Financial Technology Chapter

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1.1 FinTech and the Transformation of Financial Industry

For years Kenya was at the forefront of the FinTech revolution in Africa and beyond, driven by the extraordinary social and economic value created by the mobile payments service introduced by M-Pesa, a simple mobile payment service launched by Vodafone in 2007. During the Covid-19 Pandemic, the impetus moved to West Africa, where Nigeria became the hottest FinTech start-up scene. Lagos, Nigeria’s commercial capital, attracted approximately a fifth of the continent’s total venture capital funding in 2020. As the coronavirus pandemic was slowing down tech fundraising, Lagos received more than $1 billion in venture capital from Silicon Valley, China and elsewhere. The largest part of these investments has gone to companies that provide network or payment services, connecting companies to customers or banks and global payment firms like Visa and Mastercard. The sheer size of the Nigerian population – 200 million people, including approximately 60 million adults without a bank account is the main driver of this explosive FinTech growth. While in recent years the opportunities made possible by this technology have opened doors for many in the region—especially low-income households—users of FinTech are utilizing the tool in more and more sophisticated ways.

It is estimated that by 2025 Africa will be home to 1.5 billion people, most of whom will have grown up in the era of the internet. As such, Africa’s demand for financial services—especially as the population remains largely un- or under-banked while also being the world’s second-fastest growing payments and banking market, will soon bypass traditional banking systems. Importantly, the continent is already the largest adopter of mobile money transfer systems, comprising nearly half of the globe’s registered mobile money customers, approximately 70 percent of global mobile money transactions, and two-thirds of the transaction volume by value.

We have seen stories like the one of Nigeria, described above, quite often during the last few years, and collectively, they contributed to our changing perception of how financial industry is defined, understood and utilized. Finance has a dominant role in the economic development around the world, and for this reason, the wave of changes happening before our eyes has consequential implications for individuals, companies, governments and regulators alike. Financial technology (FinTech) sector is evolving at rates that we have never seen before with a large number of companies, including start-ups, mature FinTech firms and large e-commerce players continuing to grow, not hindered even by the global pandemic of the last couple of years.

This chapter introduces the developments in the banking industry and financial markets within the key context of FinTech. The objective of the chapter is to provide students with a good understanding of how new technologies in the financial industry actually function. Students will be able recognize the implications of the FinTech growth on banks, businesses, and consumers, and, perhaps most importantly, understand the limits, risks, and societal implications of these emerging technological advances. The chapter will address current and developing technological tools in the financial industry while explaining key new concepts in start-up financing (venture capital, ICO’s). It will also expose new conceptual approaches to regulation in the context of the new range of financial services and products, while identifying social and wealth distribution issues generated by FinTech, as well as possible future developments. Finally, the chapter will explore the impact of the pandemic on the FinTech sector and an evaluation of FinTech in the post-pandemic world.

The chapter starts with a discussion of how finance and technology have evolved and are continuing to transform finance around the world. In this context, it will address key
interactions between finance and technology over time, providing a better context to understanding of the developments that are taking place today and are likely to continue in the future.

What is FinTech

Financial technology (FinTech) is the intersection of financial services and technology, and emerged over the last decade as an industry that uses technology to improve activities in the financial sector. Its focus is finding unique and innovative ways to take advantage of emerging technologies such as big data, analytics, Artificial Intelligence (AI) and mobile access, to compete with traditional financial methods in the delivery and improvement of financial services. The recent entrepreneurial start-ups are intensely developing new FinTech applications, which are significantly transforming the delivery of financial services and products, aimed particularly at millennials.

The analysis of the technological changes taking place in the financial industry leads to an identification of three key observations. First, the link between finance and technology is not a novel phenomenon; for hundreds of years, technological innovation has been a central driver for transformation in finance, as it has always been at the forefront of new technology developments, and an early adopter for every major advancement. This trend started back with the development of the transatlantic cable in 1866 and continued all the way to the introduction of the Automatic Teller Machine (ATM) in the early 1970’s, which marks the beginning of the modern financial era, leading to what we call FinTech today. Second, traditional financial services is, and has always been, the leading user of information technology and is the main driving force in the IT industry since its inception in the early 1990’s, with an estimated total
spending of US$596 billion in 2021.\(^1\) Third, what we call FinTech today covers the entire scope of services and products traditionally provided by the financial services industry, and it is not confined to specific sectors (e.g. financing) or business models (e.g. peer-to-peer lending, crowdfunding).\(^2\)

**History and Evolution of FinTech**

Finance and technology have always been strongly connected and mutually sustaining since the earliest years of their development. When we look at the earliest days of finance dating back thousands of years ago, the original technology in finance was the development of money, first the coin and later, shortly after 1000 A.D. paper money. Money is the first physical form of technology that allowed people to materially implement the ideas embedded in finance. Next came the creation of administrative systems of record keeping of government finances, payments for taxes and agricultural production or building facilities. A very important step in the technological development of finance was the emergence of the modern corporation and its dispersed stock ownership, allowing the separation of *ownership* and *control* at the beginning of this century. This, together with the development of new financing options in the form of banks and the introduction of stocks, bonds, and other financial contracts, established the foundations of the financial and economic developments and the start of a globalization trend that lasted until the First World War.


During the period following the Second World War, while financial globalization and growth slowed down dramatically for a few decades, as the world economy was slowly rebuilding, technological developments, in particular communications and the development of codes for secure transmissions continued to rapidly evolve. Ultimately, all these early technologies led to groundbreaking thinking in computer technology and in effect, eventually to artificial intelligence (AI), one of the most exciting developments happening in financial technology today. In the 1950s the first credit cards were introduced, and 1967 marked two very important advances in the evolution of financial technology: Texas Instruments created the first hand-held financial calculator, and, the first Automatic Teller Machines (ATM’s) was established.

