Abstract

The latest tech-enabled financial services supported by the blockchain technology promises to disrupt the strategic positioning of financial institutions and pave the way for FinTechs and TechFins to gain financial centrality. While there has been a growing number of studies on blockchains, we lack a comprehensive view of their nature and implications in the financial industry. Moreover, numerous novel blockchain-enabled financial instruments emerged in recent years expanding global finance ecosystems and the provided services. In this study, we shed light on the main features of blockchain and identify the range of services offered by FinTechs. More importantly, we inductively develop a Blockchain Fintech Fitness Framework that maps the most suitable blockchain technologies – conceptualized along eight features – to the different categories of financial services offered by FinTechs. The framework identifies the structural changes and organizational barriers that FinTech ecosystems need to grapple with to actualize the technology’s capabilities.

Keywords: Blockchain, TechFin, FinTech, dynamic capabilities, financial services

Introduction

During recent years, FinTechs and TechFins have disrupted the financial industry gaining rapid market centrality. According to EY, one third of digitally active consumers now use two or more FinTech services (EY, 2017). In the United States, a country where FinTech penetration is below average (Gulamhuseinwala et al., 2017), 36% of all personal loans in 2017 were extended by FinTechs (Claessens et al., 2018), up from less than 1% in 2010. The personal loan market reached a staggering $138 billion in 2017 (Corbett, 2019). Fintech lenders’ mortgage market share increased to 18% in 2016, up from two percent in 2010 (Lorenzo, 2019). Two years ago, Alipay, a leading FinTech company, processed 1.05 billion transactions, in a single day, during the Global Shopping Festival (Millward, 2016). In addition, government authorities in numerous countries introduced financial technology projects and programs aimed at facilitating financial transactions (Pollari and Ruddenklau, 2019). The Hong Kong Monetary Authority, Australia, UK, and Singapore Maritime and Port Authorities, and Dubai Customs Authority initiated financial technology related projects as well.

Despite its infancy, global investment in FinTech soared at a record pace in the first half of 2018 to reach $57.9 billion (Miller, 2018) surpassing the capital that was invested in 2015 (Nonninger, 2019).
Novel financial instruments are replacing conventional ones (Altamirano & Beers, 2018). For instance, micro financing instruments like M-Pesa and Amazon Cash as well as payment instruments like Alipay and Amazon Pay are replacing credit cards and loans (Wenner et al. 2018). Digital funding via initial coin offerings (ICOs) and crowdfunding platforms; internet-based international trades with virtual currency swaps, and buyer-led supply chain financing; all have changed the financial playbook, disrupting the banking sector to its core (Cumming et al. 2019). Conventional banks, on the other hand, are curtailed by their bureaucratic inertia to adapt to a technology-enabled, yet under-regulated, financial ecosystem, what led Gartner to publish an article titled: “Digitalization Will Make Most Heritage Financial Firms Irrelevant by 2030” (Moore, 2018). According to EY, traditional bank’s current level of engagement with FinTech is insignificant, where only 25% of banks are extensively exploring novel FinTech products (Gulamhuseinwala et al., 2017). A recent report reveals that only 7% of legacy banks have set up fintech labs and the majority favored being passive investors in FinTech start-ups than initiating their own programs (Graham, 2018). This has led to the dominance of FinTech companies in the personal banking sector, taking over the international personal lending services in 2016, from a mere 5% market share only three years back (see figure 1 below). It is thus evident that FinTech “achieved initial mass adoption in most markets” (Gulamhuseinwala et al., 2017).

Despite the exponential growth of FinTech, relevant academic research only emerged in the past two years. According to web of science (queried on February 20, 2019), publications that fall under FinTech were merely 7 journal articles in 2015. This number increased to 120 publications in 2018 (figure 2).

