

Hazik Mohamed and Hassnian Ali

Blockchain, Fintech, and Islamic Finance

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Hassnian Ali

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Building the Future in the
New Islamic Digital Economy



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Advance Praise for *Blockchain, Fintech, and Islamic Finance*

The authors are to be congratulated for this book. It is an important pioneering effort. The work is on the frontier of knowledge in the new area of Fintech. As is well known, the financial sector is suffering from low levels of trust in a trust-intensive industry. Islamic finance too is facing a low-trust environment that has denied it the use of the strongest of its characteristics: risk-sharing. As a result, it has resorted to debt-based financing. Blockchain/smart contracts provide potentially powerful tools to address the low-trust challenge. The authors have done a great service to Islamic and conventional finance by producing a book that should be read by anyone interested in finance and economics.

— Prof. Dr. Abbas Mirakhor, Holder of the First Chair of Islamic Finance at INCEIF; retired Dean of the Executive Board of the International Monetary Fund (IMF), Washington D.C.

This is an important contribution by the authors to two emerging fields—Islamic finance and FinTech. In this respect, it touches two frontiers as this research could pave the way for the development of both fields. FinTech offers great potential for reaping the benefits of Islamic finance and this book provides an excellent overview of the issues and applications. I am confident that researchers, policy-makers, and practitioners would benefit from this important work.

— Dr. Zamir Iqbal, VP Finance and Chief Financial Officer (CFO) of Islamic Development Bank (IsDB), Jeddah; former Head of World Bank Global Islamic Finance Development Center, Istanbul.

In this digital era, new technology has proven to bring agility, scalability, innovation, and efficiency in operations and means of doing our work. This book argues, persuasively, that the Fintech and Blockchain applications are not only the channels of fusing technology with Islamic finance; it also lays the foundation for new Islamic digital economy, while keeping in view the Maqasid Al-Shariah. This book is a first-of-its-kind contribution to the literature on constructing the Islamic digital economy.

— Dr. Hussain Mohi-ud-Din Qadri, Patron, International Centre of Research in Islamic Economics (ICRIE) Minhaj University, Lahore.

While the growth of fintech firms has already become a game changer in the conventional financial sector, its application in Islamic economy is still in an incipient stage. The authors of this pioneering work deserve appreciation to not only offer a historical perspective on these exciting developments but also suggest ways to building Islamic digital economy with the use of these tools, especially distributed ledger technology. I would recommend this book to all those who are interested in building a trusted, just and efficient Islamic digital economy.

— Zahid ur Rehman Khokher, Assistant Secretary General of the Islamic Financial Services Board (IFSB), Kuala Lumpur.

The authors hit the mark; blockchain needs to become part and parcel of economics, finance and policy across Muslim-majority countries. It is critical for the leadership to understand what blockchain is and its potential application. Islamic economies need to carefully consider the adoption and the potential institutionalization of blockchain across various facets of their economics. The authors lay the groundwork in this book, and it is a must-read for the broad audience whose desire is to focus on a next generation technology, its adoption and implications.

— Omar Rana, Director of Strategy and Finance at Finalytix, Toronto, and former Chief Investment Officer for a US\$500M private family office in the GCC.

Dr Hazik Mohamed:

I dedicate this book to my daughters, Aliya and Nadrahuda. And to all their cousins, young and old—Syazwan Hanif, Mohamed Hasif, Abdul Hadi, Haris, Abdul Rahman and Abdul Rahim.

This book contains the shifting trends of the world that you're growing up in. Prepare your contributions for the world to come ... and the Hereafter that awaits.

Hassnian Ali:

First, to the most devoted and conscientious person in my life, no one else, my late father Ghulam Hussain.

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All praises to Allah, the All-Compassionate, the Most Merciful, without Whom nothing is possible. Blessings upon our beloved prophet Muhammad ﷺ and upon his family and companions.

We acknowledge the advice and recommendation extended by Professor Abbas Mirakhor and Nick Wallwork in regards to the manuscript.

We also want to express our appreciation to Jeffrey Pepper and his team for their responsive actions in making this book a reality within the seemingly impossible schedule that we had proposed.

Hassnian would like to express his profound gratitude to his mother, Muniran Bibi, and his late father. Their forbearance, guidance and support has been exceptional, and he would not be who he is today without them. Hassnian also acknowledges his dear sister, Rakhshinda Parveen, his elder brother, Arfan Ali, and especially his twin brother, Muhammad Saqlain, who understands and encourages him to achieve great things.

Dr Hazik recognizes his family for being the heart of inspirational support, especially his wife, Anisa Hassan; his siblings, their spouses and his in-laws for their generosity and prayers; and his beloved parents (deceased) who laid the foundation of belief, endeavor, fairness and justice.

Foreword

If you have yet to delve into the world of blockchain and fintech and how they are connected to Islamic finance recently, this book is the most comprehensive and practical book ever written on the topic. It looks deep inside the working protocols of both blockchain and fintech. Interestingly, this book covers all the relevant and interconnected topics, making it a must-read book on the subject of blockchain and fintech.

When I was asked to write a few words reflecting on my thoughts about this book that was sent to me, I immediately felt the vibrancy of this book, even by merely looking at the table of contents. The content coverage and selected issues and sub-topics reflect well the intensity of the authors' knowledge and exposure, as well as their intuition. As everyone has been looking for a master key for this most timely knowledge, I am confident this book will prove to be useful and timely.

It may surprise you to know that this book's algorithm fits perfectly well with the issues presented in it. This makes this book special, as everything and anything mentioned in this book is essentially framed by cutting-edge knowledge of blockchain, fintech and, to a considerable extent, the digital economy. This is not an easy task to accomplish, unless the authors are exceptionally articulate in explaining these concepts. They have proven themselves to be masters in this field of knowledge and practice.

This book is equally informative with regard to Islamic finance, covering aspects of the Islamic capital markets, Islamic investment, retail banking, *takaful*, trade financing and *sukuk*. I would like to believe that this is the most striking contribution of this book toward the further development of Islamic finance via smart technology. It appears to me that Islamic finance has no other option but to embrace this up-and-coming way of doing banking, insurance, investment and fundraising. If Islamic finance does not choose to be agile and scalable, as well as innovative, Islamic finance is obviously destined to face constraints and obsolescence, due to stiff competition on many fronts. As the saying goes, life is not the art of avoiding, but is the art of adapting and improving.

The era of digitalization and platform has finally arrived. Nevertheless, this brings less benefits and credence to Islamic finance if Islamic finance refuses to embark on further refinement, enhancement and perfection via blockchain and fintech. This is one of many insights that the authors of this book are trying to impress upon the readers. You will find all these aspects of this books both challenging and yet promising.

How will your knowledge be transformed after reading this book? I have taken the liberty to pose this question in your early journey embarked upon with this book. I have a gut feeling that any reader—of course with an inquisitive

mind—will unlock not only the real potential of Islamic finance in the fourth Industrial Revolution era, but also, more importantly, discover the logic and power of smart technology to accomplish more things smarter, quicker and safer than an average man is capable of, given the same time allocation and complexity of the tasks at hand.

For all intents and purposes, we can't compete with technology, more so smart technology. We have to come to terms to these new technologies. It is reasonable and logical for humankind to embrace these developments and use all sorts of technologies to increase production and efficiency. At some point in time, we need to believe in technology as the savior for some of the complex, compelling problems and crises faced by humanity, even in the space of human sciences.

In all honesty, I could be a bit biased in my future outlook about smart technology, and that includes blockchain, fintech and artificial intelligence—given the fact that I am also a hardcore practitioner of smart technology in some of my initiatives—but of course, I did not conjure up this sentiment out of thin air. The world has long been moving toward perfection and precision—at least in some areas of life. Any and every evolution in this world started from humble beginnings but it will strike hard when it is the right time. The only problem is that we don't know when is the best time for everything. A quote from Martin Luther King may shed some hope. He once said, “There is always the right time to do what is right.”

Obviously, I am not in a position to say for sure when is the right time for this new and smart technology. However, I am confident that this book has emerged at the right time for the readers to be enlightened with comprehensive, trendy and impactful insights about almost everything that is connected with the themes of blockchain, fintech, digital economy and Islamic finance.

Finally, I am extremely pleased and delighted to introduce this book to you and I hope you will enjoy reading it as I did.

— Datuk Dr. Mohd Daud Bakar,
Chairman of the Shariah Advisory Council at the Central Bank of Malaysia
and the Securities Commission of Malaysia

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Preface

The demand for fintech solutions is underscored by the rapid adoption of technology, high-levels of mobile usage and rising rates of internet penetration, an increasingly urban, literate and young population, as well as a segment of consumers and micro, small and medium-sized enterprises (MSMEs) underserved by traditional banking solutions. These factors and the economic potential of ASEAN have also attracted large numbers of investors to the sector.

To realize the potential benefits fintech innovation can bring will require commitment and collaboration. Banks, industry leaders, fintech companies and regulators should continue to collaborate to create an ecosystem to drive greater access to financial services in the Islamic economy. Building the Islamic fintech ecosystem is complicated and it involves various market participants and stakeholders coming together and working toward shared goals of a unified Islamic economic community, increased financial inclusion for the unbanked and the seamless cross-border flow of goods, services and payments.

The Islamic world is ripe for technology transformation across sectors such as e-commerce, travel and hospitality, and, of course, financial services. Technology unicorns Lazada, Go-Jek, SEA (formerly Garena) and Grab are just the beginning of a bigger push of tech companies enabling connectivity, consumption and economic growth. Where 2010 saw the rise of Chinese tech giants and 2015 the re-awakening of the Indian subcontinent, the next five years will be marked by the tremendous opportunities in ASEAN.¹ It was imperative that this book covered the developments of fintech in every region of the world, beyond the traditional markets of North America and Western Europe.

When this project was conceived, there were rapid developments in the Initial Coin Offering (ICO) world due to the rapid rise of bitcoin value, which drove up the prices for other cryptocurrencies as well. Suddenly the attention shifted to the ease of raising capital via a decentralized platform where regulations were non-existent. During this time, there were many ICO projects that were launched and were able to raise large amounts of money within a short period of time. Financial opportunists saw this as a great new way of raising capital for businesses at an early stage (or even at the idea stage) while others saw it as highly risky, being in uncharted territory and unregulated by financial regulators. The problem for regulators was multi-fold and one clear issue was its categorization. The tokens issued at ICOs were used differently and due to their nature, would

¹ <https://www.forbes.com/sites/outofasia/2017/08/22/the-5-driving-factors-behind-aseans-imminent-FinTech-boom/#301d2b845cf3>

be needed to be categorized differently. This is also the view from the Shariah perspective.

As this contentious area continues to generate deeper discussions and attract more attention, the greater opportunities actually lie in the applications of the underlying technology. These opportunities involve the construction of a new digital ecosystem and innovation ecology that is able to disrupt and shift all existing ways of doing commerce, right down to its administration and governance. The applicability of such technologies is now only limited by our imagination, having been transformed by the start-up ecosystems sprouting all over the world and investment capital that chase them. No longer are “unicorn” companies built in certain “Valleys” or the limited geographies of traditionally tech-leading nations; they are now being built, and launched from non-traditional countries like Estonia, Kenya and Indonesia.

Islamic finance and its digital economy offer opportunities for Muslims and non-Muslims as both populations now seek a convergent solution to their pressing issues—rebuilding trust and confidence in a financial system that had lost them. Some technologists imagine this world without intermediaries, while others just want a faster and more efficient way of transacting. Either way, the challenge comes from accountability, and embedding that sense of accountability within the new systems that are being built, based on the sharing of risks and profits that anchor the nature of our economies, including the sharing economy of underutilized assets.

The history of Muslim innovation dates back to the Golden Age when the Muslim world produced great thinkers who shaped the way we looked at the world, and in particular mathematics. The first mathematical step from the Greek conception of a static universe was made by Al-Khwarizmi (780–850), the founder of modern Algebra. Al-Khwarizmi wanted to go from the specific problems considered by the Indians and Chinese to a more general way of analyzing problems, and in doing so he created an abstract mathematical language which is used across the world today. He enhanced the purely arithmetical character of numbers as finite magnitudes by demonstrating their possibilities as elements of infinite manipulations and investigations of properties and relations. Al-Khwarizmi is also credited for the development of the lattice (or sieve) multiplication method of multiplying large numbers, which was later introduced into Europe by Fibonacci. Al-Khwarizmi carefully laid down analytical solutions of the various forms of the quadratic equation and illustrated his method of solution by practical examples—being the basis of what algorithms do in problem-solving. Since algorithms make up many computational as well as AI solutions today, it is apt to recognize these important contributions by him.

Since there are rotten apples and black sheep even in the virtual world, cybersecurity has become an important component in protecting digital rights and associated digital assets. This will be an important area of development which is constantly evolving because of the creativity of hackers and cyber-criminals. That challenge has been prevalent for the police in the physical world, and it continues to be a challenge in the virtual world.

One of the key takeaways from this book is that it helps the reader craft a strategy to embrace digital disruptions so that any agency, corporation, organization or entity can respond to them in ways that benefit their stakeholders and people whom they serve. Our sincerest hope is for the readers, especially the youth and industry leaders, to be able to use our work as a companion to their digital journey, in traversing the imperceptible terrain of the unknown and providing sound arguments against change inertia and legacy systems stagnation.

Chapter 1

Introduction

The Rationale for Financial Disruption

The global financial and economic crisis has done a lot of harm to public trust and confidence in governing and financial institutions, as well as the principles and the concept itself of the market economy. It has also eroded a lot of public trust in corporations. The climate of global financial uneasiness can partly be attributed to the global meltdown of 2008 where governments and other regulatory agents failed in their responsibility to monitor and steer unrestrained speculative and damaging financial activities. Outside of the instrumental complexities of collateralized debt obligations and credit default swaps, the repeal of the Glass-Steagall Act,¹ or macroanalysis of global imbalances (in levels of savings and investment), prominent voices have echoed in unison on the erosion of trust and confidence in the global financial system. The main theme of financial reform in the aftermath of 2008 was basically to encourage greater responsibility after (ex post) and accountability for risks taken prior (ex ante), in the form of not bailing out the bankruptcies, and limiting the increasing complexity of financial instruments, transparency, and answerability for derivative trading to prevent investment managers from making enormous bets with other peoples' money, among other improvements.

In response to the deteriorating fiscal and banking conditions in some countries, and increased financial fragmentation, major governments like the European Union (EU) and the United States had supplied liquidity at very long maturity and at low rates to counter the impending risks for their banks. As the monetary policies struggled to deliver their intended outcomes, credit and economic growth were falling, leading to rising unemployment and reduced consumption and investment. The public grew more restless, with increased resentment and decreased confidence in the ability of their governments to tackle the depressed markets.

This frustration worsened with the bailouts of “too big to fail” entities, and have resulted in very smart individuals creating ways to invent their own trust

¹ The Glass-Steagall Act of 1933 was enacted in response to the stock market crash of 1929. This bill was repealed in 1999 by the Gramm-Leach-Bliley Act during the Clinton administration because it was seen as being too restrictive for local banks and businesses to compete with foreign banks.

mechanisms through technology. If you look at bitcoin, for example, its blockchain technology was born out of the need to keep people honest in the absence of a central authority and designed to be public and allow anyone to participate. The design sacrificed efficiency in order to ensure that theft would not pay because rewriting the ledger would require so much computational power. Subsequently, with verifications coming in from various nodes all over the world, a system like the blockchain has developed a mechanism of trust where two people who have not met and do not know each other are able to make a transaction through a technology that has done the checks and instilled a level of trust that is required in such transactions, by eliminating fraud and margins for fraudulent activities. This is one of the major reasons that disruptions, especially in the financial industry, are occurring and at a massive scale. Creating a system that is harder to tamper with and easier to audit will lead to great benefits in an industry that is being increasingly regulated by central authorities. Beyond such rationale, other additional benefits lie in operational advantages like cost reductions, improved efficiencies, transparency, and productivity.

Ethics and Technology

Two fundamental concepts in the Islamic worldview that would have significant implications on economic (including financial) behaviors are the concept of man as *khalifah* (vicegerent) and *‘abd* (servant/slave). The Qur’an (Surah al-Baqarah, Qur’an 2:30²) mentions that the human being has been created to be a *khalifah*, a vicegerent on earth to establish God’s commandments,³ a unique position (with a mission) not granted to other creations. To be a *khalifah*, the human being is endowed with a delegation of authority from God to fulfill “consciously” (not by force) the divine patterns on earth. He is granted free will to either implement or annihilate these divine patterns through his actions. He is the only being that can act contrary to his nature (i.e., not fulfilling God’s primordial command), while no other creations be it animals, plants, or angels can do so. Human beings are free to use the bounties and blessings conferred upon them (*taskhir*), but at the same

² “And [mention, O Muhammad], when your Lord said to the angels, ‘Indeed, I will make upon the earth a successive authority.’ They said, ‘Will You place upon it one who causes corruption therein and sheds blood, while we declare Your praise and sanctify You?’ Allah said, ‘Indeed, I know that which you do not know.’”

³ Allah’s s.w.t. commandments include establishing justice, fairness, equality, and to fight corruption, evil, and fraud.

time, they must carry out their duty toward God mainly as an *'abd* (who serve and worship Him) and *khalifah* (who holds *amanah* as God's representative on the earth) to *isti'mar*, that is, to prosper the earth and to create a moral social order on earth. All man's actions, including his economic activities, should be viewed in this complete commitment to God by obeying the prescribed framework.

Another example that shapes the relationship of the ethical concepts that make up the ethical foundation of Islam is the belief of the connection of *dunya* (the present world) and *akhirah* (the hereafter). Muslims are advised to be very conscious of this correlation in every action they take and choices they make. When all economic goals are *only* directed to the happiness of human beings in this world, institutions are likely to suffer from immoral sentiments that are opposed to upholding divine laws meant to benefit human beings. In conventional economics, a rational individual is free to maximize his utility as much as possible without any moral, social, or religious commitment. Consideration for a "hereafter" reward and punishment of the consequences of economic choices and decisions made are not included in such a theory. Instead, an Islamic or more enlightened or universal concept of justice and responsible viceregency would constrain an individual maximization of utility in view of the greater good.

The presence of *al-jannah* (Heaven) and *al-jahannam* (Hell) provides "the form of the moral conscience" whenever a man chooses to do anything in this world. It is the very source of moral values. Man, as long as he lives as a member of the Muslim community, is morally required to always make choices that are connected with good and to avoid those that are connected with harm. In fact, these universal principles also apply to all other religions and value systems.

However, behavioral economics informs us that our choices are also governed by our emotions as well as situational factors and the environment. Even with deep moral precepts, our actions are highly influenced by our moods, feelings, and peer pressure, which may be irrational to moral decision making. As such, if the prescribed behaviors of the Economic Man can be mechanized in a system that uses technology to overcome our irrationality, those behaviors that harm the integrity of the financial system in the long run can be prevented. Technological advancement may have the ability to limit⁴ poor decisions and detect and prevent fraud and deception early before a collapse in trust and confidence occurs again.

⁴ While we encourage the limits to bad decisions, it does not equate to limiting choices. There is a difference in removing opportunities for fraudulent activities and leaving room for possible productive ones like innovation.

Digital Transformation and Development

The computing power of digital systems is becoming stronger, faster, and cheaper at an exponential rate and it is in line with one of the most famous laws, Moore's Law,⁵ that predicted it. Digital Islamic revolution, digitalization, and digital transformation have become the most frequently used words in this last decade, but especially in the last few years. This term of digital transformation has no universal definition due to its diversity and it encompasses many dimensions like digital supply chain, digitalization of services and products, and so on. There is a plethora of definitions of this term, used to describe the offline-to-online migration of commercial operations and businesses, including those found in many published research works. Solis, Li, and Szymanski (2014, p. 7) defined this term in a concise way in these words: "the realignment of, or new investment in, advanced technology and business models to more effectively engage digital customers at every touchpoint in the customer experience lifecycle." There are also different terms used in different countries with the same concept like "smart industry" and "industrial value chain initiative" in Japan, "industrial internet" in North America and "Industrie 4.0" in Germany and so on (Matzner et al., 2018, pp. 3–21).

What started as a digital transformation has not been restricted or limited to a specific industry but has spread to a number of industries, seeking similar improvements and benefits. This has influence and clout in each and every industry like the health care industry (Belliger & Krieger, 2018), manufacturing industry (Liere-Netheler, Packmohr, & Vogelsang, 2018; Rüßmann et al., 2015), engineering, construction, and architecture industries (Boland Jr., Lyytinen, & Yoo, 2007) and at the top of the list, the banking and financial industry (Kenser, 2018).

The agenda of digitalization has not only received considerable attention from different industries and businesses, but governments and regulatory authorities have also had to keep up with the disruption and changed business environment and markets. They have begun to give importance to and keep abreast with the new era of digitalization in order to be able to remain relevant in their fiduciary and "watchdog" duties. The most recent and latest example of this is the newly formed German government, which emphasized it in their list of most dedicated items (Liere-Netheler et al., 2018). Unsurprisingly, other governments are following suit as studies have shown that the use and adoption

⁵ Moore's Law is named after Intel cofounder Gordon Moore. He observed in 1965 that transistors were shrinking so fast that every year twice as many could fit onto a chip while its costs halved. In 1975 the pace adjusted to a doubling every two years.

of information communication technologies (ICTs) by the large number of population has a very positive relationship with the gross domestic product (GDP) of the respective countries (Mičić, 2017).⁶

Digital transformation is imperative for the financial services industry to remain competitive and achieve longevity in the market. The survival of financial institutions is connected with the adoption of innovation, and in embracing digital transformation, to radically improve efficiency and performance within the organization (Scardovi, 2017). Digital transformation and new technology adoption have changed the way of doing business and channels that offer banking and financial products and services are more intuitive and trustworthy. These new ways may be very different from the past and have resulted in reshaping the existing models of businesses and the creation of new innovative ones. In doing so, the transformations have created new industry and market leaders.

According to Forbes (2018) ranking of the top 100 brands, the top five brands are from the area of technology. These five top brands are valued at US\$585.5 billion. Table 1.1 provides the Forbes ranking and growth of these five giants.

Table 1.1: Forbes Ranking (2018), Top 100 Brands

| Rank | Brand | Brand Value (US\$B) | 1-Year Change |
|------|-----------|---------------------|---------------|
| 1 | Apple | \$182.80 | +8% |
| 2 | Google | \$132.10 | +30% |
| 3 | Microsoft | \$104.90 | +21% |
| 4 | Facebook | \$94.80 | +29% |
| 5 | Amazon | \$70.90 | +31% |

In a wider trend, the anecdotal evidence shows that the technological conglomerates have been surpassing other industries from the last decade and also in Forbes rankings in terms of number of brands and value. The most recent report also shows that the number of technology brands (20%) and their value (US\$872.6 billion, 40%) are much greater than other industries (see Figure 1.1). The value of the financial services industry is only US\$160.2 billion with thirteen brands. This difference of number and value of brands in the tech and financial industries is due to the difference in strategy toward innovation and digitalization.

⁶ Mičić (2017) cites different empirical and nonempirical studies that explain the link between digitalization, ICTs, and the national GDP. This study is based on evidence from European countries and concludes that digital transformation has positive impact on the GDP of these countries in terms of growth in productivity, and employment.

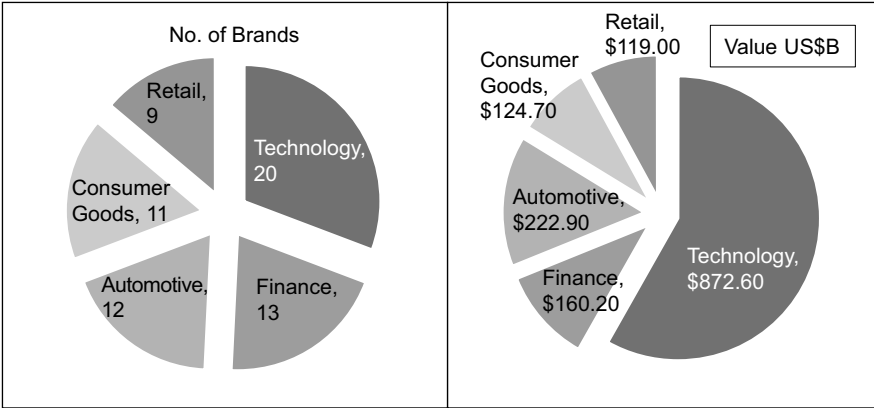


Figure 1.1: Forbes (2018) 100 Most Valuable Brands List

It was inevitable that technology would meet finance and spawn fintech. The use of technologies like algorithmic machine learning, collecting massive amounts of data and interpreting them for decision-making or “crystal-ball” predictions (predictive analytics), and distributed ledgers (blockchain) in financial industry will give rise to innovative business models with increased levels of efficiency, productivity, cost-effectiveness while also improving on customer-centricity. The most important thing and also a great challenge for both fintech platforms and financial institutions is to adopt and implement a very pertinent, practical, and transparent strategy for digital transformation within the organization as well as in external engagements. This is not only essential to harness the opportunities afforded by such advancements in technologies, but it communicates the vision of the organization moving forward into the new digital economy.

Shifts in Customer Behavior

A customers’ journey is the way the customers choose to satisfy their wants and needs and will typically encompass many different processes (Buckley & Webster, 2016). Digital transformation is changing the customers’ behaviors in unimaginable ways, and this changing and influence of digitalization in the lives and psychology of customers is very significant for all industries, in particular for the financial services industry.

The new generation’s ways of acting and reacting to situations have also changed. The younger generation lives in a different world than their parents lived through. The millennials who are born between 1980 and 2000 encompass

more than half of the world's population. They are projected to hold US\$7 trillion as liquid assets in 2020 (Aldridge & Krawciw, 2017). The adoption of technology, like smartphones and other smart devices is more popular in the millennial generation and also in digital natives (the generation born after 2000). These youth prefer digital channels to access services and products, and they can not imagine life without smartphones or the internet. The recent survey by PwC (2017) about the digital behavior of customers shows that 46% of the survey respondents use digital channels, mobiles, tablets, and laptops to access banking services as compared to 27% in 2012. Similarly, the access to banks through brick and mortar branches has shrunk from 15% to 10%. Increasingly, customers are leaving physical bank branches and moving to digital channels, which marks a significant shift in consumer behavior (PwC, 2017).

The digital transformation shift has also changed the expectations and wants of the customers. Today, customers want banking (or any other service) from anywhere they are and at any time, regardless of if they are in the office, or at home in the evenings, or at a beach or in a park at the weekend. This digital behavior of customers has set a new bar for different services industries. The industry is trying to fulfill the needs of these digital mindsets by using omni channels and advanced technologies. The competition among financial institutions and fintech platforms to provide more customer-centric services is increasing (Dharmesh, 2016).

In addition, McKinsey⁷ notes that fintech startups are moving beyond addressing a customer's financial needs to offering a wider range of services, blurring the industry's boundaries. For example, Social Finance (also known as SoFi), began offering financial products to students and young professionals but has since expanded to provide career coaching and networking services. Another prominent example is Holvi Payment Services, a Finnish start-up acquired by Spanish financial group Banco Bilbao Vizcaya Argentaria (BBVA) in 2016, that began by offering banking services to micro, small, and medium-sized enterprises (MSMEs) and expanded to provide other paired offerings, such as an online sales platform, bookkeeping services, expense-claims systems, and a cash-flow tracker. The scope of products and services offered by fintech companies is expanding rapidly, from being focused on payment applications, lending, and money transfers, their reach now extends into areas that include a broad engagement throughout the value chain. The new offerings cut across a wide range of

7 <https://www.mckinsey.com/industries/financial-services/our-insights/bracing-for-seven-critical-changes-as-fintech-matures>

financial services: corporate and investment banking, insurance, MSMEs, retail, and wealth management.

Changes in Engagement and Purchasing Behaviors

Fintech has also introduced a different way to speak to customers—to understand them, reach out to them through social media channels or any channel the customer prefers, and even accept payments through the means of social media. Businesses can now speak to customers wherever they are at any moment—all thanks to the rate of mobile technology adoption, omnipresent connectivity, and the growing socially enabled apps.

Having a better understanding of how customers behave in their channels of preference also allows businesses to identify the right moment to intervene and develop a comprehensive strategy that works holistically across channels such as search, video, social, and display. This leads to the next important change that happens across industries enabled by their respective fintech solutions—the context and messaging.

Nowadays, the context of conversation between customers and brands is as important as ever. The relevance of the message is arguably the most significant factor predicting the success of the “operation.” Companies need to look at how people are searching—the questions they ask, the terms they use—and create ads and content that provide helpful answers.

The ways fintech has contributed to the opportunity to be relevant to every customer without the need for a million customized solutions are with chatbots and chat commerce. Built into messaging apps, chatbots come as close to the customer as possible by being a personal assistant in any endeavor. They provide a relevant answer and allow them to complete a purchase in an instant. Messenger is an example of a solution that has grown into a platform for chatbots to connect brands with customers, find the exact product customers are looking for and provide an opportunity to buy that product in moments.

Structure of the Book

This book looks at the main building blocks to enable trust in impersonal financial transactions within a highly globalized society. These innovations like artificial intelligence (AI), big data, blockchain, machine learning, internet of things (IoT) devices, are the disruptive tools that will play a crucial role in boosting the financial sector (banking, *takaful* [insurance], investment, etc.) including the

Islamic finance sector. Addressing the digital revolution that is happening right now will foster competitive advantage for the Islamic finance industry.

Fintech is a rapidly growing sector of the financial market, which has evolved into a very dynamic area through the rise of smartphone penetration and operational cost reduction. Digital disruption has created a *sharing economy* having the potential to share resources via utilization of underused assets by previously disconnected potential users, and a decentralized scaling power to reach remote and underbanked populations across the world for the enhancement of financial access and inclusion. The blockchain industry is one of the first identifiable large-scale implementations of decentralization models, conceived and executed to scale the complex levels of human activity, possibly even those who have yet to be imagined, which could further establish the sharing economy in the Islamic digital economy.

While this chapter lays down the rationale for financial disruption and explores the emergence of fintech, Chapter 2 examines the different categories of technologies that may have been inaccurately lumped under fintech, which primarily is meant to deal with only the financial industry. In that chapter, we explore its historical beginnings and expand across its movement and scale through the global landscape. In doing so, the chapter sets the foundation and structure, while providing the key concepts needed as a foundation for the understanding of the elements discussed in the remaining chapters.

Chapter 3 iterates the significance of fintech within the current financial services industry from its popular applications like crowdfunding and peer-to-peer (P2P) lending to the trends that will shape it like AI, big data, cloud computing and IoT. Chapter 4 explores the current developments within the Islamic fintech fraternity globally, and tracks the different initiatives being driven by several Islamic countries in the Gulf Cooperation Council (GCC) and the Association of Southeast Asian Nations (ASEAN). It also discusses the challenges faced and impediments to Islamic fintech. Chapter 5 begins by relating the increasing investments into fintech, including the blockchain space, to emphasize the interest in technology that has caused positive disruptions over the last few years. It discusses the potency of fintech and the blockchain for the Islamic economy, along with its potential applications when its capability and strengths are unleashed, very much like what happened for the internet in the late 1990s.

In Chapter 6, the use cases for blockchain are expanded into several key areas that are necessary for the Islamic economy. A key application of the blockchain is the smart contract technology which, along with other enablers like payment, transaction settlement, registries, and document storage systems, will be essential for building more efficient and cost-effective blockchain-based versions of

takaful, Islamic capital markets, media rights, property rights, land and title deeds registries, intellectual property and trademark protection.

Chapter 7 continues the case studies of the applications into the evolution of the next phase of blockchain where transnational and intergovernmental organizations, like the ASEAN, GCC, International Monetary Fund (IMF), UN, and World Bank are concerned. There is a scale and jurisdiction consideration that certain transnational operations can be more effectively administered, coordinated, monitored, and reviewed at a higher organizational level through a unified blockchain-based system.

Finally, having laid out the relevance, significance, and developments of the global fintech community, Chapter 8 provides recommendations for Islamic institutions to respond in this era of digitization, shifting behaviors of consumers as well as the new challenges that come with it, such as collaboration models to spur innovation, agility, and scalability along with circumventing cybersecurity issues.

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Chapter 2

Fintech—Definition, History, and Global Landscape

Introduction

In the past, fintech was dismissed by traditional financial industry professionals as new skin on old rails. In actuality, Fintech sets new performance standards and has the potential to raise traditional banking and financial industry by offering customer-centric services and upgrading financial products and services designs. It also promotes greater financial inclusion through better means for customers to access the financial products and services. This chapter details the definition and concept of fintech, followed by the evolution and history of its existence. It also attempts to paint the global landscape of fintech, which includes fintech investments in major regions including Europe, the United States, Asia, and Africa, to provide a broad understanding of the changing financial landscape.

Definition and Concept of Fintech

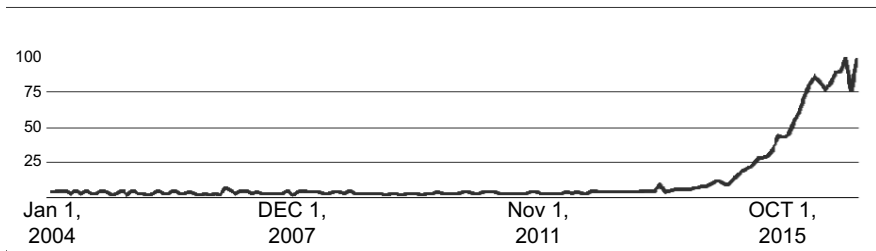
Fintech in the etymological and general perspective is the portmanteau of financial technology, refers to an emerging financial services sector that is fast becoming indispensable to financial institutions, and is constantly impacting the way technologies support or enable banking and financial services. Freedman (2006, p. 1) in his book *Introduction to Financial Technology* describes financial technology as being concerned with building systems that model, value, and process financial products such as stocks, bonds, money, and contracts. Schueffel (2016) defined fintech as “a new financial industry that applies technology to improve financial activities” after making an analysis of more than 200 scholarly studies over the last forty years. We believe that this newly minted term can be associated with start-ups and companies that are providing highly innovative and pioneering financial services or products with the combination of information technology (IT) enabling ventures or by using the latest available technology.

Waupsh (2016) explained the three groups of fintech products as white label, direct, and gold label. “White label” is the type of product that is delivered to end users of financial institutions through the financial institutions. These products are not developed by the financial institutions themselves but are purchased from a fintech vendor who developed them. Examples of these products include Moven’s work with TD bank and Westpac in Canada and Bill Pay from Check-

Free. The second, “direct (to consumers or to business)” is directly delivered from fintech platforms to consumers and to business. Examples of this type are Stripe, Venmo, Square, and Wealthfront. The third type, in between the above two, is “gold label” and has features of both types of products. Like direct, gold label fintech products are branded solutions to reduce user problems and also have unique features. But these are also designed for financial institutions to help them compete like white-labeled products and services. These are also distributed by the financial institutions. Examples of this type are ApplePay, Dwolla, and Kasasa.

One of the basic differences between fintech and the bulk of the traditional financial institutions, is the use of advanced, innovative, and digital technologies. The traditional financial industry has large built-in IT infrastructures, and the industry is spending a big part of revenues on IT and its infrastructure like servers. But the emerging fintech companies are the ones creating products using more advanced technologies such as internet of things (IoT) devices, mobile phones, blockchain-based innovations, big data analytics, and machine learning. By using these technologies fintech companies are providing cheap and easy-to-access services, from transfers and trading to crowdfunding, while operating largely outside of the banking regulations.

The “fintech” term was coined by Bettinger in 1972 in his “FINTECH: A Series of 40 Time Shared Models Used at Manufacturers Hanover Trust Company.” Fintech’s popularity began in the early 1990s and was initially used as a reference to the “Financial Services Technology Consortium”—a project started by Citigroup in order to assist technological cooperation efforts. Santarelli (1995) cited many studies on technological innovation and economic advancement, which were conducted during the 1980s and 1990s and showed that economic development can be enhanced and reinforced through the fusion of new technologies. However, as Figure 2.1 shows, it was only after 2014 that the sector took off and attracted the attention of the masses, which included everyone from technologists and researchers to industry participants, regulators, and consumers alike. Forward-looking nations started accelerators, incubators, and designed fintech ecosystems for their industry to thrive and to remain competitive in the increasingly globalized financial environment.



Source: Google trends for “FinTech” search (2018).

Figure 2.1: Group Trends

As such, new and ultra-modern models of business are being introduced in the market continuously. Fintech has become one of the most dynamic, engaging, and energetic segments of the financial services marketplace. The most active areas of fintech are data analytics, artificial intelligence (AI), digital payments, digital currencies, crowdfunding, and other forms of peer-to-peer (P2P) financing. Table 2.1 shows the top sectors and investment in those sectors in 2017.

Table 2.1: Investment by Sectors (2017)

| Sector | Investment (Year 2017) |
|-----------------|------------------------|
| Mobile Payments | US\$450 billion |
| P2P Lending | \$9 billion |
| InsurTech | \$2.1 billion |
| Blockchain | \$512 million |

Source: Compiled from KPMG, 2018 and Statista, 2018

Evolution of Fintech

There have been four stages (Table 2.2) of industrial revolution, in which the first Industrial Revolution used steam power and water to mechanize and increase production. The second Industrial Revolution used electric power to create the bulk production. The third used advanced electronics and information technology to make the production autonomous. Now we are in the fourth Industrial Revolution that features the digital revolution that started and has been occurring since the middle of the last century. It is typified by a fusion of technologies and cyber-physical systems that are blurring the lines between the economic, physical, biological, and digital spheres.

Table 2.2: Stages of Industrial Revolution

| First Stage | Second Stage | Third Stage | Fourth Stage |
|--|---|--|--|
| 1780s–end of eighteenth century | 1870–start of twentieth century | 1960–1970 | 1970–present |
| Start from mechanics, introduction of first water- and steam-powered mechanical manufacturing facilities | Introduction of electrically-powered mass production based on the division of labor | The usage of electronics and IT to achieve further automation of manufacturing | Introduction of cyber physical systems |

Source: Modified from Henning (2013).

It is important to discuss three major eras of the fintech evolution. The first era, known as fintech 1.0, was from 1866 to 1987 where the financial industry, while progressively became interconnected with technology, was widely still an analog industry. The next era started in 1987, during which the financial services industry in developed countries were not only becoming significantly globalized but also innovative and leveraging on digital technologies. This period was characterized as fintech 2.0 and this era continued until 2008. During this period, fintech was largely controlled by the traditional regulated financial industry that used technology to deliver financial products and services. Since 2008, we saw the emergence of fintech 3.0 where a large number of new entrants (start-ups) and innovative technology companies have started to provide financial services and products directly to several businesses and the general public. In the following sections, each fintech era is discussed in detail. Table 2.3 summarizes the fintech evolution.

Table 2.3: Summary of Fintech Evolution

| Date | 1866–1987 | 1987–2008 | 2009–present | |
|--------------|-------------------|----------------|-----------------------------------|----------------------|
| Era | Fintech 1.0 | Fintech 2.0 | Fintech 3.0 | Fintech 3.5 |
| Geography | Global/developed | Global | Developed | Emerging/developing |
| Key Elements | Infrastructure | Banks | Start-ups/New entrants/innovators | |
| Shift Origin | Analogue linkages | Digitalization | 2008 financial crisis | Last mover advantage |

Source: Modified from Arner, Barberis, & Buckley (2015).

Fintech 1.0 (1866–1987)

In the late nineteenth century, the merger of technology and finance created and established the foundation of the first period of financialization that continued until the start of World War I. During this period, new technologies such as the telegraph, transatlantic cable, steamships, and railroads built financial interlinkages across the borders, permitting speedy transmission of financial transactions, transfers, and payments around the globe. Meanwhile, the technological advancements together with essential resources enabled deeper research and development of new innovations and other existing technologies.

The pantelegraph was invented by Giovanni Caselli in 1865, which was most commonly used to verify signatures in banking transactions. The very first telegraph was introduced in 1838, which was followed by the laying down of the first transatlantic cable in 1866. It provided the fundamental infrastructure for the first cross-border financial transaction in the late nineteenth century. In 1900, consumers and merchants exchanged their goods using credit for the first time in the shape of charge plates and credit coins. The Fedwire Funds Service was established in 1918 by the Federal Reserve Banks to transfer funds and connect all twelve Reserve Banks by telegraph using the Morse code system. It was the first code system used in the banking industry. J. M. Keynes, the renowned economist wrote *The Economic Consequences of the Peace* in 1920 and gave a clear description of the correlation between finance and technology in the first phase of the modern economic exchange: “The inhabitants of London could order by telephone, sipping his morning tea in bed, the various products of the whole earth in such quantity as he might see fit, and reasonably expect their early delivery upon his door-step” (Keynes, 1920, pp. 10–12).

Modern-day credit cards were introduced in 1950 starting with Diners Club. In 1958 American Express was founded by Frank McNamara. Quotron Systems introduced the Quotron in 1960, the first electronic system to provide selected stock market quotations to brokers through desktop terminals. The global telex network was put in place in 1966, which played a crucial role in providing the communications necessary for the next stage of financial technology development. Code-breaking tools were developed commercially into early computers by firms such as International Business Machines (IBM), and the handheld financial calculator was first produced by Texas Instruments in 1967. Barclays Bank introduced the first automated teller machine (ATM) in 1967, calling it a “robot cashier,” which allowed customers to get cash around the clock. With this, Barclays Bank arguably marked the commencement of the modern evolution of today’s fintech, along with the launch of the calculator. The ensuing decades between 1967 and 1987 was the time when financial services moved from an analog to a digital

economy. The Clearing House Interbank Payments System, or CHIPS, was established in 1970 to transmit and settle payment orders in American dollars for some of the largest and most active banks in the world. The NASDAQ—National Association of Securities Dealers Automated Quotations—was established in 1971 in the United States, which signaled the end of fixed securities commissions. The Society for Worldwide Interbank Financial Telecommunications, or SWIFT, was established in 1973 to solve the problem of communicating cross-border payments. The first online brokerage, E-Trade, was founded in 1982, when it executed the first electronic trade by an individual investor. It is also worth mentioning that the first online banking platform was introduced in Britain in 1983 by the Bank of Scotland for the Nottingham Building Society (NBS) customers. It was called “Homelink” and became the first internet banking system by connecting via a television set and the telephone to send transfers and pay bills. The world’s first online shopper, Jane Snowball, in 1984 used a Gateshead SIS/Tesco system to buy food from Tesco (Zimmerman, 2016).

Throughout this period, financial services providers enhanced their IT budget and its use in their financial operations, steadily replacing different types of paper-based methods and procedures by the 1980s, as computing power developed and risk management technology proceeded to manage different internal risks. Among the noteworthy examples of fintech innovations that are widely recognized by financial experts and professionals would be the Bloomberg terminals. Michael Bloomberg began Innovation Market Solutions (IMS), later to be known as Bloomberg LP, in 1981 when he left Solomon Brothers, where he used to design in-house computer systems. IMS called its product Market Master at first, and the twenty original units operated at Merrill Lynch at the end of 1982. In the 1980s, stock exchanges from New York to Tokyo were going electronic, a prerequisite for a truly sophisticated online service for traders. And fortuitously, Bloomberg terminals were in ever-increasing use among financial services providers (Arner et al., 2015) along with other forward-looking devices such as the over-the-air (wireless) portable pocket receiver QuoTrek, which gave instant stock market quotes to traders. The Bloomberg Terminal of today provides more than 325,000 subscribers (as of October 2016) with everything from an array of information on financial matters to a chat system to the ability to actually execute trades. It processes 60 billion pieces of information from the market a day.

Fintech 2.0 (1987–2008)

The year 1987 is considered historic because the risks regarding cross-border financial connections and their link with digitalization and technology attracted

the attention of regulators. One of the strong images from this period is that of the investment banker wielding an early mobile telephone, which was first introduced in the United States in 1983 and completely illustrated in Oliver Stone's film *Wall Street* in 1987. That same year also witnessed the "Black Monday" stock market crashes whose impact on markets around the world clearly depicted they were interconnected through technology in a manner not seen since the 1929 crash. Almost thirty years later and there is still no clear consensus on the causes of the crash, at the time much focus was placed on the use of computerized trading and finance systems by financial services providers, which bought and sold automatically based on preset price levels. The reaction led to the introduction of a variety of mechanisms, particularly in electronic markets, to control the speed of price changes ("circuit breakers"). It also led securities regulators around the world to begin working on mechanisms to support cooperation, in the way that the 1974 Herstatt Bank crisis and the 1982 developing country debt crisis triggered greater cooperation between bank regulators in respect to cross-border issues (Traxpay Team, 2016).

The heavily digitalized financial services industry in the late 1980s was established on e-transactions between financial industry participants, financial services providers, and customers around the globe, by using the fax, having augmented the telex. In 1998 financial products and services had developed for all practical objectives into the first digital industry. The collapse¹ of Long-Term Capital Management (LTCM) coincided with the Asian and Russian financial crises of 1997–1998 showed the initial risks and limits enabled by complex computerized risk management systems. However, it is important to be aware that the highly leveraged nature of LTCM's business, coupled with a financial crisis in Russia (i.e., the default of government bonds), caused massive losses and made it difficult for LTCM to cut its losses in its huge positions, totaling roughly 5% of the total global fixed-income market, and had borrowed massive amounts of money to finance these leveraged trades.

However, it was the emergence of the internet that set the stage for the next level of development, beginning in 1995 when Wells Fargo used the World Wide Web (WWW) to provide online account checking. By 2001, eight banks in the United States had one million customers online, with other main jurisdictions

¹ Due to the small spread in arbitrage opportunities, LTCM had to leverage itself highly to make money. At the fund's height in 1998, LTCM had approximately US\$5 billion in assets, controlled over US\$100 billion, and had positions, whose total worth was over US\$1 trillion. At the time, LTCM also had borrowed greater than US\$120 billion in assets. <https://www.investopedia.com/terms/l/longtermcapital.asp>

around the world rapidly developing the same systems and related regulatory frameworks to address risk. By 2005 the first direct digital banks having no physical branches emerged (e.g., ING Direct, HSBC Direct) in the UK.

In the 2000s advancements in internet connectivity paved the way for a host of new fintech companies to introduce consumer-facing solutions. PayPal was launched in 1998 and it was among the early fintech companies that started transforming the way people managed their money through payments. eBay was also one of the first e-commerce empowerment websites that permitted consumers to create the market and establish prices for auction items. And it all began to snowball from there (Desai, 2015). Crowdfunding was started by a Boston musician and computer programmer (Brian Camelio from the United States) when he first launched a project based on the website with the name of ArtistShare in 2003 (Freedman & Nutting, 2015).