However, it was the period from 1976 through the early 1990s that defined the modern area of FinTech, where key developments were the transition of financial services from an analogue to a digital industry, the creation of a series of domestic and international electronic payment systems, the establishment of NASDAQ in 1971 and, finally, to the emergence of the internet. All these progressive developments of the early computer prepared the field for the sorts of FinTech advancements, which we see today.

The internet bubble of the 1990s allowed the rise of companies like Amazon, Google and Apple, which are the dominant players in today’s digital transformation and the rise of FinTech as one of the most promising trends in world economies. By the beginning of the 21 Century, the financial systems became fully digitized, as all transactions between financial institutions, market participant and customers around the world are now taking place electronically. This trend is also observed in the increased use of IT by financial institutions during the last few decades in their internal operations, risk management technologies. It is estimated that
approximately one third of large banks’ employees are engineers, more than Twitter or Facebook. Citi Research, in a 2016 study reports that median IT expense, as a percent of business revenue is approximately 9 percent for the banking industry and about 5% for the high-tech industry, while it goes as low as 1% in the energy sector. The new millennium brought changes at an accelerated pace compared to what we have seen before in the financial sector.

**Recent Developments in the Finance Industry**

The global financial crisis of 2008 marked a defining moment in the development of FinTech. The crisis started with the subprime real estate market meltdown in the U.S., quickly spreading throughout the global financial system into developed markets around the world, and impacted both developing and emerging markets through the global economic slowdown that followed. The worldwide market conditions post-2008 exhibit a series of factors that catalyzed the growth of the recent FinTech boom. *First*, as the crisis was mainly driven by banks, the public trust in traditional financial institutions deteriorated and their standing was damaged in the eyes of the customers. *Second*, as the financial crisis transformed into a severe economic crisis, it was followed by a large number of job losses, particularly by the financial professionals and younger workforce in the financial industry. The job losses forced this educated workforce to look for opportunities elsewhere and FinTech offered them a new industry to apply their skills. *Third*, the global financial crisis caused the emergence of a large number of regulatory changes designed to prevent similar events to happen in the future. Although these new regulatory changes...

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obligations were well needed (e.g. Dodd Frank Act, Basel 3) they led to large increases in compliance and regulatory costs of financial institutions, which, in turn, decreased their profitability.

As the crisis prompted many calls for reform of Wall Street, they eventually led to the passage in 2010 of the Dodd-Frank Wall Street Reform and Consumer Protection Act, which contains several mechanisms to mitigate systemic risk. The act calls for stricter rules for bank capital, liquidity, and risk management practices, especially as banks become larger and their potential failure would be more threatening to other institutions. With more capital supporting banks, the potential for one insolvency to trigger another should be contained. In fact, bank capital levels are higher today than they were before the crisis.

In a related measure, the act requires large banks to undergo annual stress tests, which simulate whether the bank has enough capital to withstand specific episodes of economic duress, for example, a major recession, a large increase in interest rates, or a severe decline in liquidity. So far, additional required capital, as well as more conservative lending and investing practices, has resulted in improved risk exposure.

Dodd-Frank also attempts to limit the risky activities in which banks can engage. The so-called Volcker Rule, named after former chair of the Federal Reserve Paul Volcker, prohibits banks from trading for their own accounts and limits total investments in hedge funds or private equity funds.

Recent legislation has resulted in a partial rollback of the Dodd-Frank Act. In 2018 Congress passed the Economic Growth, Regulatory Relief and Consumer Protection Act, exempting most small to medium-sized banks from Dodd-Frank rules, including stress tests.
Some large banks (but not the largest) are no longer deemed “systemically important,” which brings about closer oversight and higher capital requirements. The 2018 act also exempts smaller banks from the Volcker Rule. Dodd-Frank remains under attack by some members of U.S. Congress, and future pullbacks are certainly possible. Regardless of these possible revisions, the crisis surely made clear the essential role of the financial system in the functioning of the real economy.

A key consequence of these regulatory actions was the emergence of new business models, new structures, and finally, new technology driven fresh players. Many governments around the world took actions to encourage the new players and business models that provided alternative finance services to businesses and individuals as lending by banks withered.

In addition to these factors, the introduction of the iPhone in 2007, with more than one billion phones sold around the world, and the spread of other types of smartphones, paved the way for the recent rise in FinTech and the digital transformation of the financial industry we are witnessing today.

**FinTech in the Post-Pandemic Economy**

The Covid-19 story in finance is dominated by further FinTech innovation and increased demand for digital services as during the pandemic years we have seen a rise of online start-ups and expansion of digital platforms into credit and payments all around the world. Digital banking has expanded in the coronavirus era, with both large banks and fintechs seeing a surge in adoption as people are spending more time at home due to public health restrictions.

Bitcoin price has also seen a large increase during the pandemic when it hit $1 trillion in market value for the first time. Investors are more and more making comparisons between bitcoin and
gold, and increasingly viewing Bitcoin as a new digital store of value thanks to its limited supply — the total number of bitcoins that will ever exist is capped at 21 million.

Still, there are many skeptics questioning the reliability of Bitcoin as a safe store of value. Economist Nouriel Roubini says that bitcoin and other cryptocurrencies have no intrinsic value, and a 2021 Deutsche Bank survey said investors view bitcoin as the most extreme bubble in financial markets.