Notwithstanding the scant literature on FinTech, the relevant publications are distributed over a wide range of subjects in the fields of business (finance, management, and economics), computer science (information systems and software engineering), and law (see figure 3). Alas, the academic literature on FinTech is scant and lacks an in-depth understanding of what services fintech encompasses and its varied applications in the disciplines of finance, technology, and law. As with every business field in its infancy stage, a better comprehension can be attained by examining white papers published by leading firms like Price Waterhouse Cooper, Deloitte and Ernst and Young.
Additionally, a review of the literature on novel financial instruments such as P2P borrowing and ICOs often highlights blockchain as a disruptive and enabling technology. Blockchain, and distributed ledger technology (a.k.a DLT), became known through the introduction of the cryptocurrency, bitcoin, that grew in value from less than $5 in 2012 to reach $20,000 in 2018 (Piscini et al., 2017). Nowadays, there are hundreds of blockchain technologies including Bitcoin, Factom, Universa, Cypherium, Ethereum, Multichain, R3, Monero, Ripple, Hyperledger, Corda, etc. Each blockchain technology has its own traits which can be a benefit or a detriment, depending on the context in which the technology is exploited (Lee et al., 2018). For instance, bitcoin being a public is unsuitable for bank settlements whereas R3 is a federated DLT designed specifically for consortiums to exchange value through the automated agreement logic designed as “smart” contracts agreements (Wang et al., 2019).

In this paper, we shed light on the field of FinTech and its many derivatives. We also specify the financial services that FinTechs offer. To do this, we turn to FinTech white papers as well as to the existing academic literature. More importantly, we conduct a thorough review of the qualities that the main blockchain technologies offer in order to develop a Blockchain FinTech Fitness Framework (BF3) that maps the various fintech services to the most appropriate features of blockchain technology. In this endeavor, we answer the following research question: Which blockchain is most suitable for the financial services that are being offered by FinTechs. Another objective of this research is to derive a set of factors that curtail the rapid adoption of blockchain in the financial industry.

The paper is structured as follows. First, we review the literature on FinTech, its derivatives, and its underlying blockchain technology. We, then, use this literature to develop the Blockchain FinTech Fitness Framework. In this section, we explain the framework development methodology adopted and identify the FinTech building blocks and principal blockchain’s features that map to FinTech financial services. Finally, we discuss the framework, as well as, the barriers that the traditional banking industry faces and provide a conclusion.

**Literature Review**

**The Origin of FinTech**

The first reference of FinTech is mentioned in 1972 where it is defined as “an acronym which stands for financial technology, combining bank expertise with modern management science techniques and the computer.” (Bettinger, 1972, p.62). Schueffel (2016) comprehensive literature review, a methodical semantic analysis of FinTech, resulted in 13 definitions that conceptualized FinTech, as a new financial sector, rather than a technology. Micu and Micu (2016), defined FinTech as a new sector in the finance industry that incorporates the whole plethora of technology used in finance to facilitate trade, corporate business or interaction and services provided in the retail industry.
Interest in FinTech grew exponentially both in practice and in research. An ever-growing collection of white papers and reports were produced in the past five years by large consulting firms, banks and financial institutions, startups, and other international associations. A Google search trend reflects the interest in FinTech as shown in figure 4 below.

![Figure 4. Interest in FinTech (Google Trends)](image)

For the most part, academic research in FinTech falls under the field of management, finance, economics, and information systems, with over 30% in the fields of computer science and engineering and another 10% under law (see figure 3). These findings are consistent with the development of the fintech field and the importance of the legal implications and constraints of the enabling platforms and networks of blockchain.

To have a better comprehension of what the FinTech financial activities encompasses, EY specified 10 financial services in 2015 and then expanded the list to 17 services (Gulamhuseinwala et al., 2017). Those service can be grouped under five building blocks (See Table 1). Money transfer and payments transactions executed by FinTech has reached 50%, with China leading the world by a whopping 83% adoption rate. Compared to the rest of the world, China is leading FinTech adoption across the spectrum with the highest adoption rate in four out of five FinTech service categories (Gulamhuseinwala et al., 2017, p.15). Other types of services delivered by FinTechs that are related to insurance, saving, and investment have reach over 20% adoption rate in 2017. These levels are expected to rise as new technology companies enter the financial industry to build use cases for analytics, artificial intelligence, big data, machine learning, and security within the financial services industry (Qi & Xiao, 2018).