By the start of the twenty-first century, financial institutions' internal operations, cross border interactions and an ever-growing number of their connections with retail customers had shifted to digital mechanisms. Moreover, financial regulators were becoming habitual of technology usage, particularly when it came to securities exchanges, which in 1987 was the most reliable source of information related to market manipulation because their trading systems and records were computerized.

During this era, it was expected that the e-banking solutions' providers would be dominated and supervised by financial institutions, but this is no longer necessarily the case. Although the use of the term “bank” in many jurisdictions is limited to companies duly regulated as financial institutions, there were many new entrants, start-ups, and firms called fintech companies providing different financial services. The fintech companies of that decade were providing services for transfer, payments, investment management, and lending. Envestnet and Yodlee were founded in 1999, Mint in 2006, and Credit Karma in 2007 providing services for personal finance and investment management. Xoom was founded in 2001, and Payoneer in 2005 providing services for money transfer and currency. Prosper was founded in 2005, Lending Club in 2006, and OnDeck in 2007 providing lending services. Klarna was founded in 2005, Adyen in 2006, and Braintree in 2007 providing services for payments. Trading and data analysis provider fintech companies are MarketAxess, which was founded in 2000, Market in 2003 and BATS Global in 2005 (FinTech Switzerland, 2016).

In other words, in developing markets there may be a lack of “behavioral legacies” whereby the public expects that only banks can provide financial services. For this populace, as it was rightly stated by Bill Gates in 1994, “banking is essential, banks are not.” Services will be essential to financial transactions but bank branches will shrink as such services can now be provided on any mobile phone.

Fintech 3.0/3.5

The third era of fintech demonstrated that financial services providers may not merely rest with regulated financial services industry. The provision of financial products and services by the institutions called nonbanks may also mean there is no reliable home financial regulators to act on the concerns of host financial regulators, and so whether the provider is authorized or not may make a little difference. It is possible to say that the 2008 Global Financial Crisis was a turning point and has increased the growth in the fintech 3.0 era.

The post-2008 situation was an alignment of market conditions, which laid the groundwork for the emergence of innovative market players in the financial services industry. Among these factors are public perception, regulatory scrutiny, political demand, and economic conditions. Each of these points is now explored within a narrative that illustrates how 2008 acted as a turning point and created a new group of actors applying technology to financial services. Two kinds of individuals were affected by the financial crisis. On one hand, the common public developed a distrust of the traditional banking system. On the other hand, many financial professionals either lost their jobs or were now less well compensated. This neglected educated workforce found a new industry, fintech 3.0, in which to apply their skills. From a political perspective, increased unemployment and reduced availability of credit because of the crisis was a challenge for the government regulators. This is the political motivation in the United States behind the Jump Start Our Business (JOBS) Act in 2012. The JOBS Act was passed to tackle these issues of unemployment and credit supply in two ways. On employment, the JOBS Act aims to promote the creation of start-ups by providing alternative ways to fund their businesses (Arner et al., 2015).

The rise of fintech 3.0 is deeply rooted in the financial crisis, and the erosion of trust is generated. People's anger at the banking system was the perfect breeding ground for financial innovation. This is considered as good timing, because digital natives (millennials) were becoming old enough to be potential customers and their preferences pointed to the mobile services they understood and mastered, instead of bankers they could not relate to. In this favorable landscape, fintech providers came in, offering new and fresh services at lower costs, through well-designed platforms or mobile apps.

The first-version cryptocurrency bitcoin emerged and was introduced in 2009, providing an equivalent type of transaction and also exchange of digital assets. It is a new type of asset, a new kind of investment. It is opening a cashless world where people can easily go shopping with a handy device or even their own valid identity. In 2011 Google pioneered the release of Google Wallet. This year witnessed the mobile phone giants Apple and Samsung released their e-Wal-

let, Samsung Pay, and Apple Pay. Before the emergence of this payment solution, PayPal was offering Payment Gate to connect buyers and merchants, which enforces and implements online payment to be used widely. There are many fintech companies that have emerged in this era.

Fintech 3.0 started and emerged as a reaction to the financial crisis along with the JOBS Act in the West, but in Asia and Africa recent and latest fintech developments have been primarily provoked by the pursuit of economic development. Some experts characterize the era as fintech 3.5. In Asia, Hong Kong, and Singapore have seen the formation of three fintech accelerators in less than a year, providing them one of the greatest concentrations of fintech accelerators in the world. Korea also has set up an expanded version of Level 39 (London's prominent FinTech coworking space).² On the regulatory side, Asian regulators have initiated a Fintech strategy and met in 2013 in Kuala Lumpur to discuss this agenda alongside the World Capital Market Symposium (Arner et al., 2015).

Eventually, a new sharing economy has emerged and developed, which is steadily shifting consumers into producers. Robo-advisors are using algorithmic programming so they can provide automated investment advice and produce personalized investment portfolios at a fraction of the cost of human advisors. Online lenders have begun to germinate, providing credit to a widely underserved market of businesses and consumers largely ignored by the traditional banks. Crowdfunding sites are also opening digital channels of financing for new entrepreneurs, many of whom are launching their own fintech start-ups, thus creating a continual stream of innovation.

Global Landscape of Fintech

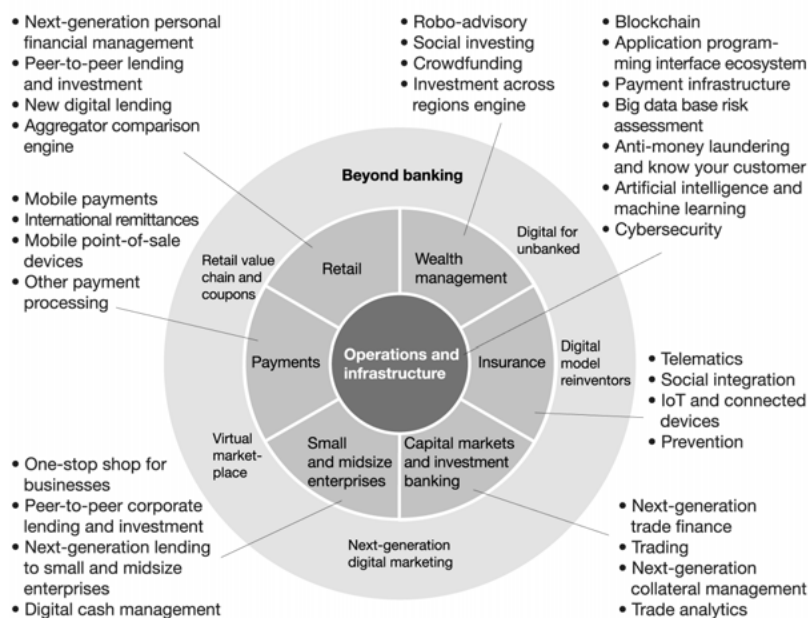
Fintech has revolutionized the entire financial services industry by using innovative and advanced technologies such as blockchain, big data and analytics, cloud computing, AI, IoT, and robo-advisors. By deploying these technologies, fintech promises to reshape finance by improving efficiency and quality of financial services, cutting costs, providing agility, and eventually creating a new global financial landscape powered by fintech.

² British fintech investor to set up S. Korean unit, KOREA TIMES (Oct. 22, 2015), http://www.koreatimes.co.kr/www/news/nation/2015/10/116_189263.html

Fintech Investment

From payments to wealth management, from P2P lending to crowdfunding, a new generation of small firms, entrants, and start-ups is emerging, with fintech firms attracting US\$19 billion in investment in 2015 (up from US\$12 billion in 2013). While 2015 was a record year in terms of deals and dollars invested in venture capital (VC)-backed companies, 2016 continues to see a noticeable pullback in activity. At the current run-rates, both deal count and total global funding are expected to fall significantly under last year's figures (Su, 2016). In 2017, global fintech financing hit a new record of US\$16.6 billion as compared to 2016 (it was US\$13.3 billion) (CB Insights, 2018).

The segments of fintech that attracted the most investments were InsurTech, with US\$2.2 billion, followed by Direct Lending with US\$1.9 billion and P2P lending (US\$1.1 billion). In the infrastructure and enabling technologies category, main investments went into business tools (US\$697 million)—a strong sign of the digital transformation of enterprises—and cryptocurrencies (US\$374 million) (Su, 2016).



McKinsey&Company | Source: Panorama by McKinsey

Source: <https://www.mckinsey.com/industries/financial-services/our-insights/bracing-for-seven-critical-changes-as-fintech-matures>

Figure 2.2: Emerging Fintech Trends

Fintech in Major Regions

Europe

Investment in fintech has witnessed a decline in Europe particularly in VC investment during Q3'16 due to Brexit vote and market uncertainty. The total number of fintech deals declined to thirty-eight and investment dropped by half, from US\$400 million in Q2'16 to US\$200 million in Q3.

Despite this, in the UK and Ireland especially, the collaborations between banks and fintech companies continued to increase, such as the Bank of England's fintech accelerator, banks are beginning to take space in incubation hubs to allow direct and ongoing interface with fintech startups. Large financial institutions are seeking fintech companies as more than an investment. Through these fintech collaborations, banks want to create and adopt solutions that can reduce risk and improve customer engagement.

In 2016, in the fintech market of this region, robo-advisory gained traction in the personal and retail banking sectors, especially for front-line customer response or as a tool in an advisor's toolbox. Now, fintech companies are also looking to combine artificial intelligence with robo-advisory solutions to offer personalized customer recommendations more efficiently. This type of development will attract investors to the European fintech market. Germany also showed continued strong performance among the European fintech companies and Switzerland made deals with Singapore for future deals (KPMG & H2, 2016b).

In Q3'17, investment in fintech companies in Europe hit US\$1.66 billion across seventy-three deals (KPMG & H2, 2017) Statista forecasted that the transaction value in the European fintech market amounted to US\$640.46 billion in 2017. This transaction value is expected to show an annual growth rate of 14.5% (CAGR 2017–2021) resulting in a total of US\$1.1015 trillion in 2021. It is also estimated that the number of potential users is expected to amount to 523.4 million by 2021 (Statista, 2016).

United States

The American fintech market has been driven by the advanced technological developments such as big data and analytics, social networks, and increased penetration of the smartphone, which have led to the rise of newer models such as marketplace funding and people-based marketing. Digital connectivity, faster and instant payment options, lower customer acquisition fee costs through referrals on the social networks have contributed to the growth and innovation of the fintech space in the United States.

One of the main factors of the development of the fintech market in the United States is the appetite for such investments. The fintech investments in the United States had seen a peak from US\$1.6 billion in 2010 to US\$3.4 billion in 2013. In 2014 and 2015 there was a dramatic rise on investments. In 2014, U.S. investments almost tripled from US\$3.4 billion to around US\$ 9.9 billion. The payments sector attracted the highest proportion of investment followed by the lending space in 2015. The fintech market increased in terms of the transactional value from 2010 to 2015 at a CAGR of over 20% during 2010–2015 (Ken Research, 2016). During Q3'17, fintech investment in the United States continued to be dominated by deals being conducted in the U.S. Of the US\$5.35 billion invested across the Americas, the U.S. accounted for over US\$5 billion (KPMG & H2, 2017).

Statista forecasted that transaction value in the fintech market amounted to US\$1.026 trillion in 2017. And it is also expected to show an annual growth rate CAGR of 17.9% during 2017–2021 resulting in the total amount of US\$1.983 trillion in 2021 and the number of potential users is expected to amount to 288.0 million by 2021. The expected market's largest segment is the segment of digital payments, which will attain a total transaction value of US\$738.34 billion in 2017 (Statista, 2016).

We observed that the fintech market in North America witnessed peaks and valleys in deal activity and investments. In Q1'16, there were 130 deals, which declined and decreased to 97 deals in Q2'16. Despite this decline in deals, corporate involvement and participation in North American fintech company deals were reasonable, with California taking the lead in Q2'16 for fintech funding, beating contender New York by 200% that quarter.

The overall investment in North American fintech dropped under US\$1 billion during Q3'16 showing a trend toward smaller deals not a lack of deal activity. The deal activity in the region was positive during Q3'16. North America saw 96 fintech deals in Q3'16, which was 50% more than in Asia.

The drop-in investment or lack of mega deals in the region during Q3'2016 was due to uncertainties related to the outcome of the U.S. presidential election and the timing of the rate hikes in United States. But in Q4'16 there was the change in the behavior of investors toward fintech markets in the region (KPMG & H2, 2016b). In Q3'17, investment in the U.S. hit US\$5.35 billion across 158 deals (KPMG & H2, 2017).

Asia

Fintech investment in Asia-Pacific quadrupled in 2015 to US\$4.3 billion. Now, it is the second-biggest region for fintech investment after North America, accounting for 19% of global financing activity, which is up from just 6% in 2010.

Among the Asian countries, China has the lion's share of investment, 45% in 2015, but India makes up 38% and is growing fast. Bangalore, Mumbai, Tokyo, and Beijing are the main fintech hubs in the region by the number of deals. Looking at deal volumes, 78% went to fintech companies targeting the banking industry, 9% to wealth management and asset management companies and 1% to the insurance sector. Payments are the most popular segment for fintech deals in Asia-Pacific, accounting for 38% of the total (Sparklabs, 2016).

Fintech in Asia faced fluctuated values in 2016, such as a decrease in Q2'16, but Q3'16 saw growth in fintech funding despite a decline in deal activity. Among the other regions of the globe, Asia was the only main region that witnessed an increase in funding between the Q2'16 and Q3'16, with total funding more than North America. It appears that investors will fix their focus in Asia if the fintech funding continues to exceed that of North America for extended periods.

The fintech VC investment in Asia with its peaks and valleys revolves around the worth of US\$1 billion plus a large number of deals. For example, lu.com and JD Finance accounted for approximately half of the overall fintech funding in Asia in mega deals in Q1'16. Q2'16 witnessed a rapid drop in mega deals. But, Q3'16 recorded a comeback and attained a high growth in fintech investment; the two major deals of this quarter were US\$449 million to Qufengi and US\$310 million to 51xinyongka (also known as U51.com).

The fintech market in Asia observed investor focus in areas such as block-chain, data analysis, and RegTech. RegTech is mainly to focus on assisting the regulatory financial institutions in managing their regulatory duties more diligently and effectively. RegTech is gaining attention in the jurisdictions of Hong Kong, Australia, Singapore, and Malaysia; these jurisdictions have started in this area due to initiatives by Sand Box. In Asia, India-based investments have seen a decline because investors focus on higher-quality deals. Singapore aspires to become a fintech hub of the future.

The VC-backed fintech companies in Asia raised US\$1.2 billion in funding across 35 deals in Q3'16. On a year-over-year basis, Asia fintech funding is on pace to top 2015's total by 30% at the current run rate (KPMG & H2, 2016b).

Statista reported that the transaction value in the fintech market in Asia was US\$1.404 trillion in 2017. The transaction value is estimated to show an annual growth rate (CAGR 2017–2021) of 25.1% resulting in a total amount of US\$3.436 trillion in 2021. Statista reported that the transaction value in the fintech market in Asia was US\$1.404 trillion in 2017. Moreover, from a global comparison perspective, it has also been shown that the highest transaction value worldwide was reached in China at US\$1.086 trillion in 2017 (Statista, 2016).

Africa

Fintech also has immense potential in Africa and the Middle East. Magnitt, a networking business for Middle Eastern start-ups, lists fifty-four new fintech companies across the Middle East and North Africa region, twenty in the UAE alone (Shubber, 2016). The fintech innovators of these regions are M-pesa, Liwwa, Zoomal, Finerd, PayFort, MadfoatCom, Fawry, and Democrance, etc. These platforms are providing services include payments, P2P lending, insurance and wealth management, etc. The payment sector in the Middle East has the highest potential among fintech innovators (Haley, 2016).

Kenya is the best-known fintech hub in Africa. The technical talent pool is maturing with improvements in developments and skills. Regionally, Kenya has a quite stable political environment and attracts fintech companies from other parts of Africa, especially in the sub-Saharan region. The main fintech companies are Innova, Pesa Pal, KAPS LTD, Craft Silicon, and big investors are Savannah Fund, NEST, Centum Investment, Novastar Ventures. M-PESA through its mobile money transfer system has revolutionized the way Kenya does business. It was launched in 2007 and within a short time period more than 17 million Kenyans used M-PESA, which is also accessible on even the simplest mobile phone. MODE was founded in 2010 and provides instant nano-credit for prepaid mobile phone users across Africa. It now has operations in thirty-one countries with a customer base of over 250 million (Deloitte, 2016). Statista forecasts that the transaction value in the fintech market in Africa Middle East (MEA) amounts to US\$59.776 billion in 2017 and it is expected to show an annual growth rate (CAGR 2017–2021) of 17.3% resulting in a total amount of US\$113.269 billion in 2021 (Statista, 2016).

Fintech is a rapidly growing sector of the financial market. It has witnessed different eras of development along with the different phases of industrial revolution. During fintech 1.0 this sector has gained infrastructural development, which includes the introduction of technologies such as the first trans-Atlantic cable and ATM. FinTech 1.0 was limited to analog technologies and due to this, it remained nonglobalized. Fintech 2.0 was the shifting from analogue to digital and obviously, it was era that pushed fintech toward becoming more globalized. New entrants and start-ups emerged and started working in this era, but still, regulatory financial institutions dominate the financial services industry. Fintech 3.0 emerged after the financial crisis of 2008, which had a catalyzing effect on the growth of fintech due to growing distrust of formal regulatory financial institutions; the public welcomed new entrants, such as the massive use of smartphones and reduction in operational costs. On a global level, fintech investments in various regions like the United States, Europe, Asia, and Africa are continuously growing. Fintech has also played a significant role in creating the sharing

economy,³ which has the potential to maximize the utilization of possessions and transform idle assets so they become productive.

Cryptocurrencies and Initial Coin Offerings

Cryptocurrencies are virtual digital currencies and named as such because cryptographic techniques lie at the heart of their implementation (He et al., 2016). In modern times the advent of cryptocurrencies is traced to the emergence of the first cryptocurrency, that is, bitcoin in 2009. Historically, the idea and concept of storing important information by using cryptographic techniques is considered older, as the term crypto is taken from an ancient Greek word *Kryptos*, which means “hidden.” Some of the records show that ancient Egyptians also used cryptography as it is evidenced by the use of ciphers by Julius Caesar in 100BC to 40BC. This means cryptography has historical roots and has passed through different civilizations (Fry, 2018).

After the emergence of bitcoin in 2009, the experiments in cryptocurrencies started happening in 2011 with the release of SolidCoin, iXcoin, Namecoin, and others. As of August 1, 2018, there are more than 1,737 different cryptocurrencies in the market. This number of cryptocurrencies breaks down into 819 coins and 918 tokens. According to CoinMarketCap data, the combined market of overall cryptocurrencies to date is valued at \$269 billion. Table 2.4 shows the increase in number of cryptocurrencies from June 2013 to the August 2018.

3 The Sharing Economy matches underutilized assets with potential users. Grab/Go-Jek/Lyft/Uber and Airbnb have transformed idle assets into economic value—by drastically changing social behavior and replacing transaction costs in order to match users with assets. In the Sharing Economy, people must become comfortable enough to trust others so they will forego the expense of insurance contracts, lawyers, security systems, and even private ownership enforcement, to enjoy the benefits of sharing assets.

Table 2.4: Number of Cryptocurrencies Available Since June 2013

| | | | |
|--------------|-------------|--------------|-------------|
| Jun 02, 2013 | 14 | Jun 05, 2016 | 593 (+2%) |
| Dec 01, 2013 | 40 (+186%) | Dec 04, 2016 | 645 (+9%) |
| Jun 01, 2014 | 298 (+646%) | Jun 04, 2017 | 809 (+25%) |
| Dec 07, 2014 | 529 (+78%) | Dec 03, 2017 | 1273 (+57%) |
| Jun 07, 2015 | 542 (+2%) | Mar 21, 2018 | 1568 (+23%) |
| Dec 06, 2015 | 580 (+7%) | Aug 1, 2018 | 1737 (+10%) |

Source: Modified from HiveEx, 2018, *Global Cryptocurrency Exchange Trends, Report & Statistics March 2018* and *CoinMarketCap.com*

It is very important to distinguish between cryptocurrencies and “tokens” and also “cryptosecurities,” as these all are considered cryptoassets. The cryptotokens and cryptosecurities are a very different type of cryptoasset and far beyond the purpose of medium of exchange as in the attribute of cryptocurrencies.

Cryptotokens are also recorded on distributed ledgers and secured by cryptography. There are different types of tokens on the distributed ledger network. These cryptotokens have some sort of claims attached to them, and some tokens resemble traditional shares and bonds. They are referred to as “security tokens” or “investment tokens” or “equity tokens.” These tokens are the digital presentation of a share in a company or a cooperation that have the most features of traditional shares and bonds but represent a very small fraction of worldwide token issuance (ICO). The more popular ones are those that provide their holders access to future services and goods. These tokens are referred to as “utility tokens.” Other types of tokens include “asset-backed token”—tokens that represent some physical asset like gold or real estate, “vote tokens,” tokens that confer their holder a right to be involved in a project development and “hybrid tokens,” tokens that are the amalgamation and combination of two or more types of tokens.

Cryptosecurities are a concept to securitize assets, just like other securities, but on the blockchain. According to Burniske and Tatar (2017), until March 2017, there were more than 800 cryptoassets in the market. The international policymakers including World Bank, IMF and others also taking an interest in cryptocurrencies. Table 2.5 depicts the perception of policy makers regarding cryptocurrencies.

Table 2.5: Definitions of Cryptocurrencies

| | |
|---|--|
| European Central Bank (ECB) | “Cryptocurrencies that are bilaterally linked to the real economy: there are conversion rates both for purchasing virtual currency as for selling such currency; the purchased currency can be used to buy both virtual as real goods and services.” |
| International Monetary Fund (IMF) | “The cryptocurrencies are the subset of virtual currencies as the digital presentation of a value. The concept of virtual currencies covers a wider array of ‘currencies,’ ranging from simple IOUs (‘Informal certificates of debt’ or ‘I owe you’s’) by issuers (such as Internet or mobile coupons and airline miles), virtual currencies backed by assets such as gold, and cryptocurrencies such as Bitcoin.” |
| The Committee on Payments and Market Infrastructures (CPMI), a body of the Bank for International Settlements (BIS) | <p>They mentioned cryptocurrencies as <i>digital currencies</i> or <i>digital currency schemes</i>. <i>These schemes have the following features:</i></p> <ul style="list-style-type: none">– They are assets, the value of which is determined by supply and demand, similar in concept to commodities such as gold, yet with zero intrinsic value– They make use of distributed ledgers to allow remote P2P exchanges of electronic value in the absence of trust between parties and without the need for intermediaries– They are not operated by any specific individual or institution |
| The European Banking Authority (EBA) | The digital representations of value that are neither issued by a central bank or public authority nor necessarily attached to a fiat currency but are used by natural or legal persons as a means of exchange and can be transferred, stored or traded electronically. |
| The European Securities and Markets Authority (ESMA) | The virtual currencies are defined as “digital representations of value that are neither issued nor guaranteed by a central bank or public authority and do not have the legal status of currency or money.” |
| World Bank | <p>WB classified cryptocurrencies as a subset of <i>digital currencies</i>, which it defines as digital representations of value that are denominated in their own unit of account, distinct from e-money, which is simply a digital payment mechanism, representing and denominated in fiat money.</p> <p>In contrast to most other policy makers, the World Bank has also defined cryptocurrencies itself as digital currencies that rely on cryptographic techniques to achieve consensus.</p> |

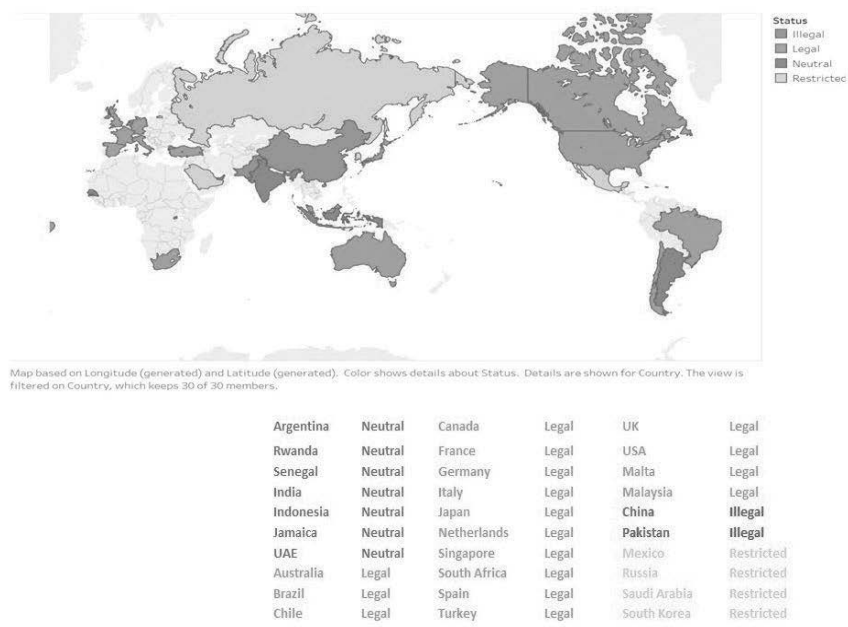
Table 2.5. (continued)

| | |
|------------------------------------|--|
| Financial Action Task Force (FATF) | Has approached cryptocurrencies as “a subset of <i>virtual currencies</i> , which it defines as digital representations of value that can be digitally traded and function as (1) a medium of exchange; and/or (2) a unit of account; and/or (3) a store of value, but do not have legal tender status (i.e., when tendered to a creditor, are a valid and legal offer of payment) in any jurisdiction.” |
|------------------------------------|--|

Source: Modified from (Houben & Snyers, 2018).

From the different points that are mentioned above by different policymakers, it appears that there are different perspectives on its definition. The definition and perspective of World Bank and FATF provides an understanding of cryptocurrencies that they are a medium of exchange having a unit of account and a store of value but not a legal tender status as there is no central authority that guarantees them. It is also noteworthy that the different definitions indicate that the structure and use case of each token is also constantly evolving, making it, at times, very difficult to categorize them effectively. This is discussed further in the section “*Fiqh* View on Coins and Tokens.”

Currently, there are a slew of cryptocurrencies that have been introduced, and their legality varies across different jurisdictions. Figure 2.3 shows the status of the cryptocurrencies in thirty selected countries.



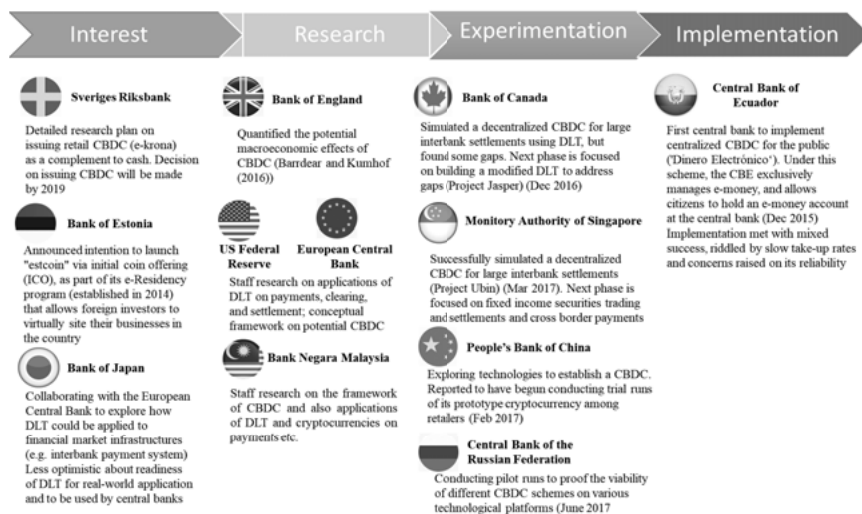
Source: Modified from CoinGecko, 2018; Shafi, Patel, Collins,d& Haidermota, 2018.

Figure 2.3: Legality of Cryptocurrencies, 2018

Due to the advent of cryptocurrencies and also blockchain technology the central banks of major economies started to think and work on their own Central Bank’s Digital Currency (CBDC). The central banks of different countries are at different stages regarding CBDC framework.

This is the most interesting time for Islamic countries, especially for the Organization of Islamic Countries (OIC), to harness this opportunity that blockchain and the concept of cryptocurrencies offer. OIC has to think and work on the uniform digital currency for the entire Islamic world. This will be a breakthrough for the Islamic finance industry as well, which is continuously facing criticism for following conventional benchmarks since its inception.

One of the major breakthroughs in the crypto world is the emergence and rise of initial coin offerings (ICOs). It would be clearer if we refer to this term as initial cryptoassets offerings, as the word “coin” implies that it includes only currencies. This is defined as a type of crowdfunding that uses blockchain or other distribute ledger technology as a decentralized P2P network as an underlying system with the cryptoassets (cryptocurrencies, cryptotokens, and cryptosecurities) on the top.



Source: Modified from Bank Negara Malaysia, BNM, 2017.

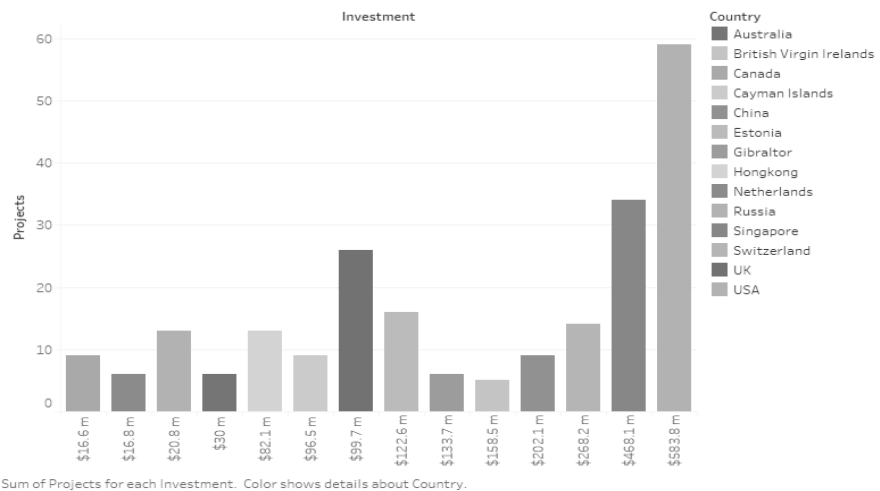
Figure 2.4: Milestones in CBDC by Central Banks

Crowdfunding and ICO, both have several similarities and differences. The similarities are: first, both are used as a way of raising funds for a project or company; second, in the fundraising process due to a public call for funds, everyone can invest; third, in both approaches, internet provides the basis for payment and communication and anyone from anywhere can contribute to any project; and finally, mostly in both ways of fundraising, contributors get something as a reward for their contribution. There are some differences in both approaches: foremost, the difference of an employed system as crowdfunding platforms use centralized and regulated systems and in contrast, an ICO utilizes a blockchain based decentralized P2P network to conduct operations. And in a crowdfunding campaign, the platform and banks act as trusted parties while, in an ICO, a network wide consensus mechanism is involved to verify the transactions.

The first successful ICO was the result of an experiment done by a software developer, J.R. Willet in 2013. He was excited by the opportunities offered by blockchain technology and cryptocurrencies like bitcoin and also wanted to do more with them. He explored that this technology can be used for some complex functions rather than just sending and receiving payments. He tried to raise funding in the shape of cryptocurrency by using a blockchain-based decentralized channel. He built a mechanism through which anyone could send or contribute a bitcoin to the team for the project (MasterCoin) and in return the contributor would receive tokens as rewards. Finally, Willet's idea succeeded and in July

2013, his team had a fund of 5,000 bitcoins with a worth of \$500. This process of raising funds was known as an ICO like the term initial public offering (IPO). After this first ICO, in 2014, Ethereum raised funding for their project in bitcoin (BTC) valued at \$18 million at the time. This was followed by many successful ICOs like new web browser called “Brave” that in May 2017 generated the amount of \$30 million.

Figure 2.5 shows the total investment amount and number of projects, depending on country of registration.⁴ Current leading countries are the United States, UK, and Singapore, while in 2017 the leaders were the United States, Switzerland, Singapore, Estonia, and the UK.



Sum of Projects for each Investment. Color shows details about Country.
Source: Modified from ICORating, 2018, *ICO Market Research Report Q1 2018*.
Figure 2.5: Geographical Distribution of Projects by Country Registration

According to the report provided by PwC (2018), the ICO volume between January 2018 and May 2018 is twice as much as it was in the entire year of 2017. The PwC report states that:

In total, 537 ICOs with a total volume of more than US\$13.7 billion have been registered since the beginning of the year. In comparison, in 2017 there were a

⁴ Country of registration means the country where the company’s legal entity is registered at the time of the ICO. If a project does not have a legal entity, it is not included in this table. Country of project registration is determined on the basis of open data, including projects’ official websites and open databases of registered companies.

total of 552 ICOs with a volume of just over US\$7.0 billion. Also, the average size of an ICO has almost doubled from US\$12.8 million to over US\$25.5 million since last year.

In the first quarter of 2018, the projects related to blockchain infrastructure and the financial services industry are raising more funds through ICOs followed by gaming, augmented reality (AR) and wallets. The funds raised by cryptocurrencies in that quarter were accounted to be US\$4.5 million (ICORating, 2018).

Due to the explosive growth of ICOs, various countries have started to think about their regulations. In Switzerland, the Crypto Valley has launched its ICO code of conduct, Thailand is taking the initiative to regulate ICOs, the state of Arizona in the United States has aimed to define when ICOs would be considered as securities in Arizona law, UK crypto companies are teaming up to form a self-regulatory body, German regulatory authorities will publish a note on ICOs, Austria has planned to make new regulations for ICOs, the United States also announced that money transmitter rules will be applied to ICOs, the Dutch finance ministry also called for ICO regulations, Japan authorities have cracked down against illegal ICO operators, and Gibraltar has announced policies to regulate ICO tokens as commercial products (CoinGecko, 2018).

ICOs have emerged as a new and relatively easier way of raising funds and it is expected that they will need more regulations in place as various innovative ICO structures enter the cryptomarketplace. Some argue that ICOs will disrupt the overall financing industry, but others consider them as additional options to venture capitalists, angel investors and crowdfunding platforms due to their unique features of P2P decentralized networks, use cases and agility.

Cryptoexchanges

As the number of cryptocurrencies has gone beyond 1700 in 2018, the number of cryptoexchanges is also expanding in the same trend. Cryptocurrency exchanges are “persons or entities who offer exchange services to cryptocurrency users, usually against payment of a certain fee (i.e., a commission). They allow cryptocurrency users to sell their coins for fiat currency or buy new coins with fiat currency. They usually function both as a bourse and as a form of exchange office.” As compared to only 70 exchanges in 2015, currently, this number exceeds 190 exchanges around the globe. This is due to an increase in demand to buy and trade cryptocurrencies. Majority of the top cryptoexchanges allowed consumer to buy, sell and trade cryptocurrencies be it bitcoin, Ethereum, or Litecoin and also sovereign fiat currencies like Euros, U.S. dollars, or Yen. Different exchanges support different types of cryptocurrencies, and some are suited for retailers

while others seem geared toward full time traders or institutions. Table 2.6 exhibits the top 15 cryptoexchanges operating at global level.

Table 2.6: The Top 15 Cryptosexchanges (1st half of 2018)

| Name | Location | Year Found.. | 24-Hour Tradin.. | Tradeable c.. | Accepts fiat |
|----------|------------------------------|--------------|------------------|---------------|--------------|
| Bibox | China with Global operati.. | 2017 | \$205.97 million | 62 | No |
| Bit-Z | HongKong, Beijing, Singa.. | 2016 | \$226.78 million | 74 | No |
| Bitfinex | HongKong | 2012 | \$424.61 million | 79 | Yes |
| Bithumb | South Korea | 2013 | \$266.51 million | 37 | Yes |
| BitMEX | HongKong | N/A | \$1.71 billion | 1 | No |
| Coinbase | San Francisco, California | 2012 | N/A | 4 | Yes |
| GDAX | San Francisco, California | N/A | \$130.14 million | 4 | Yes |
| Gemini | New York | N/A | \$21.97 million | 3 | Yes |
| HitBTC | HongKong | 2013 | \$263.93 million | 22 | No |
| Huobi | Multiple Asian offices, Un.. | 2013 | \$685.60 million | 248 | Yes |
| Kraken | San Francisco, California | 2011 | \$135.69 million | 17 | Yes |
| OKEx | HongKong | N/A | \$1.15 billion | 145 | Yes |
| UPbit | South Korea | 2017 | \$265.75 million | 142 | Yes |
| ZB.COM | Samoa | 2017 | \$261.35 million | 61 | Yes |

Source: Modified from (Hansen, 2018).

From the regulatory perspective, each exchange is governed by law based on the location of the exchange. An international exchange has to follow the law of multi-jurisdictions. Not all the exchanges are regulated, some of them are still unregulated and vulnerable to regulatory issues. In 2017, due to the complete ban by the Chinese government on trading of cryptocurrencies, the exchanges based in China had to move their offices outside the country. At the end of 2017, Japan's regulatory authority also suspended these services of cryptoexchanges to the customers within the country as per new guidelines issued by the Japanese Financial Services Agency. As for the United States, the exchanges in different states of America are subjected to State regulations, which vary from state to state, on top of compliance to Federal regulations. In New York, the state has implemented "BitLicense" in 2015 that issued licenses to approved virtual currency businesses.

Unlike the traditional regulated exchanges, decentralized exchange users have to protect their details of transactions with their own private keys. Being unregulated, the protection afforded by traditional exchanges are not in place or enforced. Such decentralized exchanges include EtherDelta, Hodi Hodi, and AirSwap, but enthusiasts of these decentralized exchanges claim that decentralized exchanges are less susceptible to cyberattacks by virtue of their decentralized network (Olagoke, 2018).

e-Wallets

Historically, the digitization of payments started in the 1960s when electronic computing penetrated the government and business world. In the meantime, the banking and finance industry was among the early adopters of digitization. The consumers of the developed world were able to make payments in the form of papers and plastic cards. The payment infrastructure was established, where the major players were banks and the government (central bank). The second domain or stage of evolution of e-payments arrived with the advent of internet and ecommerce. In the initial period, the old players offered their services (credit transfers, direct debits, etc.) online. The old payment services or payment infrastructure was not developed for the internet and these systems were not optimal in terms of security and usability. This situation opened up an opportunity for new entrants and for new services that fit the needs of the internet era. PayPal is the best example of that era, and still is today. Due to the emergence of new platforms, especially in the payments industry in 2005, the banks and banking communities started to introduce their own online banking systems. Banks built their online websites to attract and engage the tech savvy customers and also to compete with the emerging platforms. In the meantime, the behavior of consumers was changing and they were becoming increasingly more tech savvy. The merchants, in a push to remain competitive, offered a diverse range of payment methods and options to keep their customers and acquire new ones. But these involved agreements with banks and payment platforms, which had to comply with financial regulations. At this stage, the payment service providers (PSPs) used this opportunity to lower the burden of merchants. They made the necessary arrangements with the banks and payment platforms to reach consumers. Merchants only had to connect once with any PSP and they were dialed in. This new segment in payments facilitated the rise of digital payments around the globe. In 2009 the PSPs were regulated under Payment Services Directive 1 (PSD1). With the emergence and appearance of smartphones in 2007, the new stage in the evolution of e-payments began. Smartphones with near field communication (NFC) technology and QR codes offered a new channel of making payments, which was called mobile payments, and this laid the foundation for mobile commerce.

The ubiquity of the smartphone removed frictions for all the players in the payments industry. The myth of “anytime, anywhere, and any device” became a reality, and made shopping on the go easy and convenient. Amidst these developments in the payment industry, the big social media channels (Facebook, WeChat), mobile commerce giants (Alibaba, Amazon), search engine (Google), and telecoms (Apple and Samsung) started offering their own channels (via apps and interfaces) for payments on these platforms. Now, we have Apple Pay, Alipay, Amazon Pay, Google Pay, Samsung Pay, and also Facebook payments. Though

most of these payment options have certain limitations, they mark a great potential to develop and grow in the future as more and more customers are engaging with these modes of payments.

Along with these new modes of payments, these channels provide the option of e-wallets to the consumers (The Paypers, 2017) to facilitate payments using cryptos. At the global level, the proliferation of e-wallets has intensified with these brands (Samsung Pay, Apple Pay, and Android Pay). Banks have also started to compete by developing their in-house e-wallets and merchants are also partnering with banks and fintech start-ups to develop their own e-wallets. According to a report (Research and Markets, 2018) the global mobile wallet market was valued at US\$594 billion in 2016 and is estimated to reach approximately US\$3.14 trillion by 2022, with CAGR of around 32% between 2017 and 2022.

Table 2.7 exhibits the details related to the general description (definition of e-wallets), payment instruments, payment guarantee, brands and market reach of e-wallets.

Table 2.7: All You Need to Know About an e-wallet

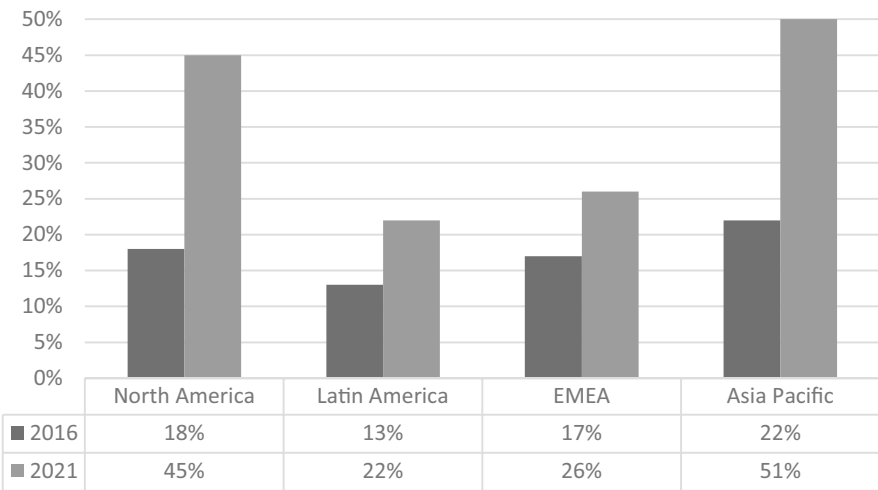
| | |
|---------------------|---|
| General Description | <p>An e-wallet is a digital and virtual tool (app or software) that offers consumers the opportunity to store their payment credentials and methods. It stores users' credentials of credit, debit cards and also other alternative payment methods. Some e-wallets are also able to store loyalty programs. An e-wallet permits an individual to make electronic transactions with an improved checkout and payment experience compared to reentering and keying in all payment credentials every time a purchase is conducted. An e-wallet can function both in physical and online stores.</p> <ul style="list-style-type: none">– e-wallet providers can also be global payment method providers, for example, Visa and Mastercard; or maybe independent, for example, Seamless/SEQR– The term “wallet” is also frequently used for e-money, that is, a stored-value account for which a license is required |
| Functions | <p>The functions of e-wallets are:</p> <ul style="list-style-type: none">– Interaction alternatives (through social media, e-mail, text messages, and voice)– Information access (app search, mapping, product or service discovery, price comparison, information shopping list)– Security, payments and financial services (identity storage [ID card, driving license or passport], mobile banking, financial services, P2P payments, financial details, Instore NFC proximity, security management)– Shopping (digital coupons, promotions, transit tolls, food, ticketing, travel, entertainment, gift cards and vouchers)– Customer relationship building (location-based marketing, loyalty programs and targeted advertising) |

Table 2.7 (continued)

| | |
|--------------------|---|
| Types | <p>On the basis of creation of e-wallets, there are three types:</p> <ul style="list-style-type: none"> – Closed e-wallets: These are created by an entity for facilitating the purchase of goods/services from it, for example, GrabPay. – Semi-closed e-wallets: These are similar to closed e-wallets but users can get financial services at specific merchants, which have signed a contract with the developer to accept them, for example, AirTel Money in India. <p>Closed and semi-closed e-wallets do not permit cash withdraw or redemption.</p> <ul style="list-style-type: none"> – Open e-wallets: Open wallets can be used to purchase goods and services at any merchant location that accepts e-wallet (point of sale) and also to withdraw cash from ATMs and banking correspondents, for example, M-Pesa. |
| Payment instrument | Depending on the e-wallet provider, several payment methods can be used: debit card, credit card, gift card, online banking e-payment, direct debit and recently, cryptocurrencies as well. As of 2017, there were over 150,000 merchants worldwide accepting bitcoin as one of their payment methods. These are the major retailers like Microsoft, Apple, Amazon, Walmart, Expedia, eBay, and even coffeehouse giant Starbucks. |
| Payment guarantee | The chargeback risk of an e-wallet depends on the payment instrument used to top up the e-wallet. For example, PayPal provides consumers a protection if they are charged for goods they did not purchase or if the order did not arrive or if the order did arrive but was significantly different than what was ordered. On the other hand, merchants are protected by PayPal when selling physical goods that are sold and shipped with proof of delivery from within the United States to buyers around the globe. |
| Brands | PayPal, Alipay, WeChat Pay, Apple Pay, Samsung Pay, Android Pay, Masterpass, Paylib, Amazon Pay, SEQR, MobilePay, Lyf Pay, Yoyo Wallet, Chase Pay, Allied Wallet, Dwolla, Paytm, MobiKwik, Pay by Bank App, PayBack |
| Market reach | <p>United States/Europe: Adoption of e-wallets is slower than initial forecasts predicted. However, it is expected that their share will increase in the next three-five years.</p> <p>India: Rapidly growing market due to the conjunction of rising smartphone usage and lack of access to financial services of a large part of the population. Also, demonetization in India has proved to be a lucrative opportunity for e-wallet players (Paytm, Mobiwiki, Snapdeal) in the country.</p> <p>China: For online payments, the e-wallets (particularly Alipay and WeChat Pay) are the most popular form of payment.</p> |

Source: Modified from Aite, 2016, *The Evolution of Digital and Mobile Wallets*; The PayPers, 2017, *Payment Methods Report 2017*.

As mentioned in Table 2.7, the rise of e-wallets is comparatively slow on the American continent and in European countries as compared to Asia. This is justified by the exploding use of e-wallets in two populous and large economies, namely India and China. Other Asian countries in that region like Japan, Malaysia and Indonesia also have active users of e-wallets. Figure 2.6 elucidates this phenomenon more clearly.



Source: Modified from WorldPay, 2017, *Global Payments Report 2017*.

Figure 2.6: The Adoption of e-Wallets Worldwide

The adoption of e-wallets is increasing globally with the rising access to smartphones and the internet. Distrust of e-wallets, lack of awareness and the lack of acceptability among FMCG merchants, especially at the grassroots level, will be needed to be overcome in order for it to truly become indispensable. However, the future looks promising for e-wallets.