A few established banks are publicly discussing entering the cryptocurrency market and blockchain technology with their own cryptocurrency. JPMorgan for example is launching the JPM Coin and a new business unit called Onyx. Most major international banks are stepping up investment aimed at narrowing the technology gap and the regulatory scene is reflecting a fierce battle between US banks and non-bank fintech. In order to survive, traditional banks have to either acquire FinTech firms to enhance the efficiency and speed of banking, invest in FinTech start-ups through venture capital (VC) investments, or enter into a strategic partnership with a tech firm to leverage the expertise of both companies. Goldman Sachs’ partnership with Apple to issue a new credit card is a good example of this last method where Goldman brings in its financial and regulatory expertise, whereas Apple brings its technological knowledge.

1.2 Technologies Underlying the Transformative Power of FinTech

The accelerated change seen in the financial industry after the financial crisis of 2008 is rooted in the new wave of technological advances that allowed for an extraordinary range of applications, touching all areas and services of the financial sector. These have been called the ABCD’s of FinTech: Artificial Intelligence (AI), Cloud Computing, Big Data and cryptography.
Banks and financial institutions have always been the largest users and originators of sizable volumes of information. The digitization of data starting at the beginning of the millennium allowed for easier and faster methods to store, transfer, search, analyse and display that information and led to the rise of new business models and products that are fundamentally changing the way finance world operates. The combination of the predominance of digital form filling replacing the old methods of paper form filling, and the collection of customer online behavior and behavioral analytics has added multitudes of layers of information that can improve customers experience while reducing costs and improving efficiency. More and more, this digital data is complemented with information derived from offline behavior, being tracked by the internet of things (IoT), smart devices like watches, cars, home digital assistants, like Amazon Alexa, and so on.

**Artificial Intelligence (AI)**

In 1965 Gordon Moore, co-founder of Intel predicted that computing power will double every 24 months. We have seen considerable progress in technology lately: the cost of processing power decreased 10 billion times in the first 50 years of the computer age, beginning in 1950’s; memory cards have seen a 1000 fold increase in memory power in the past 10 years, a laptop has flash storage of one terabyte, 100,000 times larger than 30 years ago; and a single smart phone has more computing power than NASA in 1969.6

Artificial Intelligence is one of the tools of the big data analytics, along with machine learning and deep learning. A broad definition of AI is “human intelligence exhibited by

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machines”, while machine learning is defined as the type of AI that provides computers with the ability to learn without being explicitly programmed.⁷

Historically in the banking industry bankers used to have personal connections to their customers, assisting them in good decision-making. As in the current digital world this personal connection is disappearing, artificial Intelligence (AI) is leveraged to bring it back. AI can process a large amount of information about customers in record time, and this data and information can efficiently be used in suitable services and products that customers want and need, resulting in higher customer satisfaction. Some of the main uses of AI we see in the finance industry are listed below.

**Automated Customer Support:** Many FinTech companies save time and money with text chats, voice systems or Chatbots, which can deliver human-like customer service or expert advice experience at a low cost.

**Fraud detections and Claims Management:** Artificial Intelligence tools can monitor user’s behavioural patterns and identify rarity and warning signs of fraud attempts and incidences. Claims management can be build up using Machine Learning (ML) techniques in different stages of the claim handling mechanism. This allows for a reduction of the overall processing time and handling costs while enhancing customer experience. With their self-learning abilities, AI systems can then adapt to new undiscovered cases and further enhance the detection over time.

**Enhanced Decision-making capabilities:** Data-driven management decisions at lower cost allows a different style of management, where banking and insurance agents ask the right questions to machines, rather than to human experts. Machines then analyze the data and come up with the recommended results, which can help finance executives make better decision.

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**Wealth Management for Masses:** Digital wealth management advisory services are offered to lower net worth market segments, resulting in lower fee-based commissions. Smart wallets developed using artificial intelligence monitor and learn user’s behaviour and actions and instruct users to control and alter their personal finance spending for better saving habits.

**Insurance Management:** AI automates the underwriting process and utilize more raw information to make better decisions for the customers. Automated agents assist the user online, determining insurance requirements, while speeding up the process. Instead of paying for the treatments that are costly for insurance it’s better to detect the risks and diseases to prevent them, lowering the probability of damages happening to the insured and also for the insurer.

**Automated Virtual Financial Assistants:** Automated financial assistants and planners assist users in making financial decisions. These include monitoring events, stock and bond price trends according to the user’s financial goals and personal portfolio, which can help in making recommendations regarding bonds and stocks to buy or sell. These systems often called “Robo-Advisors” and are increasingly being offered both by established financial companies and FinTech start-ups.

**Predictive analysis in Financial Services:** Predictive analytics in financial services can directly affect overall business strategy, sales nurturing, revenue generation and resource optimization. It can serve as a game changer by enhancing business operations, improving internal processes, and surpassing competitors. Using a massive amount of data to find patterns and predict insights, predictive analysis can help calculate credit scores and help prevent bad loans. These results and insights can reveal what will happen next, what the customers are going to buy, how long an employee might last, etc.
Cloud Computing

There is a lot of talk about the Cloud, and for good reason. Cloud computing eliminates the capital expenditure of buying hardware and software and setting up and running on-site data centers. This happens because cloud computing allows for software to reside at data centers on servers run by companies specializing in managing such servers and also provide value-added services such as cyber security protection and updates. This permits new businesses, such as alternative financial providers, to avoid high capital expenditures on expensive infrastructures and to focus instead on refining client experience. Cloud computing also allowed new and innovative business models to thrive. Software as a service or SaaS businesses bypass the traditional vendor model of software development. Software is located in the cloud and is purchased at a lower cost based on subscription models, with automatic upgrades made on a continuous basis. This means that online capital markets and startup virtual banks, like Simple in the U.S. require less upfront cost to prototype new business models and user interfaces become available faster and at a fraction of a cost. In addition, the cloud enables connected Internet of Things (IoT) devices to collect data and stream more services like financial services to customers via new interfaces including, smart watches, homes and cars and appliances. Cloud computing allows institutional level technology support to retail businesses where user customers can transact on their home or office computer or on the road via their smartphones or smart cars. FinTech has arguably democratised financial services, allowing non-traditional firms to enter the space. By harnessing the power of new technological developments in areas such as cloud computing and Big Data analytics, FinTech organisations have become key players.
Big Data Analytics

