

RESEARCH ARTICLE

FinTech Innovation: Review and Future Research Direction

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Abstract

This paper aims to survey the most recent theoretical and empirical literature on FinTech innovations in the financial sector. The purpose of this review is to investigate how FinTech Innovations are altering and reshaping the universe of financial service providers, and challenging traditional business models and infrastructures. This study summarizes the opportunities and challenges of FinTech Innovations and the implications to the legacy incumbent financial services companies. FinTech innovation fusions technological capabilities, potentially provides innovative financial products and services to foster financial inclusion, streamline processes, and lower costs to clients. FinTech can bring greater competition and diversity in financial services. Further, this research interprets the findings from the lens of institutional theory to advance the theoretical understanding of social changes facilitated by FinTech innovations in revolutionary areas in banking (lending, payment), security trading (real-time settlement, automated investment), and insurance (personalized experience). The investigation points out the regulatory concerns highlighted in the scholarly works, suggesting collaboration is critical to enable multi-stakeholders to anticipate and foster pro-innovative, transparent regulations to deliver meaningful benefits to innovation and financial inclusion. Lastly, this review identifies future research areas to further enrich knowledge to create a future-proof, more efficient, and resilient financial ecosystem to enhance financial stability in the digital era.

Key Words: *FinTech; Innovation; Incumbent; Inclusion; Financial stability*

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1. Introduction

FinTech, the fusion of finance and technology [1,2], has attracted significant attention in academics, industries, and governments. Since the 2008 global financial crisis, the use of FinTech innovations to automate investment, introduce new lending platforms, personalize insurance, and changing banking services has increased [3]. FinTech is now revolutionizing, reshaping, and redesigning the whole financial landscape [2], emerging as a new sphere for the banking and financial services industries [4]. Progressively, it innovates and disrupts the whole existing financial system [5]. The current surge of FinTech innovations is largely driven by technological advancement in AI, blockchain, big data, cloud computing, platforms, mobile, social media, etc, and the changes in customer preferences [6]. FinTech Innovations refer to technologies that enable non-financial institutions such as Fintech start-ups and large, established technology companies (BigTech) to provide financial services [7]. They affect many aspects of finance such as wholesale payments, retail finance, equity capital raising, credit monitoring, investment management, and insurance [5] from banking to payments to risk management [3]. According to Hua et al. [8], most types of FinTech innovations generate positive value. Chen et al.[9] indicate blockchain, cybersecurity, and Robo-advising are the most valuable FinTech innovation types to innovators. FinTech innovations are distinguishable from the traditional financial service providers by embracing the new capabilities from technologies to innovate and revolutionize product offerings and business models to supplement customer experience and accommodate their changing demands [3,4,9-11]. The new business models of FinTech firms typically have greater flexibility, efficiency, and opportunities [5], with instant contact, live data, credit ratings, and updates [1]. These changes drive traditional financial providers such as banks to seek new technologies and ways to compete or collaborate with FinTech companies to stay relevant in the digital transformation. For instance, it is reported that US financial institutions increased 25% their technology spending, compared to a 9% increase globally [12]. Digitalization has facilitated FinTech innovators to introduce new technologies and innovative methods to the financial market to open new opportunities and improve access to finance and respond to the funding gap in the economy for SMEs and start-ups [68]. The emergence of FinTech lenders in equity crowdfunding, P2P lending, online mortgage lending, and especially those App-based FinTech companies which are more competitive, more efficient, and more profitable [13]. For example, the rise of P2P lending will affect the future of relationship banking, it may not replace banks anytime soon, but certainly, they will affect the revenue base of banks and other incumbent financial institutions [14] and challenging our traditional view of intermediation [68] with the use of distributed ledger technologies such as blockchain.

In recent years, FinTech companies on a global scale are working to disrupt and transform how financial assets are formed, managed, and traded [3,15]. Scholarly literature is exploring FinTech innovations driven by digital transformation. A number of studies have interpreted the impact of FinTech innovations on banking [10,14,16-18], lending [4,19,20,21,70,72], investment [13,22-26,69], regulations [15,64,65], etc. Many have identified the importance of studying FinTech. For instance, Palmié et al. [4] indicate the current knowledge of the topic of FinTech is limited. Senyo & Osabutey [7] state the wide acceptance and use of FinTech innovation remains inadequate. Gomber et al. [10] argue it is “at stake” for long-standing incumbents to effectively hoop up with FinTech Revolution. Wang et al. [5] note the effects of FinTech on the financial system are less understood. Gozman et al. [3] suggest more academic research is needed to provide more insights into the FinTech innovation and revolution. Chen et al. [16] also highlight the need for a better understanding of FinTech to move up the value chains in the financial service industry. Based on

our observations, this review is motivated by three reasons. First, FinTech is developing at a fast pace, with many new financial products and services introduced in the market. The current FinTech innovations may promote financial inclusion of SMEs or individuals who have no credit history or young people who know how to use Apps on smartphones. There are still opportunities for FinTech innovations to promote financial inclusion to the aging population who can't cope with the fast development of FinTech innovations. Second, the competition between FinTech firms and traditional financial service companies in search of the new equilibrium in the financial market. Third, the changing social acceptance of new FinTech products and services in the digital era, and the regulatory issues FinTech raises on some new FinTech products and services such as crypto assets.

This paper aims to fill the gap in the literature by surveying the most recent published theoretical and empirical studies on FinTech innovations. The review will examine how FinTech Innovations are altering and reshaping the universe of financial service providers, challenging traditional business models and infrastructures. The objective of the investigation is to provide a fuller picture of the FinTech landscape to reveal the values and risks associated with the FinTech revolution in lending (crowdfunding, P2P lending, ICOs), payment (digital currencies, mobile payment, digital wallet with fiat money), Investment/wealth management (real-time security trading and settlement, Robo-advisor in portfolio diversification), and insurance (emergence of InsurTech companies offering personalized solutions linked to mobile devices, big data with improved risk pricing). This investigation is guided by the main underlying research question: what are the opportunities, challenges and implications of FinTech Innovations?

The main contributions of this review are threefold. First, this study reviews the existing literature and summarizes the opportunities and challenges of FinTech Innovations, and the implications to the legacy of incumbent financial services companies. Overall, Fintech innovations bring greater competition and diversity in financial services, open opportunities to create a more efficient and resilient financial system embracing the new capabilities of advanced technologies. However, the innovations will affect the revenue base or market share of banks and other incumbent financial institutions, which will further lead to additional risk-taking among incumbents to maintain margin and stay relevant in the digital transformation. Simultaneously, any new technology is not risk-free, especially digital technologies that are associated with their own systematic and cyber risks, and regulatory uncertainties. Second, this review interprets the FinTech innovations from the lens of institutional theory to study the social changes in new ways in banking, security trading in the marketplace, and insurance to understand the legitimacy of those changes. Lastly, this study identifies future research areas that afford further investigation to enrich knowledge in FinTech innovation to promote an ecosystem of incumbents and FinTech actors to enhance financial stability.