Fiqh View on Coins and Tokens

There is a plethora of studies available that discuss the cryptocurrencies especially bitcoin and its Shariah appraisal. These studies only focused on cryptocurrencies and Shariah ruling about them and leave the two main types of cryptoassets out of the discussion. They mainly conclude that cryptocurrencies like bitcoin have all the important and basic characteristics of a currency but their main concerns were articulated around regulatory issues and authority, and high

volatility in prices caused by speculation. Some of the studies also highlight the issue of criminal use of these cryptocurrencies like terrorism funding thus violating the antimoney laundering (AML) regulations. In this section, our focus is cryptoassets, which include cryptocurrencies, cryptotokens, cryptosecurities and the *fiqh* (Islamic jurisprudence) view on them.

As per the definition of *mal* (asset or wealth) according to the *fiqh* interpretation of the Shariah, the scholars of the four famous schools of *fiqh* (Hanafi, Maliki, Shafi'e, Hanbali) agree that *mal* can be anything of (1) commercial value means having natural desirability, (2) having storage ability, and (3) can be owned. Shariah provides flexibility in the form of *mal*—it may be tangible or intangible. As such, cryptoassets can be considered as *mal*.

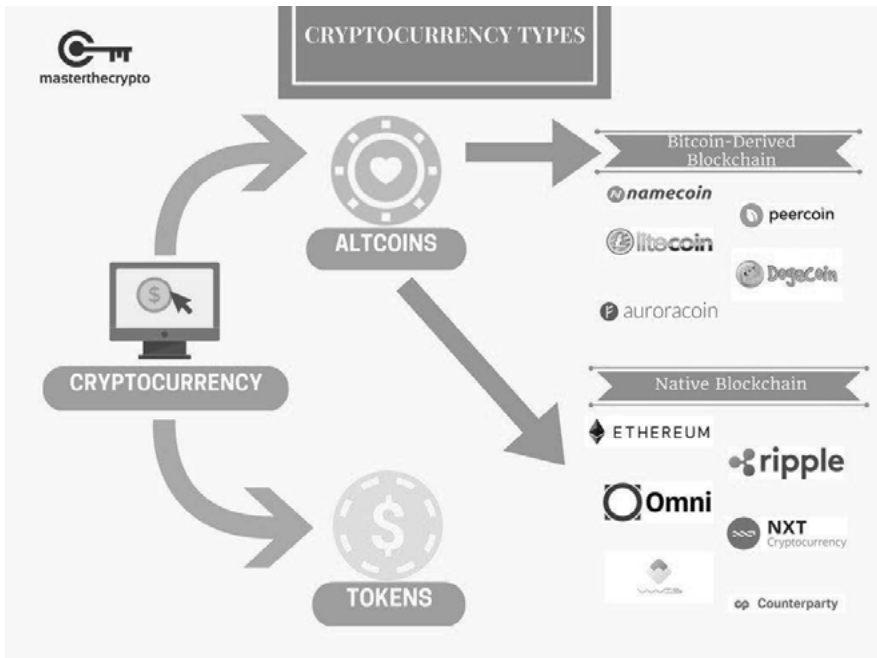
For cryptocurrencies, some scholars (especially the gold dinar proponents) have expressed opinions that they should be backed by a real asset like gold. Now, we have cryptocurrencies like Onegram as it is claimed that this cryptocurrency is backed by gold. Currently, there are also many ICOs that are tokenizing real assets like real estate, and gold. These ICOs are viewed as less volatile (Fry, 2018). However, in the categorization of cryptocurrencies (coins and alt coins), its function is like that of sovereign fiat currency, which is a means of exchange.

To attain proper acceptance and full Shariah-compliance, there are some important conditions that have to be followed. A Shariah-compliant asset can not be from the list of *haram* (prohibitions); for example, wine is an asset but it is not permissible so it is not Shariah compliant (Nordin et al., 2017; Nurhisam, 2017). Another consideration is that its use case cannot violate the *Maqasid Al Shariah* (objectives of the Shariah) regardless if the asset is tangible or not. Hence, the usage of the asset (including goods and services, virtual or real) has to conform to the spirit of the Shariah, not just its forms. Though the asset itself has Shariah legitimacy, its eventual usage and practice has to be in accordance to its intended design.

The first step to recognize the legitimacy of cryptocurrencies is through categorizing the 1700+ cryptos that are out there. First, we make a distinction between the two broad categories of the cryptocurrency—coins and tokens:

- A coin is a digital currency, which is used like existing currencies to pay for goods and services. They are usually built using Bitcoin's open-sourced protocol, and typically have no other purpose than to pay for goods and services.
- A token is another form of cryptocurrency (with more features than just currency), that is usually issued on top of another blockchain. Generally, tokens represent utility or an asset, or sometimes both. Most tokens exist to be used with decentralized applications, or dApps.

The critical difference between the two is that tokens are issued through an ICO, and can take various forms, that is, digital asset (digital rights), means for accounting (number of API-calls, volume of torrent uploads), share (stake) in a specific start-up, incentive for using a system or payment among participants.



Source: <https://masterthecrypto.com/differences-between-cryptocurrency-coins-and-tokens/>

Figure 2.7: Categorization of Cryptocurrencies

From a *fiqh* perspective, since coins are straight-forward forms of digital currencies, Shariah rules on currency will be applied to them (e.g., cannot be treated like a commodity to be traded like Forex). ICOs, however, are not so straight-forward. These types of cryptocurrencies need to be clear in their use case and purpose of issuance in order to remove confusion and/or deceptive ambiguity (*gharar*).

The use of the token must be specified clearly—currently, tokens usage can be generally categorized as (but not limited to):

- *Asset-backed token*—token that represents some physical asset like gold or real estate but can also be intangible like talk-time for telcos or GBs of storage.
- *Equity token*—token that represents some stock or equity in the company that issues it. However, few companies have attempted such an ICO because it is tedious, and follows guidelines similar to IPOs.

- *Security token*—tokens that are securitized are security tokens. Investors buying them expect profits in form of dividends, revenue share or (most commonly) price appreciation. However, they are subjected to securities regulations and limitation on who can invest in these tokens and how they can be exchanged.
- *Utility token*—also called application tokens. They are used to provide people with access to either a product or service. Depending on the ICO strategy, most tokens are expected to gain in value based on their limited supply.

Each token will be treated differently according to the *fiqh* understanding of the Shariah as well as the regulatory authorities because of its nature and usage. Due to this, its treatment by the regulators as well as the Shariah will be in accordance to its nature and usage—the way they are used as well as the way they were intended to be used.

As such, it is impossible to give a blanket *fatwa* (religious ruling) on tokens when their usage and intended use case can be highly divergent and cross multiple Shariah rulings. Also, token/ICO design are also constantly evolving; so are regulations from the appropriate authorities.

As mentioned, these are the guidance notes for the contemporary Islamic scholars to consider when it comes to the legitimacy of cryptoassets according to the Shariah. The assessment of Shariah-compliance too should include the procedural processes from creation to the result of any cryptoassets and its mechanisms. For Muslim participation, before launching a project of any cryptoassets it should be scrutinized as per Shariah guidelines, and clarification should be sought from Shariah experts who have the relevant economic, financial and technical (blockchain and token experience) capability.

Progressive Importance of CyberSecurity

The growth of cryptoassets and cryptoexchanges around the globe is growing to be relentless. At the same time, cyberattacks have increased, including scamming and hacking attempts, and these events have become inevitable if money and wealth is at stake.

The first historical heist happened in the cryptoworld in 2014 when the largest bitcoin exchange of that time, Mt Gox, was hacked by cyberhackers and the cryptoexchange was attacked so badly that it had to be declared bankrupt. This hack was followed by the DAO hack faced by Ethereum in 2016 when the criminals siphoned away one-third of funds—about US\$50 million dollars. The second largest bitcoin heist happened in the same year in 2016 at a Hong Kong-

based cryptocurrency, Bitfinex, which lost 120,000 BTC that day, worth US\$72 million. They have since bounced back into the cryptoworld and back into the mainstream.

The year 2017 suffered its own attacks when the data from thousands of servers and nodes were attacked in an unprecedented manner. The entire year of 2017 saw the cryptocurrency exchanges lose around US\$66 million in cyberattacks, but it was much worse in the first half of 2018 according to Roh (2018). So far, it is recorded that a total of US\$761 million has been stolen by hackers from the various cryptocurrency exchanges. It is also estimated by the report that this value will hit US\$1.5 billion by the end of 2018. The two major cryptocurrency attacks in the first half of 2018 were the Coincheck hack in Japan, which lost US\$500 million and the Coinrail hack in South Korea where the exchange lost US\$40 million (CCN, 2018).

It has also been reported that cryptocurrency is being used as a tool for cyber extortion payments. With regard to this, the U.S. Financial Crimes Enforcement Network (FinCen) has banned one of the largest unregulated cryptocurrency exchanges—BTC-e. The CEO was arrested for his involvement in a 300,000 bitcoin heist. In that exchange, only 5% of the total transactions were actual bitcoin transactions and 95% of them were cyber extortion payments (University of Cambridge, 2018).

There are many factors behind the increasing number of cyberattacks including lack of right and skilled talent in cybersecurity, especially for exchanges. The attacks expose massive security concerns on cryptocurrency systems, and their lack of protection for the assets on their platforms and robustness to respond to attacks and reduce loopholes within their systems. This requires a clear strategy of cybersecurity by cryptocurrency exchanges to decipher and defend from attacks in a decentralized anonymous network.

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Chapter 3

Importance of Fintech and Its Applications

Introduction

This chapter covers the importance of fintech within two important perspectives: the financial services industry perspective and digitalization or technological perspective. Financial innovation is reshaping the different areas of the financial services industry, that is, finance and investment, financial operations and risk management, cost, price, and return, payments, and remittances and crowdfunding.

New digital innovative and advanced technologies are reshaping the value proposition of existing financial products and services. Fintech is becoming more and more disruptive by leveraging the latest and advanced technologies such as blockchain, cloud computing, big data analysis, internet of things (IoT), robo-advisory, and artificial intelligence (AI). In this section, technologies that are being used by fintech to provide financial services and products are discussed in detail. By deploying these technologies, financial innovations can provide agility, transparency, cost effective and customer centric products and services.

Today, we live in a connected global world with the availability of the internet and the beginnings of 5G. The world is going to be better connected and “smarter” due to the emergence of new innovative and digital tools including smart wearables and devices, smart houses, smartphones, mobile health care, and much more. In this era of the IoT, the psychological behavior of customers and consumers of every industry has been changed. They demand services, wherever they are, whenever they want and at any time, quickly. Their approach, thought-process, and decision making about products and services have changed.

Financial innovation is rising because technological advancement has enabled a deeper understanding of consumer behavior and customer preferences. Getting to the heart of how people buy and receive information to make their buying decisions is critical to any business today. Cognitive analytics can also help financial service providers reach out to unbanked and underbanked people and provide better access to finance for them when psychological biases are determined, understood, and overcome. This will lead to a great leap toward financial inclusion.

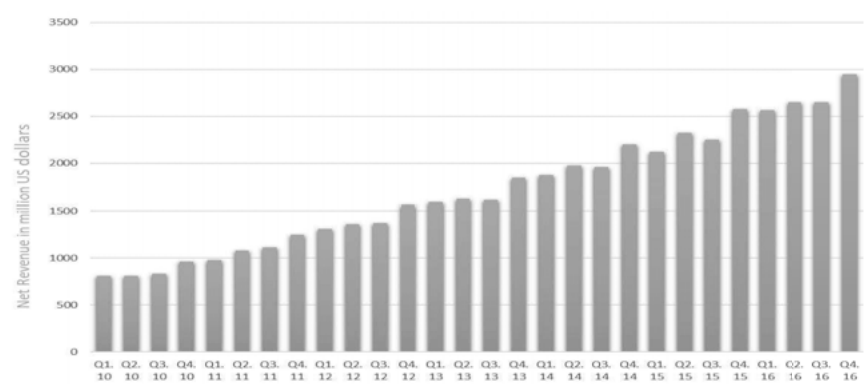
There has been a storm of financial innovation from the customers’ perspective, enabled by rising customer expectations for more personalized and digital experiences, enhanced access to venture capital funding, reduced barriers to entry and accelerated advancements in technology.

Financial Innovation within the Financial Services Industry Perspective

Payments Industry

Payments in historical perspective have been utility products; basically, transactional and tactical in nature and volume-driven. The reality is that a payment was often deemed as merely the final and last step in a transaction, with limited and restricted opportunity to provide value-added solutions or services (BNY Mellon, 2014).

But today it is not the same; the payments industry now is in a state of continuous change, underlying several cutting-edge economic, technological, and demographic factors across the length and breadth of the value chain. The industry is witnessing rapid development in innovations across the value chain, thus making it more splintered. New entrants called nonbanking payment systems in the form of fintech companies and established big tech giants (PayPal, Apple, Facebook, Google, Amazon) have caused major disruptions and have nullified the traditional intermediation in major parts of banking and the payments landscape. The first and most effective symbol of the fintech revolution can be perceived within the payments services industry. PayPal is identified as the most successful and strongest player in the field of the payment industry. Statistics shows the net revenue of PayPal during, Q4'16, at 2.98 billion U.S. dollars (Statista, 2016) (see Figure 3.1).



Source: (Statista, 2016).

Figure 3.1: PayPal's Quarterly Net Revenue (2010–2016)

Eventually, a payment in 2020 will be about providing strategically important solutions and transferring value in support of broader activity in several areas including investment, trade, retail, public and commercial sectors. The PwC Market Research Center forecasts that the number of noncash transactions will also grow by 69% from 2013 to 2020 and the transactions value per minute will be one million (PricewaterhouseCoopers, 2016).

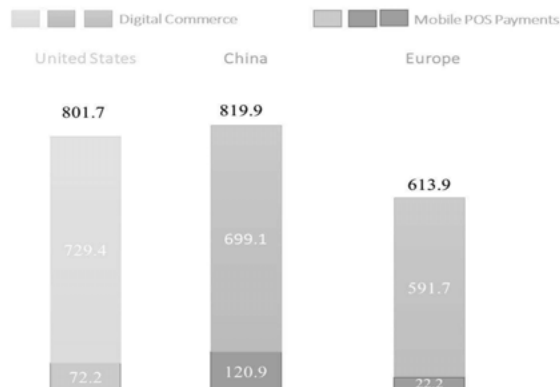
Cloud computing, open source software, big data and analytics, developers on demand, social media, open app stores for distribution, and blockchain can, or will, enable rapid technology adoption and deployment in the financial services industry especially in the fintech sector and in particular, the payments industry. These technologies could leapfrog antiquated payments mechanisms and systems in several areas such as cross border payments. In addition, the use of Bluetooth, NFC, QR codes in contactless merchant-based payments is also threatening the existing payments models (PricewaterhouseCoopers, 2016).



Figure 3.2: Digital Payments

Digital payments can be defined as noncash transactions processed through digital channels and include digital commerce, mobile payments and peer-to-peer (P2P) money transfers. Figure 3.2 illustrates the definitions of these types.

The global market size of digital payments at the end of 2016 is expected to be US\$2.221 trillion. Among the different regions United States accounted for 29% of global digital payments, followed by China who led the mobile payment transaction value with US\$467.7 billion in 2016. Statista forecasts that U.S. mobile payments will grow at an annual rate of 62% between 2016 and 2021. Digital payments were one of the main drivers of all fintech transaction value and accounted for at 85% in 2016 (Statista, 2016). In 2017, with a global transaction value of US\$2.754 trillion, the digital payment segment remained the biggest segment in the fintech industry (Statista, 2017).



Source: Modified from Statista, 2017.

Figure 3.3: Digital Payments Transactions Value in 2017 (US\$ Billion)

Crowdfunding and P2P Lending

P2P lending is defined as “the practice of lending money to individuals or businesses through online services that match lenders directly with borrowers.” P2P stands for peer to peer and P2P lending is also called debt-based crowdfunding and more recently, market place lending or MPL.

The largest P2P platform in the world in terms of issued loan volume and revenue is the Lending Club, which was launched in 2006 in San Francisco. Table 3.1 shows the financial results of the Lending Club for the quarter, which ended September 30, 2016.

Table 3.1: Financial Results of Lending Club Q3’2016

| (\$ in millions) | Three Month Ended | | | Nine Months Ended September 30, 2016 | |
|---------------------------------|-----------------------|---------------|-----------------------|---|---------|
| | September 30, 2016 | June 30, 2016 | September 30, 2015 | 2016 | 2015 |
| Organizations | 1,972.0 \$ | 1,955.4 \$ | 2,235.6 \$ | 6,677.5 \$ | 5,782.5 |
| Operating Revenue | 112.6 \$ | 102.4 \$ | 115.1 \$ | 366.3 \$ | 292.2 |
| Net Income/ (Loss) ¹ | (36.5) \$ | (81.4) \$ | 1.0 \$ | (113.7) \$ | (9.6) |
| Adjusted EBITDA | (11.1) \$ | (30.1) \$ | 21.2 \$ | (16.0) \$ | 45.2 |

(1) Includes US\$1.7 million of goodwill important in the quarter ended September 30, 2016 and US\$37.1 million year to date in 2016.

Source: Lending Club Report, Q3’2016.

This is a vigorous and interesting part of financial innovation for lenders due to the potentially high returns, simplified application process, and quick lending decisions, but these are linked with high risks because of limited guarantee of the amount repaid. The opportunities posed by P2P lending may have a significant impact on financial institutions. P2P lending also provides loans to those entrepreneurs and small and medium-sized enterprises (SMEs) who can not get loans from regulated financial institutions, for example, banks. According to Morgan Stanley, it is expected that marketplace lending will approximate US\$290 billion by 2020, averaging 51% growth per year. But in a more optimistic case, this sector is seen to be exceeding US\$490 billion by 2020 (Coraggio, 2017).

Crowdfunding is a term that refers to a practice of generating funds or capital investments for a reasonable cause, project, or enterprise by getting funds from many individuals or organizations. Crowdfunding is adopted when an innovative and new idea that has the potential to generate revenue and create jobs demands financial support to become a reality. It mostly takes place on crowdfunding platforms (CFPs), that is, internet-based platforms that connect fundraisers to funders with the objective of funding a particular campaign from typically many individuals (Belleflamme, Omrani, & Peitz, 2015). These CFPs provide access to funds and capital for a segment of the population who can not easily access it through traditional means.

Crowdfunding was started by a Boston musician and computer programmer (Brian Camelio from the United States) who for the first time launched a project based on the website ArtistShare in 2003. Maria Schneider's jazz album "Concert in a Garden" was the first project of ArtistShare. This campaign raised about US\$130,000 that enabled her to produce music, pay her musicians, etc. Eventually, her album won the 2005 Grammy Award (Freedman & Nutting, 2015). After the success of this first CFP, many CFPs have emerged in the market. The key players in the present global crowdfunding market are Patreon, Gofundme, Indiegogo, Kickstarter, and Teespring. Other prominent vendors in the market are CircleUp, Causes, Crowdfunder, Crowdrise, FirstGiving, Fundable, Donor-Choose, GiveForward, FundRazr, Gust, Innovational Funding, FundRazr, Kiva, Innovational Funding, RocketHub, and Youcaring (Research and Markets, 2016).

A research firm provides an overview of the American crowdfunding CFP as of January 2017, which shows that as of that month, the number of launched projects on Kickstarter amounted to 335,396, and the success rate among those amounted to 35.75% (see Table 3.2). Kickstarter is one of the largest platforms in terms of projects and revenue.

Table 3.2: Key Statistics for Kickstarter

| Projects and dollars | Projects U.S dollars. Success rates in percent |
|--|--|
| Launched projects | 335,396 |
| Live dollars millions U.S dollars | 18 |
| Live Projects | 3,788 |
| Success rate (%) | 35.75 |
| Successful dollars (billion U.S. dollars) | 2.49 |
| Total dollars pledged (billion U.S. dollars) | 2.84 |
| Unsuccessful dollars (million U.S. dollars) | 3.26 |

Source: Collated from Statista (2017) and Kickstarter.

Analysts forecast the global crowdfunding market to grow at a CAGR of 26.87% during the period 2016–2020 (Research and Markets, 2016). Statista forecasted that transaction value in the crowdfunding segment would amount to US\$7.23 billion in 2017 and is expected to show an annual growth rate (CAGR 2017–2021) of 27.3% resulting in the total amount of US\$18.97 billion in 2021. It is also estimated that the average funding per campaign in the crowdfunding segment amounted to US\$992.66 in 2017. In addition, Statista also forecasts that in the crowdfunding segment, the number of funding campaigns will amount to 13,784,220 by 2021 (Statista, 2016).

The crowdfunding sector has brought innovative disruptive models to giant existing industries like transportation and real estate, leveraging advanced technologies and the internet to generate massively scalable businesses. Crowdfunding is an easy-to-access alternative for entrepreneurs as compared to regulated traditional financial institutions.

Neo-Banking

The emergence of neo-banks is considered as a paradigm shift in the banking industry (Oracle, 2017). These neo-banks are also called digital only banks, app-only start-up banks, and challenger banks. Neo-banking is not merely the distribution of data through the internet. It has in-built vision and aims to reach customers through digital omni channels and provide the services they want to them and through the channel of their choice. They do not have a separate digital team for digital-based projects; rather neo-banks have digital integration in their core. Neo-banks offer banking services in a simpler way and with a cost edge as compared to traditional banking products.

There are now about fifty-seven neo-banks operating in different jurisdictions and mostly located in the United Kingdom, like Atom, Monzo, Tandem, and Metro. These banks have raised millions of dollars of funding from different investors. Tandem has raised US\$77 million, Starling US\$70 million, Atom US\$268 million, and Monzo has raised US\$46 million (Skinner, 2017).

These banks are attracting customers in real time with their cheaper and better offerings to the tech savvy generation of this digital era. These challenger banks are a very promising avenue for reaching more and more customers through innovative business models and digital channels.

Asset under Management

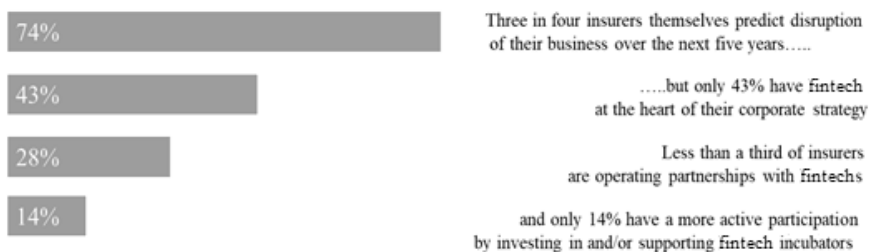
It is no doubt that a high level of disruption by financial innovation has already started to reshape the nature of payment and lending practices; a new wave of disruption is making its way into asset management. According to the PwC's global fintech survey, half of the respondents (53%) from the asset and wealth management industry expect that this sector is also under disruption by fintech companies (PricewaterhouseCoopers PwC, 2016a). Blockchain can be leveraged to build a client profile in a much more efficient way. Storing client profile data on blockchain allows for data points—profile data, preferences, net worth, account information, social media profiles—to be shared as needed, with each individual block of data being stored securely, but permissioned for access by the individual (read, write, edit) as needed. Also, a decentralized ledger technology allows the distribution of trusted value transfer and execution, allowing the disintermediation of authorities: the network becomes the intermediary. In this scenario, master ledgers held within clearing houses and banks, for instance, will be replaced by distributed ledgers with no intermediaries.

Regarding asset management, the UK is the largest fund management center in Europe and the second largest globally, accounting for over £6.2 trillion of assets under management (David, 2016). To date, blockchain has seen limited deployment in situations requiring large volumes of data, and the linear nature of the technology calls into question its ability to handle such a volume. In addition, firms face product complexity limitations, as initial rollouts of complex products can be difficult to change later on the distributed ledger.

InsurTech

InsurTech is one the segments of financial innovation addressing existing insurance opportunities, potentials, and challenges.

A 2016 PwC survey showed that insurance companies are very much aware of the fintech revolution and that 74% of the survey's respondents deemed financial innovations as a threat for their industry (PricewaterhouseCoopers, 2016b). It is the effect of an external factor, such as use of advanced technologies like big data and analytics and blockchain as well as the rise of the sharing economy and the ability to improve operations.



Source: PwC (2016) Payments in the Wild Tech World: Digitization and changing customer expectations.

Figure 3.4: PwC's Global Survey of Innovation in the Insurance Industry

PwC'S global survey 2016 depicts that 68% of insurance industry players are dealing with financial innovation and have taken concrete steps to tackle upcoming challenges and/or embrace opportunities. However, only the players who are most innovative have fintech at heart and want to explore more active ways to participate in the ecosystem, such as incubators and venture funds.

Insurers are introducing lifestyle apps that give additional consumer value on a continuing and constant basis. The constant consumer involvement will begin to reshape price as the key buying criterion. There is the example of Knip, which is an innovative digital insurance manager that provides users with an easy-to-understand analysis and overview of existing insurance policies, and services in an app. Clark is another insurance platform that works similarly to Knip. Insurance companies should transform digitally and understand the needs of a tech-savvy generation. Big data analytics can play a major role in this area through generating intuitive policies from processing massive data of users' behavior, which can provide insights into customer needs and forecast their requirements.

Deploying smart contracts powered by blockchain, customers and insurers can manage claims in a more transparent, responsive, and irrefutable manner. Some start-ups such as Blockstream, Everledger, and Tierion are working in this direction. Several companies such as insPeer, Peercover, Friendsurance, Lemonade are effectively using social media. Social media activities are helping insurance companies to improve their business and connect with customers. InsurTechs, with the help of IoT, are equipped to offer relevant packages based on real use and behavior rather than averaged statistics. Domotoz is an IoT solution for the connected home that offers a platform for home insurers to rate risk and manage claims (Let's Talk Payments, 2016).

Fintech within the Technological Perspective

New digital innovative and advanced technologies are, in a way, reshaping the value proposition of existing financial products and services. Financial innovation is becoming more and more disruptive by leveraging the latest and advanced technologies. In this section, we elaborate on the technologies being used by fintech companies to provide better financial services and products.

Blockchain and Its Applications

Blockchain is also called *distributed ledger technology*. Blockchain is a public ledger of business transactions. A blockchain network works as intermediary in a decentralized system for the exchange of assets and information. The two main technology components are “P2P” or shared data storage and public-key cryptography (Mainelli & Milne, 2016).

According to an Accenture report, blockchain is one of the most talked about topics in the present financial services industry. There are 90% of bank executives who are interested in blockchain and currently their banks are exploring the use of blockchain in the payments industry. Moreover, this report also highlights the benefits of using this technology in the payments industry: lower frictionless cost, shorter settlement time, reduced errors, new revenue opportunity, and lower administrative cost (Accenture, 2016a).

More than fifty banks including Barclays and JPMorgan Chase have joined the R3 consortium. This consortium has objectives to find ways to use the blockchain as a decentralized ledger to track money transfers and other transactions. R3 has plans to make its technology open source, which could speed up its wider adoption. Nasdaq Inc. is already using blockchain in collaboration with start-up

Chain.com for trading securities in private companies. The Australian Stock Exchange has started working with blockchain start-up Digital Asset Holdings to catalyze its clearing and settlement services in the equities market (Kharif, 2016).

Fintech start-ups including Chainalysis and IdentifyMind Global are helping banks comply with KYC (Know your Customer) and AML (Anti Money Laundering) regulations in the deployment of blockchain for banking services (Deloitte, 2016b). Santander, UniCredit, Reisebank, UBS, ATB Financial, CIBC, and the National Bank of Abu Dhabi are all working with Ripple's technology, which deploys a distributed ledger of the sort that also underpins bitcoin. HSBC and State Street have successfully tested blockchain in bond transactions in 2016, while Bank of America announced a partnership with Microsoft to experiment with the system (Shen, 2016).

Blockchain technology has a big potential beyond cryptocurrencies such as in the payments industry, trade finance, capital markets, insurance, and investment management. There are three main blockchain benefits for the payments industry: efficiency, disintermediation, and transactions cost reduction. Blockchain can provide an efficient infrastructure for the speedy settlement of money movement and decrease the need to use intermediary entities, like banks, for cross border payments.

We will delve much deeper into this truly revolutionary technology in Chapter 5 as well as its extended use cases in Chapter 6.

Cloud Computing

Cloud computing is the on-demand delivery of compute power, database storage, applications, and other information technology (IT) resources through a cloud services platform via the internet with pay-as-you-go pricing. Rather than owning their own computing infrastructure or data centers, companies can rent access to anything from applications to storage from a cloud service provider (CSP). One benefit of using cloud computing services is that firms can avoid the upfront cost and complexity of owning and maintaining their own IT infrastructure, and instead simply pay for what they use, when they use it. In turn, providers of cloud computing services can benefit from significant economies of scale by delivering the same services to a wide range of customers.

Building the infrastructure to support cloud computing now accounts for more than a third of all IT spending worldwide, according to research from IDC.¹

¹ <https://www.idc.com/getdoc.jsp?containerId=prUS42831017>

Meanwhile, spending on traditional, in-house IT continues to slide as computing workloads continue to move to the cloud, whether that is public cloud services offered by vendors or private clouds built by enterprises themselves.

Gartner Research² predicts that around one-third of enterprise IT spending will be on hosting and cloud services for the next few years indicating a growing reliance on external sources of infrastructure, application, management and security services. Analyst Gartner predicts that half the global enterprises using the cloud now will have gone all-in on it by 2021.

Cloud computing has become necessary to our economy due to our need for storing large amounts of data and the requirement to have it accessible easily. The U.S. National Institute of Standards and Technology (NIST) has defined it as “as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort” (Hawes, 2010). There are three major categories of cloud computing as services: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). These cloud services offer on-demand data access and ubiquitous communications. Cisco forecasted that CSPs will process more than three-quarters (78%) of IT workloads by 2018. In TechTarget’s forecast, 80% of the financial services institutions will run on hybrid cloud architecture by 2018 (TechTarget, 2016).

Big Data Analysis

International Data Corp (IDC) defines big data as “the intelligent economy produces a constant stream of data that is being monitored and analyzed. Social interactions, simulations, mobile devices, facilities, equipment, research and development (R&D), and physical infrastructure all contribute to the flow” (IDC, 2012).

According to IDC, the market for big data technology and services will grow at a CAGR of 23% through 2019. IDC further predicted that annual spending will also reach US\$48.6 billion in 2019 (Olavsrud, 2015). The volume of data is growing exponentially, and it is expected that, by 2020, there will be more than 16 zetta-bytes (16 trillion GB) of useful data generated (Turner et al., 2014).

There are many ways for the financial services industry to achieve business advantages by mining and analyzing data. These include enhanced detection of fraud, retail customer service, and improvement of operational efficiencies. Many

2 <http://www.gartner.com/smarterwithgartner/cloud-computing-enters-its-second-decade/>

fintech companies are also leveraging on big data to provide more customer-focused and intuitive services.

In 2016, the White House published a report exploring that big data can be used to reveal or possibly reduce employment discrimination by promoting efficient and ethical mechanisms for mitigating discrimination in employment opportunities. The White House report also showed that by using big data, educational opportunities can be further increased, while improved algorithms that can potentially help law enforcement become more effective, transparent and less discriminatory (The White House, 2016). The potential for big data is expected to impact all sectors, from healthcare to media, from energy to retail (Manyika et al., 2011).

There are several ways for the financial services industry to achieve business advantages by mining and analyzing data. These include enhanced detection of fraud, retail customer service, and improvement of operational efficiencies. Big data can also be used to identify exposure in real time across a range of sophisticated financial instruments like derivatives. Predictive analysis of both internal and external data results in good, proactive management of a wide range of problems from credit and operational risk (e.g., fraud and reputational risk) to customer loyalty and profitability. Many organizations are building their core business on their ability to collect and analyze information to extract business insights. Big data technology adoption within industrial sectors is not a luxury but an imperative need for most organizations to survive and gain competitive advantage.

Internet of Things

The IoT is becoming an increasingly popular topic of conversation in the digital age. It is a concept that not only has the potential to impact how we live but also how we work. But what exactly is the IoT and what impact is it going to have?

The IoT, refers to billions of physical devices around the world that are now connected to the internet, collecting and sharing data. Thanks to cheap processors and wireless networks, it is possible to turn anything, from a phone to a drone, into part of the IoT. This adds a level of digital intelligence to devices that would be otherwise dumb, enabling them to communicate without a human being involved, and merging the digital and physical worlds.

Processors that were cheap and power-frugal enough to be all but disposable were required before it became cost-effective to connect billions of devices. The adoption of radio-frequency identification (RFID) tags—low-power chips that can communicate wirelessly—solved some of this issue, along with the increasing availability of broadband internet and cellular and wireless networking.

The adoption of IPv6—which, among other things, should provide enough IP addresses for every device the world is ever likely to need—was also a necessary step for the IoT to scale. Adding RFID tags to expensive pieces of equipment to help track their location was one of the first IoT applications. But since then, the cost of adding sensors and an internet connection to objects has continued to fall, and experts predict that this basic functionality could one day cost as little as 10 cents, making it possible to connect nearly everything to the internet.

According to the *Ericsson Mobility Report*, 84 million new mobile subscriptions were added in 2016 Q3, hitting a total of 7.5 billion. The number of mobile subscriptions is continuing to rise across regions. It is also estimated that by the end of 2022, there will be 8.9 billion mobile subscriptions. Mobile broadband subscriptions will also reach 8 billion, with a 90% growth rate. Many tablets have also been sold currently, but their use is limited without a mobile subscription. The reason of this is that the price difference between WiFi only models and those with mobile capabilities is still quite significant. Despite this, the number of tablets and PCs with mobile capabilities through subscription will increase 30% by 2022. The report also forecasts that by 2022, the number of smartphone subscriptions will reach 6.8 billion, with 95% of the subscriptions registered on LTE, WCDMA/HSPA, and 5G networks (Ericsson, 2016).

The IoT is an emerging and new paradigm in the science of computers and technology in a general sense. In recent years, it has invaded our lives without us being aware of it, yet it is gaining ground as one of the most promising technologies. The European Commission defines IoT as “things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts” (Atzori, Iera, & Morabito, 2010, p. 2).

The IoT was initially most interesting to business and manufacturing, where its application is sometimes known as machine-to-machine (M2M), but the emphasis is now on filling our homes and offices with smart devices. The number of objects able to record and transmit data to other objects is continually growing. It is forecasted that the number of devices connected to the internet will increase from 10 billion today to 50 billion by 2020 (Payvision, 2016). The IoT could give retailers, sellers and their banks access to real-time data on assets and services that they monitor as well as transparency on their goods in transit (Santander, 2015).

Robo-Advisors

Robo-advisors are digital platforms that provide automated and algorithm-driven financial planning services like investing. This service boasts of its ability to require little to no human supervision. A robo-advisor collects information from clients about their financial situation as well as their future goals. To do this, you are asked to answer a survey or a couple of online questions. From this, they use the data you have entered to offer advice.

The advent of modern robo-advisors has completely changed that narrative by delivering the service straight to consumers. After a decade of development, robo-advisors are now capable of handling much more sophisticated tasks, such as tax-loss harvesting, investment selection and retirement planning. The industry has experienced explosive growth as a result; client assets managed by robo-advisors hit US\$60 billion at year-end 2015 and are projected to reach US\$2 trillion by 2020. Other common designations for robo-advisors include “automated investment advisor,” “automated investment management” and “digital advice platforms.” They are all referring to the same consumer shift toward using fintech applications for investment management.

There are emerging firms that are leveraging on client algorithms and information to develop automated portfolio allocation and investment recommendations tailored to the individual customers. Such firms have been termed as “robo-advisors.” Clients can easily access robo-advisory through digital user channels for very low fees and sometimes for free (Deloitte, 2016a).

Robo-advisors can eliminate behavioral biases and handle routine account maintenance without human involvement. They quickly attained market traction, overseeing US\$19 billion by the end of 2014. KPMG and CGI forecast that the number will hit US\$2 trillion in assets by 2020 (Patpatia & Association and CGI, 2016). In addition, KPMG’s 2016 survey forecasted that 75% of survey’s respondents are interested in robo-advisory services (KPMG, 2016). MyPrivateBanking, a research firm, estimated that hybrid robo services will rise by 2020 to a size of US\$3.7 trillion assets worldwide; by 2025 the total market size will grow to US\$16.3 trillion (MyPrivateBanking, 2016).

A Japanese insurance company, Fukoku Mutual Life Insurance, has replaced more than 30 of its staff by using IBM Watson cognitive computing software robot known as Amelia, which can understand the semantics of the language and can answer business queries like a human. The Japanese company has plans to use Amelia to read medical documents that are used to assess payments. Although the robots will eventually calculate payment amounts, the final approval decisions will still be made by qualified human personnel (Computer Weekly, 2017).

The main advantage of robo-advisors is that they are low-cost alternatives to traditional advisors. By eliminating human labor, online platforms can offer the same services at a fraction of the cost. Most robo-advisors charge an annual flat fee of 0.2% to 0.5% of a client's total account balance. That compares with the typical rate of 1% to 2% charged by a human financial planner, and potentially more for commission-based accounts.

Robo-advisors are also more accessible. They are available 24/7 if the user has an internet connection. Furthermore, it takes significantly less capital to get started, as the minimum assets required to register for an account are typically in the hundreds to thousands (US\$5,000 is a standard baseline). One of the most popular robo-advisors, Betterment, has no account minimum at all.

In contrast, human advisors do not normally take on clients with less than US\$100,000 in investable assets, especially those who are established in the field. They prefer high-net-worth individuals who need a variety of wealth management services and can afford to pay for them.

Efficiency is another significant advantage these online platforms have. For instance, before robo-advisors, if clients wanted to execute a trade, they would have to call or physically meet a financial advisor, explain their needs, fill out the paperwork, and wait. Now, all of that can be done with the click of a few buttons in the comfort of one's home.

Robo-advisors hold the same legal status as human advisors. They must register with the U.S. Securities and Exchange Commission to conduct business, and are therefore subject to the same securities laws and regulations as traditional broker-dealers. The official designation is "Registered Investment Adviser," or RIA for short. Most robo-advisors are members of the independent regulator Financial Industry Regulatory Authority (FINRA) as well. Investors can use BrokerCheck to research robo-advisors the same way they would a human advisor.

In the United States, assets managed by robo-advisors are not insured by the Federal Deposit Insurance Corporation (FDIC), as they are securities held for investment purposes, not bank deposits. This does not necessarily mean clients are unprotected however, as there are many other avenues by which broker-dealers can insure assets. For example, Wealthfront, the second-largest robo-advisor in the United States, is insured by the Securities Investor Protection Corporation (SIPC).

Artificial Intelligence

In 1956, the fathers of "modern" AI, John McCarthy, Marvin Minsky, Allen Newell, Claude Shannon, Nathaniel Rochester, and Herbert Simon came together for

summer school at Dartmouth College (New Hampshire) under the hypothesis that every aspect of intelligence and learning can in principle be so precisely explained that a machine can be made to simulate it. That date is considered the birth of AI because after that time numerous research groups around the globe began to engage in the construction of artificial systems with the avowed goal of equaling, emulating, or even surpassing human mental and physical abilities (Lungarella et al., 2007). In the 1960s, the U.S. Department of Defense took interest in this type of work and began training computers to mimic basic human reasoning. For example, the Defense Advanced Research Projects Agency (DARPA) completed street mapping projects in the 1970s and produced intelligent virtual assistants in 2003.

AI is an area of computer science that emphasizes the creation of intelligent machines that work and react like humans. AI makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks. Using modern technologies, computers can be trained to accomplish specific tasks by processing large amounts of data and recognizing patterns in the data.

As such AI has become a hot topic, with many talking about the advantages that it can bring to the highly regulated financial services industry. AI can help banks in their anti-money laundering (AML) and counter-terrorism financing (CTF) screening or employee misconduct detection efforts by replacing costly functions that are currently done manually by humans (Arslanian, 2016).

Another example is that of the Swedish bank, SEB, which is using AI software from IPsoft for its customer service function, after achieving success in an internal project. While a customer service experience of the future may involve automation of some kind, the help of a virtual human called a cognitive agent may be the next evolutionary step. Cognitive agents are virtual assistants that can supposedly think and act like humans, be able to handle complex interactions and learn from situations. SEB in Sweden is the first bank that has decided to use IPsoft's cognitive technology for customer services (Flinders, 2016). For SEB, it is all about scalability and the fact that they now have customer service solutions that they can roll out quickly.

Machine Learning and Deep Learning

Machine learning (ML) is a branch of AI based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention. It was born from pattern recognition and the theory that computers can learn without being programmed to perform specific tasks; researchers interested in AI wanted to see if computers could learn from data. The iterative aspect of ML

is important because as models are exposed to new data, they can independently adapt. They learn from previous computations to produce reliable, repeatable decisions and results. Essentially it works on a system of probability—based on data fed to it, it can make statements, decisions or predictions with a degree of certainty. The addition of a feedback loop enables “learning”—by sensing or being told whether its decisions are right or wrong, it modifies the approach it takes in the next iteration (future).

ML applications can read text and work out whether the person who wrote it is making a complaint, making a contractual agreement, offering congratulations or simply making a declaration. They can also listen to an instruction, decipher the speaker’s accent, and find pieces of information to match the request, or decide what to do next if the information is unavailable. The idea was to be able to communicate and interact with electronic devices and digital information, as naturally as we would with another human being through ML and neural networks. Think Siri, Alexa, or Cortana.

Within the field of data analytics, ML is a method used to devise complex models and algorithms that lend themselves to prediction; in commercial use, this is known as predictive analytics. These analytical models allow researchers, data scientists, engineers, and analysts to “produce reliable, repeatable decisions and results” and uncover “hidden insights” through learning from historical relationships and trends in the data.³ In the current AI revolution, ML has entrenched itself to eventually develop human-like AI. In the last few years, we have begun to hear about deeper concepts than ML—*deep learning*.

Deep learning is used by Google in its voice and image recognition algorithms, by Netflix and Amazon to decide what you want to watch or buy next,⁴ and by researchers at MIT to predict the future.⁵ MIT designed a predictive system, a deep-learning method called adversarial learning, wherein two neural networks try to outsmart each other. Using this technique, the researchers were able to generate predictions that were deemed to be realistic 20% more often than a baseline model of other computer-generated methods.

Because deep learning work is focused on developing big data neural networks, they become what are known as deep neural networks—complex logic networks to deal with classifying very large datasets, like Google’s massive image

³ https://www.sas.com/en_sg/insights/analytics/machine-learning.html

⁴ <https://www.forbes.com/sites/bernardmarr/2016/12/08/what-is-the-difference-between-deep-learning-machine-learning-and-ai/#1980ca7b26cf>

⁵ <https://www.ibtimes.com/artificial-intelligence-mit-researchers-create-deep-learning-algorithm-can-peer-2452024>

library, or Twitter's never-ending barrage of tweets. With datasets as comprehensive as these, and logical networks sophisticated enough to handle their classification, it becomes trivial for a computer to specify something (a lot of things really) with a high probability of accuracy in what it presents to human beings.

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Chapter 4

Emergence of Islamic Fintech and its Developments

Introduction

Shariah rules and regulations are the underlying tenets of Islamic finance products. The terms and conditions of these contracts are always written in legal documents and these documents need to be executed in the right way to ensure proper compliance. At the moment, the mechanisms are manual and the processes take a lot of time and are costly. Advanced technologies such as artificial intelligence and automatable smart contracts have the potential to significantly improve the overall process, efficiency, transparency, and saving of time.

With the digitalization and technological revolution, the financial services industry is witnessing the most significant transformational development of the era, one that is certainly positive and inclusive for these populations. Thus, automation is increasingly developing not only as a tool that can improve financial performance, but also functioning as an effective tool to enhance sustainability and efficiency. Technology has the potential to contribute effectively, particularly in the area of financial inclusion and sustainable development, offering new ways for integration for those who are excluded from the financial services industry and have a superior financial and social status, while ensuring that they have access to a wide range of financial products in line with their values. Rather than looking at the fintech revolution as unwelcoming, we should leverage on it to advance economic and social goals in embracing it as an opportunity, because its potential for social impact is enormous.

There is no doubt that Islamic fintech is at its infancy, and a very limited number of platforms have emerged. As compared to the global (conventional) fintech landscape, the size of Islamic fintech is indeed very small. But the start-ups that have emerged in these last three–four years, have shown credible performance and acceptability by the Islamic markets. Islamic crowdfunding has been the main segment of Islamic fintech still, with several platforms already using some aspects of blockchain. Four Islamic countries, Brunei Darussalam, Malaysia, Bahrain and UAE, have issued regulatory frameworks for fintech to allow the banks, institutions and start-ups to collaborate and develop innovative business models and test them within controlled guidelines. These developments show that the global landscape of fintech adoption will continue to evolve as the regulators and industry work together in key areas of regulatory implications on new

technological advances in the financial sector for responsible development of products and services.

What Is Islamic Fintech?

As Shariah-compliant finance grows and institutions embrace mobile and internet banking, the sector believes it offers strong opportunities with meaningful steps being taken to develop fintech ecosystems in key markets to grow the industry. But how does one really define Islamic fintech?¹ How does it differ from conventional fintech for that matter?

Etymologically, Islamic fintech is the amalgamation of technology and Islamic finance, which means that any product or service that spawns from fintech must abide by the rules extracted from the Qur'an and Sunnah known as the Shariah. True to its fintech label, its digital distribution of Shariah-compliant financial products and services is delivered through innovative digital channels known as omni-channels. Islamic fintech platforms utilize revolutionary technologies like artificial intelligence (AI), blockchain, big data, extensive cloud computing and internet of things (IoT) devices in providing Islamic financial services in a more sophisticated and transparent way. Its activities will involve deploying new tech-based business models to promote economic, environmental, financial and social goals, which include better services across all Islamic financial services and product performance, and broader benefits like financial inclusion, poverty alleviation and social justice. Islamic fintech would enable greater access to Islamic financial services in cheaper, easier and more efficient ways to provide opportunities for financing, payments, and investment aligned to the intended objectives of the Islamic Divine Laws (*Maqasid Al-Shariah*).

Alignment between Islamic Finance and Fintech

The Islamic financial system has an in-built and inherent character of risk sharing and rule-compliance. In practice, however, Islamic banking and finance is no different from the conventional finance industry, which relies heavily on risk transfer and/or the shifting of risk from lender to the borrower. This incongruity does not sit comfortably on the different sections of the Muslim society with regards to Islamic banking and financial services. Since the emergence of Islamic banking

¹ Keep in mind the definition of fintech and the types of fintech products explained in Chapter 2.

in the 1960s and 1970s, this industry has faced much criticism due to its mimicking of conventional interest-based risk-transfer/shifting modus operandi of banking. Likewise, the consumers of Islamic banks expect guaranteed or fixed returns similar to existing conventional banks. This is a poor understanding of the profit-and-loss-sharing mechanism that an ideal Islamic finance system should uphold. The consumers, like the banks, should be willing to undertake the risk and share the outcome, be it profits or losses. This is the basis of risk-sharing or having “skin-in the-game.” Both parties have a vested interest in a transaction or investment and will likely work closely to achieve shared objectives. The core values of caring, cooperating, preventing possible harm, etc. are then ingrained in such agreements.