You probably heard the phrase: *Data is the new oil*, which means data will become one of the most valuable commodity of the 21st Century. Data has always been valuable and has been around for a few decades now. The large technology companies like the ones called in one acronym FAANG – Facebook, Apple, Amazon, Netflix, Google have approached data in a totally new way since the beginning of this century, recognizing that the data one generates is very valuable and that data is their business. It is frequently said: if it’s free, you’re the product. The data tech companies collect is structured, meaning it is organized so it can be searched, indexed and this can be transformed into value easier than unstructured data.

Big data refers to data sets that are too large or complex to be dealt with by traditional data-processing application software tools. Current usage of the term *big data* tends to refer to the use of predictive analytics, user behavior analytics, or certain other advanced data analytics methods that extract value from data and was originally associated with three key concepts: *volume*, *variety*, and *velocity*.

*Volume*: Organizations collect data from a variety of sources, including business transactions, social media and information from sensor or machine-to-machine data. In the past, storing it was a problem, but new technologies have solved the issue. Combination of behavior tracking and Internet of things is increasing considerably the amount of data points available.

*Velocity*: Data is collected at an unprecedented speed and must be processed in a timely manner. Sensors and smart metering are driving the need to deal with huge amounts of data in near-real-time.
Variety: Data comes in all types of formats – from structured, numeric data in traditional databases to unstructured text documents, email, video, audio, stock ticker data and financial transactions.

As this transformation process occurs, FinTech startups are increasingly providing the necessary analytical tools to process and analyze data held by financial institutions. Some application examples include identification of credit risk in loan portfolio, transaction of quarterly reports into investment advice, or performing complete audit risk review. While these have always been performed by banks, today the combination of data availability and analytical tools make it possible to do these in a fraction of time without a loss on accuracy levels for much lower costs.

Distributed Ledgers Technology and Blockchain

An important and evolving component of this set of new technologies is the Distributed Ledger Technology (DLT). A distributed ledger is a type of database and the best way to understand it is by comparing with its counterpart: a centralized ledger. Centralized ledgers are the most common data storage devices in finance today (Zetzsche, Buckley and Arner, 2018).

As seen in Figure 1 below, in a centralized ledger data is stored and maintained by a trusted administrator, which records transactions, verifies transactions and sends receipts. This type of ledger has a series of inherent risks, as it can be hacked, compromised or even destroyed. In contrast to traditional databases stored in a single server, a DLT uses many interdependent computers to store and manage the data, data that has been replicated and shared across multiple sites, which makes it very difficult to hack. Therefore, DLT addresses the risks present in centralized ledgers by raising the barriers for manipulation of stored data and, as stated in the report: A Blueprint for Digital Identity by the World Economic Forum. DLT has a series of
features that hold a lot of potential for the future of finance: low-transaction costs – as they eliminate the need for intermediaries, immutability – transaction history is maintained and verified through the network, preventing the falsification of information, and convenience – record-keeping and transactions can be executed from any device, on or off-line.  

**Figure 1. Different Ledger Types**

![Diagram of different ledger types](source: Paul Baran, On Distributed Communication Networks, 1962)

The immutability of DLT has been questioned, however, after Ethereum, a cryptocurrency based on DLT was attacked on June 17, 2016. The hackers were able to break into the DAO (Decentralized Autonomous Organization) and take $45 million, and that resulted in a 40% drop in the price of Ether tokens and a 70% drop in DAO token.  

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10 The DAO was a digital decentralized autonomous organization, and a form of investor-directed venture capital fund; it was crowdfunded via a token sale in May 2016 and set the record for the largest crowdfunding campaign in history.

Blockchain is one type of such distributed ledgers that was made famous by its application to the first digital asset, the Bitcoin. Blockchain refers to the way that data is stored on the ledger: not individually, but in a block, as a container of multiple data points, bundled together in a specific order, “the chain”.12 A blockchain in FinTech offers a more comprehensive, accessible, and secured network for businesses, reduced costs, and efficient service and processes. Over the years, security and transparency have also increased because Blockchain is a decentralized system. When finance is involved with blockchain, any organization can assure security while saving costs. Apart from that, it can also increase the speed of transactional processes amidst banks because of their protected and dedicated servers. Blockchain offers be a great new approach for financial institutions as it can provide data integrity and allow full transaction history for the customers as well.

Biometrics

Biometrics refers to the measurement and statistical analysis of people’s unique physical and behavioral characteristics and it is used for identification and access control. As mobile banking and other financial services become widely available, it became essential for organizations operating in the FinTech industry to take all the available security measures. Biometrics is the best way to bring security to the next level, providing users with the confidence that their data is protected.

The strong recommendations to avoid using cash during the COVID-19 pandemic fueled the growth of the biometric payment cards market. Public health concerns have created more interest in contactless biometric identification solutions. Contactless financial cards became

commonplace before the crisis, but even more changes towards contactless smart access systems are to come.

1.3 Bitcoin and Other Cryptoassets

Bitcoin

Blockchain technology was introduced towards the end of 2008 in a white paper by a person, or a group of people, called Satoshi Nakamoto, titled “Bitcoin, A Peer-to-Peer Electronic Cash System”, which constitutes the basis for Bitcoin, released in 2009. Bitcoin was the first cryptocurrency to be created and marked the beginning of a new platform that has more than 6,000 cryptocurrencies as of the end of 2021. Bitcoin grew steadily in popularity since its introduction because of its features: it’s decentralized, has no central authority, is low cost, has no borders and has a fixed supply, as there are only 21 million bitcoins programmed into the system that are going to be released.