This paper starts by articulating the purpose, context, motivation, and clarifying the contributions of the study in the introduction part, followed by the relevant literature review on Fintech and its developments in section 2. The subsequent section 3 outlines the scope of the review and methods. Following on from this, section 4 presents the findings of our review focusing on the opportunities and challenges of FinTech innovations in lending, payment, investment/wealth management, and insurance. Section 5 provides the discussion on the summarized Fintech innovations and articulates the theoretical implications on social changes with new financial products and services and practical implications to financial service providers and users. Finally, this study outlines the future

research direction to expand FinTech literature with advanced technologies. This review aims to be useful to scholars, financial service providers and users, tech companies, and policymakers.

2 Literature Review

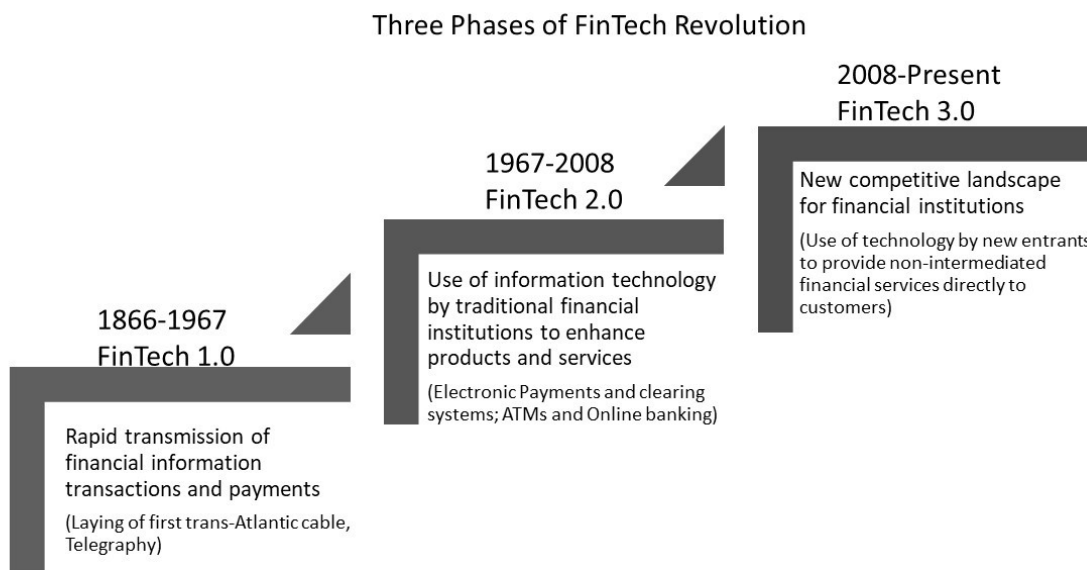
This section provides an overview of FinTech's innovative landscape, which it is argued revolutionized the financial industry, and challenged the long-established financial services models and infrastructures [2,3]. FinTech innovations affect the degree of contestability in financial services [27].

2.1. Definition of FinTech

The simplest form of FinTech definition is the combination of technology and finance [1], the short form of Financial Technology [13], and the use of technology to provide new and improved financial services [14]. The Financial Stability Board defines FinTech as “technologically enabled innovation in financial services that could result in new business models, applications, processes or products with an associated material effect on financial markets and institutions and the provision of financial services” [28]. The study of Chen et al. [9: p2067] proposes and formulates a broad typology of FinTech comprising seven categories: cybersecurity, mobile transactions, data analytics, blockchain, peer-to-peer (P2P), Robo-advising, and internet of things (IoT). However, this typology requires the intended or actual use of those categories of technologies that lie within the field of financial services. Further, their study indicates the most FinTech innovations yield substantial value to innovators, with blockchain, Robo-advising and IoT are the most valuable innovation types in the overall financial sector, based on their data in the US on patent filings from 2003-2017. Additionally, in some cases, they indicate that technology such as Robo-advising shares big data, artificial intelligence, and machine learning technologies with the broader category of data analytics. Overall, FinTech Innovations leverage the new capabilities from advanced technologies to drive significant operational improvement in financial services, for example, the transition to branchless banking; real-time transaction and credit monitoring, Credit scoring and approval, and transformations in customer acquisition and retention [10].

2.2. FinTech Revolution

The FinTech Revolution helps to understand how the traditional financial systems have been disrupted with alternative finance and payment systems [10,16]. The extant scholarly literature indicates the three development phases of FinTech innovations but interprets them in different ways. Chang et al. [1] articulate three primary breakthrough directions of Fintech, which are mobile payment, smart contract, and blockchain, focusing on instant contact, live data and credit ratings and updates. Palmié et al. [4] suggest three waves of financial technology ecosystems: electronic payment, blockchain and cryptocurrency, and artificial intelligence. Chen et al. [16] and Thakor [14] summarize three phases of the FinTech Revolution: FinTech 1.0 from 1866 to 1967, FinTech 2.0 from 1967-2008, and FinTech 3.0 from 2008 to present (See Fig. 1 below).



Source: Thakor (2020:2) and Chen *et al.* (2021)

Figure 1: *Three phases of FinTech Revolution.*

From 1866 to 1967, the financial industry was somewhat connected with technology but was an analogue industry [16,66]. From 1967-2008, the financial industry started to transform from an analogue industry to a digital one. Society started to use electronic payments and clearing systems, ATMs, and online banking was introduced later in 1980 in America and mainly used among the developed countries. Since 2008, FinTech has emerged in both developed and developing economies. With the advancement in technologies, FinTech innovations create a new competitive landscape for financial institutions, with the new entrants of tech companies to offer financial services, and traditional financial service providers begin to compete or partner with FinTech firms to offer digital products.

Bollaert *et al.* [68] indicate the main driver behind the initial growth of FinTech is the advancement in technology which reveals a relative inefficiency in the traditional financial system. Gomber *et al.* [10] illustrate three separate pillars of innovation that lay the foundation for the FinTech revolution: 1) the large amounts of capital available for technology innovation for financial services globally, for example, in the first half of 2018, the global FinTech sector raised \$41.7 billion [14]; 2) the use of new technologies to design and deliver new financial products and services to meet the changing demands of consumers; 3) the disruption and transformation of business model to streamline the processes and personalize services based on big data analytics or Robo-advising.

