are being implemented.

1.5.2. Smart Contracts and Their Applications

Originally called "self-enforcing contracts," a smart contract is essentially a soft implementation of a traditional legal contract. Smart contracts are digital agreements embedded in the code of a program. Smart contract code contains not only the agreement itself but also an executable program that can enforce the agreed terms. A smart contract takes the forms of written code along with the present code execution environment: the blockchain system. Essentially, smart contract execution is performed by the decentralized blockchain nodes managing the current state of the system. The transaction is approved by the consensus mechanism of the blockchain, and it is cryptographically logged into the shared tamper-proof transaction ledger.

The main advantage of a smart contract is lowered counterparty risk. More specifically, the digital contract execution is sufficiently automated, eliminating the need to trust a central intermediary to guarantee performance. Smart contracts are well adapted to simple transactions where the involved parties are insecure about trustworthiness, transaction complexity, or transaction size. An example is a simple exchange transaction where one party sends currency of interest to another party. The process requires a central intermediary to guarantee that both parties perform the exchange transaction since performance is very complex and time-consuming to initiate and monitor.

1.6. Global Adoption Trends

Digital payments are growing rapidly, led by Asia-Pacific, and are increasingly becoming a global phenomenon. The majority of the fastest growing markets for digital payments witnessed growth of over 25 percent over the last four years. Covid-19 has helped accelerate the digital shift across many aspects of consumer life. While some payment trends are motivated by safety, many consumers are finding new digital services helpful and are likely to continue using them after the crisis is over. This could open a new Global Digital Payments Era likely to last several years. COVID-19 has acted as an unprecedented catalyst for digital services. Even before the pandemic, billions of consumers around the world were already forging new Digital Behaviors. Almost predicts that digital transformation could take the form of a "great leap" that accelerates changes already underway by a decade.

Regional Adoption Patterns

Digital payment adoption and growth trends vary markedly between and within regions. This indicates the growing importance of building localized digital payment solutions tailored to the needs, issues, and habits of specific countries and consumers, rather than one-size-fits-all services. In Asia Pacific, the mobile payments ecosystem is evolving quickly, driven by many players offering services on every level, from payments processing to consumer engagement. Adoption is favoring niche operators that either have a localized focus or address a specialized marketplace, as well as ecosystem partners looking to entice merchants and consumers with products like micropayments.

In contrast to the rapid and diverse growth of digital payments in Asia Pacific, other than a few exceptions, large regions in Latin America and Eastern Europe are growing leisurely. Turkey is a bright spot in the Middle East North Africa payments market. Turkey's growth reflects a general transition from cash to card, in parallel with deeper penetration of e-commerce and virtual banks. Adoption of digital payments solutions has not been as swift or efficient in Europe as it has in Asia. European responses have been diverse and fragmented, influenced particularly by differences in consumer demand.

1.6.1. Regional Adoption Patterns

The diffusion of digital payment systems is neither uniform nor equal across all regions. Within specific regions of the world, adoption patterns may also differ according to each country's economic and financial characteristics, policy frameworks, and available payment infrastructures. Such patterns are often the result of a complex relationship between different types of innovation, the demand and supply-side factors, technological infrastructures available, agent preferences, and habits; thus making it difficult to identify critical determinants. However, increased smartphone penetration, access to affordable telecommunication networks, and the emergence of strong industrial players in the FinTech space must be considered among the major enabling factors.

While payment systems are continuously evolving, the pandemic conditions of 2020 and beyond, lockdowns, and the resulting changes in consumer behavior have accelerated the decline of cash usage in favor of digital payment alternatives. In this context, digital payment systems and their underlying infrastructures may hold key implications for goods and services flows, payment systems and citizens' well-being, financial stability and integrity, and monetary policy transmission. For example, this increased role of digital means of payment blurs the boundaries between the different types of digital payment instruments. Time will tell whether the major innovation efforts launched or accelerated after the pandemic will lead to the widespread adoption of private sector payment instruments or whether central banks will ultimately have to launch digital currencies.