At the onset of the COVID-19 pandemic, when most central banks around the world were taking action to depreciate their currencies and bond yields were converging to zero, it was reasonable for investors to look for alternative vehicles for storing wealth. Given its prevalence among cryptocurrencies, Bitcoin got most of the attention as it appreciated at the impressive rate of over 800% from $7,150 in March 2020 to its peak of $68,880 in November 2021. As of January 2022, Bitcoin was trading at around $46,390, once again down 30% from its November high. In a world dominated by uncertainty on all fronts at the beginning of 2020 at the onset of the pandemic, with market volatility surpassing the global financial crisis, and equity markets and oil prices plunging to multi-year lows, Bitcoin was seen to offer some attractive features such as limited supply and global exchangeability. Many investors recognize Bitcoin to have the
capability to serve as “digital gold”—an alternative store of value and potential inflation hedge for portfolios. While there are many cryptocurrencies out there now, Bitcoin has still the dominant market share around the discussion of a potential “digital gold.”

In the previous 2017 rally, while Bitcoin still enjoyed a heavy amount of direct speculative interest, it saw lower returns and its share of the total cryptocurrency market fell sharply, as a large portion of the overall speculative activity was captured by the large wave of ICOs (initial coin offerings), where speculators bought into new cryptocurrency tokens offered by new companies promising revolutionary new decentralized technologies and business models. In contrast to the 2017 rally, in the recent one from 2019 and up until to the end of 2021, Bitcoin outperformed other cryptocurrencies, with its market share now back to its highest levels since early 2017. The growing interest in the idea of Bitcoin as a “digital gold” seems to be the main driver of these trends. It is true that Bitcoin has some of the qualities necessary to act as a viable storage of wealth: it cannot be devalued by central bank printing, its total supply is limited, it is easily portable and exchangeable globally, and has the potential to provide diversification. Although these discussions are present among investors across the world, large institutional investors do not see it yet as a viable replacement for gold, due a series of challenges.

One of these challenges is volatility. Bitcoin remains an extremely volatile asset, and its future purchasing power remains a fundamentally speculative proposition. Compared to established vehicles of storing wealth, such as gold and real estate, Bitcoin faces a much wider range of outcomes in terms of its future value. Second, Bitcoin still faces significant regulatory risks and lacks any of the underlying government backing or deep history that would provide a more fundamental baseline of future demand. While greater regulation might help Bitcoin gain broader institutional acceptance, it could also trigger selling by some of its largest existing
owners who prioritize a lack of public oversight around the asset. Thirdly, while there have been improvements, current levels of liquidity still constitute real structural challenges to holding Bitcoin for large traditional institutions. Finally, it is still unclear if Bitcoin will provide diversification when portfolios need it most, namely, during periods of economic slowdown. The main reason for this uncertainty comes from its short life history—with just over a decade in existence—there is not enough data to credibly conclude that Bitcoin, like gold, will reliably offer portfolio diversification in the future.

**Initial Coin Offerings (ICO’s)**

In essence, crypto assets are a new type of asset class. Similar to regular securities that are bought and sold in stock market exchanges, crypto-assets are trading on cryptocurrency exchanges, a new type of crypto-marketplace where one can buy and sell digital assets. As with regular markets, there is a primary market, where companies can raise money by issuing a digital asset to investors for the first time; these instruments have been called Initial Coin Offerings (ICO’s), and subsequent trading in tokens and other digital assets (such as Bitcoin and Ethereum) are taking place in a secondary market between traders. Although there are no specific general rules and regulations for digital exchanges yet with standards varying wildly from one exchange to another, there are specific differences between digital and classical exchanges. The first difference relates to custody and settlement; a traditional exchange acts as an executor when a trade occurs while custody and clearing is dependent on a broad network of trust partners (such as banks and clearing-houses) who will hold the assets on behalf of the traders. For a digital exchange, as there is no general regulatory requirement and the industry is still at the beginning stages of development, they act more as a marketplace than an exchange and provide all three elements of execution, custodian and clearing on each transaction. Second, traditional exchanges
are open between 9:30 a.m. and 4:00 p.m. and are closed on weekends whereas digital exchanges trade for 24h per day, 7 days a week. Third, clearing happens within a working day from trading in a regular exchange but for crypto-exchanges clearing can be almost instantaneous.

Crypto-Assets Classification

Although there is no unified classification of tokens, we can group them in a few distinct types: utility, asset-backed, real cryptocurrencies and security tokens.

A utility token gives owners access to services provided by the project, and in effect pre-paying or pre-purchasing a future service or project the company creates. They are not designed as investments.

Asset-backed tokens share a common element in being linked to an asset of real value that can be cashed out and retained, which sidesteps the significant flaw of their first-generation predecessors like Ripple, or Ethereum.

Cryptocurrency or payment tokens are based on fundamental blockchains, such as Bitcoin and Ethereum, and are considered a means of payment, and an item of inherent value like gold or cash. They are designed to be a medium of exchange store of value.

Security Tokens are in effect investment contracts representing legal ownership of a physical or digital asset like real estate, ETF’s, etc. A token is classified as security when there is an expectation of profit from the effort of others. If the Initial Coin Offering (ICO) doesn’t follow certain regulations, then they could be subject to penalties. However, if all the regulations are properly met, then these tokens can give their owners the right to use the network and the right to take advantage of the network by voting. Since there is a limit to token availability, the value of the tokens can go up because of supply-demand forces.
Security tokens are issued by what is called a Security Token Offer (STO), and, like ICOs, they are fundraising tools, which have certain regulations, and hold the token issuers accountable for their actions. Unlike the regular utility tokens, STOs generate “security tokens” which are real-time digital assets that operate within legal boundaries.

