

Toward Understanding FinTech and its Industry¹

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Structured Abstract:

Purpose – To define FinTech, differentiating it from financial technology, and use the definition to develop an industry framework.

Design/methodology/approach - Using the existing literature on FinTech and incorporating these contributions into the traditional financial structure, characteristics are outlined and placed into a framework that describes the FinTech industry.

Findings: FinTech is a specific type of Financial Technology, defined as technology used to provide financial markets a financial product or financial service, characterized by sophisticated technology relative to existing technology in that market. Firms that primarily use FinTech are classified as FinTech firms. Using these definitions, the paper provides a structure for the FinTech industry, classifying each type of FinTech firm by FinTech characteristics.

Research limitations/implications: Research that would inform the economic importance of FinTech would be served with an increased understanding of FinTech firms and the FinTech industry.

Originality/value - This paper contributes by defining FinTech and developing a comprehensive framework to describe the emerging FinTech industry.

Keywords: algorithmic trading, blockchain, crowdfunding, cryptocurrency, digital bank, FinTech, InsurTech, LendTech, peer-to-peer, RegTech, robo-advising

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Toward Understanding FinTech and its Industry

“The magical combination of geeks in T-shirts and venture capital that has disrupted other industries has put financial services in its sights.” (2015)

1 Introduction

In a surprisingly prescient manner, FinTech was defined by Bettinger (1972) as, “...an acronym which stands for financial technology, combining bank expertise with modern management science techniques and the computer.” Nearly fifty years later, the widespread adoption of the personal computer and the existence of the internet and mobile connectivity, the current state of FinTech deserves a fresh treatment.

Finance has been characterized by technology throughout its history as noted by Ferguson (2018). He asserts innovations have been the cornerstone of finance, including the earliest uses of money, the introduction of Arabic numerals and interest theory, the birth of the bond markets in Italy, creation of the joint-stock company and the secondary market for shares in the Netherlands, through modern manifestations via central banking, ATMs, and digital currency. Yet it appears that FinTech has unleashed something beyond the normal path of financial technology. How rapid is this advance now? A search in ABI/INFORM shows the usage of the term FinTech has grown twenty-five-fold over the past decade to over 1,000,000 works containing the term FinTech, spawned by a new industry of FinTech firms (*Figure 1*). The FinTech industry is the focus of this paper.

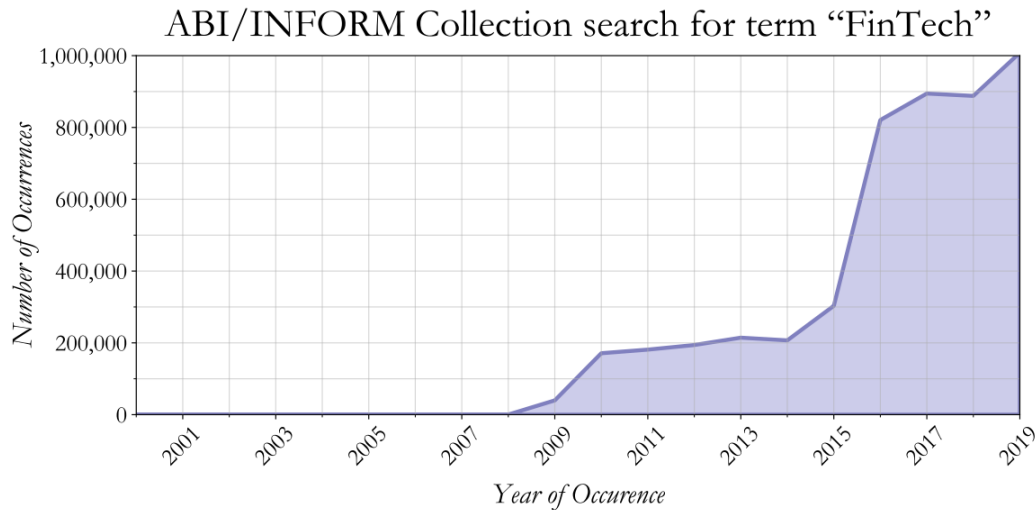


Figure 1

To encourage FinTech research, *The Review of Financial Studies* issued a novel call for a special issue dedicated to FinTech (Goldstein et al., 2019). *Financial Management* similarly published a special issue regarding FinTech (Parlour, 2019) and the *Journal of Corporate Finance* has issued a Call for Papers for a conference and special issue on FinTech and Digital Finance. These were preceded by a 2017 conference, jointly sponsored by the Federal Reserve Bank of Philadelphia and the New York Stern School of Business (Jagtiani and John, 2018)

Jensen and Meckling (1976) theorized that a firm is a nexus of contracts. The nature of these contracts governs what types of products and services different firms will provide. While nothing

prevents a firm from shifting its strategy, in practice firms often organize along lines of business recognized as industries. In a traditional sense, the FinTech industry defies easy classification. Although products and services provided by the industry are financial in nature, the processes and tools are mostly from the technology industry. FinTech industry classification is predicated on defining the term FinTech.