It is predicted (pre-Covid forecast) that the global FinTech revenues are expected to grow to more than €188 billion in 2024 [77]. The scope of FinTech activities started from mobile payments, money transfers, peer-to-peer loans, and crowdfunding, to the newer world of blockchain, cryptocurrencies, and Robo-investing [2: p1648]. Blockchain technology is part of the technological backbone of FinTech [14], which has been heralded as a great financial disruptor [13], and as a

game-changer [75]. Economic Forum Survey reported that 10% of global GDP will be stored on blockchain by 2027 [29].

2.3. Phase III of FinTech Revolution

Presently, the phase III of FinTech revolution maps the new competitive landscape for financial institutions to provide non-intermediated financial services directly to customers. The recent study of Chen et al. [9] found blockchain being particularly valuable to FinTech innovators.

Blockchain has become popular due to the rise of Bitcoin. Since then, the growth of cryptographically secured digital currencies, assets (digital tokens) have been exponential [67]. Blockchain has the potential to fundamentally change the existing finance and FinTech Industry due to the innovation in visibility and traceability of data [1] to resolve the problem of trust, security, and control over data in financial services [17]. Chen et al. [9]; Goldstein et al. [2]; Gomber et al. [10] acknowledge blockchain as a type of FinTech. Blockchain is regarded as the 5th disruptive computing paradigm [30,31] after mainframes, personal computers, the internet, and mobile/social media. It is claimed that “blockchain will do to banks and law firms what the Internet did to media” [32] as “next-generation Internet” [33] to become the new “foundational technology” [34] to reshape our society [35,36]. The simplest definition of blockchain is “a chain of data blocks each of which is created to record a transaction” [37: p51]. Underwood [38: p15] defines blockchain as:

“When a user wants to add a transaction to the ledger, the transaction data is encrypted and verified by other computers on the network using cryptographic algorithms. If there is consensus among the majority of computers that the transaction is valid, a new block of data is added to the chain and shared by all on the network. Transactions are secure, trusted, auditable, and immutable. They also avoid the need for copious, often duplicate, documentation, third-party intervention, and remediation”

There are five basic principles underlying blockchain technology: distributed databases, peer-to-peer transmission, transparency with pseudonymize, irreversibility of records, computational logic [34]. Blockchain technology can be designed to fit for different purposes to grant different rights to access, record, update and validate transaction records. Blockchain can be public (permissionless) where everyone can join the network with no restrictions, or private (permissioned) where only the authorized person can access, update and validate transactions on the chain [39]. Additionally, blockchain-enabled smart contracts allow terms or contracts to be self-enforcing through automated execution [74] to reduce costs of verification and enforcement [39]. Therefore, blockchain is one of the most remarkable technological innovations in the financial sector to increase settlement efficiency, shorten settlement times, reduce reconciliation efforts [10][30], lower transaction costs, provide transparency in debt and equity capital administration, enhance bank international transfer, make export credits faster [40], enable network [41], eliminate the need for intermediaries, and address the trust issues in economic transactions [42].

Artificial intelligence is another value driver in FinTech Innovations. There is no widely accepted definition of artificial intelligence [43]. This study adopts the definition of artificial intelligence and machine learning from the UK government industrial strategy white paper, which defines

Artificial Intelligence as “technologies with the ability to perform tasks that would otherwise require human intelligence, such as visual perception, speech recognition, and language translation”. Machine Learning as “a type of AI that allows computers to learn rapidly from large datasets without being explicitly programmed”

[44: p37]

In the financial sector, the concept of artificial intelligence is based on “devices that can interpret and understand tasks and take action to complete those financial tasks”, such as Robo-advisor, digital broker, or assorted devices used in trading, tax management, to offer a high degree of automation and efficiency improvements [4]. The surge in AI studies is accelerated by improved techniques such as deep learning, access to large quantities of data, and increased computer processing power, which enables AI to be deployed far more extensively [43]. It is estimated that AI will add up to \$15.7 trillion to the world economy by 2030 [45].

This review has focused on the rise of Robo-advisory services in investment and wealth management. They are increasingly becoming the biggest form of disruptive technology in investment and online stock trading [4]. The impact is even more profound when used together with blockchain-enabled short trading horizons and immediate settlement, and information sharing on social media platforms. Robo-advisors refer to “algorithms to develop automated portfolio allocation and investment recommendations tailored to the individual client” [46: p1]. Gomber et al. [10] indicate that Robo-advisors enable automated acquisition of information and data processing to offer more cost-efficient and customer-oriented ways to manage investor’s diversified portfolios. Robo-advisor is the FinTech innovation offering digital investments cherry-pick solutions based on investors’ pre-defined parameters of investment goals, financial ability, and their aversion to risk. It offers the service with little or no human intervention, which challenges the intermediaries such as financial advisers or asset managers. The traditional financial advisory firms or wealth management firms are limited by their existing infrastructure to process a large amount of data from the market, Robo-advisor start-ups address the complexity of data management faced by incumbents with help of Robo-advisors to offer automated advisory services to meet the changing consumer demand [4].

2.4. Institutional perspective of FinTech Innovation

Fintech Innovations are disrupting the traditional financial services by introducing new products, services, and technologies to deepen financial inclusion and changing the way people bank, pay, receive money, and buy insurance. The technologies bring changes in our social systems. From institutional perspective, Scott [47: p507] highlights that “*all organizations exist in an institutional environment that defines and delimits social reality. And just as with technical environments, institutional environments are multiple, enormously diverse, and variable over time*”. The sociological strand of institutional theory informs ‘*the socially constructed, historical pattern of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality*’ [48: p804]. The technological advancement has changed the technical and institutional environments in which businesses operate. We are increasingly experiencing the changing business processes and business models, and new ways of recording, updating, validating, and sharing digital information. Institutional theory offers good theoretical lens for this study to examine the interaction between Fintech Innovation and social change. Social reality guided by people’s values, beliefs, and rules in the society [48] are changing, which are driven by FinTech innovations using new technologies such as artificial intelligence,