**Stablecoins**

*Stablecoins* are digital currencies that are backed by assets, such as fiat currencies or gold. The asset-backing feature of these cryptoassets make them less susceptible to wide variations in their values and keep their prices more stable. Stability is achieved through two features of these assets. First, the issuer agrees to mint and buy back coins at par, and second, the issuer holds assets to back its obligation.

Tether (USDT) is the most successful stablecoin; it was launched in 2014 by a group called Tether Limited that keeps $1 USD in reserve for each USDT issued. In effect, Tether is digital cash for a dollar-denominated liability. While it is more stable than other cryptocurrencies, it is still decentralized, meaning it is not tied to any centralized system or agency. The pros and cons of stablecoins are a major source of debate among economists. Some state that they offer low-cost, real-time and more competitive payments to what businesses and consumers have available now. However, stablecoins are still a cryptocurrency, and as such, a relatively new entity with possible yet unknown risks.

In May 2021 U.S. Securities and Exchange Commission (SEC) Chair Gary Gensler made a strong statement regarding the need to regulate cryptocurrency markets. Regulators usually pay this level of attention to systematically important segments of the financial systems as banks and money market funds and the recent calls from the SEC is adding to the evidence that stablecoins
have the potential to play an important role in the future of global finance, as a pillar for payments and financial services.

Overall, as their name suggests, the reason cryptocurrencies were designed in the first place was to be a type of electronic cash. However, cryptocurrencies are not exactly like the cash we carry. They exist electronically and use a peer-to-peer (P2P) system.\(^\text{13}\) There is no central bank or government to manage the system or step in if something goes wrong. Some people find this appealing because they think they have more control over their funds but in reality, there are significant risks. With no banks or central authority protecting participants, if their funds are stolen, no one is responsible for helping them get their money back.

1.4 Innovative Business Models

In this section we look at a series or more recent business models that have emerged over the last decade and have disrupted the finance industry and the economies around the world. New marketplace finance and banking sees an unbundling of the full-service bank, to allow FinTechs to specialise in specific products or financial services, and a separation of value along different lines. Digital services and e-commerce businesses are embedding financial products with additional data, banking and supporting technology intermediaries and create unique products that are tailored to specific situations.

New Financing Platforms

International Organization of Securities Commissions (IOSCO) notes: “One of the more notable developments in recent years has been the emergence of online alternative financing

\(^\text{13}\) A peer-to-peer system is a network in which two or more computers share files and access to devices, such as printers, without requiring a separate server computer or server software.
platforms, aimed at bringing together firms and individuals looking for capital and others that have money to lend, invest or donate”. They list peer-to-peer lending (P2P) and equity crowdfunding (ECF) as two of the more predominant ones.

Peer-to-peer lending (P2P) is a business model that allows individuals to obtain loans directly from other individuals, businesses or even institutional investors, cutting out the financial institution as the middleman. P2P lending is also known as social lending or crowd lendling. P2P lending websites connect borrowers directly to investors. The site sets the rates and the terms and enables the transaction. Most sites have a wide range of interest rates based on the creditworthiness of the applicant.

Equity crowdfunding (ECF) is a new form of fundraising that allows a start-up or other small enterprise to obtain capital through small equity investments using online portals to publicise and facilitate such offers to crowd investors. The ECF therefore is a framework that enables start-ups and SMEs to access market-based financing through a platform registered with the Securities Commission.

In the 2017 report titled “IOSCO Research Report on Financial Technologies”, International Organization of Securities Commissions (IOSCO) lists a series of benefits of P2P lending and ECF, including: greater access to capital, cost advantages, market driven system and investor choice and diversification. The same report mentions the risks common to these different types of platforms: risks of conducting general solicitation/unlicensed activities, disclosure risks, cross-border risks, risk of collapse, fraud or malpractice by the platforms or by the users of the platforms, among others.
Retail Trading and Investment Platforms

Retail Trading and Investment Platforms are other business models that have seen a dramatic evolution over the last 25 years. ISOCO, in the report mentioned above, lists the following types of online trading and distribution platforms that “have become more mainstream as a result of the evolution”: online brokerage platforms, online asset management platforms and exchange-based distribution platforms. As a result of these, “traditional brokerage houses have been challenged by the increasing cost-competitive environment, prompting the use of technology to automate processes and increase product breath and depth”14

The Rise of the Institutional Investors

An important phenomenon during the COVID-19 pandemic has been the tremendous increase of the retail investors’ power. In the US, many people used their pandemic stimulus payments and extra time at home as an opportunity to start investing. This trend has spread globally, with technology making it easier than ever to start investing, even at low volumes.

Retail investors, also called individual investors or amateur investors, are the non-professional counterpart to institutional investors. The key difference between retail and institutional investors, aside from their average portfolio size, is that retail investors trade with their own money. Until recently, smaller investors were largely shut out of the stock market, but the recent rise of digital trading platforms with no-minimum investment accounts and low- or zero-commission options has made investing more accessible than ever. The largest portion of retail investors control their own investment accounts through apps like Robinhood or TD Ameritrade. On Robinhood, for example, the average account size is $3,500, compared to

$100,000 on E-trade and $240,000 with Charles Schwab. This new category of investor became visible during the saga of the video-game retailer GameStop that saw its stock price go from about $40 to almost $400 in a matter of days, only to lose three-quarters of its value in 85 minutes few days later.\textsuperscript{15}

1.5 Cybersecurity and Regulatory Landscape

Although FinTech is still growing at incredible speed, it is competing with a large number of established giants in the finance industry. Given its size, the impact on the economy and people’s lives it is not surprizing that finance is a highly regulated industry. For a while after its inception, in spite of the strong regulatory environment in the banking industry, FinTech has been able to circumvent this regulatory impact because of its relatively small size. As the sector is growing and it becomes more integrated with conventional finance, regulatory oversight is becoming a necessity. Main issues of concern within this regulatory framework is avoidance and prevention of financial crimes: terrorist financing, money laundering, safety of customer data and information, etc.