When people use the term FinTech, it is unclear whether they are envisioning the same concept. Buzzwords used by the financial press are meant to pique interest, but can confound matters unnecessarily. In fact, it appears that FinTech has fallen victim to a dilution in meaning. As *Figure 1* shows, both the popular press and academe now regularly use the term FinTech. The absence of a broadly accepted definition has led to cavalier use of the term. This creates a challenge for new research.

This paper contributes in three ways. First, it defines the term FinTech: FinTech is technology used to provide financial markets a financial product or financial service, characterized by sophisticated technology relative to existing technology in that market. Second, it uses the definition of FinTech to identify FinTech firms and create an industry framework to increase understanding of this emerging research area. Finally, it provides a description of firms in the industry using this framework with characteristics set forth in the definition of FinTech.

This paper is organized as follows. Section 2 includes a review of the FinTech literature. Section 3 develops the movement from financial technology to FinTech, defining FinTech in this section. Section 4 provides a framework for the FinTech industry. Section 5 relates each node from the framework onto the definition of FinTech. Section 6 discusses some commonly held misconceptions about FinTech not otherwise addressed and Section 7 concludes.

2 Literature Review

This paper provides a flowchart entitled *The FinTech Space (Figure 2)*, to organize the literature review. FinTech firms use *Agile Technologies (I)* to create *FinTech Assets (IV)* and *FinTech Services (V)*. The *Value of Agile Technologies (II)* has impacts on how these technologies are held (*Ownership Structure*). *FinTech Firms* comprise the *FinTech Industry* and give rise for the need to set industry *Asset Standards (III)*. *FinTech Regulation (VI)* has been placed on both *FinTech Firms* and *FinTech Services (V)*. Each of the numbered nodes *I–VI* from *Figure 2* is treated in this literature review.

Blockchain and machine learning are representative of *Agile Technologies (I)*. Blockchain is perhaps the most popular FinTech innovation. Blockchain has received considerable treatment, including how blockchain mitigates settlement risk (Chiu and Koeppl, 2019), how blockchain can increase trust in ecommerce (Cong and He, 2019), the benefits of blockchain to society (Biais et al., 2019), and the propensity of firms to strategically use FinTech terms like blockchain, bitcoin, or cryptocurrency in 8-K disclosures (Cheng et al., 2019). Research regarding machine learning has been conducted on FinTech lending using alternate data (Jagtiani and Lemieux, 2018) and asset allocation (Routledge, 2019). From the management information systems literature, Gomber et al. (2018) documented the technological innovations which characterize FinTech.

Chen et al. (2019) study the value of FinTech innovations using machine learning to identify FinTech patents (*Value of Agile Technologies (II)*). Their algorithm classified innovations into seven

areas: cybersecurity, mobile transactions, data analytics, blockchain, peer-to-peer, robo-advising, and the internet of things (IoT). Though these innovations affect FinTech, some are more aptly classified at information technology firms, such as cybersecurity, data analytics, and IoT. With respect to price informativeness, a working paper by Grennan and Michaely (2019) studies increased price informativeness for stocks with FinTech data coverage, concluding investors rely on FinTech data intelligence, in addition to traditional pricing sources.