**TechFin: A Derivative of FinTech**

The success of FinTech sparked the interest of technology companies like Google, Amazon, Facebook, Apple (GAFA), and Alibaba to enter the financial market (W.UP, 2019). The difference between FinTech and TechFin is based on the origin of the underlying organization; finance or technology. Such large firms represent a threat to traditional banks as they possess significant amount of consumer behavior data. Combined with big data analytics, machine learning, and artificial intelligence, TechFin companies can extract advanced intelligence on consumer behavior to help tailor innovative financial facilities based on needs (Zetsche et al., 2017). The founder of Alibaba and the leading TechFin company Ant Financials, which runs Alipay, has been accredited with coining the term TechFin1.

**InsurTech: Another FinTech Derivative**

One example where TechFin is currently creating exceptional value is in the insurance industry. Recently, insurance companies started adopting usage-based insurance, telematics, wearables and other sensory devices to help better estimate policy quotes, process claims, and innovate new products. For instance, By Miles, which is a UK-based insurance technology startup (InsurTec), tracks drivers and provides pay-per-mile car insurance2. Other companies like Lemonade, Cuvva, Kasko, and BIMA are offering microinsurance, usage-based insurance, and peer-to-peer (P2P) Life, property and casualty insurance and automated end-to-end services in different sectors and geographies (Catlin et al., 2018). For example, Cuvva offers hourly on-demand car insurance via mobile apps and Kasko provides add-on purchase insurance coverage on e-commerce websites. (ibid).

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Table 1. FinTech Services and Categories

<table>
<thead>
<tr>
<th>Categories</th>
<th>2017 services</th>
<th>2015 services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money Transfer and Payments</td>
<td>Online foreign exchange</td>
<td>Online foreign exchange</td>
</tr>
<tr>
<td></td>
<td>Pay via cryptocurrency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overseas remittances</td>
<td>Overseas remittances</td>
</tr>
<tr>
<td></td>
<td>Online digital-only banks without branches</td>
<td>Nonbanks to transfer money</td>
</tr>
<tr>
<td></td>
<td>Nonbanks to transfer money</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mobile phone payment at checkout</td>
<td></td>
</tr>
<tr>
<td>Financial planning</td>
<td>Online budgeting and financial planning tools</td>
<td>Online budgeting and financial planning tool</td>
</tr>
<tr>
<td></td>
<td>P2P platforms for high-interest investments</td>
<td>P2P platforms for high-interest investments</td>
</tr>
<tr>
<td></td>
<td>Investments in equity crowdfunding platforms and rewards crowdfunding platforms</td>
<td>Investments in equity crowdfunding and rewards crowdfunding platforms</td>
</tr>
<tr>
<td></td>
<td>Online investment advice and investment management</td>
<td>Online investment advice and investment management</td>
</tr>
<tr>
<td></td>
<td>Online stockbroking</td>
<td>Online stockbroking and spreadbetting</td>
</tr>
<tr>
<td></td>
<td>Borrowing using P2P platforms</td>
<td>Borrowing using P2P platforms</td>
</tr>
<tr>
<td></td>
<td>Borrowing using online short-term loan providers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Car insurance using telematics (black box) that monitor driver behavior</td>
<td>Car insurance using telematics (black box) that monitor driver behavior and health premium aggregators</td>
</tr>
<tr>
<td></td>
<td>Insurance premium comparison sites</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Activity-based health insurance that tracks your exercise</td>
<td></td>
</tr>
</tbody>
</table>

RegTech: An Essential Extension to FinTech

While TechFins have a technological advantage over FinTechs, facilitating rapid development of new financial products that are more efficient than traditional financial instruments, one key barrier that those industries suffer from is the regulatory framework they must operate under. While many countries have strict financial regulations discouraging some financial firms to enter new markets, other countries, like China, has an open regulation policy allowing both FinTech and non-financial services firms to innovate (EY, 2017). As such, regulations play an important part in facilitating or preventing new FinTech players and products. In the insurance sector (or InsurTech), existing regulatory frameworks are the number one barrier for new entrants and innovations (Catlin et al., 2018).