blockchain technology, Robo-advisors, big data analytics, P2P lending platforms, social medias, smartphones, etc. to offer innovative financial products and services that are more efficient, more flexible, and more inclusive. FinTech impacts all actors in our society to capture values in different way. Scott [47] view institutionalization is the social process of accepting a shared view of social reality, which is taken for granted as defining “way thing are” or “way things are to be done”. For example, the pandemic has accelerated social acceptance of online shopping, online trading, mobile banking etc., and people often refers to the “new norms”. Similar to FinTech, the society is changing their perceptions towards new technological products and services, e.g. the switch to online banking or mobile banking. The long-established financial Institutions can collaborate with new FinTech firms to form collective power to influence regulatory environment to form new institutional standards to offer similar digital products and services. In this way, new FinTech innovations will gain social acceptance and legitimacy through the notion of institutional isomorphism, conceptualized by DiMaggio & Powell [49]. Institutional isomorphism can be achieved through coercive legitimacy stems from political influences, mimetic legitimacy from copying competitors (FinTech firms Vs incumbent banks and financial institutions), and normative legitimacy from professionalization. Legitimacy refers to social acceptance or generalized perception towards most desirable course of action that reflects social reality [50]. Simply, legitimacy is socially accepted norms. New institutional arrangement with FinTech innovation is not automatic [51]. The process starts with early adoption by some actors then diffuses to be widely accepted to form proper institutions (ecosystem of incumbents and FinTech) [51-53]. During the process, a plurality of logics coexists to affect actors simultaneously to constrain individual or organisational behaviour [54,55].

3. Methods

This study adopts a systematic analysis of the most recent published scholarly literature from quality journals. The editorial team of the *Review of Financial Studies* noted in 2017 that the academic finance community was not actively researching FinTech. They described the emerging FinTech phenomenon and published a special issue on FinTech, in 2019. Based on our observations, FinTech has developed exponentially in the past few years. Increasingly, three and four-star academic journals are beginning to publish both theoretical and empirical papers on FinTech. As previously mentioned in the literature, FinTech covers different categories of technologies such as cybersecurity, mobile transactions, data analytics, blockchain, peer-to-peer (P2P), Robo-advising, and internet of things (IoT) [9], big data, crowdfunding, social media [2].

We used “FinTech” as the keyword search in Scopus, which is the largest abstract and citation database of peer-reviewed literature. Our initial search generated 2,351 articles on the 10th of Sep 2021. Thereafter, we refined the subject area to “Business, Management and Accounting” and “Economics, Econometrics and Finance”, document type to “article” and “review”, publication stage to “Final”, source type to “Journal”, and language to “English”, which left us with 603 articles. We further filtered the results of 603 articles by source title to select three and four-star Journal articles, which further refined our results and generated our final datasets of 45 articles (See Table 1)

Table1: Document by Journal.

Journals	Field	ABS ranking	No.of Articles
Technological Forecasting And Social Change	SocSci	3	15
European Journal Of Finance	Finance	3	7
Journal Of Corporate Finance	Finance	4	5
Journal Of Management Information Systems	Info Man	4	5
Journal Of Empirical Finance	Finance	3	3
Review Of Financial Studies	Finance	4*	3
Journal Of Banking And Finance	Finance	3	2
Journal Of Financial Intermediation	Finance	4	2
Technovation	Innov	3	2
British Accounting Review	Account	3	1
		Total	45

Our review conducted a word frequency query on all the keywords listed in the N=45 articles, “Fintech”, “Financial”, “blockchain”, “innovation”, “lending”, “business”, “crowdfunding”, “finance”, and “banking” occur very frequently in our datasets (see Figure 2).



Figure 2: Word frequency Query Results from Keywords of N=45 article.

Among the datasets of N=45, 5 of them were published in 2018, 4 of them were published in 2019, 15 of them were published in 2020, and 21 of them were published in 2021 (See Figure 3).

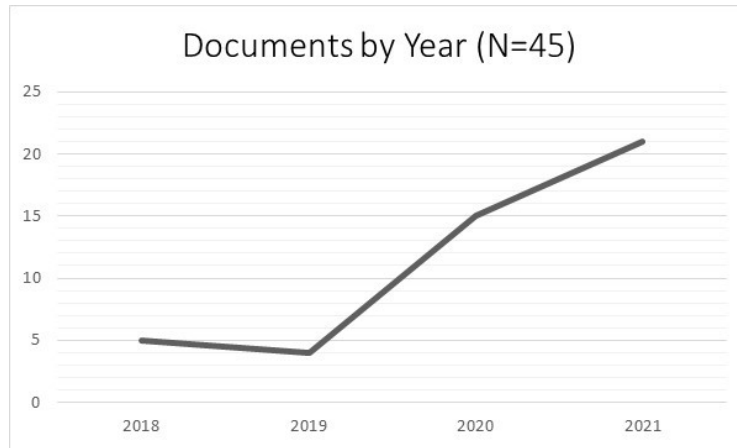


Figure 3: Document by year.

In addition, the datasets of N=45 have covered different countries, such as UK, China, United States, Germany, Switzerland, Australia, France, Singapore, Finland, Norway (See figure 4).

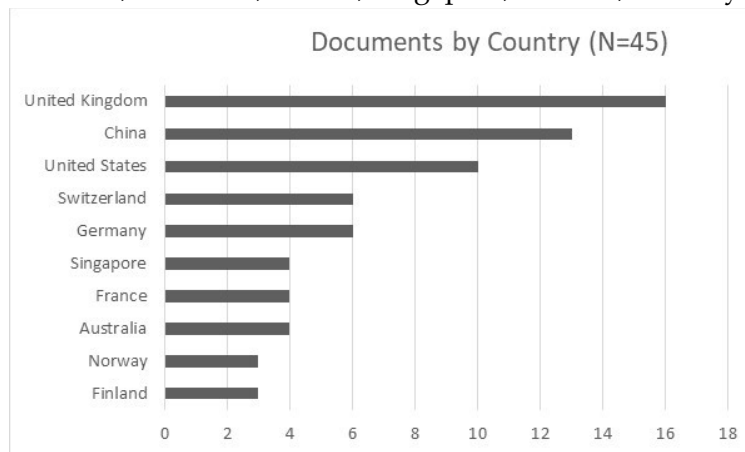


Figure 4: Document by Country.

The 4* and 3* Journals typically represent highly regarded journals and generally have excellent and good Journal metrics and impact factors within their field, in this case, within the FinTech field [56] and key contributors to scholarly work [57]. Subsequently, we used Mendeley to manage the references and Nvivo 12 software to code all papers based on their main perspectives (banking, P2P lending, regulatory sandboxes, FinTech Phenomenon, Portfolio diversification, etc.), and methodologies (conceptual, empirical, review, editorial, interview, experiment, etc.) (See Table 2).

Table 2: Overview of studies in 3- or 4-star journals investigating financial technologies (N=45).