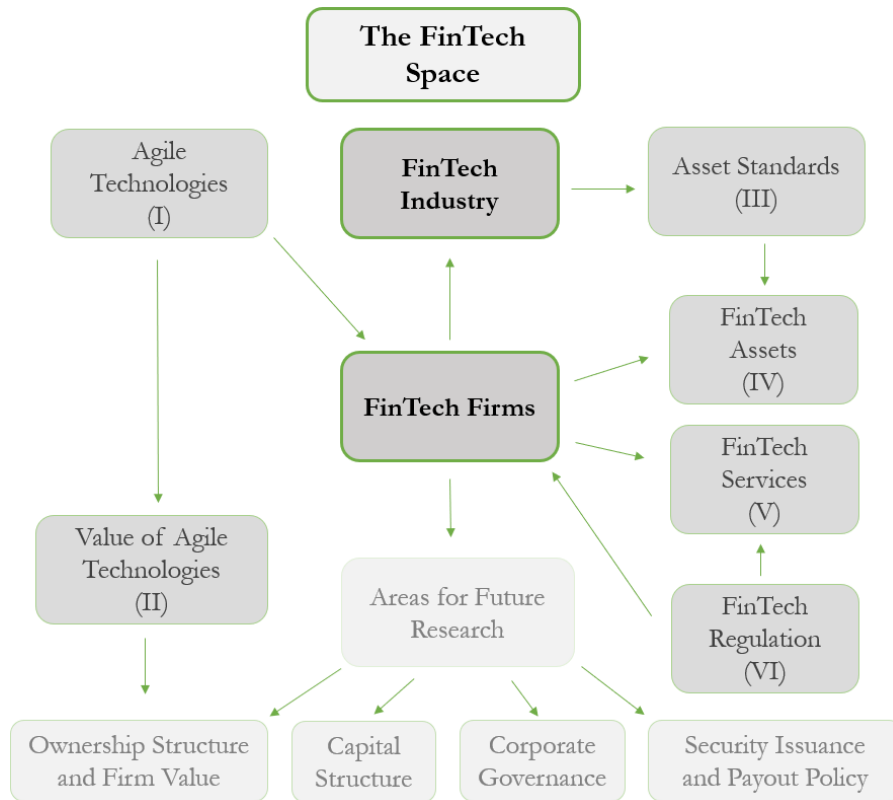


Figure 2

With respect to *FinTech Assets (IV)*, considerable research has been conducted on cryptocurrency, including bitcoin. (This paper differentiates cryptocurrency as an asset, from its associated technology blockchain.) Recent studies have considered the asset pricing properties of cryptocurrency (Hu et al., 2019), the economics of bitcoins (Schilling and Uhlig, 2019), and price prediction for bitcoins using machine learning (Chen et al., 2020).

Regarding *FinTech Services (V)*, firms such as banks and mortgage lenders now face FinTech competition. Buchak et al. (2018) classified banks without depository services as shadow banks, and investigated the services offered by FinTech and non-FinTech shadow banks, noting FinTech lenders make use of alternative information to set lending rates for borrowers. Nowak et al. (2018) noted small businesses seem able to signal their financial strength through self-description in peer-to-peer lending descriptions. Fuster et al. (2019) researched the role of technology in a market ripe for streamlined processes, the mortgage market. They find the innovation offered by FinTech lenders reduces processing time 20% and does not simply target lower creditworthy customers.

Vallée and Zeng (2019) researched the difference between conventional banking and an emerging FinTech area, peer-to-peer (P2P) lending, noting that credit decisions made in FinTech P2P lending uses different information than what is used in traditional credit decisions. This has become increasingly important to serve millennials whom, because they are less likely to use traditional credit channels, would be underserved without P2P lending. Tang (2019) investigated whether P2P lending is a complement to or substitute for banks, finding P2P serves both of these roles, depending on the credit channel sought.

Additional *FinTech Services (V)* include crowdfunding and robo-advising. Chemia and Tinn (2019) documented the benefits to firms using crowdfunding, as both an avenue to understanding customer demand prior to production, as well as a funding source. D'Acunto et al. (2019) studied robo-advising finding investors experienced benefits including increased diversification and reductions in certain behavioral biases in portfolio decision-making.

Finally, *FinTech Services (V)* includes algorithmic trading, including high frequency trading (HFT). Hendershott et al. (2011) questioned whether market quality improved in the face of algorithmic trading. They found that spreads narrowed and adverse selection was mitigated, suggesting algorithmic trading improved liquidity. Menkveld (2013) used proprietary data as a case study investigation of the characteristics of high-frequency trading, finding this particular HFT served as a market maker.

The financial services industry has been working toward FinTech regulation and establishment of *Asset Standards (III)*. The International Token Standardization Association has been working on implementing ISO identifiers, and recently began working with Bloomberg's Object Management Group on the Financial Instrument Global Identifier. The Association for National Numbering Agencies is also working on digital identifiers. The Global Digital Finance Group is developing rules of conduct to minimize the need for regulatory involvement.

FinTech has been noticed by regulators (*FinTech Regulation (VI)*). The Financial Stability Board (FSB), an international body of representatives from over 20 countries provides oversight of the international financial system, published a paper about FinTech oversight in 2017 (Wilkins et al., 2017) The FSB defines FinTech as, "technology enabled innovation in financial services that could result in new business models, applications, processes of products with an associated material effect on the provision of financial services." The FSB connects FinTech innovations to the world economy with a regulatory framework to mitigate FinTech risks.