To address the impact of new business models and disruptive technologies on the existing regulatory frameworks, governments and central banks in different countries are currently setting up sandboxes and steering committees (Zetschse et al., 2018). Moreover, with the advances of big data, analytics, and machine learning, improved regulatory technologies – or RegTech – can come to life. More than ever, central banks and financial institutions are exhausting their resources to tackle money laundry, financing terrorism, and fraud. RegTech services like AML (anti-money laundry), KYC (know your customer, and CFT (combating financial terrorism) can streamline financial services and drastically reduce cost (Arner et al. 2018). The FinTech industry is in a unique position to provide value to the financial sector by offering such services augmented with new technological tools like AI and analytics.
Blockchain as an Enabler of Financial Services Innovations

Today, the world is investing billions to champion the underlying blockchain technology and apply it in different contexts and use cases (Koens and Poll, 2018; Swan, 2018). Spending on Blockchain-based applications is expected to grow to 9.7 billion in 2021 (Swan, 2018). Blockchain runs on a large number of devices and is able to record anything of value (e.g., money deeds, equities, etc.), thus termed the Internet of Value (Tapscott and Tapscott 2017). Its underlying infrastructure allows value to move from one device directly to another (i.e. peer-to-peer) and be stored securely and privately (Joshi et al., 2018). Trust is established by network consensus cryptography and software programs thereby eliminating the need for a trustworthy intermediary (Di Pierro, 2017; Tapscott and Tapscott 2017). This allows members on the network to make transactions with confidence without involving banks of government entities. Tapscott and Tapscott (2017) adeptly summarize the main principles of blockchain’s underlying technology. These are:

- **Distributed database**: every blockchain network member has the complete database and its history and is capable of verifying other members’ transactions.
- **Peer-to-Peer Transmission**: members communicate directly without intermediaries.
- **Transparency with Pseudonymity**: members transact using their blockchain unique address but can choose to provide proof of their identity if they wish so.
- **Irreversibility of Records**: transactions cannot be reversed once verified.
- **Computational logic**: transactions can be linked to prespecified algorithms – or smart contracts – that can be triggered automatically when certain conditions are met.

While those principles are effective in facilitating P2P transactions such as payments, financial institutions will not accept them. For instance, banks cannot allow all transactions to be shared publicly with every member on the blockchain network. It is also crucial for financial institutions to be able to reverse transactions when necessary (Godfrey-Welch et al., 2018). Another factor that limits the applicability of the standard-form of blockchain to the financial industry is scalability, which is the capacity to handle a growing number of transactions (Eyal et al., 2016). Moreover, while blockchain inherently possesses security improvement, a feature highly valued by the financial sector, there exist security issues that remain unsolved such as DDoS attack and the need to protect private keys (Swan, 2015).

In recent years, there has been a surge in the number of blockchain and DLT applications that got commercialized; some of which addressed several concerns voiced by the financial industry (e.g.; Hyperledger, Ethereum, Ripple, R3 Corda). Yet, it is still unclear which platforms are more appropriate in the financial sector and how those platforms can support the diverse set of financial services that the financial sector offers or can offer in the future.

Specifying the Blockchain FinTech Fitness Framework

Research Methodology

An extensive review of FinTech technical reports and scholarly publications was conducted to identify the FinTech services. Additionally, we reviewed technical reports, documentations on github and pertinent blockchain related websites in order to select the primary blockchain technologies that are currently being exploited by the financial sector and extract their key features. We also reviewed the existing blockchain projects that are ongoing (e.g., Marco Polo and We.Trade). The analysis of the selected literature was cyclical. We used technical reports to specify the financial services currently offered by FinTechs. Also, we looked at existing blockchain projects intended to commercialize those services and extracted the main features of the underlying technology. Then, we examined the academic literature and technical reports to identify the benefits and shortcomings of each blockchain feature.
FinTech Building Blocks

Based on EY’s FinTech adoption index of 2017, FinTech services can be classified into five main categories (as shown in Table 1). From a technical standpoint, two main requirements are necessary from the underlying technology to fully address the suite of financial services. First, the ability to facilitate secure fund transfers and payments; and second, the capability to consolidate transaction data for advanced analytics and reporting. When supported by the technology and regulations, these two features are sufficient to guarantee the provision of conventional financial operations, in addition to the creation of new financial instruments (Avgouleas & Kiayias, 2019). Blockchain solutions are promising instruments that offer both requirements despite the challenges facing current blockchain frameworks.