Fintech innovations	Focused area	No. of studies	Innovative technologies mentioned in Titles	Studies	Main research method
Banks	Banking/ Financial markets	7	Fintech	[10]	Conceptual
	Banking		Fintech	[14]	Review
	Banking		Fintech	[16]	Empirical
	Bank risk taking		Fintech	[18]	Empirical
	Banking		Fintech	[73]	Corrigendum
Financing	Banking	8	Blockchain	[17]	Interviews
	Bank misconduct & online lending		Fintech	[6]	Empirical
	Mortgage lending (FinTech lenders)		Fintech	[19]	Empirical
	Investor platform choice (p2P lending)		Fintech	[21]	Empirical
	The role of provision points in online Crowdfunding		Fintech	[70]	Empirical
	Government affiliation and P2p Lending		Fintech	[80]	Empirical
	P2p Lending (Repetitive consumer loan applications)		Fintech	[71]	Empirical
	P2p Lending (Herding behaviour)		Fintech	[72]	Empirical
	The round number heuristic & Entrepreneur Crowdfunding performance		Fintech	[82]	Empirical
	Access to finance		Fintech	[68]	Review
ICOs	Fintech	[58]	Review		
Regulations	Regulatory sandboxes (social interactions)	3	Fintech	[64]	Interviews
	Regulatory sandboxes (new incubation model)		Fintech	[65]	Empirical
	Policy direction (widespread or confined geographically)		Fintech	[15]	Empirical
Fintech Sector	Fintech landscape (Start-ups)	3	Fintech	[3]	Empirical
	FinTech Phenomenon		Fintech	[2]	Editorial

	China's FinTech Sector		Fintech	[79]	Review	
Innovation	Classify innovations	8	Fintech	[9]	Empirical	
	Disruptive innovation ecosystems (InsurTech)		Fintech	[4]	Interviews	
	Unearthing antecedents to Financial Inclusion		Fintech	[7]	Empirical	
	Business model		Fintech	[11]	Review	
	SME efficiency		Fintech	[62]	Empirical	
	Financial services		Blockchain	[1]	Interviews	
	Financial literacy & wellbeing		Fintech	[84]	Empirical	
Investment	Network		Blockchain	[41]	Conceptual (use case)	
	Diversified portfolio	11	Fintech	[13]	Empirical	
	Portfolio diversification		AI	[24]	Empirical	
	Corporate finance		Fintech	[22]	Review	
	Effect of experience sampling on Investor risk-taking behaviour		Fintech	[69]	Experiment	
	Ultra-short Tenor interest rate curve		Blockchain	[23]	Empirical	
	Social media/Bitcoin		Blockchain	[26]	Empirical	
	Intraday High-frequency cryptocurrency data (algorithms)		AI	[25]	Empirical	
	Consumer credit evaluation		Big data	[20]	Empirical	
	Blockchain related name changes on corporate performance		Blockchain	[63]	Empirical	
	Applications		Intellectual capital		Fintech	[5]
Bitcoin			5	Blockchain	[59]	Empirical
Digital tokens		Blockchain		[67]	Empirical	
Applications to different Business functions		Blockchain		[40]	Review	
Trade finance		Blockchain		[42]	Interviews	
Mobile Money	Fintech	[81]		Qualitative comparative analysis		
Total	Fintech, Blockchain, AI, Big data	45			Empirical: 27 (60%) Conceptual: 2 (4%) Review: 7 (16%)	

Editorial: 1 (2%)
Interviews: 5 (11%)
Corrigendum: 1 (2%)
Experiment: 1(2%)
Qualitative comparative analysis: 1(2%)

60% of articles in our datasets are empirical papers. For example, Huynh et al. [24] used daily data from Thomson Reuters for eight financial asset classes for the period from 19th December 2017 to 16th January 2020 to investigate the role of AI, robotics stocks and green bonds in portfolio diversification. Benedetti & Nikbakht [67] used a unique set of publicly available and hand-collected data from 3625 tokens traded in 108 marketplaces to examine the role of cross-listings in the digital token marketplace ecosystem. Abbasi et al. [62] used the data of 1617 SME firms from 22 OECD countries during the period 2011-2018 to examine the impact of FinTech on SME efficiency, etc. 16% of articles reviews Fintech innovations in banking [14], access to finance [68], ICOs [58], China's FinTech Sector [79], and corporate finance [22], etc. 11% of articles applied interview to generate insights to their research topics. For example, Kowalski et al. [42] conducted in-depth interviews to examine how blockchain technology influences the trust relationship among trading partners.

This study summarizes the opportunities and challenges and implications of FinTech innovations to understand the cooperation and contestability in financial systems between new entrants and incumbents.

4. Results

In the extant FinTech literature, a consistent theme is the creation of new forms of competition and collaboration between new entrants (FinTech companies) and incumbents (traditional financial intermediaries such as banks, venture capitalists, stock markets, angels) [2,3,5,68,70]. Fintech innovations cover two aspects of transformation in the financial industry. The first one is some technology companies take advantage of their technologies to offer innovative financial services. The other one is the traditional financial institutions conducting transformation by using new technologies and taking on more of a FinTech form to offer digital products [2,16]. For example, FinTech start-ups are racing to fill the gaps in the customer experience left by traditional firms [2]. On the other hand, the long-established banks and venture capitalists are investing in FinTech on a massive scale, recognizing the value it will create in the future and remain relevant [68].

FinTech innovations provide great opportunities by altering traditional financial models through mechanisms of disintermediation, the extension of access, hybridization, financialization, and personalization [3]. Disintermediation refers to the ability of customers to interact directly online with financial service providers without an intermediary such as a bank. Extension of access refers to reduced barriers to entry and allow new actors such as tech companies to engage in the financial value chains. Hybridization refers to the purposeful cohesion of business models, products, and services to facilitate innovative services. Financialization refers to new forms of competition and collaboration. Personalization refers to customer-centric strategies to create personalized services. Through these mechanisms, the FinTech sector makes financial services more inclusive and more efficient [7,79]. Overall, the business models of FinTech firms are more flexible, efficient and opens

up new opportunities [5]. FinTech alters the market structure of the financial service industry and disrupts the universe of financial service providers with greater competition and diversity in lending, payment, insurance, and trading [27]. Simultaneously, the FinTech sector is facing big challenges from regulatory uncertainties [40,65,68,79]. This study summarizes Fintech innovation enabler, FinTech innovations in the financial services, as well as the opportunities, challenges, and implications of FinTech from our datasets (see Figure 5 for summarized topics covered in this review).