This paper is closest to two recent works. First, Dandapani (2017) reviewed recent developments in electronic finance considering the costs, benefits, and protections, focusing on payment systems and additional areas of infrastructure: cloud computing, valuation metrics for multisided platforms, quantum trading, and cybersecurity. Das (2019) provided an important review of technologies (machine learning, artificial intelligence, network modeling, automated trading, blockchains and text analysis), discussing the implications for various areas of finance (risk modeling, consumer finance, and payment systems.) In addition, Das (2019) discussed topics related to FinTech including cybersecurity, illicit finance and fraud prevention.

While research has been conducted in areas surrounding the FinTech industry, this is the first paper focused on firm classification and providing an industry framework, which stands in the

middle of *The FinTech Space* as noted in *Figure 2*. A better understanding of the breadth of *FinTech Firms* and the *FinTech Industry* is important to enable future research in areas such as *Ownership Structure and Firm Value*, *Capital Structure*, *Corporate Governance*, and *Security Issuance and Payout Policy*.

3 From Financial Technology to FinTech

This paper begins by distinguishing Financial Technology from FinTech. Although FinTech originates from the phrase Financial Technology, FinTech is a proper subset of Financial Technology. Double-entry bookkeeping is Financial Technology essential to financial accounting, but it is not FinTech. Whereas, cryptocurrency is FinTech specifically as well as Financial Technology more generally. The definition for Financial Technology is:

Financial Technology is technology used to provide financial markets a financial product or financial service.

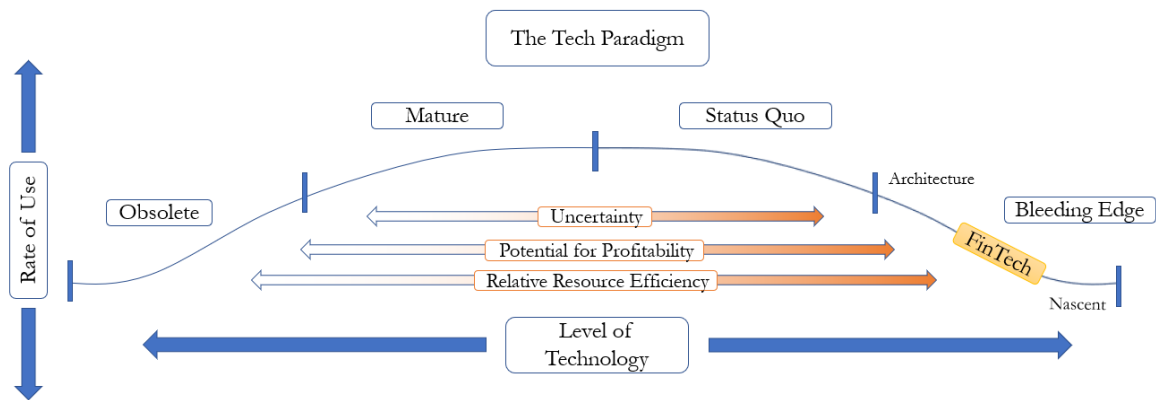


Figure 3

The movement toward FinTech, a distinct type of Financial Technology, necessitates focus on the type of technology. In the spirit of the bell curve of innovation introduced by Rogers (1962), this paper defines *The Tech Paradigm* as an ordered space that tracks the lifespan of a given technology in a particular market (*Figure 3*). This space is partitioned into four ordinal levels of technology, from least to greatest: *Obsolete*, *Mature*, *Status Quo*, and *Bleeding Edge*. *Bleeding Edge* combines the concepts of leading and cutting edge, which implies increased riskiness of quickly advancing, even unreliable, technology. *Mature* and *Status Quo* technologies enjoy the highest rates of use within a given market, whereas *Obsolete* and *Bleeding Edge* technologies experience the lowest.

The Tech Paradigm illustrates this space is a relative measure for degree of uncertainty, potential for profitability, and relative resource efficiency. With increasing uncertainty, potential for profitability, and relative resource efficiency, firms are placed more rightward on *The Tech Paradigm*. For example, firms that prefer lower risk and more certain outcomes will likely use *Mature* technology. Non-FinTech financial firms, which will be referred to as incumbent firms, exist somewhere in the *Obsolete*, *Mature*, and *Status Quo* levels of technology. This paper proposes a definition for FinTech as:

FinTech is technology used to provide financial markets a financial product or financial service, characterized by sophisticated technology relative to existing technology in that market.