Fund Transfers and Payments

Cryptocurrencies, powered by public blockchain infrastructures, have been the recent spotlight of FinTech (Underwood, 2016). They were introduced as instruments addressing the issues associated with money transfer and payment. Bitcoin, Ethereum and other cryptocurrencies offer direct transactions that are much faster to clear than traditional intermediary-based systems such as SWIFT (Vovchenko et al. 2017). They rely on the presence of distributed network nodes, each keeping an identical up-to-date copy of the transactions record and validating its authenticity. Transactions are aggregated into blocks and validated by the nodes through a predefined transaction validation protocol (e.g. proof-of-work) before reaching consensus for submitting them to the immutable shared record: the blockchain. In the Bitcoin network, transactions are validated every 10 minutes approximately. This model of transactions does not only offer intermediary-free transactions in trustless environments (Hansen and Kokal, 2018), but also ensures transaction transparency and traceability, as well as cutting transaction costs (Bott & Milkau, 2016). This new way of freely creating and transferring value between trustless peers paved the way to new financial instruments such as initial coin offerings (ICOs) and coin exchanges.

Despite the promising advantages offered by such blockchain-powered models, current regulations and technology readiness put these in a disadvantaged position when compared to conventional banking systems. In terms of regulations, several red flags are raised (Guo & Liang, 2016). The identity and legibility of the network nodes, the tokenization of fiat currency into cryptocurrencies, the governance of the public blockchain, irreversibility of transactions and resolution procedures in case of disputes are among the main concerns (Cai, 2018).

From a technical point of view, the scalability of blockchain solutions in terms of throughput does not compare to the velocity offered by traditional intermediary-based transactions (Dinh et al., 2018). For instance, at the time of this writing, Bitcoin has a cap rate of 60 transaction per second (tps) and an average of 7 transactions per second (Croman et al., 2016), whereas Visa claims the ability to process 24000 tps. On the other hand, this delay ensures the security and integrity of the blockchain that is crucial for public blockchains. Therefore, an immediate replacement of traditional payment models by blockchain-based mechanisms is not viable. In terms of security and trust, while blockchains might be safe data structures, several security issues should be addressed before a wide adoption occurs to replace current digital wallets. Safeguarding peers’ private keys, securing APIs linking blockchain infrastructures to peripheral applications (e.g. wallets, next-generation payment gateways) and preventing attacks such as 51%, denial of service and mempool attacks are all serious topics advocated.

Figure 4. Review Methodology for Framework Development
Data Consolidation and Analytics

Financial planning, saving and investment, borrowing, and insurance are financial service categories that heavily rely on the information and business intelligence extracted from historical data (Trelewicz, 2017). Big Data analytics that employ methods like regression, clustering, classification and predictive analytics is an integral part of FinTech solutions that offer these service categories.

Financial planning processes deal with 1) estimating financial capital requirements, 2) assessing the competition and reliability of funding sources, 3) framing of financial policies for cash control, and 4) setting contingency plans for financial uncertainties (Mulvey & Vladimirou, 1992). As such, they rely heavily on analytics to evaluate current market conditions and predict future outcomes. Savings and investments also require advanced analytics to identify trends and accurately assess the profitability of alternative options. Similarly, borrowing and insurance services rely on analytics for credit scoring and underwriting risk (Lee and Shin, 2018). While conventional banking systems are catching up on the data analytics bandwagon, the data analyzed is limited to the institution and its direct network of partners, resulting in a myopic vision to conceive reliable predictive insights at a macro level. Potential challenges facing data analytics lies in finding a fine balance between the availability of rich data and respecting privacy standards. Thus, FinTech and conventional banks need to abide by AML and KYC procedures as required by financial regulations, on one hand, and respect data privacy policy, such as GDPR, on the other. Such inconveniences are particularly magnified as data is distributed across different networks for different stakeholders (e.g. healthcare institutions and insurance companies) and the provision of relevant, data rich, sources of information becomes cumbersome. Integrating artificial intelligence, machine learning and data analytics into blockchain solutions would boost the power of transactional data (Salah et al., 2019; Ravi & Kamaruddin, 2017).