Today, Islamic banking and finance is heavily based on risk transferring and risk shifting. The balance sheets of Islamic banks show the concentration of two products, that is, *murabahah*, which is trade based mark-ups and *ijarah*, which is a lease-based product. Islamic banks have very low percentage of truly risk sharing products on their balance sheets, which are *mudarabah* (silent partnership) and *musyarakah* (joint venture). Also, Islamic banking and finance, which should have operationalized the ideals of the Shariah to pursue capitalistic goals *alongside* social aims, have made little headway in financial inclusion among the underbanked and unbanked population. The democratization of formal financial services is indeed crucial for the economic empowerment of the Muslim ummah, or the general public. The true soul of Islamic finance is to instill inclusivity and shared prosperity; at this stage, the current Islamic banking model does not seem fit to the bill. The transformation of Islamic banking institutions from a risk transferring to risk sharing model, should be built on norms and rules, which are the essence of a truly Islamic economy. It should not be a system to compete with the existing interest-based risk-transfer/shifting conventional system. The rhetoric of Islamic finance literature and conferences are enriched with the discussion of risk sharing but the real understanding and implementation of the risk sharing model is very limited and requires a disruption.

Islamic fintech provides the opportunity for the adoption and application of a risk sharing model in Islamic financial institutions through small innovative start-ups who want to contribute to the Islamic finance industry. One example is neo-banking or virtual banks. This Islamic neo-banking model provides the opportunities for financiers and investors who are looking for true Islamic risk-sharing, interest-free products and services, which are not currently possible through existing Islamic banks. The modus operandi of the Islamic fintech should be highly congruent with the asset-backed, interest-free, risk sharing, under-leveraged real sector model of the ideal Islamic economy.

Islamic fintech can then be articulated through the democratization of financial services and the delivery of financial services via new digital channels. Its essence should include the elimination of asymmetric information, fraud, no-confidence and distrust between counterparties, be they financial institutions, regulators, family offices and customers. It also reduces the deceptive ambiguity in the operations and business models of not only counterparty transactions but creates positive ripple effects throughout the entire supply chain within the Islamic economic eco-system. For instance, monitoring through a public distributed ledger (blockchain) in the application of smart contracts, Islamic fintech companies can bring more efficiency and transparency in their operations. Similarly, the usage of IoT devices in *takaful* can make insurance claims submission and processing more nimble and agile. The cash *waqf* (Islamic endowment) model on blockchain also could be a great breakthrough in *waqf* management too.

Social and ethical impacts of financial services are also one of the main promises of Islamic fintech. For example, the financing for a welfare project is often not possible through traditional banking and financial institutions, but now through crowdfunding, take, for example, LaunchGood and Skola Fund, it is possible for individuals and small businesses of any sector to get funding for their social impact projects.

Islam and Fintech in History

History has witnessed that Islamic banking at the commercial level started and emerged in the 1970s. From the banking perspective alone, Islamic finance started very late in the game as compared to conventional banking, which started in the 1660s with the formation of the Bank of England.

However, in the twentieth century, Islamic revivalists worked to define interest as *riba*, to enjoin Muslims to lend and borrow at “Islamic Banks” that avoided interest-bearing fixed rates. By the twenty-first century this Islamic Banking movement had created “institutions of interest-free financial enterprises across the world” (Choudhury, 1992). The movement started with activists and scholars in the late 1940s and early 1950s (Siddiqi, 1981). They believed commercial banks were a “necessary evil,” and proposed a banking system based on the concept of *mudarabah*, where shared profit on investment would replace interest.

And this revival of greater Islamic observance was not unjustified. The developments in the fields of social sciences, humanities, and natural sciences made by past Muslims were remarkable. They were the best innovators and inventors of their times. Their focus was serving time and money on learning, education

and making inventions. Muḥammad ibn Mūsā al-Khwārizmī² was one of the first to have introduced algebra, numeric digits, and the basic notions of algorithms to the world. These basics of algebra and algorithms are now considered the pillars of technology since every modern device and technology is based on some fundamental algorithm. Freedman (2006), in his book *Introduction to Financial Technology* clearly mentioned that the father and pioneer of the technological revolution was the Muslim Mathematician, al-Khwārizmī. *The Compendious Book on Calculation by Completion and Balancing*, translated into Latin by Robert of Chester in 1145, was used until the sixteenth century as the principal mathematical textbook of European universities.³ Unfortunately, the Muslims to date have been unable to follow the path of their great ancestors who had made defining and world-changing concepts, which still reverberate, centuries later, until today.

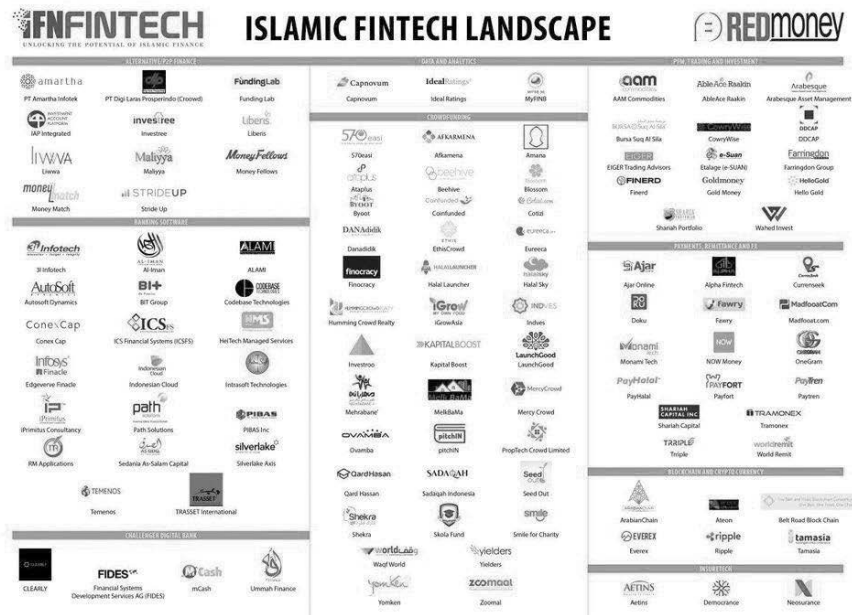
Nevertheless, the tide of the fintech revolution seemed to have awoken some segments of the Islamic society. About 120 Islamic fintech players have emerged on the Islamic fintech landscape; most of these 120 players are less than five years old. Comparatively, the conventional fintech global landscape consists of more than 2,000 fintech platforms; half of which have been around more than five years. In itself, it is encouraging to note that massive frustrations with the current Islamic banking and finance models are now being translated to wider innovation for improved models and use cases.

The excitement about fintech is not a just fantasy or a passing fad. Fintech is something that will put the whole financial industry (conventional *and* Islamic) on a level playing field. The segment that gives greater priority to innovation and openness, will capture future market share and dominance. For the Islamic finance industry, this can erase centuries of lagging behind in the banking game, and an opportunity to springboard alongside the conventional system to offer

2 Al-Khwarizmi's treatise on algebra (*The Compendious Book on Calculation by Completion and Balancing*, ca. 813–833 CE [8]:171) presented the first systematic solution of linear and quadratic equations. One of his principal achievements in algebra was his demonstration of how to solve quadratic equations by completing the square, for which he provided geometric justifications. He was known as the Father of Algebra. The term algebra itself comes from the title of his book (specifically the word *al-jabr* meaning “completion” or “rejoining”). His name gave rise to the terms algorism and algorithm. His name is also the origin of (Spanish) *guarismo* and of (Portuguese) *algarismo*, both meaning digit.

3 Fred James Hill, and Nicholas Awde (2003). *A History of the Islamic World*. p. 55. “‘The Compendious Book on Calculation by Completion and Balancing’ (Hisab al-Jabr wa H-Muqabala) on the development of the subject cannot be underestimated. Translated into Latin during the 12th Century, it remained the principal mathematics textbook in European universities until the 16th Century.”

and deploy competitive products that are Shariah-compliant through the effective use of new technologies for innovative business models and capabilities to scale.



Source: Islamic FinTech Landscape Red Money, 2018.

Figure 4.1: Islamic Fintech Landscape

Islamic Fintech Developments Around the Globe

Fintech has begun to penetrate into the Islamic finance space, where these new Islamic fintech platforms are leveraging on social media data and analyzing them for practical purposes such as targeted marketing and profiling user behavior. This section looks at the global landscape of Islamic fintech platforms (see Figure 4.1) and we divide them according to the different categories of their services and underlying technologies.

Islamic Fintech

Islamic fintech can be defined as the technologies that are deployed in Islamic finance to uphold and entrench Islamic rules and values in order to build a just, resilient and sustainable economy. It utilizes all the necessary elements of technology, which will disrupt cumbersome processes, bottlenecks, and inaccessibility of funds by the underserved segments of society. In the subsequent sections, we categorize the current existing Islamic fintech platforms and analyze their use cases and applications for the industry in order to serve their target markets more efficiently.

Islamic Crowdfunding

Although crowdfunding has only just gotten attention, it has a lengthy history with roots going back to the 1700s.⁴ The Statue of Liberty was partly crowdfunded in 1885 when Joseph Pulitzer, through his newspaper *The New York World*, launched a crowdfunding campaign⁵ to raise the remainder of US\$100,000 required to fabricate the base where the statue now stands. They raised \$101,091, from more than 160,000 donors, including young children, businessmen, street cleaners and politicians.

Modern crowdfunding gained traction in the United States when Brian Camelio, a Boston musician and computer programmer, launched ArtistShare in 2003. While conventional modern crowdfunding started to evolve in 2000s, modern Islamic crowdfunding only started to gain traction a decade later, when Eureeca formed in 2012.

Beehive

Beehive, based in Dubai, is the UAE's first online marketplace for peer-to-peer (P2P) finance. This platform facilitates access and faster processing of small and medium-sized enterprise (SME) loans for businesses and it also provides an opportunity for individual investors to generate returns higher than savings rates in an environment where risks are shared.

Beehive also works with Islamic legal advisors and Islamic financial services experts to establish structures that permit investments in a Shariah compliant

⁴ Alexander Pope set out to translate Greek poetry into English in 1713 and asked for subscribers to pledge two gold guineas to support his work in exchange for acknowledgements of an early edition of the book.

⁵ "The Statue of Liberty and America's Crowdfunding Pioneer." BBC.com. May 25, 2013.

manner. According to the CEO, Craig Moore, all businesses campaigning on their site are being checked to make sure that the business activities and the use of funds comply with the rules and principles of the Shariah. Any business that does not comply with the Shariah rules will be considered as a conventional investment and will be processed in the conventional way.

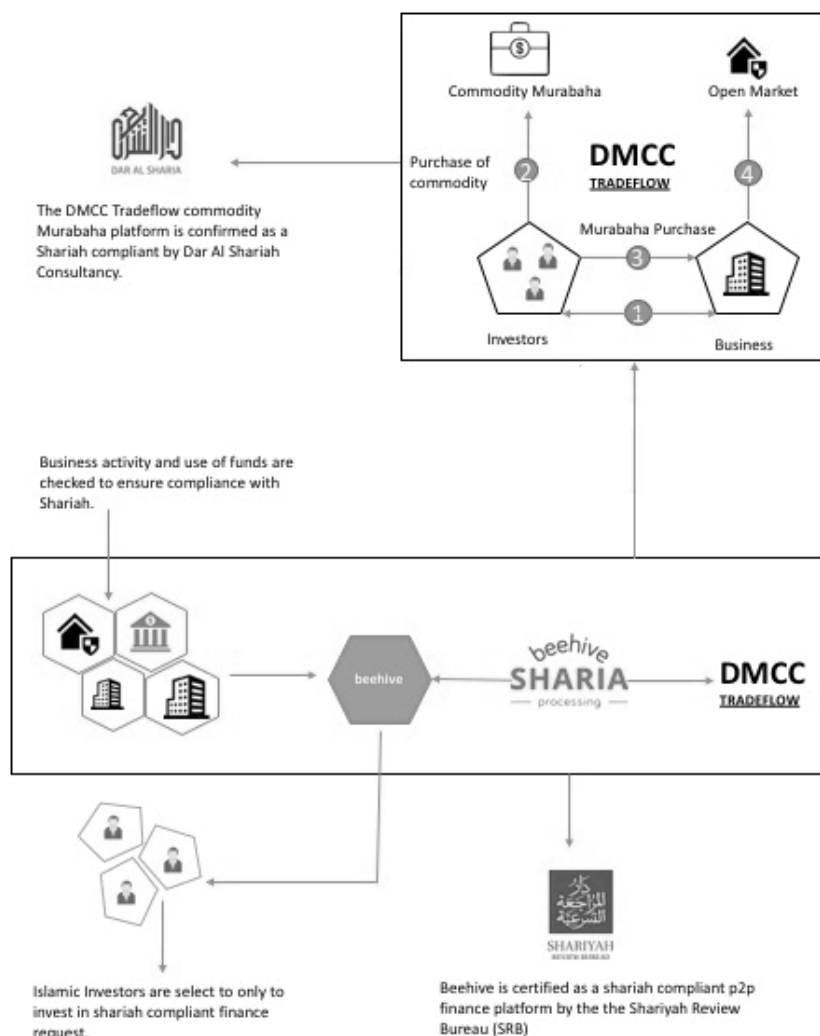
Beehive has launched a platform named Commodity *Murabahah* Trading Platform (CMTP) with the cooperation of UAE'S Dubai Multi Commodities Centre (DMCC). The CMTP facilitates the electronic transfer of ownership and possession via tradeable warrants (see Figure 4.2). This platform also provides a solution to the Islamic finance industry and access to locally stored Shariah compliant commodities for the execution of commodity *murahahah* transactions and transfers ownership and possession electronically. Apart from DMCC CMTP, Dubai also collaborates with Emirates Islamic and Emirates Islamic Financial Brokerage (EIFB) to offer the Nasdaq Dubai Murabahah Platform⁶—an online platform for Islamic financing.

Beehive uses commodity *murahahah* contracts to underpin loans by purchasing and resale of traded commodity on the Dubai Multi Commodities Centre at specified prices (see Figure 4.2). Beehive, which does not issue loans directly, has so far 250 funding requests thanks to an explosion of start-ups. It has 6,000 registered investors—mostly from the UAE—and has channeled a total of US\$40 million to borrowers according to Forbes⁷ (17 February 2018). In its first year, Beehive operated largely on the margins of the UAE's financial sector before it received a formal license in March 2017 after the Dubai Financial Services Authority (DFSA) issued regulatory guidelines around P2P lending. New regulations in Dubai and Bahrain signaled they were embracing fintech, leading to the introduction of fintech funds and accelerators.

With a proper P2P regulatory framework in place, Beehive was able to secure US\$5 million in a first venture round led by Riyadh Taqnia Fund in December 2017.

⁶ The Nasdaq Dubai Murabahah Platform uses *wakalah*-based (representative or agent-based) certificates, which enables Islamic financial institution to offer cash financing to customers in a quick and efficient manner.

⁷ <https://www.forbesmiddleeast.com/en/FinTech-startup-beehive-is-closing-the-gap-for-sme-finance-in-the-gcc/>



Source: Modified from Beehive.com

Figure 4.2: Working Process of Beehive

Easi Up

Easi Up was founded in 2014 in Paris, France. It is a platform that focuses on educational projects. This platform allows for everyone (namely European residents) to show and make visible their projects and campaigns for investors to get investment and funding to convert their dreams into reality. Because of the lack of proper funding, the activities are limited. But it provides an opportunity to youth

entrepreneurs and students for getting funds for promoting ethical and Shariah compliant projects through Islamic and ethical ways.

EthisCrowd

EthisCrowd is the world’s first real estate Islamic Crowdfunding Platform that facilitates the use of funds for real estate projects. Now, the platform has a community of 17,000 private investors that fund and invest in real estate activities in Asia.

The platform has established headquarters in Singapore and has branch offices in Kuala Lumpur, Jakarta, and South Africa. The platform has completed the real estate project of building houses in Indonesia, which has been crowd-funded US\$2.2. million in its first twenty months.



Source: EthisCrowd, 2016.

Figure 4.3: Track Record of EthisCrowd

The platform also presents opportunities to users who are interested in businesses and start-ups and can fund them from a minimum of US\$800 to get started. Club Ethis matches investors with a start-up that is based on the individual’s background and preferences. It is Shariah-compliant and does not deal typically with alcohol, pork, gambling, speculation, or loan and interest-based finance, which captures the Muslim audience and investors from Southeast Asia and the Middle East.

Ethis has collaborated with different communities and organizations including collaboration with TanganDiAtas.com, one of the largest SME/Entrepreneur groups in Indonesia, Kapital Boost based in Singapore, which provides hybrid

Islamic Crowdfunding and mainly focuses on SMEs, and with LOKAmotion Malaysia, which is a retail start-up incubator that is making waves in Malaysia.

In 2016, Securities Commission Malaysia awarded six P2P Lending licenses, one of which is the world's first license for Shariah-compliant P2P awarded to Ethis Kapital Sdn Bhd., making them the first authorized platforms in the ASEAN region.

Eureeca

Eureeca is one of the earliest equity crowdfunding platforms. It provides its member-investors, who include casual or angel investors and institutional firms, to buy shares in growth-oriented businesses. The platform launched in 2013.

The platform has received a license from the UK Financial Conduct Authority and Securities Commission Malaysia in 2015. The platform has offices in London, Dubai, and Kuala Lumpur. Eureeca offers potential investment opportunities from the Middle East, Europe, and Southeast Asia to a wide network of investors, according to its website (eureeca.com). It is not strictly Shariah-compliant nor provides halal (permissible according to Islamic rules) financing, but according to its managing director, Sam Quawasami, the platform provides equity finance, which in principle, is more aligned with the Islamic finance spirit of risk-sharing through *mudarabah* and *musyarakah* models.

FundingLab

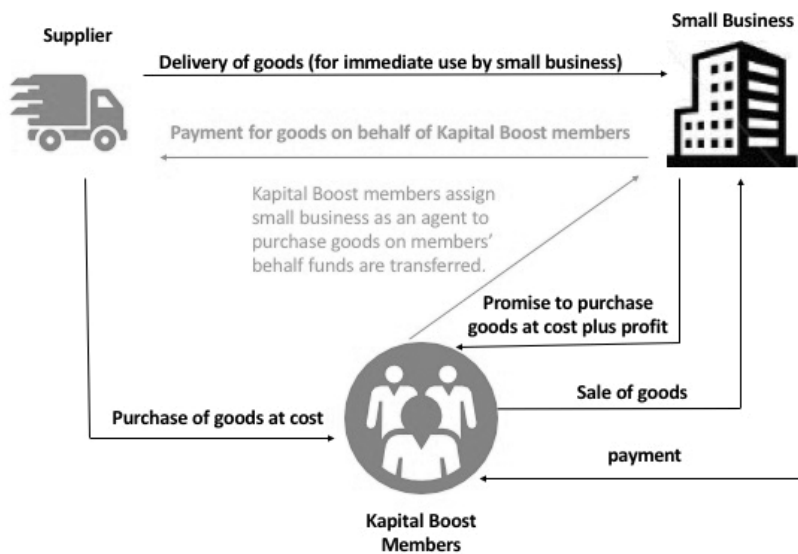
FundingLab is a nonprofit Scottish Charitable Incorporated Organization. The platform enables the underprivileged young entrepreneurs and students by providing financing through crowdfunding. The platform has adopted a reward-based crowdfunding model by making sure it complies with the Shariah.

The platform has a network of investors and users in Pakistan, Palestine, and Bangladesh and wanted to develop this crowdfunding model to help more people, especially young entrepreneurs, students, and recent graduates who want to start their businesses but have no or little capital. The platform intends to spark the spirit of doing business among Muslim youths, and has initiated collaborations with different platforms and academic institutions like LUMS, a renowned university in Pakistan.

Kapital Boost

Kapital Boost was founded in July 2015 specifically to focus and tackle the issues of lack of Shariah-compliant retail investment opportunities. The platform mainly focuses on micro, small, and medium-sized enterprises MSMEs, which

will lead to the growth and development of the less privileged communities. This Singapore-based platform adopted a hybrid crowdfunding model, which involves reward and donation-based crowdfunding—an option for investors to invest in MSMEs or partake in a donation campaign. This crowdfunding platform has received a Shariah pronouncement from the Financial Shariah Advisory & Consultancy (FSAC) on its *Murabahah* crowdfunding structure. The pronouncement process took several months to complete. As part of its review, FSAC’s Shariah Committee was presented with the business model, processes, legal structure, and documentation relating to Kapital Boost’s crowdfunding. Figure 4.4 depicts the working processes of Kapital Boost.



Source: Modified from Cosseboom, 2015.

Figure 4.4: Kapital Boost Working Process

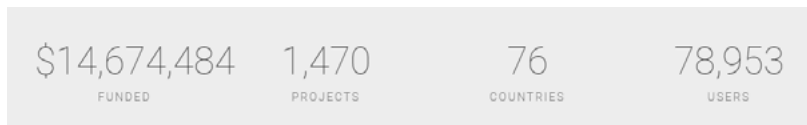
Kapital Boost provides asset purchase and invoice financing, which are used to help MSMEs and meet their capital needs. Kapital Boost matches MSMEs with investors who pool funds to collectively purchase goods or equipment and thereafter on-selling the same to the SMEs at a markup. Kapital Boost generates competitive annual returns (15–24%) for investors. Additionally, the platform is the only one in Singapore that does not charge an investor fee. Since its launch in July 2015, Kapital Boost has raised more than S\$1.3 million for twenty-six MSME cam-

paings, with an annualized average return of 22%. As of October 27, 2016, twelve of the campaigns have paid off their funding.

LaunchGood

LaunchGood is the largest Islamic crowdfunding platform mainly focused on the Muslim community worldwide, that started operations in October 2013. It is one of the most active crowdfunding platforms at present. Project creators choose a maturity date and a minimum funding goal and usually provide rewards for contributors at different levels. Co-founder and chief operating officer, Amany Killawi, distinguished LaunchGood from other platforms describing it as an empathic platform, which helps people raise funds with the help of a complementary campaign coach to provide support and feedback every step of the way. She claims that LaunchGood campaigns are twice as likely to succeed than other campaigns because they are invested in each campaign doing well, because every success is a success for the Muslim community. Other contributing factors include having the cheapest fees in the industry and access to a community that cares and believes in your cause.

Today, they have launched a wide range of crowdfunded projects, including those that go beyond helping only Muslim communities (e.g., repairing Jewish cemeteries, rebuilding torched churches, etc.) through their site and have raised their profile along with millions of dollars in doing so. The platform now has thousands of active users and donors in almost seventy-five countries, an attribute that reflects their truly inclusive Islamic spirit. Figure 4.5 shows the number of total projects launched by LaunchGood and quick snapshot of some of its significant statistics.



Source: LaunchGood.com

Figure 4.5: Snapshot of Projects and Funds and Coverage as of December 2017

LaunchGood has been featured in 2014 by the American Muslim Consumers Conference's Entrepreneur Showcase as one of the six emerging start-ups in a shark tank style competition for a \$10,000 prize.

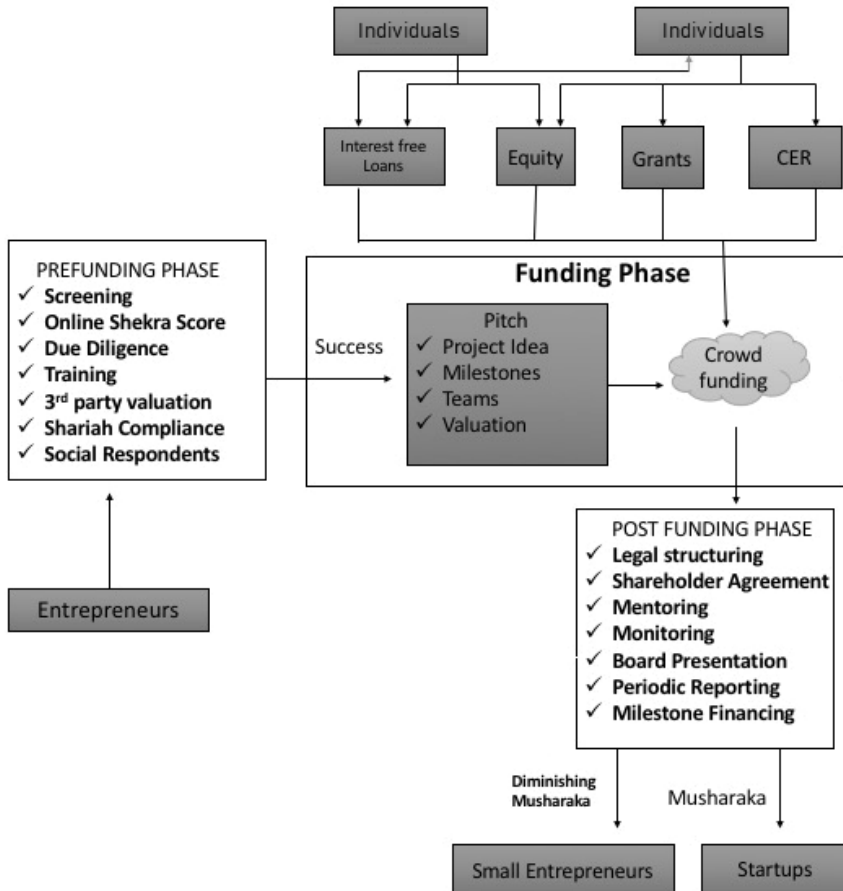
Narwi

Narwi was founded and launched in June 2015 by Silatech in Qatar. It is an online nonprofit Islamic crowdfunding platform that is enabled and supported by Kiva.org, which is one of the world's largest online microlending platforms. The projects financed by Narwi are financed through Shariah compliant products. The platform provides services in Palestine, Yemen, Iraq, Jordan, Egypt, Lebanon, and Somalia, and intends to expand to Morocco and Tunisia.

Narwi is a platform that allows donors to support very small and microenterprises. The microentrepreneurs can establish an endowment, or Narwi-Waqf, with as little as US\$25, which created a significant number of jobs in the Middle East and North Africa.

Shekra

The platform went “live” in Cairo in November 2016. There are seven founders of this platform who come from very different backgrounds such as aviation, technology, investment and banking, who have pooled their resources to support Egyptian start-ups. Shekra established a framework through which it defined its core characteristics and opportunities that exist in the MENA market. Unlike other crowdfunding platforms, Shekra relies on a closed network of investors due to the regulatory restrictions in the MENA region (Marzban & Asutay, 2014). Figure 4.6 describes Shekra's process flow.



Source: Marzban & Asutay, 2014.

Figure 4.6: Working Process of Shekra

Skolafund

Skolafund is a web platform for needy students, who have difficulty in paying off their school fees. They have no choice but to crowdfund for their higher education goals.

Skolafund went “live” in April 2015 with an alpha version website that lasted until August 2015. During this first period of four months, the platform raised approximately RM 25,000 from 125 members of the community to crowdfund six students. After this success, the team decided to increase their online presence and have crowdfunded more than forty-two scholarships and counting. They intend to make higher education accessible and affordable to those who qualify.

They strongly believe that no one should be deprived of education merely because they can not afford it.

Zoomal

Zoomal was launched in 2013 and asserted itself as a leading platform in the region. That provides equity crowdfunding. The platform has completed crowd-funding of 200 projects. The majority of the projects were related to Egypt, Jordan, Morocco, Algeria, and Lebanon.

The platform provides a financing alternative to the regulated institutions, i.e. banks and helps the individuals by leveraging the internet and social media (Oddone, 2015).

It does not specifically target the halal companies or Shariah compliant finance, but according to its chief executive officer (CEO), Abdullah Abbasi, most of the projects on the site are actually Shariah-compliant. He went further to say that they have a plan to develop a certification scheme for projects such as *sadaqah jari'ya* (voluntary ongoing charity) as Shariah-compliant products.

Islamic Fintech deploying Blockchain

Blockchain remains as the frontier of new technologies that will enable the fintech sector to the scale that few other technologies are able to. Successful deployment of a blockchain-based fintech solution by Islamic startups or institutions would greatly expand the breadth and depth of who they serve and the extent of how they can do so.

Blossom Finance

Blossom finance is a start-up that established first in San Francisco and later relocated to Jakarta, with the intention to focus on microfinance in Indonesia. Blossom did not make public the details of its first investment in a microfinance institution in Indonesia until May 2015.

According to Blossom's CEO, Matthew Joseph Martin, he became a Muslim in 2010 and thus developed an interest in Islamic finance, Blossom only gives money to those microfinance institutions, which operate on a profit-and-loss-sharing principle instead of risk transfer of interest-based systems. In fact, Blossom does not handle loans directly, it works with Shariah-compliant microfinance institutions. They make partnerships with institutions and the underlying process of collecting and disbursement of funds is operated as a sharing model using the blockchain technology.

The transfer of money from investors to microfinance institutions is done by deploying the blockchain technology, which reduces the costs and time, especially for cross-border money transfers. Through the whole process, Blossom ensures the implementation and adherence to Shariah rules, so as to move money within a short time, at low cost and also in a transparent way. The beneficiaries receive money in local currency (Indonesian Rupiah) and investors can invest and cash out their returns in local currencies like Euros, British Pounds, and U.S. dollars (Freischlad, 2016).

GoldMoney Inc.

GoldMoney Inc. is a Canadian fintech company that has received the certification of Shariah compliance for its gold-based financial products. It has deployed blockchain technology for its process of providing financial products or Shariah-compliant financial products. The firm claims that their financial products are fully backed by gold reserves, and that they use the immutability of the blockchain ledgers for the collection of money or investments from investors and the disbursement of funds and returns (Vizcaino, 2017). It is certified by the Bahrain-based Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI), and ensures the implementation of recently launched Halal Gold standards by AAOIFI (Maierbrugger, 2017).

According to a company statement, it has more than 1.3 million users across 150 countries and manages US\$1.7 billion in client assets. They believe that being Shariah-compliant will considerably raise their profile in the market, and demand will grow from the Muslim-majority countries globally.

Islamic Robo-Advisors

Robo-advisors are a set of financial advisory tech that provide financial advice or investment management based on proprietary algorithms and numerical rules online with moderate to minimal human intervention.

World's First Robo-Advisor

A robo-advisor called Wahed Invest is the world's first automated Islamic investment platform. Initially New York-based, Wahed Invest Inc, a financial advisory company founded by Junaid Wahedna launched its platform on September 26, 2016. This robo-advisor is an automated platform, which can analyze thousands of halal securities worldwide to create portfolio allocations with the highest growth potential for its clients. Its main aim is the provision of easy access to halal portfolio management for the 2 billion Muslims around the world, as well

as for non-Muslims who want to delve in Islamic ethical investing. Wahed Invest offers a low minimum investment amount of US\$7,500 to start, according to its website (2016). They are registered with the Securities and Exchange Commission (SEC) and monitored by its Ethical Review Board. The board includes prestigious names in international ethical finance, including Sheikh Taha Abdul-Basser, former Islamic Chaplin at Harvard University and Shariah Board member of Fajr Capital (Maierbrugger, 2017).

Asia's First Robo-Advisor

On October 27, 2016, two months after the launching of the world's first Islamic robo-advisor, the Kuala Lumpur-based Farrington Group declared that they would be introducing Asia's first Shariah-compliant robo-advisor. This online tool named "Algebra" will provide automated portfolio and asset management advice. The platform is available to all investors from any jurisdiction with a minimum fee of US\$200 per month.

Others

This section accounts for all other technology platforms not categorized earlier. These make up an array of different types of platforms.

Investment Account Platform

Malaysia is undoubtedly one of the key jurisdictions of Islamic finance, where the Islamic financial services industry has introduced new standards along with innovative Islamic financial products. The Investment Account Platform (IAP) is no different. This new initiative is a multibank platform that provides the cross-border multicurrency channel by linking it to regional and global economies. It expedites the channeling of funds from institutional investors to provide financing large viable ventures. The IAP will be able to provide investors with access to a wide range of investment opportunities, and to the Islamic banks, new sources of funds. The platform is owned and developed by a wholly owned unit of Raed Holdings, IAP Integrated Sdn. Bhd, supported by a consortium of Islamic banks comprised of Bank Muamalat Malaysia, Maybank Islamic, Affin Islamic Bank, Bank Islam Malaysia, Bank Kerjasama Rakyat Malaysia and Bank Simpanan Nasional. It can be expected that more banks will join the platform, and the number of companies listed is expected to double.

Bursa Suq Al Sila

One other online platform that was launched in Malaysia for commodity *Murabahah* transactions is the Bursa Suq Al Sila (BSAS) online platform, which was developed by Bursa Malaysia Bhd. This online platform is a Shariah-compliant commodity *Murabahah* trading platform, which provides the facilitation of *murahabah* and *tawarruq*⁸ transactions. The online platform experienced exponential growth between 2009 and 2014, where it witnessed an annual growth of 178%, which shows the acceptability and demand of the Shariah-compliant products mainly from the largely Muslim populations of the MENA and Asian regions.

International Turnkey Solutions “ETHIXS”

International Turnkey Solutions (ITS) “ETHIXS” is a suite of financial products in Turkey, that provides their Islamic banks comprehensive banking solutions related to core banking, trade finance, delivery channels, online banking, branch automation and reports in addition to other banking services. ETHIX is also in full compliance with the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) and International Accounting Standards (IAS).

The platform offers an integrated system for financial institutions and banks to deliver Shariah-compliant products. It also empowers Islamic banks to make improvements in operational efficiency by reducing costs in different areas of Islamic banking. As a standalone module, it is easy to integrate and offers full support through its back-end accounting functionalities with straight-through processing⁹ (STP) built on a Service Oriented Architecture¹⁰ (SOA) platform and web services-based model.

ETHIXS provides Shariah-compliant software solutions and software-enabled services to the Islamic finance industry, and has been awarded the best Islamic Technology Provider by the Islamic Finance News (IFN) Best Service Providers’ poll in 2015 mainly due to their strong uptake from many existing clients

8 *Tawarruq* is a financial instrument where a buyer purchases a commodity from a seller on a deferred payment basis, and the buyer sells the same commodity to a third party on the spot to raise capital.

9 Straight-through processing (STP) is an initiative used by financial companies to speed up the transaction process. STP encompasses a set of internal and external applications, business processes, and standards that will redefine the settlement and processing paradigm within the capital markets industry.

10 The service-oriented architecture (SOA) is the technology that breaks down everyday business applications into individual tasks or processes that can be cost-effectively restructured and integrated to provide greater flexibility and responsiveness.

across the Middle East, specifically the Gulf Cooperation Council (GCC), and Asia Pacific.

As Sidq

The As Sidq platform is Malaysia's first online and digital Shariah-compliant platform for personal Islamic banking and finance. It was launched and introduced in 2009 by a Malaysian company called Sedania Corporation Sdn. Bhd.

This platform claimed to provide true halal banking with a completely automated and online fintech platform that permits financial services providers, mainly Islamic banks to give cash (liquidity) to their customers on a deferred payments basis. It also ensures full Shariah compliance and uses the Islamic finance product based on the *tawarruq* concept (Majelan, 2017).

As Sidq has received an approval of Bank Negara Malaysia BNM and is in accordance with the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) international standards according to its website AsSidq.com. RHB Islamic Bank was the early adopter of this platform, and the platform has been recognized internationally as an outstanding technological product. As Sidq has won numerous awards including the "Most Innovative Islamic Finance Transaction" during the 2010 Sukuk Summit, a winner at the KLIFF Islamic Finance Awards 2010 as well as Frost and Sullivan's "Most Innovative Product/Application of the Year 2010"). To date, approximately 20 financial institutions have adopted this platform in Malaysia and As Sidq continues to stay ahead through collaborations with the key players in the industry.

Islamic Fintech Alliance

In April 2016, a cluster of eight Islamic crowdfunding platforms, including Ethis Crowd, Funding Lab, Kapital Boost, Natwi, EasiUp, Blossom Finance, Launch Good and Skola Fund joined together to set up an "Islamic Fintech Alliance" (see Figure 4.7).



Source: islamicFinTechalliance.com

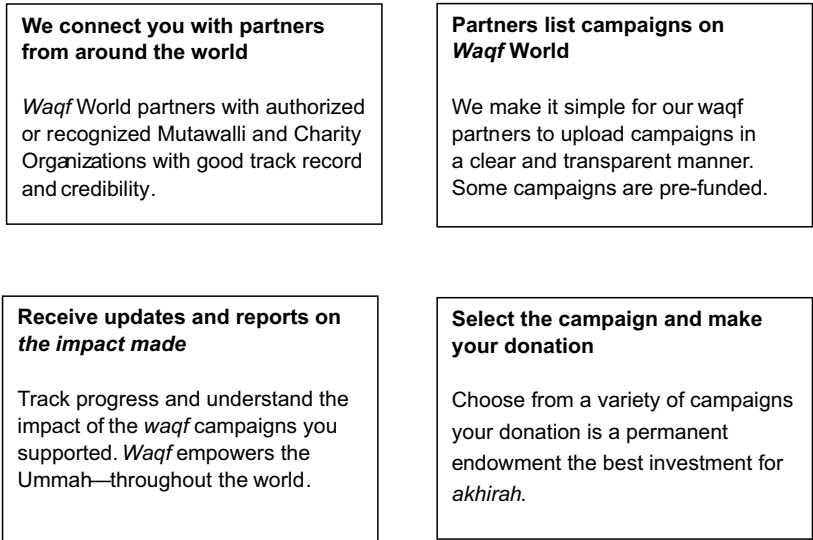
Figure 4.7: Founding Members of the Islamic Fintech Alliance

The primary objectives of this alliance were to foster greater safety and develop trust by promoting and implementing shared standards for Islamic fintech. They also wanted to broaden the access of Islamic fintech and its social impact by ensuring the support and assistance of a wide network of innovators and eventually to establish and develop a sustainable and truly global ecosystem of Islamic crowdfunding by both supporting and with the support of regulators and stakeholders.

World's First Islamic Endowment Crowdfunding Platform

The former Malaysian prime minister Tun Abdullah Badawi launched the *waqf* crowdfunding platform called Waqf World. It was officially revealed as the world's first *waqf* platform at the 12th World Islamic Economic Foundation Forum (WIEF) held in Jakarta between August 2 and 4, 2016. Initially, the idea of developing such a platform was proposed by the research center for Islamic Economics and Finance of Universiti Kebangsaan Malaysia (UKM) in a discussion which was organized by the Islamic Development Bank's Research and Training Institute (IRTI) in January 2016 (Alois, 2016). The managing partner of Waqf World, Adi

Rahman, welcomes any *waqf* organization from around the globe to list their projects on the site.



Source: Modified from waqfworld.org

Figure 4.8: Working Process of the *Waqf*World

Waqf is one of the oldest yet the strongest Islamic institution that can unite and bring socioeconomic development to the Muslim World to bring about positive change. Hence the development of the Muslim community (ummah) is the focus of WaqfWorld.org. According to Tun Abdullah Badawi, the former prime minister of Malaysia, *Waqf* World uses technology to improve cash *waqf* flows to *mutawallis* (who are authorized or recognized *waqf* trustees or managers) and charities for their crowdfunding campaigns to raise funds for various initiatives which include Islamic microfinance, education and human capital development, humanitarian relief and social enterprises.

Islamic Countries' Initiatives for Islamic Fintech

There are several cities around the world accelerating toward building Islamic financial hubs for their region. These leading Islamic financial hubs in different regions are taking the lead in exploring the extended use of Islamic financial technologies within their ecosystems. Although the focus of this section is on

Islamic countries' initiatives, we have included London as well since it is a key Islamic finance hub for Europe.

Islamic Republic of Pakistan (Islamabad, Lahore)

In the Islamic Republic of Pakistan, 60% of the total population is made up of youth. Pakistan is suited well to embrace the digital age because of its large ratio of young population and also their disproportionate excitement toward technology adoption. Pakistan Telecommunication Authority (PTA) has recently reported that annual cellular subscribers by March 2017 are more than 139 million (70% of population) (Pakistan Telecommunication Authority PTA, 2017). According to the GSMA report, Pakistan will have 17 million new unique subscribers by 2020 (GSMA, 2017). The Mobile broadband penetration has also improved from 3% to 16% (PTA, 2016). According to Pakistan Economy survey 2016–2017, which is published by the Ministry of Finance, Pakistan, the subscribers of 3G and 4G LTE have expanded to 39.88 million by March 2017, by registering a new 10.3 million subscriptions to 3G&4G LTE networks during July 2016–March 2017 (Govt. of Pakistan, 2017). The steady growth in the consumerization of IT among Pakistanis shows that their behavior and psychology is also changing with gradual speed that can be translated into a step toward the digitalization of the country.

The level of financial inclusion is very low in Pakistan and it is considered among the least financially inclusive countries in the world. A large proportion of the population is unbanked having no access to formal or informal financial services, and about 85% of the population are underbanked, lacking access to formal financial services. The high cost of banking infrastructure prevents the dissemination of financial services beyond a small portion of the population. However, digitalizing financial services offers a promising solution to overcome problems of reach and scale. This is attested by a fintech survey done in 2016 (Karandaaz Pakistan and FinSurgents, 2017) whereby 92% of senior executives and 80% of middle managers interviewed agreed that fintech has a significant role to play in emerging markets with low financial inclusion. McKinsey & Co. (Manyika et al., 2016) reported that digital finance has the potential to provide access to 93 million people in Pakistan alone which will increase to US\$263 billion and US\$23 billion in terms of new deposits and credit respectively. It will also provide an opportunity for the Pakistani government to save US\$7 billion by preventing leakage of tax and stopping illicit activities. It also has the potential to create 7 million jobs in Pakistan and can boost the percentage of gross domestic product (GDP) 7% (\$36 billion) by 2025.

To achieve the goal of digital financial inclusion, the Ministry of IT issued the “Digital Pakistan Policy” in which they mention the establishing of innovation centers for fintech in major cities of the country (Ministry of Information Technology MOIT, 2017). In December 2017, Dr. Umar Ali Saif, the chairman of Punjab Information Technology Board and Vice Chancellor of Information Technology University (ITU), Lahore signed a Memorandum of Understanding (MOU) with Digital Financial Services Research Group (DFSRG) University of Washington (Seattle, USA) for the establishment of the first FinTech Center in Lahore, Pakistan. The chairman explained that this fintech center will be used for activities including authentication, customer experience studies, cyber security, data analytics, financial management and fraud prevention, etc. The center will also work with the financial industry, academia and government and will also promote digitalization of payments especially Government to Person (G2P) and vice versa (Ahmed, 2017). The Islamic financial industry in Pakistan also aims to explore untapped fintech opportunities in the country. For this purpose, the 2nd World Islamic Finance Forum was held on March 19–20, 2018 at Karachi, Pakistan and fintech and blockchain were prominent areas in the conference agenda. To promote the awareness and also to trigger discussions on fintech and blockchain, a conference was held entitled “Role of Blockchain in Emerging Pakistan” under the flagship University of CMOSATS Pakistan on April 28–29, 2018. The potential opportunities that blockchain offers, different models and use cases were discussed among experts, academicians, and government personnel at the conference. These developments in policies, collaborations and also other tech-related events are laying the foundation for a futuristic and robust fintech ecosystem in Pakistan.

Banks and mobile money providers are embracing and going toward the use of digital technologies and channels to make their operations and products more efficient. Meezan Bank Limited, which is one of the Islamic banks of Pakistan with the largest network in the country, signed an agreement with VMware.inc, a global leader in cloud infrastructure and business mobility, to meet the growing demands through IT (Business Recorder, 2017). But, currently, there are only twelve players including banks, fintechs and mobile money providers in Pakistan that have branchless banking licenses. These include UBL, MCB, HBL, JS Bank, Bank of Punjab, Meezan Bank, Tameer Microfinance with Telenor, Waseela Microfinance with Mobilink, U-Microfinance with Ufone, Askari Bank with Zong, Bank Alfalah with Warid and FINCA with Finja. Unfortunately, none has interoperability among their services and wallets (Karandaaz Pakistan & FinSurgents, 2017).

Pakistan has some ways to go, and other lessons can be learned from more advanced countries like implementing regulatory sandbox for fintech, moderniz-

ing existing digital infrastructure, working on interoperability, coordination, and collaboration, information and communications technology (ICT) and financial literacy; these are the essential building blocks for developing a robust fintech ecosystem in Pakistan.

Kingdom of Bahrain (Manama)

Bahrain has been a regional financial center for over four decades and has the largest concentration of financial institutions and funds registered and domiciled in the region. The financial services sector is the second largest contributor to GDP (16.5%), and there are over 400 financial institutions licensed in the Kingdom, including almost 80 conventional banks and 25 Islamic banks. Bahrain's strong ICT infrastructure and established platforms for innovation and entrepreneurship, make it well-placed to become a regional hub and breeding ground for fintech investments.

Bahrain's journey toward fintech was officially initiated by the Central Bank of Bahrain (CBB) and they subsequently developed a regulatory sandbox for fintech in June 2017. The CBB aims to provide an innovative and virtual testing environment to new entrants in the region, which will lead it to becoming the fintech hub of the Gulf region (Treki, 2017).

Since the development of the first regulatory sandbox in June 2017, CBB has approved more than five applicants, which included the robo-advisory investment platform Wahed Invest, BitArabia, an online bitcoin exchange Belfrics, a London-based forex cash management solution for businesses called Tramonex; and NOW Money, the Dubai-based account and remittance service for low-income workers in the GCC (Finextra, 2017; Peyton, 2018).

In November 2017, the Bahrain Economic Development Board, and Fintech Consortium, launched "Bahrain FinTech Bay" (BFB) claiming that it will be the largest fintech hub in the Middle East and Africa. It is an initiative to create the environment and provide the platform to accelerators, investors, fintech start-ups, entrepreneurs, regulatory bodies and financial institutions. The BFB will be a building consisting of 10,000 square feet of usable space and situated at Arcapita building overlooking the waters of Bahrain Bay and the Arabian Gulf. It will be comprised of state-of-the-art facilities, workstations, coworking spaces, communal areas, hot desks, and a variety of shared infrastructure, making it the ideal hub for local and international corporate innovation labs and fintech start-ups to secure bases for themselves (Bahrainedb.com, 2017).