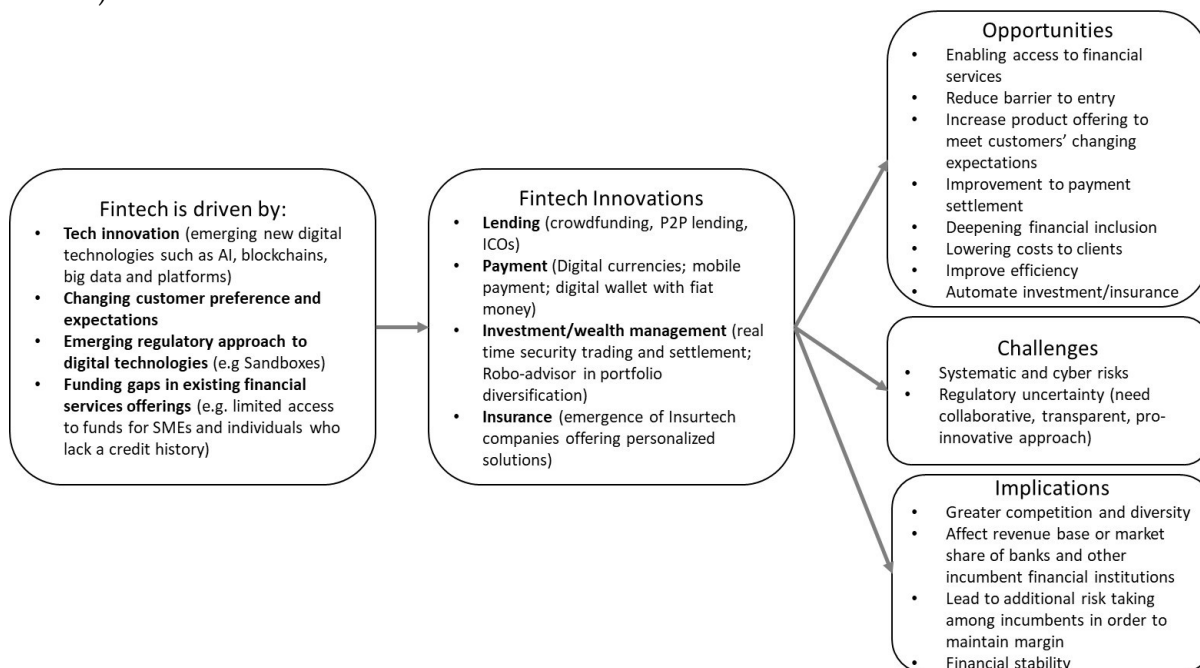


Figure 5: Summarized topics covered in this review.

This review articulates our summarized topics based on three areas of change accelerated by FinTech innovations: 1) FinTech innovation affects banks in lending and payment, 2) FinTech innovation affects the security market in investment/wealth management, 3) FinTech Innovation affects Insurance with a personalized solution link to mobile devices with improved risk pricing. Further, the challenges and implications will be discussed in section 5.

4.1 FinTech innovation affects banks in lending and payment

The FinTech enabled innovative lending and payments are largely driven by the advancement in technologies and shortcomings in traditional equity and debt funding channels, and limitations in the existing payment arrangement built upon cumbersome legacy systems [3][68]. In addition, traditional banking systems involve many bookkeeping and settlement works that add to the labour costs and human operation risk and errors [1,17]. Bertsch et al. [6] found a positive association between bank misconduct and the expansion of online lending. FinTech innovators adopt forward-looking strategies with streamlined business models to offer customer-centric financial products and services that combine speed and flexibility [13]. FinTech innovations provide innovative financial products and services to lead the financial sector towards digital banking and suppressing traditional banks [16]. The overall trend in the industry is marked by a further process of digitalization of banking products and services, Wang et al. [18] suggest banks must invest in new technologies to compete and stay relevant. FinTech drives significant

improvements in bank operational changes towards branchless banking, online and mobile banking, or new digital-only banks, which also opens the market for nonbank firms to offer financial services. Traditional banks are altering their physical branches due to lower transaction volumes at physical branches, and the reduced costs of facilitating transactions digitally [10]. Digital banking is no longer an option but an imperative [16], especially with the development of new technologies and smartphones [4]. FinTech provides alternative lending and payments solutions that generate greater competition and diversity in the financial sector.

Lending (Crowdfunding, P2P Lending, ICOs)

Many studies in our datasets discuss new sources of financing for entrepreneurial start-ups using crowdfunding, P2P lending, and Initial Coin Offering (ICOs) through platforms. P2P is the dominant worldwide form of crowdfunding [70]. ICO is a cryptocurrency version of crowdfunding [14][58]. The digitalization of finance is challenging our traditional view of intermediation. There is a shift towards new intermediaries such as platforms (lending platforms or social media platforms). Crowdfunding, P2P, ICOs represent new “marketplace lending” using online services that directly match lenders with borrowers without using an intermediate bank [14].

Crowdfunding is a way for individuals, businesses, and organizations to raise funds online in the form of donations or investments. There are four types of crowdfunding: reward-based, donation-based, equity, and debt crowdfunding [4]. The objective of crowdfunding is to democratize access to capital and provide entrepreneurs with a broader range of potential funders [70].

The P2P market provides new access to capital for small firms and individuals who are constrained from borrowing via commercial banks [80]. P2P platforms are likely to be more efficient than traditional financing through banks, as they offer a direct link between lenders and borrowers [13] [71]. P2P platform innovation eliminates layers of costly intermediation, enables multiple sources of funds from investors of any number and size to lend to a single borrower [72]. Now hedge funds and large financial institutions are actively participating in P2P lending. These platforms use algorithms to create credit scores to price and distribute loans online to facilitate repaid lending decisions and provide attractive interest-rate deals for both borrowers and lenders [68].

Initial Coin offerings (ICOs) permit young ventures to access external financing with fewer information frictions. The study of Zhao et al. [58] in our datasets has summarized the many empirical findings from academic research on ICOs. For example, source code availability, a token presale, token utility, founders’ education, work experience, social networks, team size, network, business model quality, project elaboration, social media activity, efforts in signalling, and tendency to be self-compliant with forthcoming regulations, leadership experience, quality of voluntary disclosure in whitepapers, etc., are all factors related to amount raised. CEO social network, team size, extensive media coverage, investor attention, information disclosure, transparency rating, etc., are all factors related to exchange listing. Quality rating by cryptocurrency experts, disclosure, credible commitment to the project, quality signals, etc., are all factors related to liquidity. Investors are driven by ideological, technological, and financial motives [78].