Blockchain Features

Public and consortium blockchains may offer a broader view of data stored in blocks which can be used to predict price movements and transaction patterns, a key aspect of devising financial strategies. In addition, the option to keep data private is preserved as public blockchains are generally pseudonymous while private and consortium blockchains can devise permissioned access to information in the form of governance logic implemented in smart contracts. Smart contracts also ensure the execution of future promises between untrusted parties whenever conditions are met.

Based on the different feature requirements of each FinTech service categories, table 2 depicts a list of modern FinTech services and map them to unique features of the underlying blockchain infrastructure. Blockchain features include:

- **Blockchain type**: The availability of the blockchain public (permissionless), consortium (federated or hybrid) or private (permissioned) (Mohsin et al. 2019).
- **Visibility**: The identity/role of users who have access to the blockchain’s details such as its structure (e.g. properties and forks) and the data stored on the blockchain via transactions (Lipton, 2018).
- **Peer-to-peer**: Whether peers of the same role can transact without the need of an intermediary. Data transactions occur either directly from one account to another or through smart contracts where peers are presented as contractual parties (Joshi et al., 2018).
- **Transparency**: The level of peers’ details attached to transactions. Three level of transparency are possible: Anonymous, Pseudonymous and Identified (Magnier & Barbon, 2018). Anonymous transactions happen when no details pertaining to submitting peers are kept as part of the transaction. In case of pseudonymous transactions, peers are partially identified using traceable identification keys (e.g. wallet addresses). In identified transactions, peers are identified in their respective transactions.
- **Immutable vs. redactable blockchains**: while irreversibility of transactions is a key feature in blockchains, the ability to amend or remove erroneous transactions can be of great benefit in several cases (Ateniese et al., 2017). Three levels of immutability can be thought of: immutable, conditionally redactable, and redactable blockchains. Most existing blockchains belong to the immutable type while
conditional mutability blockchains allow modifying the transaction history under certain conditions without disturbing the chain of other transactions (e.g. the µchain project). Mutable blockchains allow data to be updated and removed, similar to traditional databases.

- **Scalability**: The extent at which a blockchain can assimilate transactions in terms of size and throughput (or transaction frequency). Three levels are defined: high, medium and low considering that Bitcoin’s benchmark of 60 tps is low.

- **Smart Contract**: refers to the ability of the blockchain to support the execution of predefined logic embedded in smart contracts upon satisfaction of certain transaction conditions (Beck & King, 2018). For example, Bitcoin blockchain does not support smart contracts, but Ethereum does.

- **API for Analytics**: The support to expose secure API endpoints for querying blockchains contents.

- **Secure Peripheral Applications**: The degree at which end-user applications, such as digital wallets, smart contracts, and third-party services (i.e. oracles) are secure and resilient. Though this is not a feature directly affecting blockchains infrastructures, they should be compatible with different data security, authentication and authorization protocols. For instance, a blockchain with draconian requirements of secure peripheral applications may not allow transactions issued by services and/or applications that do not meet certain security standards (e.g. certified by a legit certificate authority).

**BF3: Blockchain Fintech Fitness Framework**

The interaction between the aforementioned financial services and blockchain technology can be observed as interdependent. While most FinTech services are only possible through the availability of suitable technologies, business requirements of the financial sector also push technology to provide better-suited solutions. Blockchain is originally a data structure with features that can support the provision of financial use cases and prototypes. However, to consider a full adoption of a new technology, several requisites are necessary to ensure technical readiness and correctness, community recognition and adoption, standardization and regulation. Figure 4 depicts a framework under which such interaction occurs between FinTech services and blockchain features that are either currently available or under development. It differentiates between the types of services as well as the core and extended features of blockchains. Table 2 supplements figure 4 by showing the degree of importance of each blockchain feature with the respective FinTech services.