There is also an establishment of a consortium of three Bahraini banks—KFH Bahrain, a unit of the Kuwait Finance House, Islamic lender Al Baraka Banking

Group and Bahrain Development Bank—to facilitate the development of the Islamic fintech ecosystem. This consortium aims to establish a company Algo Bahrain dedicated and specialized for research and development in the area of Islamic fintech. It will grow and promote Islamic banking in the country through Shariah-compliant solutions (Townsend, 2017), and aims to launch fifteen fintech platforms before 2022 (elgilani, 2017).

To further capitalize the opportunity in the Middle Eastern banking industry, the Kingdom of Bahrain has entered a partnership with the fintech incubator and ecosystem builder, Singapore FinTech Consortium (SFC), and the asset management advisory firm Trucial Investment Partners, to initiate, nurture and sustain Bahrain's fintech ecosystem, by leveraging on the expertise of the SFC. These partnerships form the catalyst that will help to grow and develop the Bahraini fintech sector, as it enables them to pull together the experience and know-how of global industry leaders (FinTech Futures, 2017).

Kingdom of Saudi Arabia (Jeddah, Riyadh)

Saudi Arabia has unique demographic and economic features that uphold its status as one of the most attractive, competitive and sophisticated places for local and international players. The population of the country is about 33 million and half of these are under the age of twenty-four. Due to having a high ratio of millennials and digital natives, the country has one of the highest penetrations of internet (91%) and also of the mobile subscriptions (171%) (We Are Social, 2018). The high penetration is due to the robust environment of ICTs in the country.

Saudi Arabia is one of the largest economies in the region of MENA. The country's economy witnessed an expansion with an increase of 1.8% in GDP in 2018 after the oil price crisis. The kingdom has launched the National Transformation Program to stimulate the government activities and investments into private sector. This program also brought up new reforms to reduce the barrier of entrance for international investors in the country.

The Crown Prince Muhammad bin Salman has come up with a very clear manifesto which is called "Vision 2030" on the diversification of the economy and on bringing moderation into Saudi social culture. This new blueprint aims to make the country independent from the oil-based economy by developing and promoting other sectors like tourism and entertainment. In "Vision 2030" technology is declared to be the heart of all the sectors.

The upshot of the above is that the Kingdom has and is building all the features which are essential to develop a vibrant fintech ecosystem in the country. In this regard, the Saudi Arabian Monetary Agency (SAMA) has very keen interest in

fintech adoption. Their willingness toward adoption of fintech is shown by their investments in the fintech sector locally and globally. For this purpose, a separate fund is relaunched named as Public Investment Fund (PIF). This is a principal vehicle for investments in fintech and also is a part of Vision 2030. One of the major flagship investments of PIF was to invest in the US\$100 billion “Softbank Vision Fund” supervised by Softbank. This fund has a key role as an investor in the fintech world. The investment done by the Kingdom in the Softbank fund is part of Softbank’s US\$1 billion investment in US fintech start-up SoFi in 2015 and also its US\$1.4 billion investment in the largest Indian FinTech PayTM initiative in 2017 (Clifford Chance, 2017).

Different initiatives have been taken within the country. One of these main initiatives is to set up a Small and Medium Enterprises Authority in 2016 to achieve the goal of encouraging and involving young and talented entrepreneurs by providing business and innovation friendly regulations, ease of access to financing, global collaborations and partnerships and also a major share of national acquisition and government bids. Another major element in the Kingdom’s fintech ambitions is King Abdullah Financial District situated at the heart of Riyadh. This will be the biggest business area in the Kingdom. The authorities unveiled that this will play a key role in making the country a fintech hub.

Recently in February 2018, SAMA has signed an agreement with Ripple, a global blockchain payments solution provider, to get support for its banks to deploy and test blockchain based payments (Peyton, 2018). In March 2018, the largest bank of the Kingdom, Riyadh Bank partnered with Gemalto, a technology provider, for introducing contactless payment wrist bands for their customers. The bank has also launched Gemalto’s contactless sticker that can easily turn a mobile device into a contactless payment device (FinTech Futures, 2018).

In July 2018, the Capital Market Authority CMA of the kingdom approved licenses of the first two fintech players. One is Riyadh-based start-up Manafa Capital and the other one is Scopeer. Both are allowed to provide crowdfunding services on a trial basis. The Kingdom has jumped onto the fintech bandwagon and is keeping on its transformational journey at a constant and balanced pace to make the country a credible hub for fintech.

Malaysia (Kuala Lumpur)

Malaysia’s journey toward a vibrant fintech ecosystem began with its vision for the future of Islamic finance through delivering actions today for a sustainable tomorrow on May 11, 2016. They understood that fintech is challenging the status quo of the financial industry and new business models will emerge. Delivery

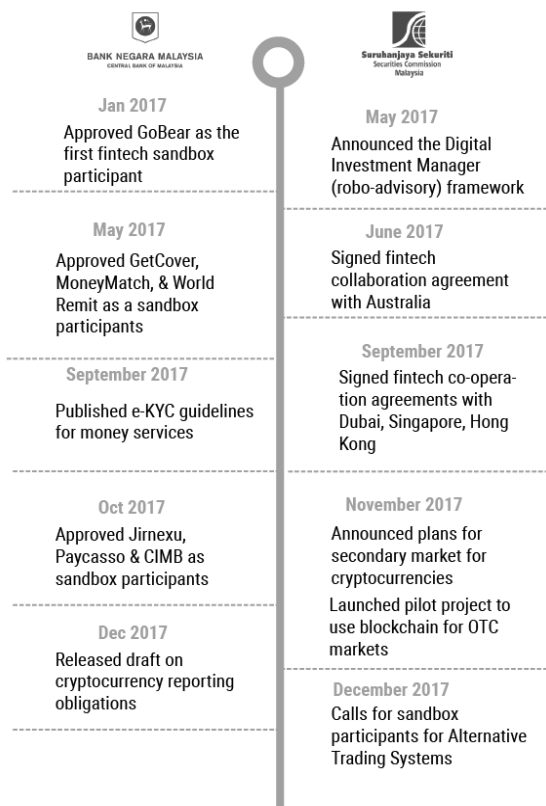
channels will challenge existing norms, but transaction costs will be significantly reduced. Rather than looking at the fintech revolution as unwelcoming, Bank Negara urged financial institutions to embrace fintech as an opportunity. By June 2016, Bank Negara Malaysia established a group entitled “Financial Technology Enabler Group (FTEG).” The operation of this group is to serve as the focal contact point on fintech-related queries, which involved matters regarding regulation and the adoption of fintech by the financial services sector.

In July 2016, Bank Negara Malaysia reached out to banks, start-ups and other stake holders in order to take comments and suggestions from them for a regulatory framework. Having received over sixty comments and suggestions from banks (conventional and Islamic), start-ups and other stakeholders, Bank Negara Malaysia developed its own financial technology regulatory sandbox framework on October 18, 2016. The framework outlined the objective of facilitating firms which are looking to test out innovative business models and products that can improve efficiency, accessibility, quality and security of financial services and products. The framework also covered opportunities to banks (Islamic and conventional) to take the ideas that can improve risk management mechanisms and discuss gaps regarding investment in the Malaysian economy. For Islamic financial services providers, it is emphasized that the innovative and novel solutions for Islamic financial services must be consistent with and according to the prevailing Shariah standards (Bank Negara Malaysia BNM, 2016).

In 2016, Securities Commission Malaysia in a landmark move, gave approvals to a series of Equity Crowd Funding platforms: Ata Plus, Crowdonomic, FundedByMe (Alix Global), Eureeca, pitchIN and Crowdplus. Securities Commission Malaysia also granted approvals to six P2P lending operators, namely Ethis Kapital, FundedByMe Malaysia, B2B FinPAL, Modalku Ventures, ManagePay Services, and Peoplender (“FinTech Malaysia,” 2017).

The year 2017 witnessed and recorded the introduction and launch of numerous key milestones in regulatory development for fintech in Malaysia, as both regulatory authorities, Securities Commission Malaysia and Bank Negara Malaysia, acted quickly to support the on-going financial disruption by introducing regulatory changes and guidelines as described in Figure 4.9.

2017 REGULATORY MILESTONES



Source: <https://FinTechnews.my/15690/malaysia/FinTech-malaysia-2017-in-review>

Figure 4.9: Bank Negara's Regulatory Milestones for 2017

Another clear and significant development in the fintech industry in Malaysia has been seen in the payments sector in 2017. Major payment players like Alipay and WeChat have entered the Malaysian market. Alipay has arranged participation with three banks of Malaysia, i.e. Maybank, CIMB bank, and Public bank. Along with this, Alipay has also received approval from Bank Negara Malaysia to jointly work with the Touch 'n' Go corporation to form TNG Digital. At the same time, WeChat has received its payments license to legally operate in Malaysia, forming a partnership with Hong Leong Bank Malaysia.

On the local front many telecommunication companies, like Axiata and Digi have also jumped into the fray where it is reported that 88 players within the

Malaysian fintech space dominated the payments segment, followed by e-wallets, based on the report entitled “Malaysia: fintech Landscape Report Oct 2017.”¹¹

Another Malaysian initiative worthy of mention is the Multimedia Development Corporation (MDeC) which was incorporated in 1996 to oversee the development of the Multimedia Super Corridor (MSC) Malaysia and to advise the Malaysian government on legislation and policies, as well as to set breakthrough standards for multimedia operations.

Established in the same year, MSC Malaysia’s primary focus was to create an ideal and conducive platform to nurture Malaysian SMEs in the ICT sector, to become world-class businesses while attracting participation from global ICT companies to invest in and develop cutting-edge digital and creative solutions in Malaysia. Seventeen years on, MSC Malaysia has driven the development of the Malaysian ICT industry, enhanced technology adoption, and has made significant strides in increasing the economic impact and footprint of ICT for the nation.

In October 2010, MDeC was given an additional task by the government, which was to develop a blueprint for a Digital Economy that draws from the huge opportunities created by the Digital world. This resulted in a program called Digital Malaysia that was officially unveiled to the public in May 2012. Digital Malaysia is a natural progression to harness the building blocks already laid by MSC Malaysia. Founded on three strategic thrusts, of moving Malaysia from supply to demand, consumption to production and low knowledge-add to high knowledge-add, it ultimately aims to create an ecosystem that promotes the pervasive use of ICT in all aspects of the economy and the first eight projects are already under implementation. This will in turn connect communities globally and enable them to interact in real time, increase the country’s Gross National Income, enhance business productivity and improve the standards of living. Ultimately, Digital Malaysia aims to turn Malaysia into a developed digital economy by 2020, that connects and empowers the government, businesses and citizens. Today, MSC Malaysia and Digital Malaysia run concurrently to spur Malaysia’s ICT industry development and digital economic growth, under the purview of MDEC, which has since been renamed as Malaysia Digital Economy Corporation.

11 https://www.internetalliance.my/wp-content/uploads/2018/02/FinTech-Malaysia-Landscape-Report_Oct2017.pdf

Republic of Indonesia (Bandung, Jakarta, Surabaya, Yogyakarta)

The Republic of Indonesia is the largest economy in South East Asia Pacific having a population of over 260 million. Sixty percent of the overall population are under the age of thirty-five who are considered as digital natives brought up in the era of internet. There is a high rate of internet and mobile penetration among these millennials and digital natives and this rate of penetration is constantly growing. This makes Indonesia a treasure trove of maiden fintech opportunities.

Indonesia is one of the earlier adopters of fintech in the region as Indonesia developed a fintech ecosystem before Malaysia and Brunei Darussalam due to having an edge in market size. The fintech market is steadily growing in the country with the annual growth rate of 16.3%. The exact figure of total investments in the fintech sector can not be estimated (as majority of the investments are undisclosed); the total disclosed investments alone in 2017 are valued at US\$176.35m. Table 4.1 shows the detail of disclosed and undisclosed deals of 2017 with announcement date, funding stage, fintechs and investors.

Table 4.1: List of Indonesian Fintech Investments in 2017

| Startup | Stage | Announcement | Value (US\$) | Investor |
|----------------|--------------|--------------|--------------|---|
| Espay/Unik | Acquired | 1-Jan-17 | Undisclosed | EMTEK |
| Cermati | Series A Ext | 2-Feb-17 | Undisclosed | Orange Growth Capital |
| Akseleran | Seed | Feb-17 | Undisclosed | Angel Investor |
| Amartha | Series A | 3-Mar-17 | \$2m | MCI, Lynx Asia Partners, Beenext, Midplaza Holdig |
| C88/CekAja | | 11-Mar-17 | Undisclosed | Kickstart Ventures, Socrates Capital |
| Kudo | Acquired | 3-Apr-17 | \$80–100m | Grab |
| Ayopop | Seed | 4-Apr-17 | \$1m | Gree Ventures |
| Bareksa | Seed | 6-Apr-17 | Undisclosed | Gernilang Dana Sentosa |
| Gandeng Tangan | | 7-Apr-17 | Undisclosed | Mariko Asmara, ANGIN |
| M-Cash | | 20-Apr-17 | Undisclosed | Kresna Graha Investma |

Table 4.1 (continued)

| Startup | Stage | Announcement | Value (US\$) | Investor |
|-------------------------|----------|--------------|--------------|--|
| Tatalite | | 12-May-17 | \$6.3m | SBI Group Japan |
| Akulaku | Series B | Jun-17 | Undisclosed | Legend Capital, Shunwei Capital, Qiming Venture Partner |
| Kioson | | 20-Jun-17 | \$450k | Mitra Komunikasi Nusantara |
| Pasar Dana Pinjarman | | 4-Jul-17 | \$50m | Itochu |
| Jukir | Acquired | 6-Jul-17 | Undisclosed | Walezz |
| Julo | Seed | 19-Jul-17 | Undisclosed | East Ventures, Skystar Capital, Convergence Ventures |
| PayAccess | Series A | Jul-17 | Undisclosed | Undisclosed |
| Artawana | Pre-seed | 4-Aug-17 | Undisclosed | East Ventures |
| UangTeman | Series A | 7-Aug-17 | \$12m | K2 Venture Capital, Darper Associ- ates, STI Financial Group, Alpha JWC |
| Payfazz | | 8-Aug-17 | Undisclosed | Y Combinator, MDI Ventures |
| Kredivo | Series A | 4-Oct-17 | Undisclosed | Jungle Ventures, NSI Ventures |
| Kioson | IPO | 5-Oct-17 | | |
| Pendanaan | Series A | 31-Oct-17 | Undisclosed | Legend Capital |
| M Cash | IPO | 1-Nov-17 | | |
| OnlinePajak | Series A | 9-Nov-17 | \$3.5m | Alpha JWC Ven- tures, Sequoia Capital |
| Bitcoin.co.id | | 23-Nov-17 | Undisclosed | East Ventures |

Source: Daily Social, 2017, *Indonesian FinTech Report*.

The growth in numbers of players in the Indonesian fintech space is remarkable. There were only 50 fintech companies identified in 2015, which has now exceeded 165 fintech companies in Indonesia (Christian König, 2018). The segment of digital payments (38%) is ranked as a top fintech segment followed by lending (31%), personal finance (8%), and so on (Fong, 2018).

Indonesian fintech is mainly regulated by two main regulatory authorities, Bank Indonesia (Central Bank) and Otoritas Jasa Keuangan (OJK or Financial Services Authority). The Bank Indonesia has established a Bank Indonesia fintech office and also launch a fintech regulatory sandbox with the aim of provision of innovation friendly environment to the new entrants that can test their new business models and products in a controlled environment. The OJK also introduced new regulations for peer-to-peer lending and for electronic money.

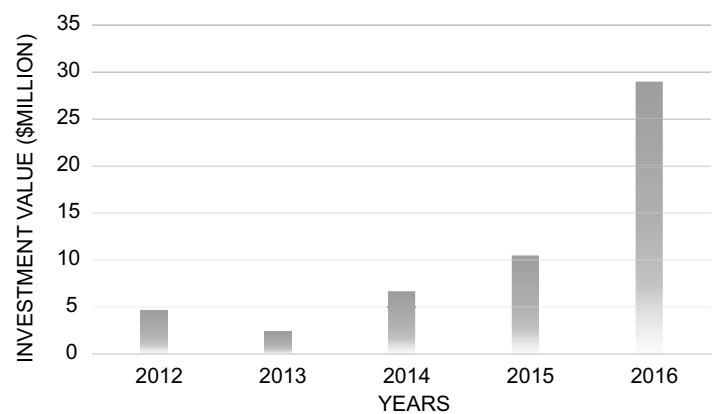
In Indonesia, the fintech sector can play a significant role in promoting financial inclusion by reaching out to the tech savvy but unbanked population. Users, regardless of gender, race or religion, can benefit from improved access to streamlined financial services. Amid all of the advantages and opportunities available, Indonesia can effectively capitalize on them through smart regulations, while creating interoperability among financial institutions and open collaboration with young fintech companies to develop new partnerships and strengthen the overall financial and economic position of a country that will be the fifth largest economy by 2030.¹²

Republic of Turkey (Istanbul)

Turkey has some unique demographic features with a population under 25 (41%), highest mobile penetration (95%), growing rate of internet users (67%) and also remarkable adult literacy rates (95%). Turkey has made exceptional growth in mobile banking and mobile payment transaction. In online retail, Turkey has also outperformed Spain, Germany, and the United States in digital payment transactions share during 2016 (BKM, 2017).

Turkey embarked its fintech journey in 2012, where the fintech sector has since grown at an exponential rate (see Figure 4.10). The local Turkish banks also invested in fintech companies. The amount of fintech investment in Turkey was recorded as US\$4.6m in 2012, which grew by 175% in 2016 and the value of fintech investments hit US\$29m.

¹² <http://uk.businessinsider.com/ranked-pwc-predicts-the-most-powerful-economies-in-2030-2017-2/>



Source: Modified from FinTech Istanbul & BKM (2016).

Figure 4.10: Fintech Investments in Turkey (2012–2016)

The size of the overall fintech market in Turkey encompasses more than 200 fintech companies and start-ups. The digital payment segment is at the top among all the fintech segments as 72 fintechs make up this category.

In 2016, the formation of fintech Istanbul through the support of Turkish regulatory authority Interbank Card Center (Bankalararasi Kart Merkezi, BKM), opened the Turkish fintech ecosystem to the world of international players—establishing partnerships with six international organizations, namely Innovate Finance, Level 39, Global FinTech Hubs Federation, Swiss FinTech, Holland FinTech and FinTech Headquarters (FinTech Istanbul & BKM, 2016).

Turkey has great potential in making Istanbul a hub of fintech. The Turkish government has launched the Istanbul Financial Center initiative with the aim of making Istanbul a global financial leader by 2023. The Turkish government also announced the formation of a Finance Technopark in Istanbul with the cooperation of a Turkish exchange and a leading university. The interoperability, cooperation and coordination among Turkish government regulatory bodies, incumbent banks and fintech start-ups is an important element that will vindicate its position in the global arena.

Sultanate of Brunei (Brunei Darussalam)

Brunei is one of the unassuming countries in Southeast Asia that has joined the fintech race. The tiny nation, one of two Islamic sultanates left in the world, is looking to develop its own fintech sector amid strong neighbors like Singapore,

Malaysia and Hong Kong, who are traditional financial hubs, due to its commitment to Islamic values and the Shariah.

In November 2016, Brunei vowed to build a strong economy based on the principles of Islam, and the government of Brunei Darussalam has made an agreement with South Korea to work on the development of Islamic financial technologies. The Brunei government made this agreement for the deployment of new and advanced technologies for the development of Islamic finance and has allocated B\$2 million for this. The demonstration of this first step was seen in the form of a seminar entitled “Exploring Islamic FinTech Seminar” organized by the Energy and Industry Department at the Prime Minister’s Office (EIDPMO) in partnership with the Embassy of the Republic of Korea. In this seminar authoritative representatives of both countries expressed their views about developing Islamic fintech sector in Brunei Darussalam through cooperation in terms of skills, advanced technologies and expertise in Islamic finance industry. Both countries felt that Islamic fintech is a good example of where we can find avenues for international collaboration and investment to create and generate capital, spinoffs in the local market for employment opportunities and, ultimately, diversify and boost their respective economies (Norjidi, 2016). This also signals Brunei’s vision of diversification of economic pathways from just the oil and gas sector.

United Arab Emirates (Dubai)

The Financial Services Regulatory Authority (FSRA) of Abu Dhabi Global Market (ADGM) took its first step toward fintech development by publishing a consultation paper for a proposed “Regulatory Laboratory” (RegLab) on May 10, 2016. This was a very exclusive framework, which allowed the new entrants who want to deploy innovative and new technology into financial services sectors (particularly named as fintech participants) to test their activities in a cost effective and controlled environment.

Under the framework of the RegLab, fintech participants have up to two years for testing and experimenting with their products within the sandbox environment, where throughout this period the participants have not had to submit a regular progress report to the FSRA. At the end of the testing period, viable business models will get the final authorization and approval for the full-launch of the business model to the market. Failing to fulfill the authorization criteria will exclude the applicants from the framework of the RegLab (ADGM, 2016). Since the establishment of the ADMG RegLab in May 2017, five fintech participants from total of 11 applicants have been approved:

1. CapitalWorld, primarily based in India, is a one-stop digital platform that automates the entire loan value chain from application to credit appraisal and post-disbursement credit monitoring. They remove the traditional hindrances of the process, like having to physically visit bank branches to apply for a loan. CapitalWorld completes the whole process online and they match the loan seeker with their partner bank. Banks disburse the loan once the applicant matches the risk appetite and other criteria set by the disbursing lender.
2. Finalytx is a U.S.-based robo-advisory platform for wealth management applications that seeks to help clients optimize their holdings, mitigate risks and costs, and identify new investment opportunities.
3. NOW Money based in UAE, which offers mobile technology to permit low income migrant workers in the UAE to access banking and remittance services, otherwise out of reach. Users get direct access to an account, debit card and remittance capabilities from a smartphone app and support from a service center.
4. Rubique is an India-based online platform that links banks and fund seekers/borrowers through a smart online financing process that connects to a range of loan, credit card, and financing options that helps to fill the gap between lenders and borrowers.
5. Titanium Escrow is a UAE-based automated escrow service that enhances trust in counterparties and stabilizes the cash-flows of small businesses.

Since 2017, more fintech participants have been selected from over twenty applications from multiple countries. Among the newly selected participants, four are blockchain firms, namely UK-based EquiChain, Hong Kong-based OKLink, UAE-based Pyppl, and a Canadian firm, Remitr (CNBC.com, 2017).

United Kingdom (London)

Although the UK is not an Islamic country, London is one of the world's biggest and largest centers for international financial institutions having headquarter of 251 foreign banks and 588 foreign quoted companies with deep aspirations to be an Islamic finance hub. Hence, we have included it in our list of countries as their initiatives will significantly impact the growth of the Islamic digital economy, particularly in Europe.

The UK is the global leader in the cross-border lending and the second center for asset under management after the United States (EY, 2014). The availability of highly skilled financial and tech talent, well developed world class technology

and financial services infrastructure, a market that is open to innovation, access to capital, mercantile and welcoming culture for international financial institutions, and innovation friendly regulatory approach are the drivers that maintain its position as a global leader of banking and finance centered in London.

The factors that lead the emergence and development of the fintech ecosystem in the UK are super digital connectivity, the trust loss after the financial crisis and introduction of new regulations by the UK government. The UK has the highest level of smartphone and internet penetration globally and is also ranked as a leader in offering financial services online. The economic crisis of 2008 had plummeted the customers' sentiments and they started to adopt new products offered by the new entrants. Meanwhile, financial institutions also seemed to fail in showing the adaptation and agility regarding technology and innovation. Finally, this financial crisis forced the regulators to monitor and supervise the banks' activities more rigorously. The UK regulators took the dynamic and open-minded approach and introduced new regulations while providing for opportunities to new entrants and companies to capitalize on their innovative products and new business models. These changes and drivers in the UK market have made London the hub of fintech for Islamic finance in Europe.

The investments in London-based fintech start-ups hit £800 million in 2017, showing a double-digit growth as compared to 2016 (Knight, 2018). The total funding attracted by the UK fintech start-ups in 2017 is valued at US\$1.34 billion (London & Partners, 2018). Among the top ten European fintech deals in the last quarter of 2017, there were seven deals linked with London-based fintech companies. Those are TrayPort (US\$726.5m), TransferWise (US\$280m), TradeTech Alpha (US\$150m), Just Giving (US\$127m), Monzo (US\$93.8m), Salary Finance (US\$52.8m), and WorldRemit (US\$40m). Out of these seven fintech startups, five were included in the top fifty hottest European fintech start-ups (KPMG 2018).

In March 2018, the UK Government Fintech Strategy announced that the government is going to make a new “fintech bridge” with Australia and a £7.5 billion public-private fintech investment fund allocated for this purpose (Knight, 2018). These steps were unveiled to uphold London's position as a global hub and leader of fintech. The investments and close alignment and connection between regulators and Islamic finance industry in UK is leading to great developments. This shows the aim of the UK government to ensure that London remain *the* hub of Islamic fintech in the world.

Impediments for Islamic Fintech

We know that innovation is a key foundational aspect in the development of Islamic finance in the digital economy. Fintech has the potential to play a major role, primarily to improve processes and cost effectiveness while maintaining strict Shariah compliance for the benefit of the industry. FinTech is necessary for Islamic finance to maintain and grow its market share—a failure to keep pace would weaken the players' competitiveness. What then impedes the adoption of Islamic fintech by Islamic financial institutions?

The principal challenge is still the regulatory environment, which is constantly evolving. A good example is the highly evolving nature of the Initial Coin Offering (ICO) market. The Islamic finance industry already has a lot on its plate, be it standardization, developing regulation and innovating new products. Regulatory limitations and concerns could hinder the ability of Islamic finance institutions to forge ahead in adopting new models linked to various fintech themes such as decentralization and privacy. Another factor is that fintech has its significant cost and integration requirements before any economic benefit can be derived. This could push fintech to the backburner, as resources may be limited to work on disruptive initiatives within the company.

Impediments to change and its challenges are a part and parcel of any industry and organization in any sector. It requires significant mindset and organizational realignment, and sufficient resources to support it. In the end, the eventual winner is the one who is able to tackle those challenges with the appropriate strategy, plan, and change management.

In order to balance the use of new technology to provide better services while controlling new operational risks, the Islamic fintech industry may overcome such challenges through:

1. **Regulatory support:** The financial industry is considered one of the most regulated industries. To foster the environment of innovation and entrepreneurship, supportive regulations and policies having great importance.
2. **Financial support:** There are a large number of companies and firms that finance conventional fintech platforms at seed, angel and venture levels. But, for Islamic fintech platforms, opportunities of financing are not enough and its very hectic as well.
3. **Shariah compliance:** This is the top priority for Islamic fintech and its basic element, which makes them Islamic. Shariah advisory scholars now need to be adept with the underlying technology, which drives digital Shariah solutions to adequately assess Shariah compliance. These Shariah scholars also need to be versed in economics and finance to make sound decisions and

would require future scholars to be multidisciplinary, just like their predecessors in the past Golden Age of Islam.

4. Agility and adaptation: Agility and adaptation is very important in the fast-changing technology world. Without agility and adaptation, Islamic fintech can not compete with its conventional counterpart in an industry where virtually every segment is being reimaged.
5. Entrepreneurial courage and persistence: This is intuitively essential, although it is not widely discussed in traditional financial literature. Any entrepreneurial endeavor requires immense courage and persistence. The Islamic world needs its young people to have these qualities and develop entrepreneurial efforts to overcome the challenges of the future of Islamic finance.

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Chapter 5

Blockchain and the Digital Economy

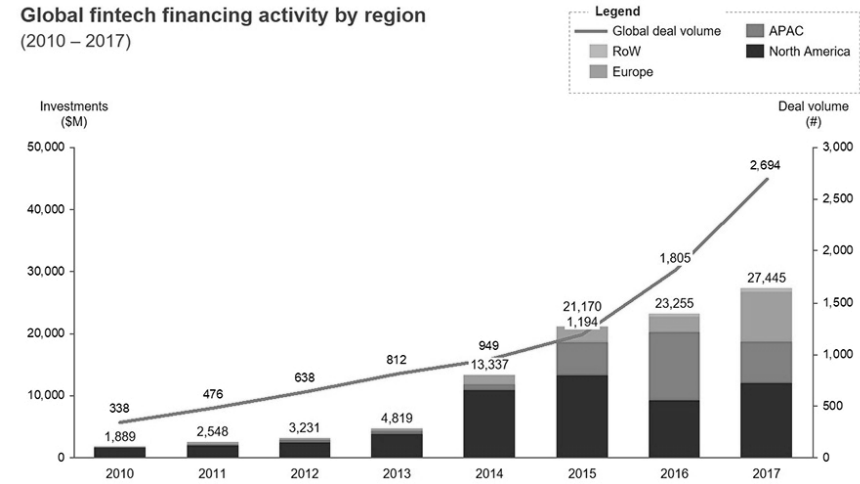
Introduction

Over the last decade, disruptive innovation in financial services has emerged from financial technology (fintech) start-ups. These new firms have been quicker than banks to take advantage of advances in digital technology, developing banking products that are more user-friendly, cost less to deliver, and are optimized for digital channels.

This relative success is unsurprising. These new players are less burdened by the demands of regulatory compliance which banks are subject to. They are unencumbered by complex and costly to maintain legacy systems. They can focus on creating single-purpose solutions, designed to offer an improved experience within just one product or service. They are more in tune with the peer-to-peer (P2P) culture engendered by the explosion of social media. And they are smaller organizations, designed for innovation.

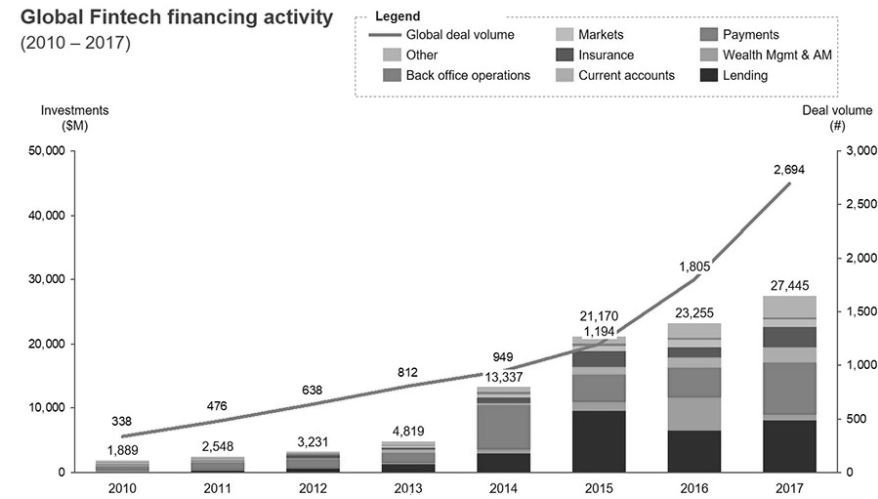
Confidence in fintech has accelerated venture capital (VC) financing in the industry to a record level of US\$27.4 billion in 2017—a growth of 18% from 2016. According to a recent report from consulting firm Accenture, the growth in fintech investment has been driven by a surge in deal value in the United States, UK, and India.

In the United States, the value of VC investment deals jumped 31% to US\$11.3 billion in 2017. Meanwhile, in the UK, deal values almost quadrupled to US\$3.4 billion, while India saw a near quintupling of investment to US\$2.4 billion in 2017. The volume of global fintech deals also rose greatly, from about 1,800 in 2016 to almost 2,700 in 2017 as shown in Figure 5.1. Much of the growth, particularly in the United States and UK, has been driven by big new investment flows from China, Russia, the Middle East, and other emerging economies. Figure 5.2 shows the capital investment by fintech segments between 2010 and 2017.



Source: consultancy.uk <https://www.consultancy.uk/news/16707/venture-capital-investment-in-fintech-reaches-record-274-billion-high>

Figure 5.1: Venture Capital Flows into Fintech by Region



Source: consultancy.uk

Figure 5.2: Venture Capital Investment by Segment

Investments in Blockchain

Major firms across the financial services landscape have made investments in blockchain-based start-ups, continuing into 2018. The herd of new strategic investors is playing an increasingly important role in the health of the financing market for these start-ups. While quarterly deal activity dropped to its lowest point since Q2'14 in Q4'16, the quarter's top two financing deals featured investments by major corporate and financial services players.

More specifically, distributed ledger developer Axoni saw Wells Fargo lead its US\$18M Series A offering, which included JP Morgan, Goldman Sachs, F-Prime Capital, and Thomson Reuters as investors. As Axoni CEO Greg Schvey said, "Deploying distributed ledger technology in production at this scale is a watershed moment for the industry. The combination of technology and business expertise being contributed to this project from across the participating firms is unparalleled and the benefits are clear."¹ Among the financial services investors are insurance providers such as TransAmerica, New York Life, and Mitsui Sumitomo Insurance Group (MSIG); payments giants including Visa, MasterCard, and American Express; as well as banks like Mitsubishi UFJ Financial Group (MUFG), Citi, Santander, and Canadian Imperial Bank of Commerce (CIBC).

Strategic investment into bitcoin or blockchain start-ups over the past three years hit its apex in the fall of 2015 and into the winter of 2016. In recent months, Deloitte, Miami International Holdings (MIAX), and Credit China placed their first blockchain bets, with Deloitte taking a corporate minority stake in appropriately named blockchain settlement and payments platform SETL.² In total, over fifty financial services firms or their strategic investment arms have invested in a bitcoin or blockchain-specific start-ups since the start of 2014.

Of note, a relatively small number of start-ups have captured most financial services investments in the bitcoin and blockchain space. For example, the seven firms listed below—Circle Internet Financial, Coinbase, Ripple, BitFury Group, Blockstream, Digital Asset Holdings, and Chain—have received nearly US\$625M in funding and are all listed among the top ten most well-funded bitcoin and blockchain companies. Between Circle's Series E round of US\$110 million, US\$118 million raised by Orbs, a purported "consumer-ready blockchain" service, US\$75 million Series B round for Paris-based secure hardware wallet-maker Ledger, they account for a significant number of financial services investors. As of the first half

¹ <http://www.dtcc.com/news/2017/january/09/dtcc-selects-ibm-axoni-and-r3-to-develop-dtccs-distributed-ledger-solution>

² <https://www.cbinsights.com/research/financial-services-corporate-blockchain-investments/>

of 2018, the total investments in blockchain-related companies have exceeded US\$1.3 billion across all investment rounds worldwide. Reported dollar volume invested in VC rounds raised by blockchain companies surpassed totals in 2017.

Trends of the Sharing Economy and the Internet of Things Era

Many people in the financial industry are trying to prepare for or predict what the financial services sector will look like in 2020. Will artificial intelligence (AI) replace operations? Will performing financial functions occur in an instantaneous manner from the palm of our hands? Will there be enough disruption so that large banks will no longer exist? The following principles are not just our forecasts for the future, but are widely shared.

Open Platforms

Most platforms already built or being built are installed or web-based, but few have been completely open. Most very successful companies are completely obsessive about keeping the system closed. In most cases, this worked very well. However, the current trend is to open, and for good reason. Recently, Google, which had frantically protected its search algorithms, opened its AI algorithms for everyone to see and interact with. And perhaps even more astonishing was Microsoft's purchase of open source leader, GitHub.

We can project the open system materializing in two related areas: first, new platforms can be built with proven open sourced financial services-oriented software. Examples include databases a company uses, such as Hadoop, PostgreSQL, and MongoDB. Second, open API (application programming interface) systems can be an enabler. Open APIs provide future flexibility as well as the ability to have other noninfluenced voices providing continuous feedback to suggest new ways to approach a problem. An open API also allows third-party vendors to build additional features and enhancements without getting stuck in the company's resource constrained pipeline and prioritizations.

An open system fits perfectly into the overarching need for transparency in the financial markets system, and more transparency will lead to better product and cost control. However, the main problem with an open system is information leakage. How do you have a fully open system to increase transparency and at the same time make sure the amount of information leakage is minimal? How do you financially capitalize on your investment in your API? The solutions to these two questions will be the fine art that will need to be mastered by tomorrow's industry leaders.

Web and Mobile (Internet of Things Devices)

There have been many iterations of web-based front-end technologies, from Microsoft's Silverlight to Adobe's Flash, yet they are fading into the history halls of technologies. The Web and HTML 5 are here to stay.

The advent of financial markets-specific containers such as Openfin, which create ease of integration among platforms and institutions by making an application native to any screen, allows the transformation to mobile to be extremely easy. The more institutions standardize on the usage of these infrastructures, the easier application deployment and integration will be.

Open sourced efforts in this space are impressive, but only if they lead to further standardization of front-end development. As for mobile, it is easy to say a platform will be mobile, but it is harder to execute transitioning to mobile if all features of an application must be made mobile. Having the luxury to build a mobile strategy from scratch is rare.

Looking at certain areas in the world, such as parts of Africa and China, the desktop model has been completely bypassed. Hence, the importance of offering the consumer full capabilities using a mobile platform. For the average financial services executive on the street, mobile means more frequent and immediate transparency. The ability to know about an issue in real time and solve that issue on a mobile platform is key for future potential users.

Cloud-Based (Internet of Things Infrastructure)

Public clouds, private clouds, cloud as a disaster recovery (DR), and cloud communications are here to stay and will increase as the adoption of cloud-based computing accelerates. All companies, regardless of size, should build with a cloud-based infrastructure in mind, and seriously consider a server-less environment with adequate cybersecurity measures.

Banks are very concerned about security, and the safety to store their sensitive information in the cloud. It should be noted that most of the high-visibility hacks in the past ten years have affected networks but fewer on cloud providers. It is much easier to protect small amounts of connection points than it is to guard large amounts of entry points coming into a system. Financial institutions need to find ways to mitigate security fears on the path to future computing, which appears to be in the cloud.

Cloud computing also serves as an opportunity to consolidate platforms and connectivity. However, it is the role of vendors to provide further efficiencies using cloud computing rather than financial institutions believing that if they simply move everything to the cloud, their processes would be cheaper and easier to maintain.

Moving operations fully to the cloud will be akin to disconnecting from cable and going wireless, but it needs to have a justified use case and may not necessarily make sense for every business. Some cloud services' pricing is flexible in that they charge by the number of minutes used on the platform. This is very encouraging and innovative, as making an upfront commitment for usage is a burden on cashflows and no longer necessary. Such technological shifts allow the financial institutions to focus on their core business areas which are managing balance sheets, providing credits and financing, trading, and risk management while using whatever tools they have at their disposal to provide mobility and maintaining competitive advantage in their space.

Clearing Trades and Settlement Transactions

A recent poll showed that 60% of participants believe that further digitization and clearing of the over-the-counter (OTC) world is certain. The recent numbers published by the largest clearing houses support this migration mainly due to crippling regulatory burdens of keeping larger amounts of capital for OTC trades. There are many factors working against full migration of OTC products to standardized clearable products. Some include the basic fact that there is no single model to price these products. Therefore, disagreements on the amount of required collateral prevents the full migration into clearing.

Another obstacle is that banks do not want to create too much transparency in these products, as they provide the bank with huge margins on trading in the current opaque market. Some financial institutions have created direct links to clearing houses and other advancements in the cleared processing of trades. New regulation around trades requires immediate processing activity on these products, and some regulations require full reporting within 10 minutes.

However, what is obviously being missed is that even in the cleared space, 50% or more of the transactions are still voice trades made over the phone. If we do not fully automate that part of the cleared trade process, we will not achieve the full compliance needed to create the efficiencies predicted by many.

Therefore, automation of the voice trade is key to the advancement of trade processing. We expect technologies in this space to rapidly advance. However, 98% accuracy is simply *not* enough in this use case. We need to be right all the time when it comes to sensitive information. By 2020, this concern will be likely addressed, and we will reach full automation of the trading process from an OTC digitization standpoint as well as from the voice trade perspective.

Widespread Use of Artificial Intelligence

If you are a vendor or start-up and want to be funded, unless you can come up with a better idea, you will need to explain how your platform will use either AI, cognitive components such as chat bots, or behavioral-based insurance underwriting, and of course you must explain how you could use blockchain in your future vision.

The short-term prediction is that AI, cognitive platforms, and blockchain will all be a major part of any meaningful solution going forward. With the explosion of big data, AI technologies are key to understanding and improving the use of this big data. AI has advanced at a rapid pace and will integrate into our daily lives, often unseen, by 2020.³ For example, we see the use of AI in our platform as a means to achieve two major goals: data quality, and trade breaks reconciliation and remediation. All of the catalysts for increased data usage are clear, but the biggest problem is the quality of the data itself. If the quality of the data coming in is poor, then you will also have poor output—quality of output is highly dependent on the quality of input.

The Holy Grail in terms of our platform's goals is to improve data quality, improve data matching of nonstructured data, and help our AI algorithms correct data impurities on their own. We have seen an explosion in the interest around blockchain and the way it could simplify the complexities of the market infrastructure.

Blockchain would drastically reduce costs while improving the ability of financial institutions to synchronize data and transactions. Some experts believe the way to prepare for it is by installing a private node distributed ledger and then preparing to expose it to other players if and when they are ready. Herein lies the main problem with the implementation of blockchain—it will only work if all the participants implement the technology until effective solutions to this problem are found. To reach this network effect or its true scale potential, one factor that is very important is the ability to define the right use case for the technology.

A main concern today is that institutions are not very selective in the choice of use case when implementing AI or blockchain. This dilutes the importance of the technology and sometimes leads to large investments in solutions being disbanded mid-way. If we are selective in our use cases, and are choosing the right technology partner, we should have full verification of the success of such

³ Fintech AI Revenue to Grow 960% by 2021, Driven by Big Data, Distributed Computing & Connectivity. *Juniper-Research*, August 2, 2016. <https://www.juniperresearch.com/press/press-releases/fintech-ai-revenue-to-grow-960-by-2021-driven-by>

technologies in the early 2020s, which will set clear key performance indicators toward the implementation of these technologies.

Regulatory Controls

If we could all agree on one area that controls the narrative of the financial institution business model and its future viability, it would be the immense amount of new regulations controlling investment capital in the market for the past decade.

Complying with the regulations became costly in the global arena. If you were local and thought you could escape the reach of the regulators, you were wrong. Furthermore, the regulatory attitude toward financial market participants was do or die, leaving no choice or time to think about future strategies.

One of the main criticisms is that most regulators were interested in collecting large fees for noncompliance issues rather than working to reduce systematic risk. New technology was patched on like band-aids put on an open wound.

Although some efforts are on the way for deregulation in the United States, many new regulations and even tighter frameworks were approved in the European Union. It is likely that we will continue to suffer higher level of regulations globally, which will distract us from the strategic views of our institutions. It will be interesting to see how regulators from less developed nations follow advanced nations to add further regulatory burdens on fintech companies.

Managing global compliance with these regulations and adjusting the financial institutions' systems to be flexible enough to deal with the newest breed of regulation is not the best way to approach this issue strategically. Utilities could provide a meaningful stepping stone for further compliance with the ever-changing regulatory environment.

Institutional Investment

The paradigm of the separation of buy-side (institutional investors) functions and sell-side (investment banking industry) functions is rapidly changing. Functions such as market making or direct clearing were not considered a real threat to the sell-side model until recently. This trend will continue to grow and therefore we believe that by 2020, at least one or two large buy-side firms will decide to enter the market making business (e.g., Citadel Securities) and direct clearing.

What this means from a technology platform perspective is that the full automation of workflows that were once deemed to be impossible to automate are now possible. Buy-side firms have no interest in becoming banks, as they are always at the forefront of creativity in financial instruments and, most important, they have the power of the user. When building our platform, we are constantly reaching out to innovative institutional investors to get their input on product

development. If there is one major risk to the banks' future business model, it is the evolution of the buy-side model.

Conversely, institutional investors have benefited from the fact that investment banks pay for most of the costs involving clearing, processing, and even trading securities. Furthermore, institutional investors are used to the banks performing functions on their behalf, such as reporting. These functions will not be handled by the banks beyond 2020; therefore, the flip side of buy-side dominance is the extra expense in technology and resources to comply with this new level of importance. The positive aspect is that institutional investors, especially the nimbler hedge fund industry, tend to think about problems with no legacy bias, and are thus part of creating new and improved workflows to deal with the new financial responsibilities.

Diverse and Choices

To get where we want to be in the fintech future, we will have to continue the simple function of mobility. Competition is good for the market and we believe that we are in an era when it will only increase, offering a diverse competitive landscape for fintech but raising other issues. One issue is currently very apparent in many parts of the industry, where there are at least six to ten choices of vendors for one problem. Blockchain, advanced AI algorithms, and payment platforms are just some examples of this proliferation.

If we provide the ecosystem in which many participants can easily integrate their services, then financial institutions would be able to “try out” any service they would like with minimal technological effort. Frequency of usage and new functionality would often be deployed in a seamless way to market participants.

Take the Amazon or iTunes models, for example. Apps come and go, succeed and fail, but the user never needs to spend more time or effort on them beyond a simple download or small fee. The other important factor to reaching diversity and choice is that you do not want the framework that gets you the ability to choose to be just another toll taker on the way to a perfect environment. The commercial business model of participants and vendors needs to change and this should happen over the next five years.

User Defined and User Experience

We have seen too many systems and technologies created by the financial industry that seem to have thought about the use case and the technology needed to achieve its goals, but at the same time neglected the user experience (UX). When the UX is poor, eventually the user will look for another alternative. Looking at the current technological offerings, some of the major platforms that support the

market infrastructure are simply terrible to use, as an average function might take a long list of manual steps to complete. There is a shift in power that is moving to the users, and vendors should assign UX a much higher importance, as it does other features. Basically, behind the traders that make money sit great people who have had to deal with inferior and cumbersome UXs.

Financial institutions rarely make that experience better unless they think it will directly affect their bottom-lines. However, by 2020, most institutions will address this issue; otherwise their competitors will do so and benefit with an increased market share because of it. Another important part of improvement to UX is the clear definition and support for user rights. Users are looking for clear rights and a flexible method to add or take away from entitlements and user preferences. Letting the user define his own trade matching algorithms is one way we are addressing this issue for 2020.

Trust in the New Sharing Economy

As Adam Smith, the father of modern economics, pointed out, a base level of trust in society is necessary for specialization and the economic growth that accompanies it. If we did not trust the butcher to give us quality meat without having to inspect the cow every time—or worse yet, if we needed to litigate after every grocery run—the whole system would come to a screeching halt.

This concept is even more critical in the sharing economy—which is often, quite appropriately, referred to as the trust economy. The sharing economy requires an incredibly high degree of trust, often based off little more than a profile picture and rudimentary reputation system. Sharing saves people time, money, and aggravation. But what really greases the wheels of this fast-growing economy is trust; it is what allows someone to take a ride from a stranger or rent a room in a house from someone they have never met. These successes in the sharing economy startled more than a few cynics who assumed that this reliance on trust, reputation, and goodwill would quickly become a giant scam or worse.