Thus, the definition of FinTech is a more focused definition of Financial Technology. Referring to *The Tech Paradigm*, *Bleeding Edge* technology is the sophisticated technology relative to existing technology. With the definition of FinTech, it is now meaningful to define the *FinTech Firm*:

A FinTech firm is a firm that primarily uses FinTech in its business model, to provide a financial product or financial service.

The Tech Paradigm can be applied to any era, but the technologies residing in each level will differ depending on the era. Presently *Bleeding Edge* technology used in financial markets is characterized by increased computational power, more sophisticated infrastructure, and data-hungry models. Many of these technologies have existed for some time and are now being applied to finance. For example, artificial neural networks are almost forty years old (Fukushima, 1980), but their application to financial markets has only recently been feasible due to the calculation time required for a sufficiently complex model.

Incumbents can adopt *Bleeding Edge* technologies, but they do not adopt enough of them, nor quickly enough for their business model to primarily rely on FinTech. This is true for two reasons. First, *Bleeding Edge* technology introduces more risk than incumbent firms are comfortable with. Second, incumbent firms are unable to make this transition because of their complexity. The ability to leverage outside technology rapidly is the essence of FinTech firms, and incumbent firms cannot to keep pace with this rapidity. Thus, it is the usage of *Bleeding Edge* technology that is the essence of FinTech firms. Without *Bleeding Edge* technology, FinTechs would be significantly less profitable, compared to incumbent firms already operating at scale with *Mature* and *Status Quo* technologies.

4 The Framework

Within the context of *The FinTech Space* (Figure 2) and the levels of technology from *The Tech Paradigm* (Figure 3), this paper hones the definition of FinTech and develops categories based on attributes common to FinTech firms. This section defines three disjoint categories of common attributes, namely: *Relation to Financial Services*, *Technological Innovation*, and *Agility*. This paper considers a subindustry to be FinTech if it has at least one attribute from each one of these three categories.

FinTech firms operate in the financial services industry, but the nature of their relation to financial services differs based on their business model. FinTech firms operate by complementing or displacing current financial services firms, or by creating new financial services markets. Examples of market creators are crowdfunding and cryptocurrency firms. The first category, *Relation to Financial Services*, includes *Complementing*, *Displacing* and *Market Creating*.

- *Complementing*: Has a core business that complements traditional finance by offering products or services to traditional financial entities. This supporting role exists because traditional financial entities are typically too slow to develop these solutions.
- *Displacing*: Has a core business model that competes for a market which has been previously cultivated or sustained by traditional financial entities.
- *Market Creating*: Has a core business that creates a new financial product or service which serves a previously unmet or underserved market.

For example, Robinhood is a brokerage app that offers a zero-transaction fee trading platform targeted to retail investors. They create revenue by selling real-time order flow to incumbents and seek time value off of the temporarily non-invested funds. Robinhood would be a displacing firm because its core business model displaces incumbent brokers from selling order flow data and earning transaction fees from individual traders.

Bleeding Edge technology is not homogeneous. Most *Bleeding Edge* technologies, measured by their rate of use, are closer to *Status Quo* technology. These *Architecture* technologies have noticeable advantages over *Status Quo* technologies but easily integrate into the current paradigm. At the right end of the *Bleeding Edge* there are *Nascent* technologies which instead defy the current paradigm. *Technological Innovation*, the second category, includes *Architecture* and *Nascent* (Figure 3):

- *Architecture*: Technology which is in a transitional phase from *Nascent* to *Status Quo*. As incumbent financial institutions recognize the proven record of the technology, widespread adoption by incumbent firms occurs. Innovations that are similar to the current paradigm tend to originate here, instead of as *Nascent* technology.
- *Nascent*: Technology which operates with the greatest uncertainty, strongest potential for profitability, and most relative resource efficiency. This technology will either prove worthy and receive broader adoption within the given market, or will fail.

A FinTech firm must be agile. FinTech firms quickly adapt to new market opportunities. Though new industries are often startup firms, this feature does not meaningfully distinguish FinTechs from Non-FinTechs. Rather, classification should focus on industry specific features. The third category, *Agility*, includes *Data Nimble*, *Niche Fulfilling*, and *Regulation Avoiding*:

- *Data Nimble*: Has a core business model that revolves around finding and processing financially relevant data more deftly than other market participants.
- *Niche Fulfilling*: Has a core business model that provides consumer choice and convenience at an individual level. When at an institutional level it instead appears as product tailoring, providing access to unique risk exposures or customized hedging opportunities.
- *Regulation Avoiding*: Has a core business model that competes in a market in an unhindered way, where the market would normally be subject to regulatory scrutiny.