![Blockchain Fintech Fitness Framework](image)

**Discussion**

**Technological Barriers**

It is evident that traditional banks, or dinosaurs as Bill Gates coined them, need to reinvent themselves to compete in the new digital age. Yet they lack the technological agility and expertise to transform their
financial operations. A study by Accenture (Lumb et al., 2017) shockingly revealed that, around 70% of about a 100 of the world’s largest banks have executive boards with members lacking any technological background. Moreover, only 3% of bank CEOs have technological backgrounds. According to Don Parker, an Executive Vice President at IBM, only 6% of bank are using their data effectively. Albeit the banks’ evident reluctance to embrace the emerging FinTech landscape, 95% of the banks that were recently surveyed by PwC are aware of the risk that standalone FinTech companies pose to their business (PwC 2016, p.16). These sentiments are echoed throughout the financial sector and advisory services. A recent report by Gartner (Moore, 2018), emphasize the “dangerous attitudes” of banks’ CEOs towards the new competition. CEOs attitudes underestimate the extend of change that digital technology such as blockchain will bring to the industry (ibid). Pete Redshaw, practice VP at Gartner, expects 80% of financial firms will go bankrupt or become obsolete. Blockchain, according to Tapscott and Tapscott (2016), is “an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value”. Participants on the blockchain keep a copy of the ledger and act as validators of transactions that are added to the ledger enabling trust in a trust-less environment. Nowadays, it is difficult to find a website, article, or book on FinTech without explicitly mentioning blockchain as its catalyst.

**Regulatory Barriers**

The second major obstacle facing traditional banks is the regulatory frameworks that they operate under. Banks are process-oriented institutions that focus heavily on upholding the tight regulations and compliance imposed by government and international bodies (Eckenrode et al., 2017). For instance, in 2017 and 2018, the banking industry was taken by the implementation of PSD2 (Payment Services Directive 2) and GDPR (Pollari et al., 2018). Such regulatory frameworks and the scrutiny that follows represent barriers for the banks’ legal departments to embrace new underregulated, or even unregulated, technological platforms (Pollari et al., 2018). In fact, a recent study showed that the lightly regulated FinTech industry led to the introduction of numerous financial violations such as unaffordable terms of repayment and deceptive prepayment charges, etc. (Lorenzo, 2019). Moreover, FinTechs are more likely to serve less creditworthy customers which increases credit risk. FinTechs are more likely to take over areas where traditional banking faces mounting capital and regulatory constraints” (Buchak et al., 2017).

**Conclusion**

IT development affected many industries and the financial and banking industry is no exception. The next generation of banking will carry significant changes to the well-established financial industry (Shmeljov, 2017). This transformation is led by FinTechs and TechFins as big players like GAFA and AliPay powered by technology will continue to improve and tailor their financial services at a fast pace (Kang, 2018). Big tech companies are exploiting the size of their customer base and the knowledge they have about their customers’ habit, needs and preferences (W.UP, 2019). In parallel, startups are offering novel services to fill the gaps that traditional banks and larger FinTechs overlooked (Svensson et al. 2019). The increasing number of FinTech services affecting an increasing number of users call for new set of regulations, governance schemes and policies. These may not keep the same pace of technology development and therefore are not immediately accepted by conventional banks and financial institutions. As a result, large FinTechs and startups are incorporating international and local regulation frameworks into technological components under the umbrella of RegTech allowing technology to regulate itself (Arner et al., 2017). Specifically, the use of data mining, big data analytics, AI and machine learning are harnessed to serve regulating new financial services and stakeholders offering augmented AML, CFT, KYC and other utilities (Zetsche et al., 2017). A major spotlight in FinTech is cryptocurrencies. The extraordinary price highs in 2017 have resulted in the public’s interest in FinTech, in general, and blockchain technology, in particular. From the search data extracted from Google Analytics, a strong positive correlation of 0.8 exists between search terms related to blockchain and searches related to cryptocurrencies. Blockchain is undoubtedly one of the FinTech expressions that has surfaced the most, delivering a set of features that are judged relevant to FinTech services. Being distributed, allowing P2P transactions without relying on central intermediaries while preserving privacy, traceability and information consistency among networked peers has pushed the technology to other FinTech services such as financial planning, investment, lending and insurance (Bott & Milkau, 2016). Yet, the nature of various FinTech services require different settings of blockchain features.
## Table 2. Blockchain Features vs. FinTech Service Categories