Payment (Digital currencies, Mobile payment, digital wallet with fiat money)

FinTech payments lie the biggest disruptive potential of fintech and make up one of the largest components of FinTech innovations [4]. The most radical payments innovation such as P2P

payment and cryptocurrency payment via online or mobile payment [3]. Some FinTech payment companies offer Bitcoin payment services to meet the needs of the emerging trend of cryptocurrencies and allow customers to use digital currency for fast and secure payment [4]. Bitcoin was first introduced by Nakamoto [83] as a peer-to-peer electronic cash system that allows online payments to be sent directly from one individual to another without going through a financial institution [59]. Bitcoin and other cryptocurrencies such as Ethereum, Litecoin, Monero, Dash, Bitcoin Cash, Augur, Stalker, Ripple, Zcash, which are digital currencies enabled by blockchain technology with decentralized forms of control, ownership, and multi-party validations. Cryptocurrencies are frequently argued to be possible alternatives to fiat currencies [14,59].

With the advancement in smartphone technologies, mobile money research is a relatively new but growing area of research in the broader mobile payment literature [7]. Banks are competing fiercely for market shares on mobile (smartphone) banking. Many banks and financial institutions use Text messages and apps to keep their customers informed of their account activities. Compared with traditional banking services, mobile money offers convenience, low transaction costs, and wide accessibility, and enables users to undertake financial transactions such as bill payment, savings, money transfer, loan acquisition, merchant payment, sending and receiving international remittance [7,81].

Digital wallets with fiat money are another area of innovation that greatly impact payments. Digital wallets enable consumers to complete online transactions without disclosing credit card details. Many payments can be executed using smartphones. PayPal is a good example of Digital wallets with fiat money. PayPal is a global online payment business allowing users to make payments and money transfers online, its annual mobile payment volume amounted to \$227billion in 2018, users are continued to increase into the 2nd quarter of 2021 [60].

In response to the increased competition from FinTech firms, banks are actively investing in new technologies such as blockchain for fund transfer, vendor financing, syndicated loans, loyalty programs [76]. Banks actively develop and apply blockchain technology to improve the current centralized banking systems [1] to share Know Your Customer (KYC), prevent Anti-Money laundering (AML), and combat the Financing of Terrorism [17]. Banks such as Barclays, Citigroup, Goldman Sachs, and UBS have formed the R3 consortium to explore the Blockchain's potential to streamline the process and reduce transaction costs. Chang et al. [1] detail three motivations for banks to adopt blockchain: cost reduction and value transfer; more effective risk control; and innovative ways to profit.

4.2. FinTech innovation affects the security market in investment/wealth management

Blockchain and Robo-advisors are the two innovative technologies mentioned in our datasets greatly impacting security trading. Blockchain would enhance greater transparency of ownership and faster, cheaper trade execution and settlement for issuing and trading corporate securities [39]. Golub et al.[23] identify demand for an ultra-short tenor interest rate curve that is updated in real-time due to very short trading horizons and immediate settlement facilitated by blockchain technology. FinTech innovations also provide new technology-enabled wealth management services using Robo-advisors to offer automated investment platforms to help clients customize their investment portfolios based on risk analysis and investment goals [4]. Robo-advisors use

algorithms to automate portfolio allocation and investment recommendations tailored to individual investors based on predefined parameters of investment goals and risk aversion [10]. Bitcoin has emerged as a new alternative investment for investors [59]. Huynh et al. [24] investigate the role of AI, robotics stocks, and green bonds in portfolio diversification, suggesting Bitcoin and gold are vital assets for hedging. Platanakis & Urquhart [59] apply the portfolio theory approach to assess should investors include Bitcoin in their portfolios. Their empirical results show, across all different asset allocation strategies and risk aversions, the benefits of Bitcoin are quite considerable with substantially higher risk-adjusted returns. Le et al. [13] also suggest the Bitcoin can be added to diversified portfolios in conjunction with gold and other rational financial assets to minimize risk. Another trend in the financial market is the use of social media for investors to share their investment ideas. Xie et al. [26] investigate the role of network cohesion in predicting the Bitcoin market to assess the impact of signal or noise in social media discussion. They empirically document a negative relationship between social media discussion network cohesion and its prediction accuracy for future Bitcoin price movement. In other words, their study found less cohesive social media discussion networks are better at predicting the next day returns than more cohesive networks because social media posts can result in increased information redundancy and decreased information diversity.

4.3. FinTech Innovation affects Insurance

Insurance is another sector affected by FinTech innovations to improve efficiency and optimize the operation of mainstream insurance business. “InsurTech” refers to insurance services provided by FinTech companies which leverage new capabilities of advanced technologies such as big data analytics [4][14]. The Recent Valuates report forecasts the global InsurTech market size is projected to reach \$11940 million by 2027, compared with \$1462.3 million in 2020. The growth in InsurTech is mainly driven by the rising demand for insurance service digitization. FinTech uses near real time data from Internet-enabled devices such as smartphones, smartwatches, computers, smart home devices, smart car devices, etc., to price premiums to offers more inclusive insurance such as social insurance and ultra-customized coverage. The major players operating in the InsurTech market include Quantemplate, Slice, Neos, Shift Technology, Lemonade, Oscar Health. Acko General Insurance, ZhongA [61]. InsurTech uses artificial intelligence to provide more user friendly and affordable customized insurance policies and premiums [4]. Private equity firms and venture capitalists and other investors such as Softbank, Google Ventures, Salesforce and Amazon are all actively investing in InsurTech [14]. The cooperation between InsurTech companies and incumbents would enable a more effective ecosystem in insurance industry to create more value and deliver real benefits to customers.

In the light of above, Fintech has evolved rapidly in banking, security trading and insurance. FinTech innovations reduce barrier to entry, enable better access to financial services, increase product offerings, improve payment settlement, deepen financial inclusion, and improve efficiency.

5. Discussion

This section is built upon the previous sections to discuss the challenges and implications of FinTech innovations.

5.1. Theoretical implications

In today's world, advancements in digital technologies make unprecedented changes to the way work, live and interact with each other. In the financial world, Thakor [14] suggest we need to rethink our theories of financial system architecture to include bank, markets and fintech firms. Some studies already adopt different theoretical lens to in their empirical investigations to study new phenomenon in FinTech innovations. For example, Senyo & Osabutey [7] use the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) and prospect theory to investigate the antecedents to financial inclusion through FinTech innovations. Alaassar et al. [65] use social capital theory to explore how social interactions within regulatory sandboxes influence the practices of regulators and regulates. Benedetti & Nikbakht [67] use equity cross-listing theory to examine the role of cross-listings in the digital token marketplace.