The sharing economy matches under-utilized assets with potential users. Uber and Airbnb have transformed idle assets (inventory) into economic value—by drastically changing social behavior and replacing transaction costs in order to match users with the assets. In the sharing economy, people must become comfortable enough trusting others that they will forego the expense of takaful contracts, lawyers, security systems, and even private ownership enforcement, to enjoy the benefits of sharing assets. The global population has become entrenched in the dominant ownership mindset. People are wading through an asset-heavy lifestyle engineered by the rise of hyper-consumption with material

possessions, most of which are not really wanted, needed, or even used. While established businesses continue to hammer consumers with various iterations of the same proven formula—create product, sell it, collect money, repeat—a new, grassroots model of doing business is emerging, providing consumers with the power to get what they want and need at less personal and environmental cost (Gansky 2010).

As advanced trust mechanisms develop, the first “transaction costs” to disappear will be the redundant ownership of assets. As the mechanisms develop further, other opportunities will arise. Airbnb and asset rental companies are, in many ways, still working off the paradigm of scale economies, the low-hanging economic fruit of our time. Trust metrics will offer even greater economic value down the road, when massive economic gains can be reaped by applying them to things like:

- Releasing business value trapped in excess capacity and unnecessary transaction costs
- Altering traits of reliability and integrity to deliver on a commitment
- Collaborate to make trust data more viable and widespread

At the same time, the sharing economy represents a significant and growing business opportunity that will play a much grander fundamental shift in economic transactions. It is a shift from an infrastructure that *protects* people *from* each other, to an infrastructure that *helps* people *trust* each other.

Trust and Reciprocity in the Economy

Institutional economists, economic sociologists, political economists, and others concerned with the social organization of economic life have long maintained that trust and confidence are crucial to effective economic functioning, not only in underwriting specific exchanges between particular agents, but in terms of a generalized foundation of trust that underpins a wider socioeconomic system. In instrumental terms, resources of trust promote economic efficiency by reducing the transaction costs of economic exchange, on the assumption that others will behave according to common norms of economic conduct. It may be possible to transact without such an underpinning of trust—in contexts where cheating, fraud or corruption are rife—but the risks and associated costs of doing so are much higher than where individuals have a reasonable expectation that others will deal plainly. Trust leads a double life as a social value and an economic

resource; as such, it is a critical concept for linking social arrangements with economic outcomes.

As financial markets have grown more complex, and exchanges within them made impersonal through electronic communications, the problem of trust has become more acute. Systemic risk requires systemic trust, and the ways in which risk has been distributed across the system via complicated and often opaque instruments has tested systemic resources of trust to breaking-point. Tighter credit requirements—inter-bank, business, and mortgage lending—are a signal example of a crisis in confidence inside the financial system. The proliferation of crowdfunding platforms, for example, seems to indicate the market seeking alternative means to traditional lending.

It should also be noted that poor and tyrannical countries find themselves entrapped in continuing mistrust, inequality, and dysfunctional institutions. High levels of inequality contribute to lower levels of trust, which lessen the political and societal support for the state to collect resources for launching and implementing universal welfare programs in an uncorrupted and nondiscriminatory way. Unequal societies find themselves trapped in a continuous cycle of inequality, low trust in others and in government, policies that do little to reduce the gap between the rich, and the poor and create a sense of equal opportunity. Demands for radical redistribution, as we see in many transitioning countries, exacerbate social tensions rather than relieving them.

However, we know that extending trust to people inspires them. It brings out the best in them and it motivates them. In fact, the reason that extending trust is so powerful is because trust is a compelling form of positive human motivation. This is a key source of economic growth and collaboration. Extending trust also in turn increases trust. It is somewhat ironic that one of the best ways to increase trust is to simply extend it. Trusting people inspires them to want to be worthy of that trust. It brings out the best in them. It makes it safer to risk and innovate, and extending trust generates reciprocity. When we give trust to people, they tend to give it back. There are many reasons for this, and the fundamental reason why the sharing economy has succeeded so far is because its positive (and counter-intuitive) outcome helps show that people are more trusting than skeptics usually assume, especially when someone else goes out on that limb first. This helped fuel much of the early optimism of a utopian trust economy where we could all operate on a system of goodwill toward mankind. But when we withhold trust, people generally will in return withhold it. In teams and organizations, giving trust manifests in greater employee engagement and retention, increased customer loyalty and referrals, and other economic benefits.

Trust and Trustworthiness (Reciprocity) in Islam

In Islam, man is entrusted with an *amanah* (trust) to establish responsibility on earth by means of virtues and bounties endowed to him by God, his initiative, creativity, and labor (*isti'mar*). Nature has been created for human beings but man is also required to establish a moral social order on earth. The concept of *amanah* implies that in all his actions, man should choose to prosper the earth (*islah*) by making the best use of resources and to fully utilize the virtues inherent in him to *isti'mar* the earth. *Ifsad* (*fasad*) or adversity or corruption, is to be avoided in managing one's role as a *khalifah*. Being a *khalifah*, man has also been granted authority to freely manage nature/universe and to cooperate with his fellow beings to complete the task of *khalifah*. As our world and the economy evolves, we seek new ways (innovate) to cope with the challenges evolution brings. We believe technology is a great way to do this, and the main building block to enable trust in impersonal financial transactions in a highly globalized environment can be identified as blockchain. This innovation that will shape the future will not only play a crucial role in boosting the financial sector (banking, takaful, investment, etc.) including the Islamic finance sector but also other economic transactions that will characterize the sharing economy.

Religious tenets, in general, could be viewed as the force behind the “invisible hand” that Adam Smith had probably alluded to, where in the pursuit of self-interest, the “invisible hand” will safeguard the collective interest. There always has been a moral and ethical obligation to pursuing one's own interest because we do not live in isolation. If we choose to ignore these obligations, the unspoken social contract breaks down and it would lead to the tragedy of commons. Building trust by upholding ethical and moral obligations, hence, reinforces public civility and communal solidarity, removes fears and mistrust in public and private institutions for a harmonious and profitable existence, by reducing risk in highly uncertain times through shared goals and reciprocal undertaking. And as we will see in the next few sections, specific technology, like blockchain, will be a key enabler to further encourage this and play a significant role in the new sharing economy.

What Is Blockchain?

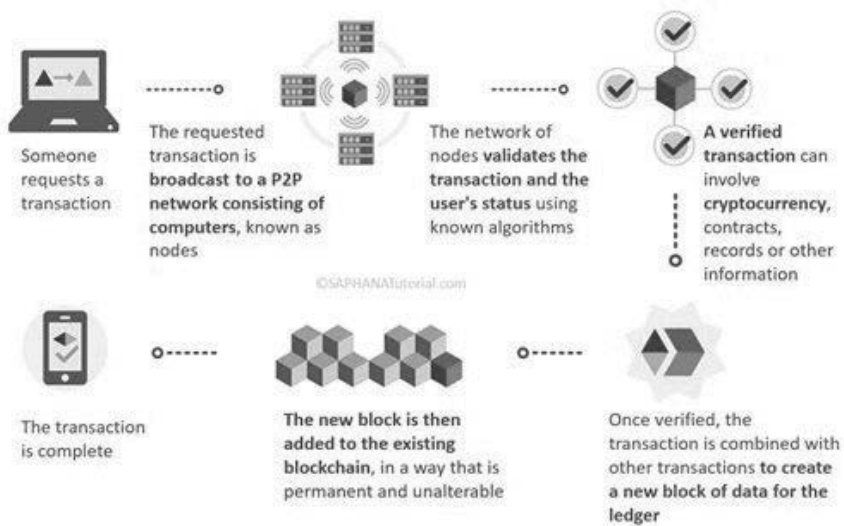
Blockchain is a P2P public ledger maintained by a distributed network of computers that requires no central authority or third-party intermediaries. It consists of three key components: a transaction, a transaction record, and a system that verifies and stores the transaction. The blocks are generated through open-

source software and record the information about when and in what sequence the transaction took place. This “block” chronologically stores information of all the transactions that have taken place in the chain, and therefore the name—blockchain. In other words, a blockchain is a database of immutable time-stamped information of every transaction in that chain that is replicated on servers across the globe. This technology is the foundation of cryptocurrencies⁴ such as bitcoin. In fact, blockchain technology was first introduced in 2009 with bitcoin, a cryptocurrency-based distributed payment protocol.

Blockchain’s main innovation is a public transaction record of integrity without central authority. The technology offers everyone the opportunity to participate in secure contracts over time, with a secure record of what was agreed at that time. This innovation carries a significance stretching far beyond cryptocurrency. Blockchain lets people who have no particular confidence in each other collaborate without having to go through a neutral central authority. Simply put, it is a mechanism for creating trust. Within this open ledger system, blockchain offers an inherent level of trust for the user, eliminating the need for the middleman and mitigating the risk of human error. Its publicly accessible log of transactions ensures that the data is protected against tampering and revision, and it is virtually impossible for individuals to modify or replace parts of the blockchain secretly.

A full copy of the blockchain contains every transaction ever executed, making information on the value belonging to every active address (account) accessible at any point in history. Every block contains a long reference number or hash of the previous block, thus creating a chain of blocks from the genesis block to the current block. Figure 5.3 illustrates how a transaction is recorded on the blockchain, based on the cryptocurrency protocol.

⁴ Bitcoin and other cryptocurrencies (also called AltCoins) gained significant momentum in 2013 with bitcoin’s sharp price rise, the historic high being US\$1124.76 on November 29, 2013. High prices and high volatility attracted speculation, as well as proliferation of competitive and complementary cryptocurrencies. Arguably, there were over 500 AltCoins based on blockchain technology as of November 2014.



Source: <http://saphanatutorial.com/introduction-to-blockchain-for-beginners/>

Figure 5.3: How the Blockchain Transaction Works

Validation is required for a new block to be added on to the blockchain. This validation process, also called mining, allows pending transactions to be confirmed; enforces a chronological order on the blockchain; protects the neutrality of the blockchain; and enables different computers (or nodes) to agree on the state of the system at any given time (Bitcoin Project, n.d.).

In traditional transactions, such as money transfers or foreign currency, there is usually an intermediary or a centralized entity that records the transmission of money or currency that exist apart from it. In blockchain, the token or digital coin itself is what has value, which is determined by the market. This is what makes the system a truly decentralized exchange. When people buy or sell bitcoins, a secret key or token is broadcast to the system. “Miners” use nodes, computers, or devices linked to a network, to identify and validate the transaction using copies of all or some information of the blockchain, which are accessible publicly. Before the transaction is accepted by the network, miners have to show PoW using a cryptographic hash function (that special algorithm), which aims to provide high levels of protection. Miners receive some form of compensation for their computing power contribution, avoiding the need to have a centralized system. New protocols such as Ripple rely on a consensus process that does not need miners nor proof of work and can agree on the changes to the blockchain within seconds. As progress is made in blockchain technology, its use will become more efficient and

applicable in many ways, that is, to transact anything of value, not just digitizing currency.

Blockchain as Currency and Payments

Using blockchain as digital currency, like bitcoin, is a way of buying and selling things over the internet without cash. The bitcoin value chain is composed of several different constituencies: software developers, miners, exchanges, merchant processing services, web wallet companies, and users/consumers. From an individual user's perspective, the important elements in transacting coins are a user address, a private key, and wallet software. The address is where others can send bitcoin to you, and the private key is the cryptographic secret by which you can send bitcoin to others.

Until blockchain cryptography, digital cash was, like any other digital asset, infinitely duplicable (like our ability to make copies of an e-mail attachment any number of times), and there was no way to confirm that a certain batch of digital cash had not already been spent without a central intermediary. There had to be a trusted third party (whether a bank or quasi-bank payment platforms like PayPal) in transactions, which kept a ledger confirming that each portion of digital cash was spent only once; this is the double-spend problem. Coin ownership is recorded in the public ledger and confirmed by cryptographic protocols and the mining community. Blockchain is “trust-free” in the sense that a user does not need to trust the other party in the transaction, or a central intermediary, but does need to trust the system: the blockchain protocol software system. The “blocks” in the chain are groups of transactions posted sequentially to the ledger—that is, added to the “chain.” Blockchain ledgers can be inspected publicly with block explorers, internet sites (e.g., www.Blockchain.info for the bitcoin blockchain) where you can see a transaction stream by entering a blockchain address (a user's public-key address, e.g., 1BpXJCi5bEjNn6DtoYJhg6wR5JwLCGLbfx).

One of the main issues blockchain can tackle is the high complexity of payments networks, due to the fragmentation of the financial industry itself, which makes it impractical for individual banks to deal directly with all other banks on the planet.

For example, when a bank gets a payment instruction from a client, it needs to find a correspondent bank that is willing to take the client's funds and terminate the payment locally at the receiving bank. And in order to do so, the corre-

spendent bank needs to have a *nostro*⁵ or *vostro* account with the receiving bank (or with another correspondent bank that has access to the receiving bank, thus adding an extra hoop), ideally with enough pre-funded liquidity to complete the payment on the client's behalf.

But when this happens, the receiving bank has no way to verify that the incoming transfer from the (last) correspondent bank, in fact, corresponds to the original client sending the money. That is why a SWIFT message from the sender is needed, so the receiving bank can understand the purpose of the incoming funds, do proper due diligence or antimoney laundering (AML) checks on the payment, and inform the receiver of the funds.

All the parties involved have different ledgers, that is, they do not share a single version of the truth, and the coordination between all these parties is slow and error-prone, many times relying on manual interventions by back-office teams. Furthermore, someone needs to perform currency conversion at either end, and different parties need to manage liquidity levels at *nostro/vostro* accounts, which involves settling against central bank accounts as well.

One way that cryptocurrencies can provide efficiency is in international trade invoicing and payments. Sourcing liquidity for local currency is a key factor to make international supplier payments more reliable. The problem for importers in emerging economies is that there are fewer buyers and sellers of local currency. This results in fewer bids and asks, making it more difficult for buyers and sellers of local currency to transact, hence, impacting on reliability of international supplier payments and their participation in trade. It is plausible in this respect that bitcoin the currency (BTC) could provide liquidity for local currencies and bitcoin the system could act as a means to pay international supplier invoices in international currencies.

For example, consider a scenario where an international supplier invoices a firm in Kenya in US\$ (Africa has been the fastest growing region in the last decade—and the microfinancing service M-Pesa⁶ originated from Kenya). Technically, the local importer can purchase BTC with local currency (KES) on an exchange that acts as an onramp—in 10 minutes the transaction is confirmed by

⁵ *Nostro* is a Latin word, which means “our.” When a bank holds an account in foreign currency in another bank it is called *nostro* account, that is, our account with them. Similarly, *vostro* means “your,” that is, your account with us. Accounts of other banks in another bank (in domestic currency) are known as *vostro* accounts.

⁶ M-Pesa was first launched by the Kenyan mobile network operator Safaricom, where Vodafone is technically a minority shareholder (40%), in March 2007. M-Pesa quickly captured a significant market share for cash transfers, and grew to 17 million subscribers by December 2011 in Kenya alone.

bitcoin, the system—and the BTC can be used to purchase US\$ on the exchange, where the balance is deposited into a bank account. Clearly this is technically feasible, as this is indeed how current remittance flows on bitcoin work—and in this example would avoid the high intermediation costs for converting the KES.

Blockchains as Databases and Public Registries

Blockchains also have a host of other uses because they meet the need for a trustworthy record, something vital for transactions of every sort. One idea is to develop tamper-proof public databases cheaply like land registries (Honduras) and registry of companies (Isle of Man); or registers of the ownership of luxury goods, like diamonds (Everledger) or works of art. Documents can be notarized by embedding information about them into a public blockchain—and you will no longer need a notary to vouch for them. Financial-services firms are contemplating using blockchains as a record of who owns what instead of having a series of internal ledgers. A trusted private ledger removes the need for reconciling each transaction with a counterparty; it is fast and it minimizes errors. Oliver Wyman, Anthemis Group, and Santander Innoventures (2015), estimate that this could save banks up to US\$20 billion a year by 2022.⁷

Public records, too, can be migrated to the blockchain: land and property titles, vehicle registrations, business licenses, marriage certificates, and death certificates. Digital identity can be confirmed with the blockchain through securely encoded driver's licenses, identity cards, passports, and voter registrations. Private records such as IOUs, loans, contracts, signatures, wills, and trusts can be stored.

Physical asset keys can be encoded as digital assets on the blockchain for controlled access to homes, hotel rooms, rental cars, and privately-owned or shared-access automobiles (e.g., Getaround). Intangible assets (e.g., patents, trademarks, copyrights, reservations, and domain names) can also be protected and transferred via the blockchain. For example, to protect an idea, instead of trade-marking it or patenting it, you could encode it to the blockchain and you would have proof of a specific invention/innovation being registered with a specific date-time stamp for future proof.

⁷ This is quoted from their joint report “The Fintech 2.0 Paper: rebooting financial services.”

Blockchain as Smart Contracts

Whereas the initial blockchain version is for the decentralization of money and payments, the next evolution of blockchain is for the decentralization of markets, and the transfer of many other kinds of assets beyond currency using blockchain, from the creation of a unit of value through every time it is transferred or divided. The key idea is that the decentralized transaction ledger functionality of blockchain could be used to register, confirm, and transfer all manner of contracts and property. Satoshi Nakamoto (2009) started by specifying escrow transactions, bonded contracts, third-party arbitration, and multiparty signature transactions. All financial transactions could be reinvented on the blockchain, including stock, private equity, crowdfunding instruments, bonds, mutual funds, annuities, pensions, and all manner of financial instruments (futures, options, currency swaps, etc.).

Smart contracts are a complex set of software codes with components designed to automate execution and settlement of contractual agreements. In other words, they are programmable contracts, which self-execute the stipulations of an agreement when predetermined conditions are triggered. Once two or more parties consent to all of the terms within the contract, they cryptographically sign the smart contract and deploy it to a distributed ledger. When a condition specified in the code is met, the program automatically triggers a corresponding action. By removing the need for direct human involvement, a deployed smart contract on a distributed ledger could make contractual relationships more efficient and economical with potentially fewer opportunities for error, misunderstanding, delay or dispute. The smart contract is also automatable and enforceable. It is automatable by a computer or network of computers, although some parts may require human input and control. It is then enforceable by either legal enforcement of rights and obligations or tamper-proof execution.

In contractual agreements within the purview of the Shariah, it is imperative that the clauses be transparent and void of deceptive ambiguity (*gharar*). Certain “expensive” law firms charge a premium to be able to craft clauses such that in cases of dispute, these clauses allow unfair advantage to them. If you really think about it, smart contracts are meant to be “dumb” such that they ideally have no hidden loop-holes and terms and conditions are plain enough to be executed automatically by code. Such is the spirit of the Shariah.

In addition, reliance on physical documents leads to delays, inefficiencies and increases exposure to errors and fraud. Financial intermediaries, while providing interoperability for the finance system and reducing risk, create unnecessary overhead costs and increase compliance requirements. Smart contracts on

blockchain have the capacity to inject greater efficiency and productivity while saving costs associated with traditional contracts.

Blockchain as Clearing and Settlement of Securities Transactions

In their analysis, Boston Consulting Group (Evans et al., 2016) noted that one of the most scrutinized uses of blockchain is for the clearing and settlement of securities transactions, currently a complex network of brokers, custodian banks, stock transfer agents, regulators, and depositories. A single transfer can require a dozen intermediary transactions, and typically takes three days to settle, of which about 20% generate errors, which has to be corrected manually.

With blockchain, two trading parties could read and write to a common, trusted, and error-free database. The transaction could be written in legal language as well as in computer code, so that the data exchange itself is the settlement. And it could be visible to regulators. The brokers (as agents of the buyer and seller) could trade on a larger blockchain to remove custodians as intermediaries, thereby reducing total transaction costs. Institutions issuing securities, such as corporations and municipalities, could issue them directly onto the blockchain, thereby removing the need for stock transfer agents.

Reduction of Fraud

It is commonly acknowledged that one of the main challenges facing the banking industry today is the growth of fraud and cyberattacks. Traditionally, bank ledgers have been created within a centralized database. This model has been more susceptible to hackers and cyberattacks as all the information is located in one place—usually secured behind outdated legacy information technology (IT) systems. Hackers and cybercriminals are well aware of evolving digital technology and have been able to bypass these security systems to commit data breaches and fraud.

In contrast, as blockchain is decentralized it is less prone to this type of fraud. By using blockchain there would not only be real-time execution of payments but also complete transparency, which would enable real-time fraud analysis and prevention. A blockchain is checked at every step of a transaction by independent miners, with all data being open and publicly available, there is a real-time analysis and verification of every bit of data and all information during the transaction. The blockchain ledger can provide a historical record of all documents shared and compliance activities undertaken for each banking customer. Mali-

cious attempts to view or change the data become part of the data itself, making third-party hacks immediately obvious.

For example, this record could be used to provide evidence that a bank has acted in accordance with the requirements placed upon it—should regulators ask for such clarification. It would also be of particular use in identifying entities attempting to create fraudulent histories. Subject to the provisions of data protection regulation, the data within it could even be analyzed by the banks to spot irregularities or foul play—directly targeting criminal activity. This would be an advantage over the current banking and payments systems, which are more susceptible to fraud and hacking. There would need to be collaboration to achieve this within the blockchain ecosystem. Banks would need to partner with regulators and fintech companies to develop credible, decentralized ledgers permitting rapid adoption of global real-time payments and settlement.

On December 30, 2015, Nasdaq announced that it had made its first ever share trade using blockchain technology. Nasdaq used its proprietary Linq platform (developed in collaboration with Chain.com and global design firm IDEO) to sell shares. As Nasdaq has pointed out, within the multistep manual process used today in banks and financial institutions there is not only plenty of room for error but also for fraud. By utilizing blockchain, organizations can reduce risk and administrative burden, as well as saving time and money. Nevertheless, banks must consider that blockchain does not yet eliminate all types of fraud.

Know Your Customer

Know Your Customer (KYC) requests currently can cause delays in banking transactions, typically taking thirty to fifty days to complete to a satisfactory level. Current KYC processes also entail substantial duplication of effort between banks (and other third-party institutions). While annual compliance costs are high, there are also large penalties for failing to follow KYC guidelines properly.

The average bank spends US\$56 million a year on KYC compliance, according to a recent Thomson Reuters survey, which also revealed that some banks spend up to US\$420 million annually on KYC compliance, AML checks and customer due diligence (CDD). Since 2009, regulatory fines, particularly in the United States, have followed an upward trend with record-breaking fines levied during 2015. Ongoing regulatory change, with no one internationally agreed standard, makes it increasingly hard for banks to remain compliant. Thus, as it can take such a long time to on-board a new customer because of lengthening KYC procedures, this is having an increasingly negative effect on customer experience.

A blockchain specialist at Rabobank proposed that KYC statements can be stored on blockchain. Once a bank has KYC-ed a new customer they can then

put that statement, including a summary of the KYC documents, on a blockchain that can then be used by other banks and other accredited organizations (such as insurers, car rental firms, loan providers, etc.) without the need to ask the customer to start the KYC process all over again. These organizations will know that the customer's ID documents have been independently checked and verified so they will not need to carry out their own KYC checks, reducing their administrative burdens and costs. As data stored on blockchain is irreversible, it would provide a single source of truth thereby minimizing the risk of duplication or error. There is also the advantage for the customer that they only have to supply KYC documents once (until they need to be updated) and that they are not then disclosed to any other party (except for their own bank) as the other organizations will not need to see and check the ID documents but will just rely on the blockchain verification.

SWIFT has established a KYC Registry with 1,125-member banks sharing KYC documentation—however, this is only 16% of the 7,000 banks on their network. The KYC Registry meets the need for an efficient, shared platform for managing and exchanging standardized KYC data and it's free to upload the documentation to the Registry and to share it with other institutions. SWIFT validates the data rigorously, informs the client if it is incomplete or needs updating, and sends out alerts to correspondents whenever the data changes.

There will still be issues surrounding security and privacy of customer's KYC information but, as long as all KYC is held on a private blockchain rather than a public one, these issues should be minimal from a bank customer's point of view. The data on the blockchain will merely be a reference point with a digital signature or cryptographic hash—which would give individuals access to the relevant client information in a repository separate to the blockchain, ensuring a secure and private way of conducting and storing a customer's KYC information. Equally important, though, is ensuring financial institutions only have permissioned access on a temporary basis so that access to KYC information is only granted when strictly necessary for that purpose, and for no other ancillary reason. Therefore, it is evident that blockchain could have a major role in streamlining these KYC and AML processes—although this may require cross-border consensus as to what is regarded as acceptable KYC documentation and what needs to be done in terms of acceptable verification of those documents.

According to a Goldman Sachs Report,⁸ the banking sector can achieve 10% headcount reduction with the introduction of blockchain in the KYC procedures. This amounts to around US\$160 million in cost-saving annually. Blockchain will also reduce the amount of budgetary resources allocated for employee training,

⁸ Schenider, J. (2016). *BlockChain: Putting Theory into Practice*. Goldman Sachs.

there will be 30% headcount reduction amounting to US\$420 million. Overall operational cost savings are estimated to be around US\$2.5 billion dollars. AML penalties will also be reduced by an estimated US\$0.5 to US\$2 billion dollars.

Blockchain Infrastructure

The elements of computing are storage, programs, and communications. Mainframes, PCs, mobile, and cloud all manifest these elements in their own unique ways. So what are the main elements of a blockchain? Just like the “cloud” that does not simply exist as a magical entity by itself, a blockchain does not exist as a chain on its own. Rather, the blockchain application is really made up of building blocks of computing that can be used together to create effective decentralized applications.

In a centralized system, programmers may use Amazon S3 for raw data storage, MongoDB Atlas for databases, and Amazon EC2 for processing. In the storage element, they may have file systems and databases, where file systems are for storing raw data like mp3s with a hierarchy of directories and files, and databases are for storing structured metadata with a query interface like SQL.

In creating decentralized apps (Dapps), the main building blocks of decentralized computing are (see Figure 5.4):

- Storage: token storage, database, file system/raw data
- Processing: stateful business logic, stateless business logic, high performance programs
- Communications: connect networks of data, of value, and of state

| STORAGE | PROCESSING | COMMUNICATIONS |
|---|---|---|
| TOKEN STORAGE Bitcoin, Zcash, ..* | STATEFUL BIZ LOGIC Ethereum, Lisk, Rchain, Tezos, .. Client-side compute (JS, Swift) | DATA TCP/IP, HTTP, Tokenized Tor |
| FILE SYSTEM or BLOB IPFS/FileCoin, Eth Swarm, Storj, Sia, Tieron, LAFS | STATELESS BIZ LOGIC Crypto Conditions (e.g. BigchainDB). Bitshares, Eos, and all stateful biz logic | VALUE Interledger, Cosmos |
| DATABASE BigchainDB + IPDB, IOTA | HIGH PERF. COMPUTE TrueBit, Golem, iEx.ec, Nyriad, VMs, client-side compute | STATE PolkaDot, Aeternity |
| DATA MARKET Ocean Enigma, DataBroker, Datum | | |

Source: <https://blog.bigchaindb.com/blockchain-infrastructure-landscape-a-first-principles-framing-92cc5549bafe>

Figure 5.4: The 3 Main Elements of Decentralized Computing

In this section, we intend to provide an illustrative understanding of the key elements of decentralized computing. Despite trying to make it as simple as we can, these sections may appear to be too technical for some readers, but insightful for others.

Storage

The fundamental computing element of storage has the following building blocks:

Token storage: Tokens are stores of value (e.g., assets, securities) whether it is air miles, bitcoins (alt coins), digital art copyrights, or telco talk time. The main actions on a token storage system are to issue and transfer tokens (with many variants), while preventing double-spends, fraud, etc.

Bitcoin and Zcash are two prominent coin systems focusing solely on transactional exchange. Ethereum happens to use tokens in service toward its mission of being a world computer. These are all examples of tokens given out as internal incentives to run the network infrastructure.

Other tokens are not internal to a network to power the network itself, but are used for incentives in a higher-level network where the lower-level infrastructure actually stores the tokens. One example is ERC20 tokens like Golem (GNT) running on top of the Ethereum main net. Another example is Envoke's IP licensing tokens, running on the IPDB network.

Finally, it is important to note that most blockchain systems have a mechanism for token storage.

Database: Databases specialize in storing structured metadata, for example, as tables (relational DB), document stores (e.g., JSON), key-value stores, time series, or graphs; and then rapidly retrieving that data via queries (e.g., SQL).

Traditional distributed (but centralized) databases like MongoDB and Cassandra routinely store hundreds of Terabytes and even Petabytes of data, with throughput that can exceed 1 million writes per second. Query languages like SQL are great because they separate implementation from specification, and are, therefore, not constrained to any particular application. SQL has been a standard for decades. This is why the same database system can be used across many different industries.

File system/Raw data storage: These are systems to store large files (movies, mp3s, large datasets), organized in a hierarchy of directories and files.

IPFS and Tahoe-LAFS are decentralized file systems that wrap decentralized or centralized raw data storage. FileCoin, Storj, Sia, and Tieron do decentralized raw data storage. The file-sharing BitTorrent also does the same, although it uses a “tit-for-tat” scheme rather than tokens. Ethereum Swarm, Dat, and Swarm-JS do basically both.

Data marketplace: These systems connect the data owners (e.g., enterprises) with data consumers (e.g., AI startups). While they are higher-level than databases and file systems, they are nonetheless core infrastructure because the countless applications that need data (e.g., anything AI) will depend on such services. Ocean is an example “protocol and network,” on which data marketplaces can be built. There are also application-specific marketplaces: Enigma Catalyst for crypto markets, Datum for personal data; and DataBroker DAO for Internet of Things (IoT) streams.

Processing

The fundamental computing element of processing for Dapps is the smart contract. “Smart contracts” systems are the popular label for systems that do processing in a decentralized fashion. This actually has two subsets with very different properties: stateless (combinational) business logic and stateful (sequential) business logic. Stateless versus stateful gives revolutionary differences in complexity, identification, verifiability, etc. There is a third decentralized processing building block: high-performance compute (HPC), which we discuss at the end of the chapter.

Stateless (combinational) business logic: This is any arbitrary logic that does not retain state internally. In electrical engineering terms, it can be structured as combinational digital logic circuits. The logic is represented as a truth table, schematic diagram, or code holding conditional statements (combining if/then, and, or, not). Because they do not have state, it is easy to verify large stateless smart contracts, and therefore to build large verified/secure systems.

The interledger protocol (ILP) contains the crypto-conditions (CC) protocol to cleanly specify combinational circuits (where the output is a pure function of the input). CC is important to know of because it is becoming an internet standard via the Internet Engineering Task Force (IETF), and because ILP is getting widespread adoption among centralized and decentralized payments networks (e.g., > 75 banks via Ripple). CC has standalone implementations in JavaScript, Python,

Java, and more. BigchainDB, Ripple, Stellar, and other systems use CCs; and thus support combinational business logic and smart contracts.

Because stateful logic is a superset of stateless logic, hence systems that support stateful logic also support stateless logic (at the expense of additional complexity and verifiability challenges).

Stateful (sequential) business logic: This is any arbitrary logic that does retain state internally—it has memory. Or, it is a combinational logic circuit with at least one feedback loop (and a clock). For example, a microprocessor has an internal register that gets updated according to machine-code instructions that are sent to it. More generally, stateful business logic is a Turing machine that takes in a sequence of inputs, and returns a sequence of outputs.

Ethereum is the best-known blockchain system that manifests stateful business logic and smart contracts running directly on-chain. Lisk, RChain, DFINITY, Aeternity, Tezos, Fabric, Sawtooth, and many more also implement it. Running code that is “just out there, somewhere” is a powerful concept, with many use cases. Trent McConaghy⁹ believes that this helps explain why Ethereum took off, why its ecosystem has grown such that it is almost a platform in its own right, and why so much competition has arisen in this building block.

Because sequential logic is a superset of combinational logic, these systems also support combinational logic.

For many use cases in decentralized processing, McConaghy deems there is a simpler approach: by simply having the processing on the client side within the browser or the mobile device, running JavaScript or Swift. This architecture is easy for mainstream web developers. For example, all that many web apps need is an application state. To build this you just need JS + IPDB (using js-bigchaindb-driver). For raw data storage and payments additions, then include the JS client versions of IPFS (ipfs.js) and Ethereum (web3.js).

HPC: This is processing to do “heavy lifting” programming for things like rendering, machine learning, circuit simulation, weather forecasting, protein folding, and more. A programming job here might take hours or even weeks on a cluster of machines (CPUs, GPUs, even TPUs¹⁰).

⁹ Founder of OceanProtocol and BigchainDB.

¹⁰ The CPU controls all of the other parts of a computer. The GPU can only handle graphics, although it can be used for calculations by some special scientific applications. A TPU is a special chip for machine learning.

McConaghy imagines that some blockchain engineers envision these approaches to decentralized HPC:

- Golem and iEx.ec frame it as a combination of decentralized supercomputer along with associated apps.
- Nyriad frames it as storage processing. Basically, the processing sits next to decentralized storage (which Nyriad also has a solution to).
- TrueBit allows third parties to program, but then does post-compute checking (implicitly checking when possible; explicitly checking if questions get raised).

McConaghy thinks some programmers are simply running heavy computation on VMs or Docker containers, and putting the result (final VM state, or just computed results) into raw data storage with restricted access. They can then sell access to these containers using, for example, tokenized read permissions. This approach asks more of clients to verify results, but it is good to know that such tech is already possible today.

Communications

The third and final fundamental decentralized computing element is communications. There are many ways to frame communications but we will focus on connecting networks. It comes in three levels: data, value, and state.

Data: In the 1960s, ARPAnet was created as a data network, and its success spawned several similar networks like NPL and CYCLADES. However, they did not have the ability to communicate with each other. Cerf and Kahn invented TCP/IP in the 1970s to connect them, to create a network of networks, which we now call the internet. TCP/IP is now the de-facto standard to connect networks. Despite its age, TCP/IP can be viewed as a decentralized building block for connecting networks of data.

Value: TCP/IP only connects networks on a data level. You can double-spend packets—send the same packet to more than one destination at once. But what about connecting networks where someone can send value across the networks? For example, from bitcoin to Ethereum, or even SWIFT payments network to say Ripple’s XRP network. In such cases, the token is intended to be able to go to one destination at a time. One way to connect networks while preventing double-spends is to use an exchange, but that is more complicated than it needs to be. Instead, blockchain engineers have stripped an exchange to its essence and

removed the need for a trusted middleman, by using cryptographic escrow. Peter can send money to Charlie via Victoria, where Victoria is passing on the funds but can not spend them (and there is a time constraint so that Victoria can not delay or stall). This is the essence behind the ILP. It is the same conceptual idea as two-way pegs (like sidechains) and state channels (like Lightning and Raiden); but the focus is solely on connecting networks with respect to value. Besides ILP there is Cosmos, which adds a bit more complexity for convenience on certain use cases.

State: Beyond connecting networks of value, engineers are pondering something with its own crypto-wallet that can hop from one network to another. These ideas include a smart contract in one Ethereum main net that can move its state to another Ethereum net, or another compatible net. Also, removing restrictions from an AI DAO to just one net and enable it to connect to others.

Some systems are already getting there; Polkadot is one that is able to connect networks of state, and Aeternity fits somewhere between the network-of-value and network-of-state spectrum.

Furthermore, as we speak, the blockchain community is starting to build systems that manifest combinations. There are many combinations of two blocks at once, usually IPFS + Ethereum or IPFS + IPDB. And there are even engineers using three or more blocks. Such is the level of experimentation and innovation that is happening in the decentralized digital ecosystem.

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Chapter 6

Expanded Use Cases of Blockchain

Smart Contracts in Islamic Transactions

Contractual agreements are key enablers for trade and commerce which record mutually agreed upon terms for execution or dispute resolution. The Quranic verses (Surah Al-Baqarah: 282–283) enjoin Muslims to put contracts in writing for fairness and accountability. As such, Muslim traders rely upon an Islamic legal and institutional framework for the purposes of accounting and accountability, while Muslim scholars define legal norms and act as mediators in commercial disputes. Possessing written records is vital to the efficiency and transparency of commerce and for monitoring trade and agreements. Islamic law is the central institutional framework of being Muslim, and its inherent legal framework dictates, among other things, the ethical norms of business behavior, to form the foundation for trust, equality, and fairness.

As the world evolves, we use technology to operationalize the specific intents of the Shariah so that Islamic economic actors can be adept at more efficient (and less risky) ways of doing business. Reliance on physical documents leads to delays, inefficiencies, and increases exposure to errors and fraud. Financial intermediaries, while providing interoperability for the finance system and reducing risk, create unnecessary overhead costs and increase compliance requirements. Smart contracts, on distributed ledger technologies (blockchain) that have the capacity to inject greater efficiency and productivity while saving costs associated with traditional contracts. Many financial enterprises are exploring the use of smart contract technology for various applications across the banking, financial services, and insurance (including takaful) sectors (EY, 2017). As of now, prototypes developed have been simplified versions of a smart contract, but more work needs to be done in key areas, which will tackle legal and regulatory compliance, scalability and security, and the ability to code complex contracts which currently dominate the financial services landscape.

How Does a Smart Contract Work?

Smart contracts are complex software solutions with components designed to automate execution and settlement of contractual agreements. In other words, they are programmable contracts that self-execute the stipulations of an agree-

ment when predetermined conditions are triggered. Once two or more parties consent to all the terms within the contract, they cryptographically sign the smart contract and deploy it to a distributed ledger (Buterin, 2013). When a condition specified in the code is met, the program automatically triggers a corresponding action. By removing the need for direct human involvement, a deployed smart contract on a distributed ledger could make contractual relationships more efficient, reliable, and economical with potentially fewer opportunities for error, misunderstanding, delay or dispute.

Smart contracts do not have to be contracts at all. They can be processes that can be administered electronically (Szabo, 1996). So, there are a wide array of applications of smart contracts. It also should be pointed out that contract technology has changed dramatically the past twenty years with companies like DocuSign providing an electronic signature platform that meant you no longer had to send your contract out to many signers and a certain amount of automation can be built in. The main difference that blockchain can afford is to add in secure measures that can ensure that the terms are upheld, often using a third-party *oracle* (not the database company), which is an electronic data feed that signals a provision of the contract has been met so that the blockchain changes state accordingly.

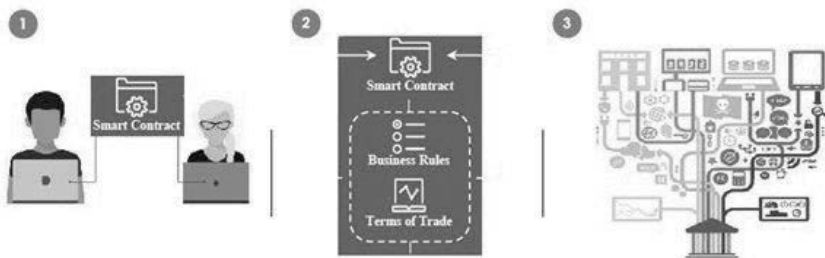


Figure 6.1: Smart Contracts on Blockchain

1. An option contract between counterparties is written as code into the blockchain. The individuals involved can be anonymous, but the contract is a public ledger.
2. A triggering event like an expiration date or strike price, and the contract executes itself according to the coded terms.
3. Regulators can use the blockchain to understand the activity in the market while maintaining the privacy of individual actors' positions.

Key features of smart contracts are: programmability, multisignature (or multisig) authentication, escrow capability, and oracle inputs:

- A smart contract automatically executes based on programmed logic.
- Multisig allows two or more parties to the contract to approve the execution of a transaction independently—a key requirement for multiparty contracts.
- Escrow capability ensures the locking of funds with a mediator (e.g., a bank or an online market), which can be unlocked under conditions acceptable to the contracting parties. Sometimes, external inputs such as prices, performance, or other real-world data may be required to process a transaction, and oracle services help smart contracts with inputs such as these.

There are several models of smart contracts being prototyped today, but the basic blockchain-based technology uses public key encryption infrastructure (PKI) to encode the terms and conditions of a contract. PKI is a method of cryptography that uses of two types of keys. The first is a public key that all parties are aware of, and the second is a private key known only to its recipient. In a smart contract transaction initiated on a blockchain depicted in Figure 6.2, the sending recipient encrypts their message into an unreadable “cipher text” using algorithms or mathematical formulas, to protect and secure the data. Only the use of a private key can decrypt the “cipher text” back into a readable “plain text.” The key benefit PKI brings to smart contract transactions revolves around security, as it is extremely difficult, if not impossible, to reverse engineer a public key to a private one, making it very resilient to failures or hacks.

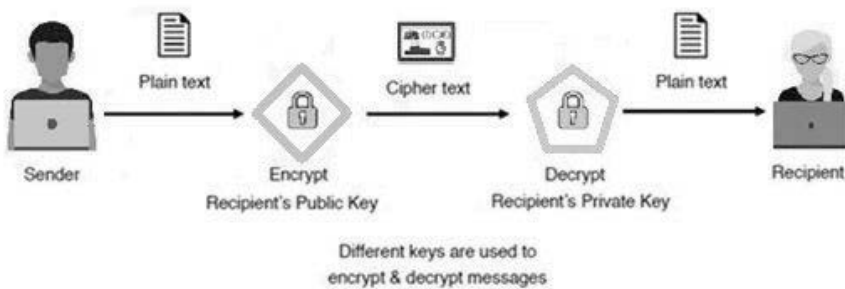


Figure 6.2: How the Blockchain Cryptography Works for Smart Contracts

Automation and Enforceability

The smart contract is automatable and enforceable. It is automatable by a computer or network of computers, although some parts may require human input and control. It is then enforceable by either legal enforcement of rights and obligations or tamper-proof execution.

The legal prose is linked via parameters (name-value pairs) to the smart contract code that provides execution. An executable software agent on the shared ledger will proceed to undertake various transfers of value in accordance with the legal prose. The parameters are a succinct way to inform the code of the final operational details.

The legality of financial smart contracts is yet to be established even in the conventional system. Initial steps have been taken in some countries to recognize distributed ledgers in their state courts, as should courts in Islamic jurisdictions. Accurate translation of legal terms according to Islamic law of contracts into software logic is another key aspect to consider. The landscape to be explored includes increasing the sophistication of parameters from base types to complex higher-order types to business logic that could be admissible in court and potentially replace the corresponding legal prose into contract code. In Islamic economies, legislators, regulators, and governments should realize the potential for distributed ledgers in increasing transparency and ease of compliance and reporting. The push from these authorities will be instrumental in overcoming legal and administrative hurdles.

Benefits and Evolution of Blockchain-Based Smart Contracts

Contracts or records stored on blockchains eliminate the need for a central intermediary to provide trust in the system. For markets that do not use intermediaries, it is still more trust than existing operations. By automating parts of business processes in the short run and possibly entire processes in the long run, smart contracts would significantly reduce the costs associated with areas such as compliance, record keeping, and manual intervention. A significant benefit from the power of the technology is in reducing costs, risks, error rates, and reconciliation processes while allowing everyone to have a shared infrastructure. It frees up capital and assists with compliance and regulatory reporting.

In trading securities, for example, most securities have a delayed settlement, with settlement times of T+2 or longer being common. Smart contracts have the potential to bring this down to minutes. This would also free up capital in the system by reducing mandatory collateral requirements for the trading of equities

and would thereby improve return on capital. With smart contracts, workflow can be made more efficient by providing each of the people or points in the workflow with greater visibility into the state of an asset in the workflow. At the next level, this could be possible among a group of companies with proper governance. Ultimately, when these smart contracts become admissible in courts, it would make the entire system operational and efficient.

Applications of Smart Contracts

Smart contracts on the blockchain could and will create efficiencies and therefore savings for every category of monetary markets, investments, and other financial services like insurance/takaful but more important, they will reorganize how certain services are run within the economy. To illustrate this, we focus on some financial service areas, which could benefit from immediate sizeable savings:

Capital Markets and Investment Banking

With the deployment of smart contracts, software can be created to extrapolate specific data or carry out specific instructions if certain parameters are satisfied or triggered. Authorized matching of trades during the settlement process can be done via smart contracts. With smart contracts, trade agreements such as collateral, loan, swap, sukuk, and other agreements could be met by writing specific instructions via code onto the ledger.

- Structured finance, like settlements of syndicated loans, sukuk, etc. A long settlement period creates greater risk and a liquidity challenge in loan markets.
- Stock exchange market infrastructure like clearing and settlements of equities.

Commercial and Retail Banking

The smart contract also facilitates automatic payment processing, only if certain parameters within the agreed upon contract are satisfied. Because of smart contracts, costly errors from the manual processing of contractual terms, including settlement instructions, can be reduced considerably. If an Asian bank has transacted a trade or swap contract with a U.S. bank, the settlement details would only be provided if the financial details of the trade match between the two banks.

- Trade finance like supply-chain documentation, invoicing, and payments in letters of credit, trust receipts, etc.

- Mortgages for housing. The mortgage loan process relies on a complex ecosystem for the origination, funding, and servicing of mortgages, with considerable costs and delays.
- Loans of any kind, including crowdfunding for start-ups and small and medium-sized enterprises (SME). Distribution of equity of micro, small, and medium-sized enterprises (MSMEs) to investors.

Takaful

By moving insurance claims onto an immutable ledger, blockchain can help eliminate common sources of fraud in the insurance industry. A shared ledger and insurance policies executed through smart contracts can bring an order of magnitude improvement in efficiency to property and casualty insurance. Through the blockchain, medical records can be cryptographically secured and shared between health providers, increasing interoperability in the health insurance ecosystem. By securing reinsurance contracts on the blockchain through smart contracts, the blockchain can simplify the flow of information and payments between insurers and reinsurers.

- Automated claims processing in commercial insurance, motor insurance, etc. Smart contracts that bring insurers, customers, and third parties to a single platform will lead to process efficiencies, and reduced claim processing time and costs.
- New products like peer-to-peer insurance/takaful.

The migration of traditional contracts to smart contracts can be estimated to save billions of dollars in the global Islamic finance markets. They are indeed significant, but do not come without challenges to be overcome, but it will be possible with the determination and resources to do so.

Islamic Trade Financing

Trade is the lifeblood of the global economy, and banks have long played an important role in mitigating risk and offering financing for domestic and international trade. Trade finance and supply chain finance provide companies with the funds and security they need to buy and sell products and services domestically and across borders. The use of open account trading has increased in recent years due in part to the ease of communication and exchange of information between businesses over the internet. However, even with open account trading, there is still a strong demand for bank services for financing, risk mitigation, data trans-

fer and data matching. These bank services are aimed at reducing the risk SMEs and large corporations face when trading, such as counterparty risk, the complexity of complying with laws and regulations in multiple jurisdictions, the risk of goods being lost or damaged in transit, and foreign exchange risk.