As we’ve seen in the evolution of FinTech, the 2008 financial crisis was a pivotal moment for financial regulation. Prior to the 2008 global crisis financial market regulation was largely relying on market-based approaches. These originate from the theories of efficient market hypothesis (EMH) discussed in detail in Chapter 11. EMH states that markets impound all available information quickly and efficiently into the prices of financial assets, and this leads to an efficient allocation of financial resources, meaning resources will flow to their most valuable uses. As we’ve seen in Chapter 11, this theory is based on a number of assumptions. Primarily,

\textsuperscript{15} See article Game Stock in the Atlantic: https://www.theatlantic.com/ideas/archive/2021/01/why-everybody-obsessed-gamestop/617857/
EMH assumes there is perfect information available in financial markets and that there are no transaction costs. Further, it states that markets exhibit perfect competition and that all market participants are rational players. Providing that all these hold, the result is an efficient capital market that properly supports a well functioning economy. In reality, we know very well that information is not always accurate, that there are transaction costs and costs of acquiring information, and that competition is, by no means, perfect. Most of the regulatory and legislative effort prior to 2008 was focused on improving the quality of information, transparency and reducing transaction costs in order to reduce market failures and help markets function in a better way. The global financial crisis fundamentally changed the way we think about finance and its regulation. The main cause for this was the problem that we now call *systemic risk*, in light of the hundreds of billions of dollars spent on bailing out large banks around the world. Systemic risk is the risk that the failure of an individual financial institution can lead to the collapse of the entire financial system, and ultimately the collapse of the economy. This is what happened in the 1929 during the Great Depression and similarly, in the great recession of 2008. As a result, regulatory bodies around the world are focusing, apart from the concepts of efficiency from before, on preventing systemic risk, maintaining financial stability as well as fairness to all market participants. Over the last few years we have seen a wave of regulations in the financial services industry all around the world, aiming for an increase of investor protection.

Further, because financial systems are very linked globally, it is important for the regulatory systems to be coordinated and harmonized as well (Loesch, 2018). All FinTech companies are subject to the financial services regulations with only two limitations: scale and delay. Smaller firms can avoid regulation as they cannot do much damage and the costs to enforce small violations that do not hurt many consumers area too high for regulators to pursue.
sometimes. The other limitation is presented by the fact that regulation takes some time to catch up with market changes and this is particularly more prominent with the FinTech industry, where we see new business models that do not fit exactly in the patterns of business seen before, and the type of regulation applicable is unclear.\textsuperscript{16}

Apart from being the key prompter of the explosive development of the FinTech industry worldwide, the 2008 financial crisis was the trigger of the development of RegTech, or regulatory technology. RegTech is inherently related to FinTech, however it is a much broader concept. RegTech is referring to the use of regulation to make financial markets and their regulation more effective, however, RegTech can be applied beyond FinTech, to any sector of the economy. Any regulated economic industry or sector can benefit from the application of technology and the improvement of that regulatory system, like for example environmental, airline, traffic regulation.

Thus, the RegTech system includes both the industry and its regulators. With reference to the FinTech, it includes traditional financial institutions like banks, investment firms and insurance companies and a growing variety of start-ups and more recent financial technology firms as well as regulators.

Post the 2008 financial crisis we have seen a strong focus on regulation to support innovation and development in the financial systems around the world and regulators have reached an acceptance of the flow new technologies with the opportunities as well as the challenges these present. Given the disruption caused by FinTech, a series of different approaches have been taken by regulators around the globe. One of these is the simple approach of doing nothing, approach seen by some as positive and by others as negative. For example,

China prior to 2015 took a very permissive approach and eluded any new regulation, which led to the explosion of Chinese FinTech industry. The contrasting approach is a do-nothing approach with a restrictive consequence: requiring new entrants to comply with existing regulations, a difficult task given the new types of business models evolving. Yet, during the last couple of years have seen a more proactive approach from regulators trying to balance the goals of growth and innovation with classical considerations for financial stability and consumer protection. One of these new approaches is what we call sandboxes – areas for experimentation in a limited context, with limited regulation – allowing both firm and regulator evaluate the optimal way to move forward.

A noticeable trend in the financial industry, apart from the rise of a large number of FinTech players, is the emergence of a novel range of business models, alternative models that unbundle offerings of traditional finance firms and creating new markets for them. These create big challenges for regulators: while conventionally regulation was constructed around existing business models – if firm is a bank, banking regulation applies. This is becoming increasingly difficult to do and the regulatory framework, while slow, is starting to focus more and more on the product level. Stephan Loesch (Loesch, 2018 p. 77) calls this “duck typing regulation”: if the product looks like a duck, and it sounds like a duck, we will then regulate it like a duck.17

The accelerated growth seen in the FinTech area presents another issue for regulators. The notion of too-big-to-fail is deeply rooted in the financial crisis of 2008, but the emergence of technologies that allows start-ups to reach consumers much faster can make them go from too-small-to-care to too-big-to-fail overnight, creating a regulatory failure for regulators. For example, Chinese firm Yu’s Bao went from zero to 90 billion US dollar of assets under

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management in only nine months, while it took large, top asset managers over seven decades to achieve this level.