<table>
<thead>
<tr>
<th>Feature Service</th>
<th>Type</th>
<th>Visibility</th>
<th>Peer-to-peer</th>
<th>Transparency</th>
<th>Immutability</th>
<th>Scalability</th>
<th>Smart Contract</th>
<th>API for Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money Transfers &amp; Payments</td>
<td>Public</td>
<td>Everyone on structure and on contents</td>
<td>Yes</td>
<td>Anonym/Pseudonym</td>
<td>Conditional</td>
<td>High in size and frequency</td>
<td>No</td>
<td>Optional</td>
</tr>
<tr>
<td>Financial Planning</td>
<td>Consortium/Private</td>
<td>Everyone on structure and permissioned on contents</td>
<td>No</td>
<td>Identified</td>
<td>Conditional</td>
<td>Low to medium in size and low in frequency</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>P2P Lending &amp; Borrowing</td>
<td>Public/Consortium</td>
<td>Everyone on structure and permissioned on contents</td>
<td>Yes</td>
<td>Anonym for lender and Pseudonym/identified for borrower</td>
<td>Yes</td>
<td>Medium in size and low in frequency</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ICO &amp; Crowdfunding</td>
<td>Public</td>
<td>Everyone on structure and on contents</td>
<td>Yes</td>
<td>Pseudo</td>
<td>No</td>
<td>Medium in size and frequency</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Stockbroking &amp; Spreadbetting</td>
<td>Consortium</td>
<td>Everyone on structure and permissioned on contents</td>
<td>Yes</td>
<td>Pseudo/identified</td>
<td>Conditional</td>
<td>High in size and frequency</td>
<td>Optional</td>
<td>Yes</td>
</tr>
<tr>
<td>Insurance</td>
<td>Public/Consortium</td>
<td>Permissioned on structure and contents</td>
<td>No</td>
<td>Pseudo</td>
<td>Conditional</td>
<td>Medium in size and frequency</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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As shown in Table 2, for blockchain-based payments and money transfer to replace intermediated payments, it is crucial for the blockchain to be exposed publicly, fulfill high levels of scalability and allow the conditional modification of previous transactions. Same features apply for services related to stockbroking. On the other hand, services that are more oriented towards decision making, such as insurance services, require features that are more aligned with analytics and business intelligence insights. This type of services also relies on smart contracts to automatically execute predefined logic upon the satisfaction of triggering conditions. Scalability is not crucial for this type of FinTech services. The variety of FinTech services, may not need the same level of features or regulation and governance models. Therefore, aiming for a single blockchain solution to cover a variety of heterogenous FinTech services simultaneously may not be currently feasible. This should not contradict with possible interoperability and integration between different FinTech solutions either via API interactions between independent blockchains or multi-purpose blockchains.

In this paper, we revisited definitions, contemporary issues, and regulatory and technological challenges faced by FinTech towards a vast adoption in traditional banking and financial systems. The emerging subfields of FinTech such as RegTech, TechFin and blockchains are also discussed. The main contribution of this paper lies in the mapping of the main blockchain features with the modern FinTech services. We demonstrated that while services related to the use case of money transfer and payment are concerned with blockchain’s scalability, other FinTech services are challenged by data privacy, security and governance issues. We therefore conclude that a comprehensive blockchain framework that satisfies the feature requirements of various FinTech services is currently not feasible, neither technically nor regulatory. Furthermore, some features that participated in the success of blockchain technology for cryptocurrency services may lead to failure if ported to other services. Irreversibility of transactions and permission-less transparency are among those features.

References