As technology shifts and the popularity of open account trading¹ has expanded (making up about 90% of global trade today), banks and corporations require solutions that will enable them to overcome the pain points found in trade finance today. The use of distributed ledgers or blockchains has been explored in areas such as payments and securities settlement, and these technologies could also be used to improve service in trade transactions.

Blockchain-Based Trade Finance

The exchange of trade data serves as the backbone for the trade finance workflow, making it an ideal starting point for the use of blockchains. The approval and matching of data found in trade documents such as invoices can be a trigger for events that follow such as the transfer of ownership or execution of a payment. By facilitating easy access to data and end-to-end transparency of the entire value chain, blockchains can create a level playing field for all parties involved in a trade transaction and facilitate improved exchange of trade information.

Settlement of securities or interest in securities are delivered, usually with a simultaneous exchange of money, to fulfill the contractual obligation. As part of the performance of delivery obligations of the trade, settlement involves the delivery of the securities and the corresponding payment. On top of that, settlement is increasingly moving toward the DVP method (delivery vs. payment)—the simultaneous and irrevocable exchange of security and cash, to minimize the seller's and buyer's risks involved in delivering one asset without receiving the contra asset at the same time. This is sometimes referred to as dependent deliveries of security or dependent payments of cash. In other words, the delivery of security will not be implemented without simultaneous payment of cash and vice versa.

The exchange of trade data and auditability of a trader's credit history can also help increase speed, efficiency, and security in financing between buyers, sellers, and their banks. The real-time visibility of events along a supply chain

¹ An open account transaction in international trade is a sale where the goods are shipped and delivered before payment is due, which is typically in 30, 60, or 90 days. Obviously, this option is advantageous to the importer in terms of cash flow and cost, but it is consequently a risky option for an exporter.

means that financing triggers can be identified sooner, which means that funds can be released faster. Blockchains can also help improve credit ratings and risk assessment procedures.

The lack of integration of trade financing to the trade cycle is the lack of transparency surrounding trade and trade finance today. Trade finance also suffers from costly and time intensive information matching, often with paper documents that can lead to delays in the transfer of goods, initiation of payment, or release of funds as part of a financing agreement. These manual processes, together with the lack of transparency, also raise the risk of error or even fraud in the case of duplicate invoice financing.

Industry stakeholders have made efforts to reduce the impact of some of these issues (such as the development of the bank payment obligation [BPO] for open account trading), but the difficulty with these solutions is two-fold: a lack of adoption and a proliferation of different platforms that lack interoperability.

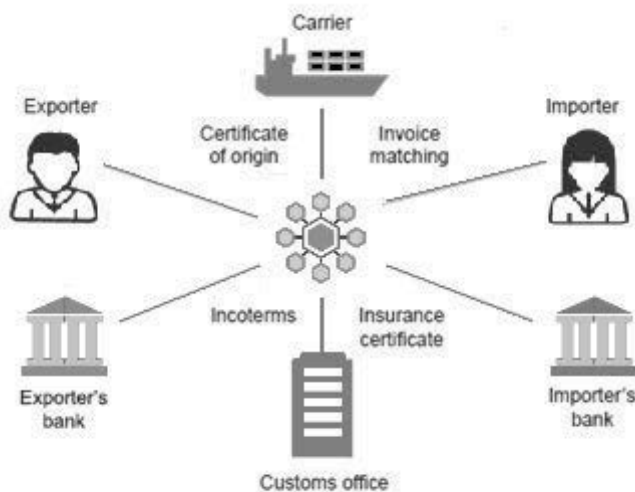


Figure 6.3: Using Distributed Ledger (Blockchain) in Trade Transactions

As the use of blockchains in trade finance takes hold, all parties involved can save time and resources by eliminating the need for some of the manual processing and data matching they do today and allowing them to focus on more profitable propositions such as creating better products, which can be vital to businesses involved in domestic and international trade. Figure 6.3 details the connecting parties in a blockchain-based trade transaction.

With real-time visibility into events along a supply chain, financing triggers can be identified sooner. This means that funds can be released much faster (between a buyer and seller, as well as to a bank as part of a factoring agreement). In addition, the blockchain allows the ability of nonbank actors (shipping companies, customs agents, etc.) to update ledgers immediately once a transaction has been finalized.

Enablers to Blockchain-Based Trade Financing

To help improve trade financial services offered by banks to their corporate clients, there are some required enablers to systematize these services. The use of smart contracts and the development of instant payment infrastructures are two such enablers that will greatly enhance the benefits for banks, financial institutions and businesses using digitally distributed ledgers in trade finance.

Blockchain-Based Smart Contracts

The transparency of events along the supply chain via the blockchain is itself a major enabler of faster payment and improved financing, increased efficiency, reduced risk of fraud, and lower costs. Smart contracts are self-executing programs that automatically carry out functions once a triggering event has taken place. They are linear contracts that can include multiple parties (buyer, seller, banks, takaful companies, etc.) that cannot be altered.

For example, if a smart contract is written between a buyer and a seller to say that once goods have been cleared by customs, 20% of the funds will be released to the seller, a smart contract would automatically disburse payment once confirmation is entered in a distributed ledger that the customs office has cleared the goods. The confirmation of approval by customs is not a triggering event requiring action by a bank; the payment is automatically made once confirmation has been entered into the system. With a smart contract, legal stipulations are embedded in the computer code, which enables the automatic execution of functions defined by a legal contract, though smart contracts may be simply transactional as well, as originally conceived by Nick Szabo's vending machine model which today translates roughly to blockchain cyberscurrency.

Smart contracts can be seen as the future of economic transactions, as they enable more efficiencies in legal contracts through a decrease in manual processing and initiation of contract terms, risk reduction through the elimination of manual errors and duplicate invoice financing. However, legal and regulatory challenges surround smart contracts in many jurisdictions, and many companies

exploring the use of smart contracts are still in the proof of concept stage. To accelerate maturity of this technology, smart contract terms need to be standardized and small scale B2B smart contract applications need to succeed. Adoption for use in trade finance will pave the way to the actualization of the theoretical benefits.

Instant Payment Structures

The development of instant payment infrastructures is another key enabler that will add speed and efficiency to trade transactions that currently may require human interactions. Over twenty countries around the world have already implemented instant payment infrastructures (like Ripple and Stellar), and major markets such as Australia, the United States, the Eurozone, and Asia are in the process of developing and testing instant payment systems. With the ability to send and receive domestic payments within seconds, the movement of money triggered by events along the supply chain can proceed more rapidly, which means that shipping companies, customs offices, and sellers have quicker access to funds. Instant payments can also enable buyers and sellers to obtain funding from their banks faster than they do today, which can lead to a further optimization of working capital and unlock liquidity from supply chains.

Current Challenges

The adoption of blockchain-based trade finance still faces several challenges, including an unclear legal and regulatory environment, the need to extend the speed and the scalability of the technology, and the challenge of creating a network effect to spur adoption of distributed ledgers in the trade finance space. If Islamic countries and industry stakeholders work together to meet these challenges, they stand to realize significant tangible benefits. Distributed ledgers can ensure full transparency of the value chain, reduced error rates and credit risk, lower costs, improved convenience, and provide a level playing field for all participants. This in turn can help corporations improve liquidity and working capital, upgrade the reconciliation process, and provide additional financing opportunities, while allowing banks to meet customer expectations, modernize information technology (IT) systems, enable the development of new products, and avoid disintermediation. In Islamic economies, legislators, regulators, and governments should harness the potential for distributed ledgers in increasing transparency and ease of compliance and reporting. The push from these authorities will be instrumental in steadily developing advanced trading, legal enforce-

ment and administrative systems that are crucial to empower justice as well as prosperity.

Takaful (Islamic Insurance) on the Blocks

As a niche section of the insurance sector, the takaful segment is significantly impacted by the disruptions occurring within the insurance sector. The global insurance market had a reasonable growth rate, with global real premium growth rates of 2.9% in the advanced economies and 7.4% in the emerging and developing countries in 2014, an improvement over the 2012 and 2013 rates (IFSB, 2016). Likewise, the growth rate of gross contributions in the takaful sector demonstrated a recovery in 2014 from 2013, when the growth rate of premiums was by far the lowest historically.

In its Islamic Financial Services Industry (IFSI) Stability 2017 report, the Islamic Financial Services Board (IFSB) observed that the reinvigorated gross contributions of the takaful sector reached US\$22.1 billion in 2014, up from only around US\$5 billion in 2006. In 2016 the global insurance market reported steady growth rates, supported mainly by emerging markets. Nonlife premiums in emerging Asia expanded at a rate of 7.3% in 2016, after a strong 9% growth in 2015.² Another notable trend in emerging Asia was the slowdown in motor insurance uptake following lower car sales. Similarly, anecdotal evidence points to lower sales of new cars in the key takaful domain of Saudi Arabia in 2016,³ and to a 13% decline in car sales in Malaysia in the same year.⁴ Meanwhile, medical expense premiums in emerging markets continued to grow at double-digit rates in 2016, attributable to operators in China where private medical insurance is gaining traction alongside state medical support schemes. Of importance, policy makers in selected Gulf Cooperation Council (GCC) countries have recently pushed for mandatory medical coverage requirements, thus supporting the uptake and premiums of medical takaful in the region.

The biggest share of the takaful sector belonged to GCC countries, followed by Iran and the East Asia and Pacific region. The other three regions (Africa, South Asia, and Levant) had a very much lesser share of the total. As takaful's share of the insurance sector is only 1%, there is a long way to go for the takaful sector. Indeed, the low penetration rates in certain countries in which the takaful

² Swiss Re, Global Insurance Review 2016 and Outlook 2017/2018.

³ Recession cripples car sales, *Saudi Gazette* (October 2016).

⁴ MAA expects slight increase in car sales this year, *The Star Online* (January 2017).

industry operates, indicate an available market for the takaful sector. Since many of the target markets like Turkey, Saudi Arabia, Pakistan, Qatar, and Egypt, have a growing middle-class and young populations with solid growth prospects, there is promise for the takaful sector to grow further.

Three jurisdictions account for 84% of the global takaful contributions: Saudi Arabia (37%), Iran (34%), and Malaysia (14%). However, the types of takaful provision are different for different jurisdictions, for example, in Malaysia nearly two-thirds of the takaful contributions are for family takaful (which features a strong savings/investment component). In Saudi Arabia and Iran, insurance such as medical/health or motor takaful is prevailing. The current low propagation of takaful services indicates there is ample opportunity for further growth of the insurance/takaful industry, combined with high population growth and a growing middle class.

Also, the IFSI report revealed that the business profiles of takaful operators differ among the countries. They found that in Malaysia, family takaful is 68.1% of the total business line, which is the highest number in the sample. The combination of a relatively young population, a high percentage of working population, a vibrant social security system, and saving incentives for retirement, play a part in the high proportion of life insurance in its society, including family takaful. Behind Malaysia is Pakistan and the UAE, which comprise a reasonable share of family takaful—around 30%. This is not so in Saudi Arabia, where health coverage is compulsory and a tradition of long-term saving using insurance/takaful products is nonexistent. Other countries with low shares of family takaful are Kuwait (at 8.6%) and Bangladesh and Qatar (both at 0%). Given the rising birth-rates and growing middle class, policies geared toward increasing public awareness of such services, as well as those encouraging long-term savings such as unit-linked instruments could grow the family takaful business.

Motor takaful is the second most important business line in the sample countries of the IFSI report, with an average of 27.7% over the entire sample of countries. Kuwait has the highest share of motor takaful, followed by Sri Lanka, Pakistan, and Qatar.

The third most important business line for takaful was Fire, Property and Accidents, with the highest levels in the domestic markets of Qatar and Bangladesh. Other business lines in the takaful sector include the Workmen's Compensation and Energy Takaful, which has a considerable traction in the UAE and Sri Lanka.

A Model for a Blockchain-Based Takaful

Smart contracts deployed through the blockchain will provide customers and takaful (insurance) companies a system to manage claims in a transparent, quick, and indisputable manner. Takaful policies, along with its terms and conditions, and potential claims can be recorded onto the blockchain and validated by the network, ensuring valid claims are dispensed and false claims are rejected.⁵ For example, the blockchain will reject multiple claims for one accident because the network would know that a claim has already been made. Smart contracts would also process claims efficiently by triggering payments automatically when certain conditions are met and validated. To more effectively detect identity fraud, falsified injury or damage reports, etc., blockchain can be used as a cross-industry, distributed registry with external data and customer data to:

- Confirm authenticity, ownership, and origin of goods as well as the legitimacy of documents (e.g., medical reports)
- Check for police reports indicating theft, claims history as well as a person's verified identity and expose patterns of deception related to a person or identity
- Proof of date and time stamps of policy issuance or purchase of a product/asset
- Validate ownership and site changes

Still, to attain full blockchain-specific benefits from these applications above what is achievable with traditional solutions and other current types of cooperation, for example, via industry associations, broad cooperation between insurers, customers, manufacturers, and other stakeholders is needed. This is an example of an ecosystem growing beyond the traditional industry practice in the sharing economy of the digital era. Emerging blockchain applications and four key areas where we see the most potential for evolution and transformation are:

Fraud Detection and Risk Mitigation

Blockchain has the potential to eradicate mistakes and detect deceptive activity because of its ability to be a public ledger across multiple unknown parties. A distributed digital depot can autonomously confirm the legitimacy of customers, policies and transactions (such as claims) by presenting a comprehensive histor-

⁵ An estimated 5 to 10% of all claims are fraudulent. According to the estimated global size of the takaful industry, this costs takāful operators more than US\$2billion per year.

ical record. As such, insurers would be able to spot fake or counterfeit transactions involving doubtful people and suspect entities.

First-mover insurers are already evaluating the use of blockchain to mitigate scams and risks related to cross-border payments and transactions linking multiple currencies. In forte insurance and reinsurance segments, where insurers are often disconnected from the clients, blockchain may be used to tackle the significant inefficiencies, disparities and errors caused by bad data quality from the front and back offices. In the United States, health insurers and regulators view blockchain as a powerful tool for fighting Medicare deceit. Validation and verification form the nucleus of the blockchain business case, which can improve many insurance processes.

Blockchain will lessen administrative and operational costs through automated verification of policyholder identity and contract validity, auditable records of claims and information from third parties (e.g., encrypted patient data between a doctor and an injured party manageable by the insurer to authenticate payment), and disbursement for claims through a blockchain-based payments infrastructure or smart contracts-linked escrow account. Providing reinsurers controlled-access to claims and claims histories recorded on the blockchain increases transparency for the reinsurer in an automated yet auditable manner.

Claims Processing and Management

In addition to mobile and digital technologies, blockchain is essential to establishing an efficient, transparent and customer-focused claims model based on higher degrees of trust through transparency. Within claims management, new data streams can enhance the risk selection process by combining location, external risk and data analytics. A distributed ledger integrated with existing systems can enable the insurer and various third parties to easily and instantly access and update relevant information (e.g., claim forms, photo evidence, police reports, and eye-witness or third-party accounts).

The use of data from a mobile phone can simplify claims submissions, reduce loss adjustment costs and increase client satisfaction, with blockchain systems connecting communications to all parties.

Correspondingly, the use of mobile technologies, satellite imagery, sensor data, and blockchain could facilitate claims payments and rescue services when natural disasters occur in remote areas. Information collected from weather stations could establish claim amounts based on actual climate readings, with blockchain facilitating more efficient data sharing and stronger protection against fraud.

In addition, this advanced technology will be able to work effortlessly with the internet of things (IoT) where massive numbers of devices are linked via the internet. For example, accident claims can be made through an app provided by the insurer by taking pictures or sending videos of accidents which are time-stamped. Together with blockchain solutions for know-your-client (KYC) data, a client can send the verified identity data to other companies for confirmation with the same app, avoiding the need to repeat the verification process, thus expediting efficiency in the on-boarding of new users.

New Distribution and Payment Models

Some international insurers are already developing partnerships and exploring new payment systems and business models (cryptocurrencies and digital wallets) to achieve capital efficiencies through a truly public global ledger system. Increased computerization used to acquire risk information in contracts also suggests new opportunities to build market intelligence, simplify payments and build financial risk models. At the very least, global insurers can use blockchain to remove asset management costs or hedging fees required for mitigating currency fluctuations in cross-border and international transactions.

In the new business model, the focus of the insurers would be on matching supply and demand and to risk calculation research, instead of asset management. The insurer could create a marketplace-like platform where customers can post their insurance demand, which could be either a standardized product or even a specific demand. The insurer then would use its risk models along with “risk assessment intelligence,” based on available historical information, to perform a premium calculation for the expected return. With this expected return, interested investors can bid or subscribe to the demanded insurance.

With the use of smart contracts and records on a decentralized ledger, the payment from the investor to the customer in the event of an insurance claim becomes cheaper, transparent, and more efficient than long-established ways. In addition, the investors know their maximum exposure as the amount defined in the smart contracts.

The insurer can also now play the role of assessor of the damage to validate the authenticity of the insurance claim. But this could as easily be outsourced to a third party and by connecting blockchain to other ledgers where verification can be done automatically.

Reinsurance

Property and casualty insurers seeking clearer visibility into their reinsurance contracts and risk exposures may gain it through blockchain. Consider the case of

an insurer seeking to offload an equal amount of risk to two separate reinsurers. A blockchain ledger could provide insight and notification if one of those reinsurers then tried to offload some of its portion to a subsidiary of the other reinsurer. It also would help insurers gain confidence that, as they pay out claims, they are appropriately rebalancing their capital exposures against specific risks.

Within reinsurance, the benefits of blockchain include more accurate reserve calculations based on actual participating contracts and automatic calculation updates once the primary information and data are updated. On top of that, insurers obtain more room to move capital and improve transparency into known risks, capital productivity and compliance. Operationally, the process of audit trails becomes simpler to chart, modeling requirements are significantly reduced and there is less coordination required between the finance and IT functions.

Blockchain-Based Islamic Capital Markets

An Islamic bank could set up a new trading platform (or move across an existing trading platform) on a blockchain protocol. Blockchain technology offers the potential to support a new medium to exchange assets without centralized trusts or intermediaries—and without the risk of double spending. As already discussed, blockchain can eliminate the threat or the risk of fraud in all areas of banking, and this could equally apply to a trading platform. Furthermore, blockchain would also address issues such as operational risk and administrative costs as it can be made transparent and immutable. The traceability and the permanent historic record that would exist on the blockchain backing up every asset or item of value that was traded, would provide assurance and authenticity all the way through the supply chain. This, again, will be determined by the advances in technology needed to speed blockchain transactions.

In practice, when a high-value item is first created, a corresponding digital token is issued by a trusted central authority which acts to authenticate the product's point of origin. Then, every time the product is bought and sold the digital token is moved in parallel so that a real-world chain of ownership is created and mirrored by the blockchain history of that digital token. The digital token is acting as a virtual “certificate of authenticity,” which would have the advantage that it is far harder to steal or forge than a piece of paper, database or spreadsheet. Upon receiving the digital token, the final recipient of the product will then be able to verify the chain of custody all the way back to the point of creation. Blockchain gives the benefit of distributed and verifiable trust that was not present before.

As a nonbanking example, Everledger, a permanent ledger for diamond certification, has adopted the use of bitcoin as a mark of authenticity providing

transparency for all parties involved—a clear attempt to prevent diamond fraud. Similarly, the immutability and digital uniqueness inherent in blockchain offers the ability to provide a secure transfer of value and endorsement of authenticity.

The challenge of maintaining data privacy among counterparties to trade transactions is also overcome by utilizing blockchain technology where tokenization, in the form of cryptography, is used to protect the trade data with parties only allowed access to permissioned information with the correct security key. This should enable the most confidential of transactions, especially financial transactions, to still take place on such a trading platform.

Clearing and settlement costs billions and, according to Santander's 2015 joint report⁶ produced in collaboration with Oliver Wyman and Anthemis Group, it is estimated that moving this into a digital record, near real-time and over the internet, will save the industry \$20 billion a year or more in overhead costs due to D+3, D+3, or T+3, the three-day clearing and settlement cycle common to most investment markets today. Many firms are leading the charge to digitize the clearing and settlement structures from Blythe Masters' Digital Asset Holdings with the Hyperledger to Overstock with T-0, along with many other key and emerging players such as Epiphyte, Clearmatics and SETL.

McKinsey⁷ expects that adoption of blockchain technology in capital markets will be marked by four stages of gradual development: single-enterprise adoption across legal entities; adoption by a small subset of banks as an upgrade to manual processes; conversion of inter-dealer settlements; and, finally, large-scale adoption across buyers and sellers in public markets.

The likely adoption of blockchain in capital markets by industry participants would be in these four key actionable areas:

- Assessment of business impact and plan for the long term. Firms should invest now in technology and expertise related to blockchain, and push for industrywide cooperation.
- Industry cooperation and engagement with regulators. Industry participants will need to work together to design solutions for specific asset classes and processes. Banks and other market participants must form consortia and work with regulators early in the design process to iron out consumer protection, fair market practice, disclosure, privacy, and security.

⁶ <http://www.finextra.com/finextra-downloads/newsdocs/The%20FinTech%202%200%20Paper.PDF>

⁷ <http://www.mckinsey.com/industries/financial-services/our-insights/beyond-the-hype-blockchains-in-capital-markets>

- Consolidate internal ledgers on the blockchain. Internal ledger synchronization is a persistent challenge, and regulatory pressure to consolidate those ledgers is mounting. A private blockchain-based enterprise solution would allow fintech companies to help financial institutions.
- Modernize post-trade and manual processes: Updating legacy systems and processes of post-trade activities such as asset booking and transfer can make workflow more efficient and productive while being less disruptive to existing business standards.

The blockchain revolution will not happen overnight, and will require cooperation among market participants, regulators and technologists. The unlikelihood of simultaneous, large-scale adoption will initially confine blockchain application to subsets of financial market participants and specific use cases. However, the potential for rapid uptake once open questions are resolved means all market participants must be aware of the potential benefits and threats and have a plan in place to respond.

Payments and Settlements

The main use case that is focused on when looking at the possibilities of blockchain for banking is that of payments.

Blockchain could be used as another way of paying each other, not depending on SWIFT and other payment schemes. There is a potential role for blockchain in payments and that blockchain could have benefits for not only bank customers, but this could also lead to operational efficiencies and cost savings for banks themselves. Payment systems collectively are currently under a lot of pressure, as there has been an urgency to modernize payments and to address the questions of safety and security since the 2008 financial crash. This has led to new market entrants, such as fintech companies, looking to solve these problems using blockchain. The existing payment system has always gone through banks and central banks, a process that was first put into place in the 1970s and 1980s. Apart from speeding up money transfers, blockchain could also help banks to operate continuously, 24 hours a day. This is now somewhat expected by customers who want an omni-channel banking experience at any time of day or night. Rabobank has been heavily involved in the on-going development and use of Ripple Lab's blockchain Ripple protocol.

As of December 2017, many banks have partnered with Ripple to use blockchain technology in making payments to customers and cross-border transactions. Ripple has said that its technology could give banks a 33% reduction in

their operating costs during the international payment process and allow lenders to move money “in seconds.” Ripple is a “real-time gross settlement system” (RTGS), currency exchange and remittance network. Released in 2012, Ripple purports to enable “secure, instant and nearly free global financial transactions of any size with no charge-backs.” It supports tokens representing fiat currency, cryptocurrency, commodity, or any other unit of value. While traditional bank wire services use a handful of intermediaries to process overseas payments, Ripple allows two banks to connect with each other without any intermediaries. Ripple uses a dynamic currency conversion technique that allows Ripple to always offer the lowest exchange rate. Using Ripple’s blockchain banks can offer competitive transaction fees as well as currency conversion fees. Ripple can be used by banks for an open-source approach to payments to replace many of the common intermediaries in the payments industry, thereby passing on savings to partner institutions, and thus by extension, to their customers. Currently, Ripple recognizes a few fiat currencies like USD, GBP, EUR, etc., commodities like gold, silver, platinum and a handful of popular cryptocurrencies like BTC, LTC, the native cryptocurrency XRP, etc. Ripple transactions are very fast—in general, it takes only about 5 seconds for a Ripple payment to go through. Currently, Ripple can also process 1500 transactions per second, a number that is 500x higher than Bitcoin’s TPS. Ripple also can scale this even further and reach as much as 50,000 transactions per second.

Thus, blockchain can be used to make payments in real-time globally, with real-time execution, complete transparency, real-time fraud analysis and prevention and at a reasonable cost. The main issue with Ripple now is that it is a proprietary blockchain network that cannot yet connect with other systems. To connect Ripple to other blockchain protocols an interledger protocol will have to be developed, tested and put in place.

VISA Europe Collab and BTL Group are working on a separate concept to make cross-border payments between banks using distributed ledgers. The project will use BTL’s cross-border settlement platform Interbit to explore the ways in which a distributed ledger-based settlements system (utilizing “smart contracts”) can reduce the friction of domestic and cross-border transfers between banks. This is a similar goal to Ripple but, as it is based on the Ethereum smart contracts concept, it is not proprietary like Ripple and thus is potentially more scalable.

Similarly, UBS, Deutsche Bank, Santander and BNY Mellon have teamed up with blockchain developer Clearmatics and trading company ICAP to create a new digital representation of fiat currency called the “Utility Settlement Coin.”⁸

⁸ <https://www.finextra.com/blogposting/14459/ubs-and-the-utility-settlement-coin>

Although this is still proof of concept, it could potentially reduce friction in delivery versus payment scenarios by providing a faster and less expensive settlement mechanism than existing funds transfer and currency exchange mechanisms.

In July 2018, Stellar, the seventh-largest cryptocurrency network, became the first digital ledger technology (DLT) protocol to obtain Shariah certification for payments and asset tokenization. The Stellar Development Foundation announced that, following a review of the technology's properties and applications, the Shariyah Review Bureau (SRB)—which is licensed by the Central Bank of Bahrain and operates an international Shariah advisory practice—had certified Stellar as a Shariah-compliant vehicle for conducting monetary transfers and tokenizing real-world assets. According to the foundation, this certification⁹ from SRB will enable Stellar to forge partnerships with Islamic financial institutions throughout the Middle East and Southeast Asia.

Sukuk on the Blockchain

One important application in Islamic capital markets for blockchain is the *sukuk* (Islamic bonds) market. Sukuk are securitized, and hence tradable on secondary markets much like a stock can be traded on a stock exchange. Islamic finance prohibits interest payments on loans and the sale of debt; sukuk markets evolved to securitize Islamic modes of financing such as profit sharing through asset ownership for a given tenure.

There are a variety of sukuk structures based on various Shariah-compliant contracts: profit sharing (*sukuk al-mudarabah*), deferred-delivery purchase (*sukuk al-salam*), leasing of assets (*sukuk al-ijarah*), joint venture (*sukuk al-mus-yarakah*), *sukuk al-istisna* (project based), and cost-plus asset purchase (*sukuk al-murabahah*). A notable difference between bonds and sukuk can be seen in the case of default: bond holders are left with bad debts, but sukuk holders have recourse to valuable underlying assets.

Sukuk has been a popular approach for governments seeking to finance infrastructure projects, but the legal complexity and overall cost to issue sukuk has kept it out of reach for smaller corporations and MSMEs. It has been an excellent way to raise much needed capital, but investors have also been always restricted to the much larger institutional investors due to the high barrier of entry, which usually starts in the millions. However, the inability to lower these barriers of entry at the retail level to thousands or hundreds of dollars to enable

⁹ <https://www.stellar.org/wp-content/uploads/2018/07/stellar-compliance-sharia.pdf>

wider participation (and access to more funds) for sukuk participation, and hence wider risk and profit-sharing in the Islamic capital market, is still persistent and remains an impediment to true shared prosperity.

A new approach announced in May 2018 by Blossom Finance¹⁰ aims to change that by using the blockchain. Blossom Finance’s “Smart Sukuk” platform leverages Ethereum blockchain smart contracts to increase the efficiency and reach of sukuk issuance globally. Smart Sukuk standardizes and automates much of the legal, accounting, and payment overhead of conventional sukuk offerings—all backed by fully licensed legal entities in the issuing jurisdiction. Blossom’s Smart Sukuk supports issuance of the sukuk in local currency and eliminates the need for institutions to add cryptocurrency to their balance sheet, and is only issued in jurisdictions with clear and viable legal frameworks to support it. Figure 6.4 illustrates a lease (*ijarah*) sukuk for a hospital construction project.



Source: Blossom Finance <https://blossomfinance.com/press/islamic-finance-upgraded-smarter-sukuk-using-blockchain>

Figure 6.4: Illustration of a Leasing Sukuk for a Construction Project

¹⁰ <https://blossomfinance.com/press/islamic-finance-upgraded-smarter-sukuk-using-blockchain>

Distributed Ledger Technology and the Over-the-Counter Market

Distributed ledger technology could introduce transparency into the opaque unlisted and OTC market space, while still maintaining transaction confidentiality. The Securities Commission (SC) Malaysia has embarked on a pilot project to explore the usage of DLT or blockchain in the unlisted and over-the-counter (OTC) market space through its aFINity Innovation Lab. SC Malaysia expanded its Alliance for FinTech community or aFINity program this year to include “innovation labs,” which act as a platform to facilitate the testing of new digital innovations within the finance industry.

OTC markets are decentralized markets, without a central physical location, where market participants trade with one another through various communication modes such as the telephone, email and proprietary electronic trading systems, as opposed to trading through a centralized exchange.

Traditionally, the unlisted and OTC market space have operated in an opaque fashion due to limited information availability. By using a distributed ledger as the technology underpinning the market infrastructure, all transactions and market activities would be recorded and made available to all market participants, while still maintaining transaction confidentiality.

Media Rights, Intellectual Property, and Trademark Protection

Today, media users are largely accustomed to having free access to a wide variety of content, and most of them are still reluctant to pay subscription fees for “premium” content behind paywalls. In addition, all media segments have suffered significantly from digitization, since content can be copied and distributed easily and without loss of quality. So far, the introduction of digital rights management (DRM) systems has not substantially reduced copyright infringements. The ensuing revenue “leakage” has been only partially recovered through new consumption models such as streaming subscriptions and micropayments for articles. The subsequent “commoditization” of content has been undermined by widespread piracy of intellectual property (IP).

Blockchain-based technologies have the potential to resolve some of these current challenges:

- Paid content can receive a boost from new, micropayment-based pricing models
- Monetization options emerge for an increasingly fragmented content inventory (e.g., blogs, news bites, photos)

- Allocation of advertising budgets becomes more accurate and targeted as media usage can be directly linked to the respective content items
- Copyright infringements and piracy would be nearly impossible

Sealed in the chain, blocks can no longer be changed: the prevention of deletion, editing, or copying creates true digital assets. These multiplied and decentralized blockchain processes lead to a high level of robustness and trust. Every participant in the network can verify the correctness of transactions. Network consensus methods and cryptographic technology are used to validate transactions. Thus, trust is not established externally by a central authority or an auditor but continuously in the network. Furthermore, the decentralized storage in a blockchain is known to be very failure-resistant. Even in the event of the failure of many network participants, the blockchain remains available, eliminating the single point of failure. New information stored in a blockchain is immutable. Its method of recordkeeping prevents deletion or reversal of transactions added to the blockchain, once further blocks have been added. However, the technology and the mechanisms are still evolving, and industry-wide adoption of standards is most probably still a few years off.

With the advent of blockchain, the media industry structure could change significantly. Blockchain technology permits bypassing content aggregators, platform providers, and royalty collection associations to a large extent. Thus, market power shifts to the copyright owners. While some applications of blockchain technology may still seem farfetched and require further technological advancements, payment-focused use cases have already been proved to work. Parts of the media value chain are therefore already endangered by new blockchain-based payment and contract options. These can fundamentally reset pricing, advertising, revenue sharing, and royalty payment processes. Payments or advertising revenues no longer need to be centrally collected. Payment transactions become less costly and the distribution of revenues is automated, based on predefined smart contracts. Table 6.1 depicts the potential blockchain-based opportunities in the media industry.

Table 6.1: Potential Blockchain-Based Opportunities in the Media.

| Potential | Cost-effective Pricing Options for Paid Content | Bypassing Aggregators/ Distributors | Distribution of Royalty Payments | Monetization of Consumer-to-Consumer/ Peer-to-Peer Content sharing | Cross-Border Consumption of Paid Content |
|------------------|---|---|--|---|--|
| Focus Areas | As micropayments become economically efficient and digital content is harder to copy illegally, new pricing opportunities arise | Blockchain allows everybody to become a marketer as reach of lead generation becomes trackable and can be compensated | Content consumption/ usage is captured in blockchain and a precise consumption-based analysis of playtimes is possible | Consumer-to-consumer (C2C)/ Peer-to-peer (P2P) content sharing and usage becomes transparent and monetizable through the blockchain | Cross-border limitations of paid content subscriptions and DRM complexities will be decreased by the blockchain |
| Industry Benefit | Low-price content (< US\$1.99) can efficiently be settled between seller and buyer | Liberalization of advertising market More precise performance tracking of advertising efforts | Near real-time allocation of royalty payments Alternative to imprecise estimates | Transparent and “controllable” P2P transactions Automated “real-time” billing Automated “real-time” billing | Decreased complexity of rights management Direct linkage of consumption to user through blockchain authentication |

Generating Advertising Revenues

Blockchain facilitates customer relationships. Based on the blockchain, everyone from leading media houses to small bloggers can easily generate advertising revenues. As blockchains permit an exact tracking of content usage, they also enable a direct allocation of advertising budgets. Together with new, blockchain-enabled micropayments, content creators can establish direct relationships with their

customers. In an extreme scenario, aggregators could even become obsolete in the future.

As soon as artists tie up digital copies of their songs or videos in a blockchain they will be able to sell them directly to their fans without any intermediaries such as record labels. Moreover, a fair allocation of revenues from music streaming becomes possible, whether advertising-based or paid content-based. Artists can market their songs independently of big platform providers wherever they want, since a blockchain permits easy tracking of usage and deduction of the associated payments.

Collections and Copyright Tracking

Collection associations could use a blockchain to create a permissioned blockchain ecosystem for musical rights. Based on a broad consensus amongst the parties involved, the industry bodies would act as “gatekeepers” to grant and/or withdraw access to the closed ecosystem. In addition, collection associations, typically acting domestically for one or a handful of countries, could use blockchain as an enabler to enter new markets, since established measurement and disbursement mechanisms in use with radio stations, broadcasters, and other parties, which, for instance, play music commercially, could become obsolete through the introduction of smart contracts.

In a different scenario, blockchain could also become a threat to traditional collecting bodies. Up to now they have been “chasing” certain commercial users who “do not pay their bills,” as exemplified by YouTubers illegally using copyrighted music in their videos, or royalty dues incurred by an event DJ. With the help of blockchain, every play of a song is recognized, counted, with royalties tracked and allocated to specific users. The role of the collecting body, collecting and distributing royalty payments, could soon become obsolete, as blockchain-based smart contracts take over the work instead.

In a nutshell, blockchain’s potential benefits for the media industry primarily relate to payment transactions and copyright tracking. Possible applications and technical innovations will have a far-reaching impact: content creators may be able to keep a close track of their playtimes, royalties and advertising revenues could be shared in an exact and timely manner based on consumption, and low-cost content could be purchased efficiently, even if priced at a mere fraction of a cent. However, there are several fundamental issues and technical obstacles, which may undermine the realization of our use cases:

- Opaqueness of blockchain platforms and standards due to quickly changing market participants

- Usability and reach of blockchain technologies in everyday environments
- Interoperability of platforms and various standards needs to be harmonized

Media players need to consider blockchain-based applications and their potential impact on the whole industry: micropayment-based pricing options for paid content, a shift of market power caused by content bypassing aggregators, and an improved distribution of royalty payments, to name just a few. To ensure continued competitiveness because of digital disruption consequences to existing media business models, companies should lose no time in identifying applicable blockchain-based opportunities as a fundamental component of their future business strategy.

LegalTech and the Evolution of Legal Services

The digitization of legal data constitutes another megatrend transforming workflows and business models. The volume of data used in legal advice has increased exponentially—a pattern seen in many other industries as well. A variety of legal technologies has emerged, enabling the digitization and automation of these and other legal-work activities (Veith et al., 2016). In fact, findings from a survey of law firm partners and legal-technology providers by The Boston Consulting Group suggest that legal-technology solutions could perform as much as 30–50% of tasks carried out by junior lawyers today. LegalTech is defined as companies that provide software and tech-enabled services to the legal vertical (including law firms and internal counsel) as well as tech-enabled legal services delivered to businesses and consumers. It is the reaction to the disruption that technology is having across all sectors of the economy. Although the legal sector is one of the most resistant to change due to its conservative nature, access to justice is a fundamental human right; while most cannot afford to hire legal representation when the need arises, there is immense potential for tech companies who are able to provide such services. Emerging start-ups like Case Text, Judicata, Rocket-Lawyer, DragonLaw and LegalTech products like LegalZoom and DocuSign have lowered the barrier to entry for legal protection that was previously confined to law offices. Now anyone can assign shareholding agreements, write their will or incorporate a company without having to seek legal counsel. The disbanding of the traditional legal business model is good news for the public interest in affordable and accessible legal protection.

To better accommodate market demands, many nontraditional legal service providers (tech-enabled firms, software automating legal work, nontraditional law

firms, etc.) have emerged. The five key areas of LegalTech according to ABA (2016) are:

Legal Research

The technology that enables the process of identifying and retrieving information necessary to support legal decision making.

- Blockchain-based referencing non-Word files (audio, pictures, etc.)
- Using predictive analytics to filter and recommend relevant documents
- Artificial intelligence (AI)-enabled virtual assistants and chatbots performing research tasks on par with a paralegal

Contract Management

The technology that enables the management and automation of legal contract creation and review.

- Automatically produce customized templates based on limited input
- Review documents for key and nonstandard clauses
- Organize and classify volumes of contracts (e.g., during due diligence for M&A projects)

Intellectual Property Management

Software used to research, manage and protect IP including trademarks, copyrights, trade secrets and patents.

- In the near term, IP management professionals will benefit from the same incremental improvements AI is providing in the legal research space.
- In the intermediate term, machine learning will enable the automation of the entire IP infringement detection process.

Automation and Analytics

The emerging class of technology that leverages big data, AI, machine learning, and other technologies to perform predictive analytics and automate legal work.

- Analyzing bodies of historical legal decisions to predict the outcome of ongoing litigation

- Enabling clients to assess the performance of their counsel by reviewing their history of outcomes
- Assessing arbitrators, jury members and judges for objectivity

eDiscovery

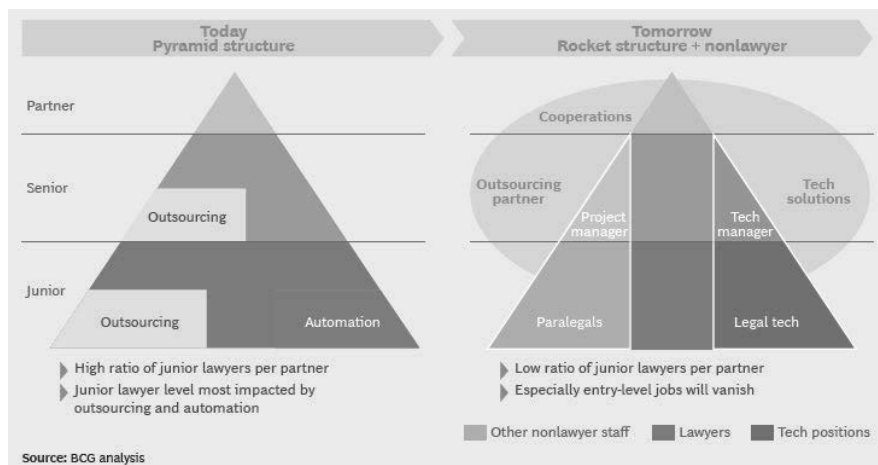
The technology that facilitates the identification, collection, preservation, processing, review, analysis and production of electronically stored information (ESI).

- Progressing from screening for keywords to predictive coding where algorithms use predictive analytics to determine the most relevant documents based on search

Blockchain coupled with the artificial intelligence cluster of technologies (AI as well as machine learning, natural language processing, machine vision, etc.) are especially applicable to the legal services space. This is because AI has been proven to be most useful/profitable when it is fed large volumes of data (e.g., legal research archives, eDiscovery ESI). They are also useful in automating time-consuming mundane formulaic tasks like screening research and filling out legal templates. As such, AI can save the consumer massive legal fees from expensive man-hours that traditional lawyers charge.

The opposition to putting data/applications in the cloud, which in turn was largely driven by fear of security breaches, has largely diminished over the last few years. Entrepreneurs and early-stage venture capitals have gotten in front of the positive tailwinds and are starting and investing in more LegalTech companies than ever before. The number of LegalTech start-ups listed on AngelList has increased from 15 in 2009 to 400 in 2017.¹¹ Figure 6.5 describes the evolution of the legal business models in the years to come.

¹¹ ABA Report on the Future of Legal Services in the United States (2016).



Source: How Legal Technology Will Change the Business of Law. Boston Consulting Group and Bucerius Law School (Veith et al. 2016).

Figure 6.5: Evolution of the Legal Business Model

The market size for LegalTech is quite sizeable, and in the United States, it is US\$16 billion in total addressable market (TAM)—US\$9.4 billion from selling to law firms and US\$6.5 billion from selling to corporate legal departments. The current actual spend¹² of only US\$3 billion reflects a less than 20% market penetration, leaving a significant potential of opportunity for LegalTech firms as well as investors. The largest areas of spend today include enterprise legal management, contract management, and eDiscovery; while the fastest growing areas over the next few years will include knowledge management, legal analytics, and contract management.

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Chapter 7

Evolution of Blockchain

Introduction

Blockchain is potentially disruptive to all business intermediaries. Its disruptiveness is proportional to the cost, complexity, and degree of transaction duplication in the existing system of intermediation. Recent technology waves—notably the internet of things (IoT), exploiting the proliferation of smart mobile devices, and augmented reality—may directly endow physical objects with information and intelligence: they make the real virtual. The technologies of token and blockchain, conversely, endow data with continuity: they make the virtual real.

Not only is there the possibility that blockchain technology could reinvent every category of monetary markets, payments, and financial services, it might also offer similar reconfiguration possibilities to a great many industries within the economy. Blockchain is fundamentally a new paradigm for organizing activity with less friction and more efficiency, and at much greater scale than current paradigms (Swan, 2015). Swan believes that it is not just that blockchain technology is decentralized and that decentralization as a general model can work well now because there is a liquid enough underlying network with the web interconnecting all humans. Including centralized or decentralized transactions: blockchain technology affords a universal and global scope and scale that was previously impossible.

The mining process of verifying blockchain transactions is what enables it to be undeniably secure proved by enduring untold numbers of cyberattacks. While bitcoin itself requires going through exchanges to convert hard currency into cryptocurrency and storing it, new blockchain technology programming changes eliminated the need for this. At the rate technology advances, blockchain will eventually run its course and sprout other potential uses along the way.

With blockchain, technology companies have finally broken through to the next leap in business transactions of every kind along with a new concept of the “internet of value” and the rapidly advancing IoT.

When combined with distributed infrastructure technology, the IoT, can significantly expand the return of investment (ROI) of an asset—its utilization. In manufacturing, for example, a distributed infrastructure-based IoT could power efficient product data-keeping. All information pertaining to a product from the point of manufacture through the time it reaches the end user can be stored on the ledger. This would include product history, revisions, warranty information

and expiration date (if applicable), thus making the ledger a trusted source of product data. Via access to the maintenance schedules on the ledger, service requests can be triggered when a product requires maintenance.

Home appliances can be designed to interact with each other to reduce energy consumption based on utilization. As an example, a washer can determine when the detergent supply decreases and automatically refills itself. The machine could also trigger a service request if it detects a component malfunction or a maintenance request based on usage and/or maintenance schedule. Blockchain can be the technology to store all of this information.

Within financial services, IoT can link the performance of a manufacturer to its lending potential. Sensors attached to goods produced at the manufacturing plant would monitor the products' retail sales, a good measure of how the business is doing. Banks can use this information to assist in a lending decision.

In 2015 Honduras implemented blockchain technology to develop incorruptible land registries. Blockchain and distributed infrastructure technology also has potential applications in takaful (the tracking of high-value goods to protect against insurance fraud), trade finance, supply chain management (the effective management and tracing of documents and entities participating in the process) and distributed identity, independent of countries or governments.

Transnational Justice Applications for the Economy

The freedom attribute associated with blockchain technologies becomes more pronounced in the future evolution of the blockchain, the next category of application beyond currency and market transactions. Through its global decentralized nature, blockchain technology has the potential ability to circumvent the current limitations of geographic jurisdictions. There is an argument that blockchain technology can more equitably address issues related to freedom, jurisdiction, censorship, and regulation, perhaps in ways that nation-state models and international diplomacy efforts regarding human rights can not. There is a scale and jurisdiction consideration that certain operations are transnational and are more effectively administered, coordinated, monitored, and reviewed at a higher organizational level such as that of the World Trade Organization (WTO).

The idea is to fortify transnational organizations from the limitations of geography-based, nation-state jurisdiction to a truly global cloud. The first point is that transnational organizations need transnational governance structures. The reach, accessibility, and transparency of blockchain technology could be an effective transnational governance structure. Blockchain governance is more congruent with the character and needs of transnational organizations than

nation-state governance. The second point is that not only is the transnational governance provided by blockchain more effective, more likely would be fairer. There is potentially more equality, justice, and freedom available to organizations and their participants in a decentralized, cloud-based model. This is provided by the blockchain's immutable public record, transparency, access, and reach. Anyone worldwide could look up and confirm the activities of transnational organizations on the blockchain. Thus, the blockchain is a global system of checks and balances that creates trust among all parties. This is precisely the sort of core infrastructural element that could allow humanity to scale to orders-of-magnitude larger processes with truly global organizations and coordination mechanisms.

Blockchain technology simultaneously highlights the issue of the appropriate administration of transnational public goods and presents a solution. Wikipedia is a similar international public good that is currently subject to a local jurisdiction that could impose on the organization an artificial or biased agenda. It is possible that blockchain mechanisms might be the most efficient and equitable models for administering all transnational public goods, particularly due to their participative, democratic, and distributed nature.

Coordination and Efficiency in Markets through Consensus-Building

Blockchain technology can facilitate the coordination and acknowledgment of all manner of human interaction, facilitating a higher order of collaboration and possibly paving the way for human/machine interaction at some level. Further, blockchain technology is not just a better organizational model functionally, practically, and quantitatively; by requiring consensus to operate, the model could also have greater liberty, equality, and empowerment qualitatively. Thus, the blockchain is a complete solution that integrates both extrinsic and intrinsic and qualitative and quantitative benefits.