One other major challenge faced by regulators concerns the role of governments and their control of money or fiat currencies. Governments around the world use their central banks to issue money, using the tools of monetary policy to apply economic influence. Governments have also the power to deliberately increase or restrict the amount of money in circulation in an economy, in an effort to stimulate investment and spending, decrease unemployment, control inflation and recessions. All of this regulatory power is lost when non-government bodies create their own currencies. Monetary and fiscal currencies will not be able to affect an economy dominated by currencies issued by other than government agencies.

Recently, International Monetary Fund (IMF) gave Canada, China, Sweden, and Uruguay as examples of countries seriously pursuing the option of a centrally controlled digital currency when talking about central bank digital currencies (CBDC) in development. In July 2018, Bank of Canada (BoC) published a working paper exploring the prospect of a CBDC for Canada, which concludes that the economic benefit for Canada of introducing a CBDC could be as high as a 0.64% increase in GDP. More and more governments are exploring these options and we see signs some major banks are following suit. Recently, J.P. Morgan became the only major bank to create a U.S. bank-backed cryptocurrency and will become the first real-use application for a cryptocurrency.¹⁸

¹⁸ See: JP Morgan is rolling out the first US bank-backed cryptocurrency to transform payments business, CNBC, Feb 14, 2019
1.6 Social and Ethical Issues

Financial inclusion, along with access to finance and financial sector development have been key goals set over the last few decades by many international organizations including Alliance for Financial Inclusion (FI), G20 (or Group of Twenty), Financial Action Task Force (FATF), International Monetary Fund (IMF). They have generated a series of policies around the world, and a momentum of initiatives to achieve these goals globally. It wasn’t until the last decade that a large array of technological developments prompted a vast potential for dramatic progress in these areas to emerge.

Based on the World Bank’s 2017 Global Index findings, approximately 1.2 billion people opened an account with a formal financial institution or mobile financial services provider for the first time, between 2014 and 2017, and, 515 million of these happened via a mobile money provider.\(^{19}\) While this is certainly an amazing improvement, as 2017 the World report states that there are still 1.7 billion people over the age of 16 that do not have access to a financial institution, representing about 31 percent of the world’s adult population.

As we have seen, the FinTech developments of the last decade transformed the way financial services are used around the world and it brought with it enormous opportunities. These opportunities are mostly valuable in emerging markets and developing economies, as we have seen by the large progress made in financial inclusion in East Africa, China and India.

Creating access to financial services like savings, payments, insurance, credit, allows people to create a future for themselves and their families, save for future education, better health and new businesses, and these, in turn, at the macro-economic level contribute to improved population health, economic growth and stronger economic systems in these places. As shown

by the article at the beginning of this chapter, mobile money is one of the drivers of these trends. The story of Lagos, Nigeria clearly exemplifies how this phenomenon has the potential to substantially reduce poverty around the world. The combination of vast access to smartphones and internet access with very weak and mostly inefficient existing financial systems and banking allows these economies to see, within a few years, developments that took western economies over a hundred years to achieve.

At the same time, these vast changes and opportunities are accompanied by new risks. The World Economic Forum is advising governments, established finance players, and FinTech start-ups to put together rules and regulations preventing the wave of new FinTech players to becoming a new systematic risk to economies. In their report titled “Understanding the impact of technology-enabled innovation on financial stability” they state: “As legacy business models and long-held value propositions in financial services are reshaped by these new ideas, key actors in the system must work to ensure economic growth does not come at the expense of systemic stability.”

In the same report, WEF identifies six big advantages created by FinTech: increased access to financial services through things like smartphones, lower cost, improved risk management, diversification of risk, increased collaboration, and increased competition. At the same time, the report warns that “technology-enabled innovations bring a new set of risks to the financial system, both conduct and prudential, and has implications for human capital (e.g. increased automation leading to fewer employees).”

The six significant risks WEF and Oliver Wyman, the Davos organiser, identify in their report are:

1. **Alternative sources of finance:** While the alternative sources of capital, like crowdfunding, promote financial inclusion and have the potential to reduce poverty globally, they have the same default and liquidity risks. The danger is that these risks are now shifted to the consumer, which “has the potential for sizeable losses to be directly incurred by average investors who may not understand the product or its associated risks”.

2. **Market electronification:** The report highlights the risks posed by the rise in algorithmic trading resulting from recent technological advances like online trading platforms and dark pools. One main concern posed by these relates to the misrepresentation of investors’ perception of liquidity in global capital markets.

3. **Security of data:** As businesses increase their reliance on technology and continue to amass larger stores of data, it becomes increasingly important (and difficult) to ensure resilient systems are in place to safeguard information.

4. **Industry conduct:** While technology-enabled innovation has the potential to support oversight functions in monitoring employee activities, it may simultaneously act as an amplifier of illicit actions that have evaded detection (e.g. predatory algorithmic trading activity). Moreover, heightened shareholder expectations and intense competition may incent the mainstreaming of new technology-enabled innovations before the requisite control environment for risk and compliance is in place.
5. **Payments effectiveness**: The rise in cryptocurrency issuances and alternative systems of storying value “may actually impact effectiveness of monetary policy and transmission mechanisms”.

6. **Regulatory arbitrage**: The report highlights challenges posed by inconsistencies in regulatory systems across countries, which “allows for some businesses to fall through the supervisory cracks, reduces portability of business models and stifles innovation.”

**Key Terms**

Artificial intelligence
Big Data
Bitcoin
Biometrics
Cloud computing
Crowdfunding
Cryptocurrency
Digital Currency
Distributed Ledger Technology (DLT)
Internet of Things
RegTech
Stablecoins

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