5 The FinTech Industry

This paper proposes an organization for the FinTech Industry into areas which reflect the structure of traditional financial services: Monetary Alternatives, Capital Intermediation, InvestTech, and Infrastructure (Figure 4). Monetary Alternatives include FinTech firms which provide money and services related to money, including firms that provide cryptocurrency, and *ex bank* payment systems. Capital Intermediation includes digital banks, InsurTechs, and LendTechs. InvestTech includes algorithmic trading, crowdfunding, financial intelligence, and investment applications. Finally, Infrastructure includes CreditTechs, Financial API Techs, and Financial RegTechs.

The structure offered in Figure 4 provides an overview of the breadth of this industry and serves as a starting point for future identification and empirical research. It places FinTech firms into broad areas which echo current financial structures (money, intermediation, investments, etc.)

Many of these firms are private and an increased understanding of the FinTech industry will be important to the financial markets, as these firms are acquired or undergo an initial public offering. According to CBIInsights (2019), there are 61 FinTech Unicorns valued at an aggregate \$221 billion.

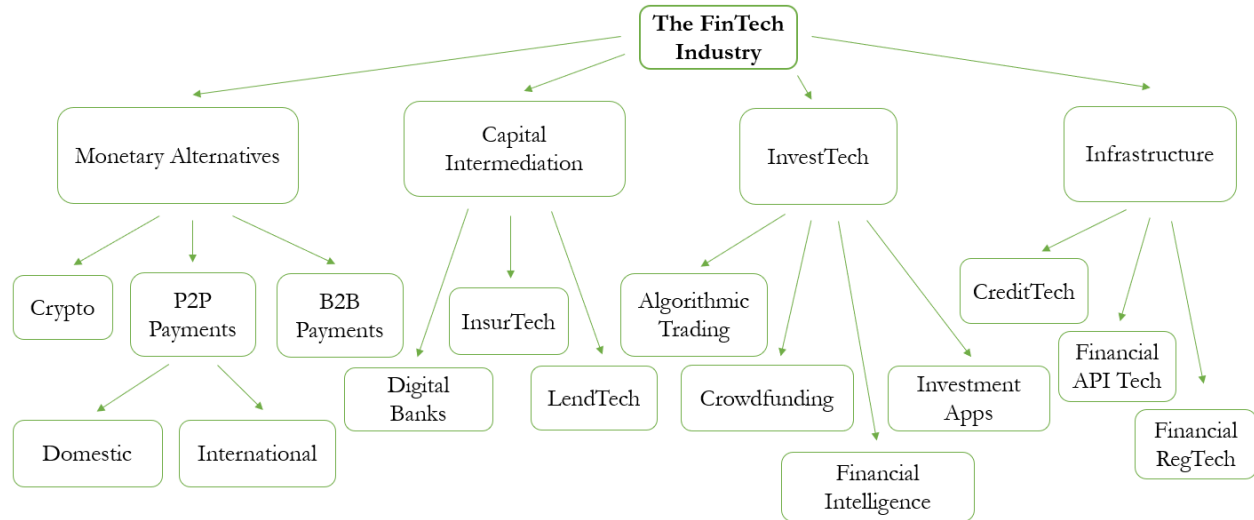


Figure 4

Table 1 organizes these four areas, classifying by characteristics outlined in Section 4, relation to financial service (*FinSvc*), technological innovation (*TechInn*) and agility (*Agile*). The relation to financial services is *Complementing*, *Displacing*, or *Market Creating*. Technological innovation is *Architecture* or *Nascent*. Agility is reflected as *Data Nimble*, *Niche Fulfilling*, or *Regulation Avoiding*. The final column in Table 1, provides a sample of FinTech firms for all fourteen of the subindustries in Figure 4, most of which are privately held. As this paper introduces each node from Figure 4, it provides a reminder within each subindustry discussion regarding these characteristics.

MONETARY ALTERNATIVES

Monetary Alternatives contains FinTech firms that fill the role banks have traditionally served. Historically, banks have provided monetary services through savings and checking related services. Over the past decade, since the financial crisis and loss of trust in the financial system (Hossain and Kryzanowski, 2019), the banking industry has witnessed tremendous change. Even the concept of local banking is disappearing, a change facilitated by the widespread availability of ATMs and the viability of internet and mobile banking services.