Despite the many interesting potential uses of blockchain technology, one of the most important skills in the developing industries will be to see where it is and is not appropriate to use blockchain models. Not all processes need an economy or a payments system, or peer-to-peer (P2P) exchange, or decentralization, or robust public record keeping. Further, the scale of operations is a relevant factor, because it might not make sense to have every tiny micro-transaction recorded on a public blockchain; for example, blog-post and tip-jar transactions could be batched into side-chains in which one overall daily transaction is recorded. Side-chains are more broadly proposed as an infrastructural mechanism by which multiblock chain ecosystems can exchange and transfer assets (Back et al., 2014).

Especially with made to measure (M2M)/IoT device-to-device communication, there are many open questions about the most effective ways to incorporate market principles (if at all) to coordinate resources, incentivize certain goal-directed behavior, and have tracking and payments remuneration. (Dawson, 2014) Even before we consider the potential economic models for M2M/IoT payments, we must work out general coordination protocols for how large swarms of devices can communicate, perhaps deploying control system and scheduling software for these machine social networks, adding new layers of communication protocols like a “chirp” for simple micro-communications such as on, off, start, and stop (daCosta, 2013).

Pragmatic Approach to Blockchain Implementation

There is an increasing amount of conversation related to the emerging technology called by the now over-used name blockchain. It seems an ironic use of that name, since much of the actual news these days concerning solutions under development is likely not a blockchain solution at all, but a different form of distributed ledger technology (DLT). If we can put semantics aside, the basis for the excitement is based on the blockchain concept, which underpins the bitcoin platform for a distributed and immutable ledger facilitating the exchange of the virtual currency.

There are several DLT platforms that are receiving interest from the financial services community that leverage some aspects of blockchain. Among them is Corda, which is being developed by R3, a fintech focused on DLT. A visit to the Corda website finds that they do not call their platform blockchain, as that word does not seem to even exist on their website. The message is clear that the platform is designed for financial services—not surprising, as R3 has been heavily funded by several large banks and others. The platform is designed to not share all transaction data across the network, as the access to transactions is restricted to only those needing to view or validate them on a case-by-case basis. This access is limited to the parties to the transaction and potentially regulators or central authorities. This form of private ledger does not share the vision of bitcoin, the public network where the transactional history is shared by all nodes. Corda supports multiple consensus algorithms, which provide flexibility to comply with different regulators but also differs from the use of miners found in the bitcoin world.

Another example are the tools being offered by Digital Asset Holdings. Digital Asset utilizes a form of private DLT, Hyperledger, which is not a true Blockchain. Like Corda, Digital Asset exists to support banking and capital markets and

central authorities such as exchanges and central counterparties (CCPs). Like the Corda platform, not all the transaction data stored on the Digital Asset platform is replicated across all the nodes. This data is shared only by those involved in the transaction. Digital Asset differs from other platforms as it employs a form of XML called Digital Asset Modeling Language (DAML) utilized to develop Smart Contracts, which automate the execution of contract terms related to the exchange of assets that interact with the Hyperledger. However, a common thread among these platforms and blockchain is the use of cryptography and some form of consensus algorithm, such as Practical Byzantine Fault Tolerance (PBFT). PBFT is effective in asynchronous environments such as the internet, where the need to maintain high availability and provide the capability to recover from bugs, errors, and malicious cyberattacks is critical.

There is some debate about the development of these private networks, as the focus moves away from bitcoin to a continuous stream of new ventures, alliances and projects on different platforms. The groundswell of excitement for a technology such as blockchain has created an unsurprisingly opposite reaction as well from cynics who are beginning to line up to rain on the parade. However, both sides seem to suffer from the same hype.

The issue is that they are both looking at blockchain as something being either black or white. Some supporters of this emerging technology believe, unequivocally, that we are on the cusp of a disruption that will change the world as we know it. On the other hand, there are the skeptics. While we would not want to lump them all together, there are certainly some skeptics who are threatened by the new technology. This includes those who may have some vested interest, professional or financial, in alternative or legacy tools and technology, as well as those who fear the focus is moving away from what they believe is the promise that a true public blockchain can provide. Legitimately, there is reason to be cynical from a technology perspective. But frontier technologies are built on healthy skepticism and experimentation.

In the discussions about how the implementation of these private networks such as Corda and Digital Asset are moving, the focus is away from the true decentralized nature of the blockchain. Currently, there are several serious challenges that cause impediments for the large-scale implementation of a true public blockchain. There are issues with scalability and latency with the blockchain model that utilizes cryptographic algorithms and shares the entire transaction history across every node in the network. At the time of this writing, there are few viable solutions to this problem, as most blockchain solutions do not provide the speed that is available using current technology. Use cases involving equity trading execution or card processing require execution cycles that DLT can not currently

provide. This explains why the current focus has been on creating post-trade processing solutions, such as for securities or derivatives settlement.

Another challenge for the technology relates to privacy laws. Several nations maintain data residency requirements. This means that any data that includes personally identifiable information may not reside outside of their national borders (Swan, 2015). Some other countries are not as restrictive but still limit access to personal data requiring strict role-based permissions, data masking and other techniques. These rules have an impact on the potential architecture, functionality and the ability to implement a public blockchain solution. Additionally, if we consider the use of a public blockchain that includes no central authority and is anonymous, how can sanctions and antimoney laundering regulations be monitored and maintained? This creates a major hurdle to obtain regulatory approval of any solution having this issue.

Get it Going First

Obviously, there are several technical and regulatory issues that remain to be solved before a true public blockchain model will become viable. So, what becomes of the work developing private networks that is ongoing with Corda, Digital Asset and others? There is much potential value to be gained from the implementation of a private DLT platform. The implementation of some form of DLT and Smart Contracts for the appropriate use cases may provide advantages in efficiency and maintaining audit trails over other alternatives. However, when considering any information technology (IT) implementation, it is important to choose the appropriate technology for the business problem you are trying to solve. The solution should never try to find the problem.

Thus, banks and other institutions must avoid considering use cases where latency and other technical or regulatory limitations would affect the success of the project. This may include maintaining the status quo by utilizing a central authority to avoid additional and unnecessary regulatory entanglements. Currently, regulators are providing varying degrees of support for the implementation of DLT. The Monetary Authority of Singapore (MAS) is directly promoting both securities settlement and cross-border payments using DLT technology. On the other hand, while some regulators have voiced concern for existing rules such as AML (antimoney laundering), most seem to be taking a more wait-and-see stance. It is critical to perform the appropriate planning, including viability and readiness assessments, prior to any potential rollout to ensure that the appropriate use cases are considered and that the integration to legacy systems is thoughtfully designed and executed. Institutions must be aware that business

operating models and processes will be affected. Change management will also be an important consideration.

The discounting by the cynics of efforts being made by those as varied as the Depository Trust & Clearing Corporation (DTCC), the recently announced Enterprise Ethereum Alliance or MAS truly miss the point that this will be an evolution and not a revolution. The fact that these platforms do not provide what many consider a pure blockchain or are being implemented with a profit motive seems to bother some in the blockchain community. Any new technology that is to be implemented successfully on this scale will need investment from many parties. It will need that investment in start-ups and by established players, such as Microsoft and IBM, to overcome the current technological challenges. It will need investment from large institutions to spend portions of their IT budgets already strained from maintaining legacy systems and trying to keep up with emerging requirements of digital banking and changing regulations.

If we look back at the history of other technologies that have brought a paradigm shift, many have taken time; even years to replace legacy business models and systems. The development of a mature DLT platform will take time as well. The current implementations of DLT clearly are not the blockchain that underpins the virtual currency bitcoin. The tools and platforms such as the offerings from Digital Asset Holdings and R3 Corda are offered as a pragmatic answer to a set of current business, technological and regulatory challenges. By implementing the appropriate use cases the potential impact of the current challenges inherent in the bitcoin example—including scalability, latency and privacy—will be reduced. These challenges make the current public blockchain model a non-starter for banks.

In other parts of the world, regulators have been providing regulatory sandboxes for financial technology, such as blockchain. The trend started in the UK in February 2015 when the first Blockchain tech sandbox was launched. The sandbox allowed businesses to test out new and innovative financial services without incurring all the normal regulatory consequences of engaging in those activities, according to the Financial Conduct Authority Director of Strategy, Christopher Woolard, who have since been inundated with interest about their sandbox.

Singapore's Central Bank introduced a similar environment in August 2016, launching a regulatory sandbox to allow local fintech companies to experiment with their solutions. In November, the Thai Central Bank started a major fintech promotion, launching a sandbox that included blockchain tech start-ups. While designed for banks, non-bank technology firms with "sufficient capital and human resources" were invited too.

Big-four professional services firm KPMG released a report¹ attributing many Asian investments in blockchain fintech to this global trend of regulatory sandboxes. The firm pointed out that the governments in Hong Kong, Australia, Indonesia, and Malaysia all created or announced sandboxes for the banking sector during the third quarter of 2016. The firm described the push as part of a greater, worldwide embrace of fintech in general by governments and other monetary authorities.

Overcoming Limitations of Blockchain

The blockchain industry is still in the early stages of development, and there are many kinds of limitations. Ideally, the blockchain industry would develop similarly to the cloud-computing model, for which standard infrastructure components—like connectivity, processing, storage and management systems—were defined and implemented very quickly at the beginning to allow the industry to focus on the higher level of developing value-added services instead of the core infrastructure. The current limitations are many but not insurmountable, and include those related to technical issues with the underlying technology, public perception, government regulation, and reported thefts and scandals.

Technical Challenges

One main challenge with the underlying bitcoin blockchain technology is scaling up from the current maximum limit of seven transactions per second (the VISA credit card processing network customarily performs 2,000 transactions per second and can manage peak volumes of 10,000 transactions per second), especially if there were to be mainstream adoption of bitcoin (Lee, 2013). Some of the other issues include increasing the block size, addressing blockchain latency and bandwidth, countering vulnerability to mining attacks, and implementing hard forks (changes that are not backward compatible) to the code. There have been some significant advancements in this area as we speak.

Another significant technical challenge and requirement is that a full ecosystem of plug-and-play solutions be developed to provide the entire value chain of

¹ “Global VC-backed fintech funding declines in Q3’16, but Asia investment reaches new high: KPMG and CB Insights.” KPMG, November 16, 2016. <https://home.kpmg.com/xx/en/home/media/press-releases/2016/11/global-vc-backed-fintech-funding-declines-in-q3-2016.html>

service delivery (Swan, 2015). For example, there needs to be secure decentralized storage, messaging, transport, communications protocols, namespace and address management, network administration, and archives linked to the blockchain ecosystem.

While it is possible that cryptotechnologies will see more adoption due to their flexibility and wider scope of potential use within banks, the benefits that distributed ledgers can bring to financial institutions and corporations will be dampened if a critical mass of adoption is not reached. If one bank uses distributed ledgers and another does not, a trade transaction involving those two banks will have to rely on legacy products and networks. Interoperability between distributed ledgers (as well as between distributed ledgers and legacy systems) will be key to enabling network effects that can produce benefits for all stakeholders. As banks and others look to the use of the blockchain in trade and finance, they should focus on how to bring industry participants together to create a network effective for blockchain-based platforms.

Business Challenges

At first traditional business models might not seem applicable to the blockchain economy since the whole point of decentralized P2P models is that there are no facilitating intermediaries to take a cut/transaction fee. However, some of the many types of business models that have developed with enterprise software and cloud computing might be applicable, too, for the blockchain economy—for example, the Red Hat model (fee-based services to implement open source software), and SaaS, providing Software as a Service, including with relevant modifications. Optimistically, the new blockchain era could usher in new types of jobs and opportunities.

Any solution will ultimately need to fit into an organization's existing financial ecosystem. Considering this fit beforehand will improve the integration process later, should the concept prove successful. Additionally, many technological partners offer different applications of distributed infrastructure technology. Choosing the partner that fits a business need and desired configuration is vital to the technology's individual success. Data privacy is another technological consideration. For example, while trading assets on an open blockchain may significantly cut costs, it is not a practical solution if all transactions are observable by all parties in the system. Consequently, the design of the technology itself will need to be reviewed depending on the application of choice.

Furthermore, moving any product or service from a centralized to a decentralized mode of operation will have vast impacts on an entire organization. A

business' front office, operations, compliance, tax, accounting, legal, and technology offices are likely to be involved. Any strategic identification of opportunities to improve a business using this technology will therefore need to consider the end-to-end operational impact of each solution.

Government Regulatory Challenges

The likelihood of a decentralized system to become commonplace is not obvious as it would have to offer the same or higher level of trust and protection than the current one. For this to happen, the system would have to possess a massive amount of computer power and efficiently cope with the enormous energy consumption required to support it. In addition, it is not clear how this system would deal with legal and regulatory concerns, as well as with matters of national security, such as money laundering, fraud, tax evasion or terrorism. Moreover, digital currencies would not be exempt from potential crashes; like the current system, if their usage reaches substantial levels, these shocks could generate systemic risk and severe economic downturns. In this scenario, monetary policy would not be able to respond effectively if it fails to boost demand among a large share of economic agents that use digital currencies.

Regulatory approval can strongly impact the success of any distributed infrastructure implementation. For example, developing a distributed ledger to assist in the clearing and settlement of financial assets may involve custodial considerations, especially if assets are considered to be held on the network at any point. These custodial considerations may require a party to submit to regulatory requirements, which in turn could increase the compliance costs of such a system. On the other hand, a well-designed, standardized, automatically reconciled ledger could provide immediate real-time access to the relevant regulator for all partner institutions on the network. This could prove to save considerable costs and therefore outweigh the additional compliance costs involved in establishing the system.

One way to comfort regulators is to allow for permissioned access for regulatory audits. The sharing of data (be it with regulators, or other parties) can be done through permissioned access via encryption keys. The access can be granted by the blockchain owner (or system provider) for regulators (and other verified authorities in a particular investigation or audit check) to view the related areas where it would help in their duties. In these early phases of blockchain implementation, the utopian version of a truly public and fully decentralized blockchain system may have to wait until the regulators (and all other authori-

ties) become comfortable with the idea of a digital economic system with decentralized operations.

Bitcoin and blockchain are themselves neutral; as any technology, they can be used for good or evil. Although there are possibilities for the malicious use of blockchain, the potential benefits greatly outweigh the potential downsides. Over time, public perception can change as more individuals themselves have e-wallets and begin to use bitcoin.

Privacy Challenges

There are many issues to be resolved before individuals feel comfortable storing their personal records in a decentralized manner with a pointer and possibly access via blockchain. The potential privacy nightmare is that if all your data is online and the secret key is stolen, lost (forgotten) or exposed, you have little recourse. In the current cryptocurrency architecture, there are many scenarios in which this might happen, just as today with personal and corporate passwords being routinely stolen or databases hacked. Any comprehensive solution must include a biometric measure that forms a bridge across the physical-cyberspace boundary. For complex, high value blockchain transactions, this legally reliable biometric connector will require a third party to confirm that the biometric measure is indeed the one belonging to the physical-space identity. Additionally, the blockchain application must incorporate a digital representation of a person's fingerprint, iris or retina pattern, or a photograph into the blockchain transaction. This means that the person's biometric information will not only exist permanently in cyberspace, it will be stored on hundreds or thousands of blockchain nodes, all beyond the control of the physical-space human being to which it belongs.

However, despite all of the potential limitations with the still-nascent blockchain economy, there is virtually no question that it is a disruptive force and that its impact will be significant. The blockchain economy has provided new larger-scale ideas about how to do things. Even if you do not buy into the future of bitcoin as a stable, long-term cryptocurrency, or blockchain technology as it is currently conceived and developing, there is a very strong case for decentralized models—the internet decentralized information and established the Information Age. The blockchain industry is one of the first identifiable large-scale implementations of decentralization models, conceived and executed to scale the complex levels of human activity, possibly even those that have yet to be imagined. Progressing toward decentralization of economic transactions would make future economic activities less restrictive and increase efficiency. Centralized systems

may exist on top of the decentralized system but they will be few and will act as forms of governance or administrators. For governments and corporations that means massive cost reductions, like reducing banks' infrastructure costs attributable to cross-border payments, securities trading and regulatory compliance by between US\$15 and 20 billion per annum by 2022. For the society, this translates to better access, transactional efficiency and savings. For Islamic finance, instead of developing new rules to control speculative and unrestrained reckless behaviors, blockchain embeds such governance measures within its technology as well as Islamic virtues that uphold the values of trust, honesty and transparency, and those that require fulfilling of obligations and responsibilities.

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Chapter 8

Response of Islamic Financial Institutions

Introduction

Undoubtedly, fintech growth is unstoppable but understanding the future of fintech requires a re-engineering of how banks operate and in-depth analyses of its customer experience. E-commerce businesses like Amazon, Apple, Facebook, and Google prove that smart data management can create a customer understanding like no other. Across retail, wholesale, and capital markets, banks are keenly aware that the digital-first model based on high-performance data analysis will create a massive advantage. This chapter will discuss the key success determinants to remain competitive in the global market for Islamic financial institutions (IFIs) with the use of fintech. It will also elucidate the challenges, which the Islamic finance industry may face in the adoption and implementation of new tech. Finally, we end with a proposal for a collaborative approach for IFI in order to harmonize strategies and adapt to the rapidly changing landscape of the market.

Important Success Factors in this Era of Digitization

Better Customer Experience with Customer Centricity

Customer centricity has been one of the driving innovations in financial services, and this is also true for the Islamic finance industry. Tech-savvy digital consumers want more personalized services that enhance convenience and improve security. Shifting from product thinking to customer-centric offerings demands speed, agility, and the ability to innovate. Monetizing social media platforms have emerged as opportunities to diversify firms' income by engaging millennial consumers. Digital experience will draw people into continual virtual engagements and online transactions.

Customers are reshaping and redefining their expectations, taking their cues from several industries that provide multichannel access, seamless integration, product simplicity, and “segment-of-one” targeting.¹ In the last few years, it

¹ “Segment-of-One Marketing” is the ability to track and understand individual customer behavior.

became clear that customers wanted to be able to do *everything* on their mobile phone, including applying for a bank account, or insurance claim. They want personalization, convenience, accessibility, and ease of use. They wanted to feel like their bank was anticipating their needs, not crafting product offerings that made sense only from the banks' bottom-line perspective. They expected no surprises and demanded transparency in terms of fees. Seventy-five percent of PricewaterhouseCooper's (PwC's) survey respondents from the banking and fintech sector saw an increased focus on the customer as the most important area of impact to their business.

King (2014) forecasted that the future of the bank will have a very different organizational structure. He further argued that the entire customer facing organization and supporting platform needed to change radically. As customer expectations are changing, companies are forced to adapt. It is expected that in 2020, companies must focus on using big data to predict customer decisions and make such intelligence accessible throughout the enterprise. In the future, customers will want to do business with firms and companies that offer a consistent, informed and greater experience across all channels of communication, taking into consideration that customers will have different preferences.

There is fierce competition among banks and financial institutions to provide the most seamless services at the lowest price, to retain loyalty, and win new business. They are aware that providing customers with experience-rich banking and placing them foremost is essential for success. Those who manage and embrace the customer-centric approach will thrive in the market (Dharmesh, 2016).

Agility and Scalability

Agility is one of the most discussed and crucial attributes of successful fintech companies. The point of agility is the ability to adapt and be nimble in the environment of competition, unexpected and unanticipated changes and opportunities. For an organization, agility is needed to thrive and take advantage of changes by quickly assembling its organizational parts: technology, employees and management, in order to take advantage of an opportunity. In this way, any organization can cater to the needs of their customers in a changing and turbulent environment in an effective and deliberate way (Goldman, 1995).

Scalability is the capability of an entity to grow and to expand across markets. It also includes the ability and capacity of the technology to expand or accept expansion to perform the increased workload without compromising efficiency, and effectiveness. It is dealt with through networks, systems, and processes.

In organizational and business perspectives, scalability is most important to meet the demands of the market. It allows companies to reach new markets that would have required them to open a satellite office or a branch in a geographical location whose market they may not be familiar with, along with new employees that are not proven. Scalability allows businesses to expand across boundaries with a single team that can be based at the headquarters, where the company was originally founded, or regionally, if a presence in an area is of value.

Islamic banks need agile product and technology development skills to bring new products and capabilities to the market much quicker than today. This requires continual iteration, real-life pilot testing, and rapid learning from customers.

Building the Ecosystem

To foster the fintech or Islamic fintech industry, there is the need to establish an innovation ecology. Stefik and Stefik (2006) explained this term as: “An innovation ecology includes education, research organizations, government funding agencies, technology companies, investors, and consumers.” Digital innovation will drive innovative products and services to the end users. It can also make products and services cheaper and more accessible for the unbanked and underbanked population.

The main entities within the innovation ecosystem are the regulators, Islamic fintech companies, IFIs, venture capitalists, government agencies, strategy and technology consultants, media and academia. These entities make up the demand and supply sides of the digital ecosystem. Every crucial component gives support to each other and strengthens each other for the attainment of common and collective objectives. Each party plays its role and uses its resource and capability to provide solutions. Regulators may provide innovation-friendly policies and an environment that gives incentives to Islamic fintech platforms to test and refine their innovative ideas, and IFIs may provide financial services or access to their internal sources and financial expertise. Incubators and regulatory sandboxes allow for the trial of prototypes in a controlled environment, while the media and academia may provide insights into trends and conduct proof-of-concept research to determine viable solutions for the gap in the industry. Managers must ensure their organizations can pivot with market shifts, even dropping or switching partnerships if the going gets too rough. The ability to adapt to new conditions will be a driving factor in maintaining the digital ecosystem, as partners and suppliers change and customer needs evolve.

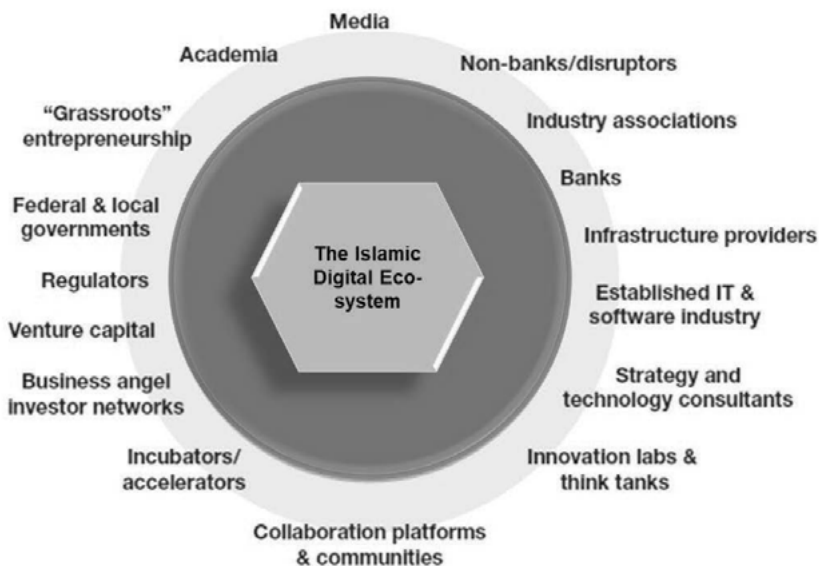


Figure 8.1: The Various Components to the Islamic Digital Ecosystem

Developing partnerships with a range of actors in the Islamic digital ecosystem (see Figure 8.1) adds strength to the community and can be a strategic way for organizations to add value to existing efforts or shore-up their areas of shortcoming and deficiencies. Investments in core and emerging technologies will ultimately define the DNA of the ecosystem. Cloud services, analytics, node architecture and servers, cybersecurity and talent development should be the biggest planned investments in technology.

Cybersecurity Management

Cybersecurity is paramount to rebuilding trust and confidence that previous financial crises have eroded. Successful financial institutions will have invested considerably in this capacity. Recent high-profile security breaches and media commentary surrounding cyberattacks have bred fear and hesitation, further eroding stakeholder trust. There are now higher expectations about security of information and privacy among clients, employees, suppliers, and regulators. These risks include the internal misuse of social media and organized cyber-crime (e.g., mass information theft, or denial-of-service attacks). This makes the fintech industry more vulnerable to cyber threats and attacks. Different reports

(CB Insights, 2018; PwC, 2016c) show that cybersecurity management is the top concern of stakeholders of the fintech industry and also the traditional financial industry who are seeking to hire or build in-house fintech outfits or want to collaborate with proven fintech entities. Cybersecurity also attracts regulators to dig deeper into this matter that combines fintech and RegTech (Arner, Barberis, & Buckley, 2016).

The combined use of blockchain, big data, and artificial intelligence (AI) can lead to a better, more sophisticated and integrated cybersecurity system, which is adaptable and effective. In addition, one of the major challenges from the end users is lack of awareness of cyber or digital risks (Villasenor, 2016) and also their negligence in taking precautionary measures while accessing financial services through digital channels. Awareness programs to educate users are helpful to manage the common cybersecurity risks.

For Islamic banks and institutions, a proactive response is vital. Key priorities include identifying and focusing resources on the business areas most in need of protection. By 2020 leading banks will have developed cybersecurity strategies that are aligned with their business objectives, risk-management protocols, and regulatory requirements. Many existing IFIs lack the resources to tackle these issues on their own, and, hence, will have to partner with qualified third parties with a full understanding of security requirements.

Challenges for Islamic Financial institutions

Regulatory Issues

Due to technological advancements and innovative models, the landscape of the financial industry is changing so spectacularly that it is completely transforming and shifting the world economy (Hayen, 2016). This dynamism in the world economy demands a dynamic and a new set of regulations to foster and regulate the growth of the fintech industry according to fair play, rule of law and best practices. According to International Data Group (IDC), it is estimated that the banks, investment banks and insurance companies globally are investing around US\$85 billion just for the provision of regulatory oversight, legislative initiatives and risk control.

The rule-making process also needs some changes due to its present glacial, unidirectional, and inflexible nature. An agile and results driven process of rule-making is important to set rules and boundaries for the ever-changing environment of finance, in particular, for the Islamic fintech industry (Brummer & Gorfine, 2014).

Regulatory support provides an ecology that helps to foster and promote the new or young entrepreneurs and also other Islamic financial institutions to test their innovative business models. In a few Islamic countries, like Malaysia, its central bank, Bank Negara Malaysia (BNM) is doing well in terms of creating an innovation-friendly regulatory environment, which can be observed from its well-established fintech (including the Islamic) ecosystem.

Likewise, it is advisable that other organizations like international Islamic financial forums and influential entities, like AAOIFI, IsDB, IFSB, ISRA, and IRTI start sharing and discussing new ideas and collaborate with Muslim entrepreneurs to enhance regulations, which can support further growth of Islamic fintech ecosystems worldwide. It is heartening to see that in the second half of 2017 and in 2018, events like the 2nd World Islamic Finance Forum, Blockchain and Waqf have placed fintech as their main themes in their forums. These are indeed encouraging signs that signal awareness and acceptance. Such initiatives provide avenues for regulators and governing authorities to discuss the complex multidimensional issues faced by the Islamic fintech industry and begin engagements with the industry on viable and practical regulations for the industry. Regulators do not want industry players just adhering to rules, or checking boxes but rather, they want them to embrace regulatory intent, and create sound, secure, unbiased businesses, where regulatory compliance and sound conduct is embedded in the processes and values of everyday operations.

Moving forward, the industry could come to a consensus on a set of prudential regulations for Islamic finance (including fintech), which can be applicable in all regions. The formation of consortia and alliances among IFIs, fintech platforms, academia, and regulatory authorities can be a good step forward.

Comfort Zones and Stagnation in Management

The hard regulations and legacy culture in an organization are infused with each other. This impedes the path of an organization to move forward especially when it comes to the path of innovation. This culture of layering and folding of management in decision-making traps an organization in the ropes of stagnation. Risk averse behavior of management becomes more complex when diffused from lower to top management. Fintech provides for quicker, more informed decision making and calculated risk-taking behaviors.

Fintech focuses on access and control of the customers' financial transactions, and Islamic fintech will provide the personalization of finance to the customers by using digital channels and innovative business models within the deployment of big data, AI, and blockchain. The process from inception and

opening of an account or executing an investment to the final rewards and other financial transactions can be directly controlled by the end users in fintech solutions.

In a financial organization that is encumbered by layers of management, it is not easily possible to do experimentation for new innovative products and business models. Getting approvals alone will take ages. In addition, experimentation involves failure and the fear of failure results in the lack of support of innovation. It is a fact that without experimentation in this era of digitalization, financial institutions will fail to compete and will not be able to provide the services and products, which the consumers expect.

The Islamic financial industry appears to be slower in the adaptation and experimentation of digitization. There are a number of conventional institutions like CITI bank, Barclays, Bank of England (BOE), and so forth, which have already made innovation labs and incubators to conduct in-house experimental trials by deploying advanced technologies, that is, big data, AI, and blockchain, etc., at different phases. But, IFIs are not showing agility and activeness in this regard. Management of IFIs need to give priority to transforming their organizations because disruptive change is inevitable and it is happening fast. IFIs need to create incentives for innovation and consider how all partners and suppliers contribute to their business development. Partners will drive innovation and growth as the businesses adopt, consume, scale, and leverage innovation for greater market share leadership.

For example, a leading financial services company turned to agile software development to support its goal of organizing around customer experiences rather than products (Olsen et al., 2017). In doing so, it sharpened the focus on raising speed to market and ensuring consistently high customer loyalty scores for sales and service delivery, especially in predominantly digital channels. The company uses agile, cross-functional teams of eight to ten people, aligned to specific customer episodes. Each team brings together the requisite capabilities in business, design, processes, and technology. The company now is taking its experience-led agile approach to scale across the enterprise, through waves of applied learning sessions, and is well on its way to improving productivity by three to four times.

Lack of Talent

Since the beginning of Islamic banking and finance in 1970s, one of the major challenges this industry is facing is lack of skilled talent. Financial Accreditation Agency of Malaysia claimed that in Malaysia, there is the need and demand of approximately 56,000 additional people in the Islamic financial industry by 2020

(WIEF, 2017). Obeidat (2016) also highlighted in his research about human capital in Islamic finance that the sustainability and competitiveness of the Islamic financial industry is highly dependent on the skills and talents of its human capital.

The fintech industry is bringing together information technology (IT) professionals, data scientists, entrepreneurs, programmers, etc., to the financial services industry. This entry of new and diverse skilled people in the circle of the financial services industry makes the fintech industry more diversified and innovative but also somewhat complex. The additional requirement of Shariah expertise and Islamic economics/finance understanding further narrows talent availability. An ideal leader of an IFI would have to be someone adept in business, economics, finance and the Shariah as well as have a technical understanding of new technology.

One way to overcome the dire need of skilled and talented human capital, could be to increase the production of skilled human capital through effective education of intellectual capital in academia and research. The need to bridge academic curricula to the needs of industry is also critical to bring much needed solutions to real problems. Although there are a number of institutions that have already begun running courses as part of degree programs in conventional fintech, there are none in Islamic finance programs. There is not a single course on fintech with regards to Islamic finance (ICD & Thomson Reuters, 2017). This is indeed very alarming and requires immediate resolution. When fintech and innovation programs are in place, there should be industrial attachment programs for tertiary students in the form of internships, project collaborations, and exchange programs. For the public or older folks who seek alternative career paths, coding academies need to be developed to skill those interested in coding and programming. It is fairly obvious that as the finance industry gets disrupted, the redundant professionals lose their jobs but the disrupters continue to employ coders, programmers, various IT specialists, and data scientists.

At the university and think tank levels, there should be more collaboration across disciplines, and collaborative cross-training and interdisciplinary research programs to complete the fintech ecosystem to supply quality and knowledgeable talents.

At the bank level, as automation pervades more activities, their workforce must evolve. Thousands of roles are becoming obsolete, including tellers, back-office processors—even routine call-center agents, as chatbots and robo-advisors take on simple inquiries. Conventional technologies have helped banks to double labor productivity every few years through digitalizing processes and applying more sophisticated industrial methods like capacity planning and lean six sigma. Opimas, a research firm, estimates that by 2025, the rollout of AI technology by financial institutions will reduce employment in the capital markets

by 230,000 people, with the largest impact in the asset management industry, where machines will replace around 90,000 people (Olsen et al., 2017). Taiger, for instance, combines machine learning with natural-language processing to automatically identify, extract, cleanse and validate pieces of information from many types of documents. The banking applications include client onboarding, due diligence and combating money laundering. After a large European bank shifted to Taiger's technology for client onboarding, its cost fell 85% and turnaround time shrank from several weeks to seven minutes, with no loss in quality. As AI spreads throughout the industry, bank professionals who previously performed those activities will have to upgrade their expertise to remain relevant.

The greatest talent challenge for IFIs is attracting technical specialists. There is a worldwide shortage of talent in advanced analytics, new technologies such as blockchain and customer experience design. The shortage is worsened by competition from more attractive fintech start-ups and companies that are building interesting solutions. Banks will have to get creative in attracting and nurturing top talent, through incentives such as elevating top performers into key roles with more latitude and flexibility for further innovation, while adapting their respective organizational cultures to manifest this new reality.

Collaboration Models for Islamic Financial Institutions

Interoperability, coordination and collaboration are the essential elements of any developed and successful ecosystem around the globe. This involves different governments, public and private sectors indigenously and outside the region. Public and private sectors can establish safe, secure, reliable, and affordable open and shared platforms for digital payments, banking services and other financial alternatives by converging their offers via omnichannels (offering the customers integrated consistent financial platforms), including decentralized shared ledgers. This will work as the catalyst of financial inclusion and will also enhance the adoption of basic and primary financial services at a larger scale.

This trend of interoperability, coordination and collaboration is pervasive and is prevailing around the world. For example, the Postal Savings Bank of China (PSBC), China's largest lender having a branch network of 40,000 branches, has deepened cooperation with Ant Financial and Tencent in internet and mobile finance. The online banks also aligned with the Chinese government's policy by providing access to financial services to the unbanked Chinese (Duflos, 2015). Peer-to-peer (P2P) lenders Jimubox, RenRenDai, and Minshengyidai and China Minsheng Bank are helping each other to manage and safeguard funds of investors (Ernst & Young EY, 2016). Dianrong.com and the regional Bank of Suzhou set

up a collaboration agreement in 2014 to target small enterprises (Finextra, 2014). More examples exist around the globe.

Interoperability, coordination, and collaboration involve different branches of the government, public and private sectors, indigenously as well as outside the region. Public and private sectors can establish safe, secure, reliable, and affordable shared platforms for digital payments, banking services and other financial alternatives by converging themselves via digital omni channels. This will work as the catalyst of financial inclusion and will also enhance the adoption of basic and primary financial services at a larger scale to those who may not have had access previously.

A comprehensive analysis of different models of collaborations between fintech companies and banks has been done in two reports provided by (EY, 2017; TheCityUK, 2017). Different collaboration models are explained and discussed in these reports. Some of the prominent models are as follows:

- *Hackathons:*

This model is not very formal, and usually is a fun way to invite start-ups and fintech companies to provide a solution on a particular use case or business challenge. Hackathons typically take place in teams and groups of coder-entrepreneurs and programmers. In these events, the organizers set off to test early-stage prototypes and ideas in an attempt to solve specific problems and offer solutions. IFIs can get quick and innovative solutions through these kinds of events while fintech companies get to pitch their ideas and take a shot at getting funded or recruited. An example of this model is the LGB innovation lab set by the Lloyds Banking group to test prototypes and find solutions to their operational issues.

- *Start-up Corporate Accelerator Model:*

In this model, fintech companies submit their applications to IFIs to propose solutions or innovation to existing problems in the form of products or services. IFIs then short-list a number of fintech applicants to further develop the proposed innovative services and products. They work together in twelve-week programs where every aspect of the solution is refined and perfected through industry experts' mentorship and internal sources that IFIs are willing to provide. Beyond merely a collaborative arrangement, this model eventually involves equity agreements where IFIs take equity stake in the fintech companies that successfully graduate from their intensive accelerator programs.

- *Enterprise Solutions:*

In this model, IFIs select products or services developed by a fintech vendor and test them in focused groups or preselected group of customers. Upon successful trials, the IFI then scales up the product to its wider market segment.

This is a straight-up commercial type of collaboration in which both parties work toward an enterprise solution that can be disseminated throughout the business organization.

– *Model of Corporate Venture Capital (CVC):*

CVC is the investment of corporate funds directly in external start-up companies. This is a simple arrangement in which the IFI takes a minor stake in one or many up-and-coming fintech companies, to secure access to innovative products and services once these fintechs come into the market and start operations. According to the 2017 CB Insights Corporate Venture Capital Report,² the number of new CVC firms making first-time investments reached record levels in 2017. One hundred and eighty-six new corporate venture capital (VC) units globally made their first investment in 2017, including stock exchange Nasdaq Ventures, and life insurance provider Northwestern Mutual, among others. Compared to 2016, the number of new corporate VC units making their first investment increased 66%, up from 112.

– *Hybrid Model:*

Hybrid model combines two or more than two models in a manner that IFIs and Islamic fintech platforms will get benefits and share the rewards of collaboration and cooperation. This may include a collaborative agreement based on support and cooperation, and also a commercial agreement that may be based on any other model like CVC, Start-up Corporate Accelerator model. Hackathons also can help IFIs to attract innovative and creative minds who can create much-needed solutions. In a hybrid model all involved parties can reap more benefits and also reduce risks and uncertainty regarding intellectual rights, ownership, costs and profits.

Islamic Fintech is Opportunity for Islamic Financial Institutions

The report provided by Accenture (2016) shows that banks are now recognizing that fintech companies typically pose more of an opportunity than a threat. The same results are also found in a survey conducted by Finextra and Dove-tail (2017). The majority of the surveys' respondents think that fintech is a great opportunity for the financial industry. In another report (PwC, 2016a) when the respondents were asked a question regarding the main opportunities related to the rise of fintech, majority of the respondents said that fintech reduces costs and improves customer retention. Similarly, in another survey also conducted by

2 <https://www.cbinsights.com/research/report/corporate-venture-capital-trends-2017/>

PwC (2016c) insurers concluded that the most significant gain from fintech is cost reduction and disintermediation. The report also identified that although people need finance for various reasons like health, education, and setting up small businesses, they can not be served by Islamic banks with their existing product structures and assessment of customer credit ratings. The paper also highlights the geographical footprint of Islamic banks, which shows that they are primarily operating in big urban cities. Finally, it is argued that most of the Islamic banking debt-based products are close, but relatively expensive, substitutes for conventional banking in terms of financial costs (Shaikh, 2018).

Islamic fintech poses great opportunities for the IFIs. In a recent survey conducted by Council for Islamic Banks and Financial Institutions (CIBAFI), the majority of respondents from the Islamic financial industry agree that Islamic fintech is a great opportunity for IFIs in terms of cutting costs and offering innovative products and eventually reaching the unbanked Muslim population (Vizcaino, 2018). For Southeast Asia, fintech can play the role of change agent toward financial inclusion. According to KPMG,³ only 27% of the region's 600 million people have a bank account (as of April 2016). This implies that 438 million people do not have access to traditional financial services in this region and in poorer countries like Cambodia, only 5% have bank accounts. This is one of the major reasons for sustained poverty in the region. Notably, Southeast Asia has a higher than global average mobile phone penetration rate. Financial services provided by fintech companies over the mobile phone, such as money transfers at low-cost and short-term loans, could help to bring people out of poverty in the region. According to the KPMG report, reaching the unbanked population in Association of Southeast Asian Nations (ASEAN) could increase the economic contribution of the region from US\$17 billion (2016) to US\$52 billion by 2030. Fintech start-ups have the potential to usher in serious social change in the region.

Collaboration is Better than Competition

It is paramount for traditional IFIs and Islamic fintech to meet the needs of digital transformation and keep on the track of journey of innovation to remain relevant and sustainable.

Traditional IFIs are considered slow in reaction to changes due to many limitations, including additional Shariah regulatory controls and risk averse culture,

³ <https://home.kpmg.com/xx/en/home/insights/2016/04/FinTech-opening-the-door-to-the-unbanked-and-underbanked-in-southeast-asia.html>

which do not tend to plague their conventional counterparts. However, IFIs do have some key advantages, if they but recognize them. They have, over a relatively short period of time, built customers' trust, a large network of interested individuals, ethical businesses and financing resources. To adapt and remain competitive, Islamic banks have to overcome old business models, which can not be modified by implementing new strategies. In short, the fastest way to evolve is for the traditional financial institutions to embrace new partnerships and collaborations with younger and forward-looking start-ups and fintech developers who provide the technological skill-sets to reinvent the future of banking and financial services.

Open Platforms

The traditional approach and model of innovation is called *closed innovation*. This is a model of innovation where organizations use their limited and internal resources, systems and human power to take initiative and implement their ideas (Fasnacht, 2009). The new paradigm of innovation is called *open innovation*. Open innovation has gained a lot of attention from scholars in the past decade (Mina et al., 2014). The match of open innovation with technological revolution and financial industry's strategy also became the mouth piece at conferences and seminars, etc. Open innovation authors and scholars mainly focused on the demand and need for the financial organization to surpass their limitations and internal boundaries for accepting and sourcing the paths of knowledge, technology and opportunities (Felin and Zenger, 2014).

For IFIs and also for the Islamic fintech industry, it is noteworthy to give importance and emphasis to open innovation as a central strategy. This brings more efficiency in the operations of an organization throughout the whole process of a customer-centric product development. Also, open innovation is a major element of the collaborative business model, which enables organizations to be flexible and enhance their competitive advantage through leveraging external sources of knowledge, technology, and expertise.

Open Banking or Financial Platforms

The business model of the bank of the future will progress toward an open banking system. Open banking means a platform-based business approach where data, processes, and business functionality are made available to an ecosystem of customers, third-party developers, fintech start-ups, or other strategic partners. The financial services provided may come from banks as well as third parties,

like private investors on crowd-funding platforms, HNWIs, venture capitalists or private equity firms. These platforms can be owned by the financial institution or by an enterprising entity (others).

The financial institution owns the platform

In this platform, the banks develop and own their digital platform where financial products and services from the bank, or not (i.e., from third parties), are offered to the bank's customers. They provide basic offerings and additionally source and/or resell (niche) third-party services, integrating those services in the offer (or redirecting consumers to the third party, that is, a broker business model). This model requires the bank to master the technical integration of the application program interfaces (APIs), as well as processing and analysis of third-party data (as in account aggregation). They will have to manage client relationships, including touchpoints through user interface and user experience (UI/UX), while having the ability to offer “a digital marketplace” where third parties can showcase their products and services to the bank's customers. An example is Royal Bank of Canada teaming up with Wave (a fintech outfit) to integrate accounting, financial and invoicing insights into its online business banking platform. Or Royal Bank of Scotland launching its own automated lending platform in response to the emergence of P2P lending platforms, which was developed by a white-label fintech company called Ezbob.

Other ownership of the platform

In this model, the IFI has to develop a niche product expertise area. It has to position itself as the leading supplier of a particular product or service (e.g., credit financing) on third-party platforms. This strategy requires them to be narrowly focused yet offering such products or services on multiple other platforms, which require preferred agreement or partnerships with the hosting platforms. An example is Transferwise, which offers international money transfers (multi-currency) in a quicker and cheaper way than traditional banks. Such value will replace money transfer facilities in banks (and elsewhere, like Western Union) as Transferwise gains traction and expands to other platforms. AliPay and Amazon-Pay are examples that focus on payments, and WeChat on P2P mobile payment.

Fundamental to adapting to the shifts toward the future of financial services and banking, Islamic banks and financial institutions need to:

- A. Create the right platform or select the best-fit ones, that is, those that bring the best customer experience or provide the best personalized services (the right service or product at the right time). Those institutions who are able to

develop winning platforms through the right use of technology and the right partnerships suited for the products and services will be successful. This can be achieved through deep learning on customers' behaviors through big data analytics and machine learning.

- B. Develop adaptive and agile responses to changing business environment. Traditional banks are focused on minimizing risks, while today's customers demand that already, they also expect speed and creative customization to existing products and services. The impact of digital transformation in banking will require Islamic banks to rethink the way the financial ecosystem operates and functions, with a new set of capabilities and closer partnerships with highly agile start-ups and third-party vendors or developers.

Beyond maintaining a strong, independent risk management function that is focused on the core financial risks that banks face, sufficient oversight of operational and reputational risk will be critical.

- Cybersecurity is now at the top of everyone's mind as new technologies, like mobile, expose customer data to greater risks.
- Vendor risk will need to be managed more closely. Islamic banks have many partners, and are responsible and accountable, from all aspects of operations and governance.
- Islamic banks have become information hubs and potential targets as governments ensure the proper payment of taxes, compliance with Shariah and KYC/AML/CTF laws, sanctions, etc.
- Increased regulatory requirements such as stress testing and IFSBs drive greater operational and reputational risk. Islamic banks will need to be able to report detailed information on portfolio metrics, trends, and be able to rapidly model alternative scenarios.
- Risk management will expand and interact more closely with every area of the bank including marketing, product development, business analytics and compensation. This requires a more robust end-to-end view of the business, and an expanded skill set within the risk organization.

Conclusion

Disruptions in banking are pushing all banks (conventional and Islamic) to take more explicit strategy decisions. Many banks have recognized that they need a truly differentiated strategy as the industry's economics have come under pressure from new technology and nontraditional entrants with disruptive business models. Large nonfinance technology firms have also been moving into markets

such as payments, raising customers' expectations for better digital tools and simple, convenient service. Ever-stricter capital and liquidity requirements by regulators have reduced banks' own balance sheet leverage. Low interest rates and low economic growth intensify this pressure that weighs on them.

Difficult as strategic choices may be, banks are finding it even more challenging to adapt their operating models quickly to a new strategy—indeed, it is often the biggest obstacle to implementing a distinctive strategy. At present, much effort and money go into operating legacy processes and dealing with regulatory requirements to keep the bank running. Gartner estimates that banks on average spend roughly 60% of their IT budgets to maintain legacy IT systems as compared to just 24% to grow the business and 16% to transform it (Olsen et al., 2017). The global financial crisis, moreover, prompted a greater scrutiny of fiduciary duties, and created mistrust in the banks' legacy talent, systems, and processes, which is being overhauled by the current disruptive revolution.

The promise of blockchain and fintech creates the possibility of coordinating our transactional activities through a multi-strength mechanism of trust and transparency within the now globalized economy. Blockchain is the technology that would operationalize the mechanism of trust as we progress from personal exchange to impersonal exchange without an intermediary. We suspect that the blockchain technological backbone will be commonplace in four to six years' time, through the proliferation of cryptocurrencies, smart contracts, full-reserve lending platforms, multicurrency money transfers, public registries, document consolidation and other processes that are yet to be imagined.

From a broader perspective, fintech will overcome conventional ways of banking/finance/insurance in the coming years and if Islamic economies do not embrace it and develop their own technological ecosystem, they will lose the unprecedented opportunity to level up a 450-year gap in finance that has long suppressed them. The adoption of all forms of financial technology will allow Islamic finance to adapt to the changing landscape of modern economic transactions and carve its own niche in the future digital economy.

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