This review interprets FinTech innovations from institutional perspective to understand the interaction between FinTech innovation and social change. The immense changes in FinTech lenders, payments, investments, and insurance are challenging our social norms in many ways (e.g., from brick-and-mortar model to online platform model, disintermediation, app-based activities, mobile banking, etc.). From businesses' perspective, they need to make improvement to stay relevant and maintain margin in the digital world. From consumers' perspective, we have more choices from different service providers. If our society all accepts the new Fintech products and services, which is great in terms of flexibility, speed, personalization without thinking of the "trust" and "risk" elements of changes. However, the social acceptance of legitimacy of FinTech products and services is still a question to many. For example, it seems easier for tech savvy customers to accept and use FinTech P2P lending, but not so easy for senior citizens who are not so good in technologies. Nevertheless, technological changes are exponential, it is hard to keep up with the changes. Therefore, many are still using traditional intermediaries such as banks or financial advisors to accommodation their financial needs. It will be a long process for people to accept the new ways of doing things, especially with finance. For example, fiat currencies have gain wider social acceptance and legitimacy, while cryptocurrencies or digital currencies are emerging. Eventually, digital currencies will replace cash, but the question is when and in what form will central banks embrace such currencies in their payment systems [14]. Additionally, banks will continue to have a funding advantage if deposit insurance is in place and investors demand safe assets. In that sense, banks are not going to be replaced by FinTech anytime soon. Instead, banks and incumbent financial institutions can enhance their competitive advantage due to existing large customer bases and well-established regulations by introducing their own FinTech products and services to bridge the gaps in their existing practices and using technologies to improve their operations.

5.2. Regulatory challenges and Practical implications (risk)

The fast-changing FinTech has two dimensions of interaction with regulations. The first dimension is the development of regulatory technology (RegTech) companies. This branch of FinTech, offers new technological tools to help businesses with compliance process through legislative and regulatory analysis. RegTech helps its customers to mitigate risks of anti-money laundering (AML) and assist them in the know-your-customer process (KYC) [1]. RegTech firms apply AI and deep

learning methods to trigger alerts for exception handling [10]. The second dimension is the regulatory challenges to deal with new technological innovations [40] (e.g., crypto assets). The existing regulatory systems is not compatible with new reality [79]. Uncertainties in the regulatory environment often holds back firms from adopting new technologies. The recent study of Alaassar et al. [64] explores regulatory sandboxes, which “constitute a prominent mechanism to enable entrepreneurial activities that guide financial technology (FinTech) firms through regulatory framework in the financial industry” (P1). Their findings indicate that regulator-regulatee social interactions increase the legitimacy, risk management capabilities, regulatees’ knowledge of regulatory framework, and regulators understanding of constrains and potential risks. However, the actual practices of regulators and regulates can be negatively affected due to lowered trust and discrepancies in expectations and underlying goals. Regulatory sandboxes allow innovation while preventing sever instability in financial markets to test new technological solutions [65]. Jiang et al., [80] discover P2P platforms with government affiliations have better performances and higher survival probabilities. Hua & Huang [79] suggest the need for a new regulatory framework, the balance between innovation and financial stability, and innovative policy tools to monitor and regulate financial risks. Fintech innovations have great implication on risk management. The innovation creates greater competition and diversity in financial service industry. For example, digital wallets and P2P lending compete on the margins banks earn on deposit-financed lending, affect banks revenue base and market shares, raise concerns on the increased risks for banks and financial stability [14]. Wang et al. [18, p397] using unbalanced bank-level panel data from China for the period from 2011 to 2018 to empirically test the effect of FinTech development on bank risk taking. Their study reveals the impact of FinTech on Banks’ risk taking is heterogenous upon bank characteristics, such as size, efficiency, scale of shadow banking and income share. They found an inverted U-shaped relationship between FinTech and bank risk taking, i.e., bank risk taking increases initially and then begins to decrease as FinTech further develops. Additionally, new technologies come with new systematic and cyber risks. For example, the downside of P2P lending is that lenders or investors bear the direct risk of loss from P2P loan default and the risk of the platform itself may collapse [71]. Jiang et al. [80] found by early 2018, over 60% of the Chinese P2P platforms had closed, 40% of them were closed due to fraud, 18% of them were liquidated due to bad performances, while the rest ceased to exist for unknown reasons. ICOs are also plagued by scams and frauds [58]. The regulatory challenges and potential risks of FinTech innovations deserve further investigation to help build a more effective financial ecosystems to enhance financial stability.

6. Conclusion

This study reviews the most recent published scholarly literature summarizes the changes facilitated by FinTech innovations in banking sector with alternative lending and payment solutions, in security market sector with real time settlement using blockchain technology, and in insurance sector with personalized innovative insurance solutions linked to smart devices with improve risk pricing. FinTech develops rapidly in crowdfunding, P2P lending, ICOs, digital currencies, mobile payment, digital wallet with fiat money, cryptocurrencies, Robo-advisors in portfolio diversification, real time security trading and settlement, InsurTech, and RegTech. FinTech provides a customer-centric services to increase product offerings to meet changing customer expectations, to improve payment settlement, and deepen financial inclusion. Further, this review also summarizes and challenges and potential risk implications of FinTech Innovations, suggesting collaboration is critical to enable multi-stakeholders to anticipate and foster pro-

innovative, transparent regulations to deliver meaningful benefits to innovation and financial inclusion, and build an ecosystem of financial incumbents and FinTech innovators to build a more efficient and resilient digital financial system.

Lastly, this review outlines some directions for future research. As others have observed, future FinTech studies need to advance finance theory, foster interdisciplinary collaboration and multi-level analysis to understand the wider range of technological innovations in financial industry, to assist policymakers to cast rightsized regulations to promote innovations and enhance financial stability. This study suggests the following questions that afford further investigation to advance knowledge to create a future-proof, more efficient and resilient financial ecosystems of financial incumbents and FinTech innovators. From market perspective, what would be the new market equilibrium for incumbent financial institutions to coexist with FinTech innovators? From regulatory perspective, are regulatory sandboxes a good approach to test FinTech innovations? What are the implications of sandboxes in different jurisdictions? From risk perspective, what are the cybersecurity risks for AI, blockchain, big data, cloud computing, and platforms? What are the impacts of FinTech innovation on risk taking in banks in different countries? From social acceptance perspective, what are the degree of acceptability and resistance to various types of financial technologies? From welfare perspective, what does FinTech mean for the ageing society? How are they being affected? Will the pension funds be affected? What is the social acceptability and resistance of this social group?

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