For example, customers who once changed banks when relocating to a new geographical area, now have the option to deposit checks and access cash from anywhere making the establishment of banking services in their new locale unnecessary. Traditional banking includes some unattractive features, including long clearing time for check deposit services and high fees associated with international transfers of funds. This is a space that FinTech now competes in offering faster and cheaper monetary services. In this section, this paper discusses cryptocurrency, *ex bank* payment systems, including both peer-to-peer (P2P) and business-to-business (B2B) payment systems.

Cryptocurrency

Perhaps the most notable new FinTechs are firms offering cryptocurrency. While the concept of digital cash was invented by Chaum (1982), the technology that began cryptocurrency was provided by Nakamoto (2008) in the paper entitled, “Bitcoin: A Peer-to-Peer Electronic Cash System.” Ushered in during a nadir of trust in the global financial system, and especially low confidence in central banking, bitcoin went from worthless to \$3,882.30 between January 2009 and January 2019. Its value at the time of this writing is over \$7,000 and has shown tremendous volatility since inception, rising to a height of \$14,182.46 in December 2017.

Cryptocurrency exchanges are predicated on the existence of cryptocurrency which requires that transactions be completed via cryptocurrency mining (*FinSvc: Market Creating*). Cryptocurrency mining creates increased need for computer hardware and generation of energy to power this hardware. Cryptocurrency mining tends to be concentrated in locales with lower power costs. For example, Siberia is an attractive location for bitcoin mining due to the availability of Soviet-era factories and relatively inexpensive energy from hydropower generation facilities.

As a purely digital alternative to sovereign currencies, cryptocurrency has made physical money less relevant and is believed by its designers to be more secure than fiat currency (*TechInn: Architecture*). Cryptocurrency has integrated into monetary systems, and is now accepted by some major retailers such as Microsoft, Overstock.com, and Subway. Brazil and China are pursuing the development of cryptocurrency, and it is likely that other governments will follow (*TechInn: Nascent*).

Cryptocurrency offers a recognized currency outside the scrutiny of governments, serving a niche market need (*Agile: Niche Fulfilling*). Cryptoexchanges permit the exchange of one type of crypto for another (i.e. Bitcoin for Litecoin). Cryptoexchanges also permit customers to convert US dollars and Euros into crypto and back again, serving as a *de facto* foreign currency exchange, and providing a standardized gateway between fiat money and cryptocurrency. Initially cryptoexchanges avoided regulatory scrutiny, but are now regulated by the Financial Industry Regulatory Authority, the Commodity Futures Trading Commission. According to Foley et al. (2019), crypto remains attractive for money laundering and tax avoidance schemes (*Agile: Regulation Avoiding*). Gandal et al. (2018) also note the propensity for price manipulation in bitcoin.

Payment Systems

FinTechs have created more efficient payment systems than offered by existing banking institutions. Transactions are easier to initiate, quicker, and require fewer intermediaries resulting in reduced transaction fees. Payment systems have evolved in FinTech from peer-to-peer (P2P), to now include business-to-business (B2B), involving domestic and international payments.

Domestic P2P Payments

Domestic P2P payments displace traditional financial services, since customers hold less money in their bank accounts and more money in P2P payment accounts (*FinSvc: Displacing*). This results in lower account balances available for bank intermediation. New customers are attracted to P2P payments due to faster processing and lower transaction fees (*FinSvc: Market Creating*).

		Relation to Financial Services			Technological Innovation		Agile			Example Firms
		Complementing	Displacing	Market Creating	Architecture	Nascent	Data Nimble	Niche Fulfilling	Regulation Avoiding	
Monetary Alternatives	Crypto			•	•	•		•	•	CHANGENOW, CIRCLE, COINBASE, RIPPLE LABS
	Domestic P2P Payments		•	•	•			•		CHECKBOOK, MILLIPAY SYSTEM, STRIPE
	International P2P Payments		•	•	•			•		AFRIMARKET, MONEYTRANS, REMITLY, TAWIPAY
	B2B Payments		•	•	•			•		BITPAY, SMACC, TRADESHIRT, ZUORA
Capital Intermediation	Digital Banks		•	•	•	•		•		ASPIRATION, CHIME, LOOT, VARO
	InsurTech		•	•		•		•		CAPE ANALYTICS, CLAIMVANTAGE, SONNET
	LendTech		•	•	•	•		•	•	AVANT, FUNDING CIRCLE, LENDING CLUB, MODALKU
InvestTech	Algorithmic Trading		•		•	•	•			ALGORIZ, AUQUAN, EPOQUE
	Crowdfunding			•		•		•		DIVIDOM, KICKSTARTER, PROPERTYMOOSE, TESSIN NORDIC AB
	Financial Intelligence	•	•			•	•			ALGODYNAMIX, DATAMINR, DATASINE, ESTMIZE, NUMERAI
	Investment Apps	•	•			•		•		ACORNS, GROWNEY, ROBINHOOD, STASH, STOCKPILE, WEALTHFRONT
Infrastructure	CreditTech	•		•		•	•			CREDIT KARMA, TALA, ZESTFINANCE
	Financial API Techs	•			•			•		ALGOMI, ALOGENT, DWOLLA, EBANKIT, XIGNITE
	Financial RegTech	•				•	•			CLARUS FINANCIAL TECHNOLOGY, KAIZEN REPORTING, SCALED RISK, SHIELD FC