1.6.2. Impact of COVID-19 on Digital Payments

The rapid growth of digital payments was accelerated by the pandemic. Validations of the concerns for consumer spending habits and health prompted consumers and merchants to implement transactions that were digital—after being initially reluctant due to concerns about security and fraud, technical difficulties, and other types of impediments. Analysts note that this pandemic-related sales growth appeared in the online B2B payments, business-to-consumer (B2C) payments, and business-to-business (B2B) segments. With infrastructure in place already having enabled online retailers to just shift sales off-premises, growth for online retail has been significant. It has come at the expense of conventional physical brick-and-mortar merchants, particularly those that have specialized in areas like non-daily essentials such as apparel and travel. Amid the crisis, B2C merchants began to realize that it was time for them to offer their clientele options for contactless checkout options, eCommerce, QR codes, and mobile applications.

Consumers have become accustomed to using digital payment types; some merchants, too, are used to accepting these payment types. Rapid at-sale payment acceptance for Big Tech, payment facilitators, and even traditional financial institutions have transformed a hitherto small selection of payments into ubiquitous everyday tools. Merchants are now expecting payment facilities to provide instant transaction settlement for all payment types on a uniform basis. After implementation of these types, doubts seem to arise about whether traditional non-financial players in markets like B2B payroll will win over customers with better pricing—either during the recovery phase or thereafter in a post-pandemic period that the majority of currency executives anticipate could very well correlate to the earlier period.

1.7. Conclusion

In this chapter, we presented a brief overview of the current global evolution of digital payment systems, and their decentralized financial infrastructure supporting those transactions using digital currencies. We traveled back to ancient history to introduce one of the earliest forms of digital inclusiveness – a commodity currency minted by the government – and explain how digital currencies had to evolve from a simple, attractive monopolization of basic economic functions by public authorities into the virtual circulating medium it became by the late 20th century avant-garde cyber punks. The establishment of a truly authoritarian political rationale for digital currency led to the need for an enhanced private virtual currency, which traded public authority, reputation and trust for the promise of anonymity, in the form of cryptocurrencies. The establishment later on of trustable decentralized ledger or blockchain protocols, led to the emergence of the DeFi concept: Decentralized Financial Services and Applications,

announcing the birth of a new financial era rooted in the combination of digital and virtual currencies.

The unique circumstances created during the COVID crisis revealed emerging trends, where online shopping, cashless economic policies by governments, financial-inclusion via mobile-phone banking, and the trust in bank deposit protection during a systemic shock led to a steep digital-currency-triggered transformation of the financial ecosystem. These emerging trends trigger new questions not only about the future design of the long-awaited Central Bank Digital Currencies, but also about the digital future of the financial industry: what institutions, processes and technologies will survive in the DeFi era? Which will be re-programmed for this new environment? What monetary policy or capital control tools will monetary authorities in charge of running this financial ecosystem be able to rely on? Are we certain about the efficiency of the automated market-making algorithms during times of crisis?

1.7.1. Emerging Trends

The digitalization of payment services began in the 1950s and 1960s, was quickened in the 1990s and 2000s with the advent of the Internet, and has since rapidly accelerated with the rise of smartphones. The latest iterations have provided consumers with an unprecedented diversity of choices. With the rapid rise of mobile payment alone, it is estimated that over one billion consumers in Asia utilize mobile payments daily, with many more doing so for particular occasions. The new wave of digital payments is currently more focused within developing countries, but it is poised for further deployment globally as this payments revolution becomes a permanent evolution. There are five critical components shaping the future of digital payment systems. First, innovations in payments technologies make payment transactions within distributed payment systems faster, more reliable, and lower in cost. Second, the ecosystems in which payments inhabit are rapidly evolving through the entry and competition of tech and fintech ecosystems against incumbent banks and payment schemes. These changes raise the stakes about how to monetize with payment services. Third, expectations of consumers are shifting as financial conversations shift from central banks and finance ministries to tech and fintech businesses that deploy digital applications and services with monetization strategies based on payments data. Fourth, the regulatory environment for payment systems is continuously changing. Regulation to protect consumer privacy and data is increasing, strengthening barriers to entry, and accelerating penalties for bad actors, particularly with Big Tech, with levels of scrutiny to which banks are accustomed. Finally, the monetary policy environment is also changing. Central banks seek to create their own digital currencies to meet the competition from tech and fintech companies with private digital currencies that pose risks to private payment systems and

monetary policy. These trends identify risks and guard rails that could cloud the prospects for financial evolution.

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