Table 1

Domestic P2P payment systems have created a new conduit for fund transfers between domestic customers (*TechInn: Architecture*). Domestic is a necessary qualifier since this space is presently segmented within country. Once money is placed in a P2P payment system, the mobile transfer of funds is faster than traditional bank transfers. While easy to transfer funds between existing account holders, customers must first create an account in the P2P payment system.

Domestic P2P payment systems provide increased customer convenience (*Agile: Niche Fulfilling*). Performing bank transfers, writing checks, and holding cash is less convenient than instant mobile transfers. Consumers spend less time conducting transactions and carrying correct denominations of physical money is unnecessary.

International P2P Payments

With global labor mobility, the need to send money to people around the world has increased; yet traditional channels have not offered competitive services, creating room for FinTech competition. International P2P payments systems, also known as cross border payments, directly compete with traditional finance which has enjoyed a relative monopoly (*FinSvc: Displacing*). International P2P payments have provided previously underserved market participants with cross border payment services which are not prohibitively expensive to use (*FinSvc: Market Creating*).

International P2P provides customers with the ability to transfer currency often more quickly than international wire transfers. This facilitates global capital flow, creating increased liquidity between consumers in different countries (*TechInn: Architecture*).

Some International P2Ps focus on paired-country transactions, while others provide broader currency exchange services. International P2P serves customers with reduced fees, and increased transactional speed (*Agile: Niche Fulfilling*). For some economically underdeveloped countries, these FinTech firms may be the only viable option to perform these transactions.

B2B Payments

Business-to-business (B2B) payment systems allow businesses to transact with one another more cheaply and extensively than existing payment systems (*FinSvc: Displacing*). Many B2B payment FinTechs offer additional services such as factor financing services and automating invoice data into accounting software. The cost reductions enable businesses to expand target markets and their supply-chain to other businesses that used previously conflicting payment systems due to preference or locale (*FinSvc: Market Creating*).

Given the recurring nature of B2B fund transfers, B2B FinTechs offer quicker transactions, increased efficiency with recurring transactions, and lower transactions fees between businesses (*TechInn: Architecture*). B2B Payments are presently very fragmented, but promise to offer both international and domestic efficiencies by reduction in transactional frictions between businesses.

B2B payments offer businesses convenience and reduced complexity for their invoice needs (*Agile: Niche Fulfilling*). Although not all B2B Payments offer a full range of factoring finance, accounting integration, and international fund transfers, many provide a full spectrum of services.

CAPITAL INTERMEDIATION

Capital Intermediation is comprised of FinTech firms that fill a classical intermediary role. FinTech firms compete with the full-service banks, the lending arm of traditional banking, and insurance companies. There are three categories of FinTech firms within the capital intermediation area, including digital banks, InsurTechs, and LendTechs. FinTechs offer swift processing with a high degree of personalization fulfilling niche market demands, which are currently underserved by traditional intermediaries.

Digital Banks

Digital banks are actively trying to displace incumbent banks (*FinSvc: Displacing*). Digital banks benefit from lower overhead costs by not hosting physical branches, which helps them reduce personnel costs. Instead, enhanced online and mobile interfaces are essential to digital banks. Digital banks have created a stronger presence in locales with lighter banking regulation easing the issuance of a banking license, and provide an attractive alternative for existing bank customers. Many digital banks provide financial intermediation and depository services to underserved customers, commonly in underdeveloped regions of the world (*FinSvc: Market Creating*).

Digital banks reduce the need for large bank staff (tellers and loan officers) by automating aspects of their respective functions using nascent technology (*TechInn: Nascent*). By utilizing application programming interfaces (API), digital banks provide increased integration of financial services. This makes the banking system more secure and API friendly, and creates more expansive offerings of banking services. Thus digital banks enhance architecture via mobile and online technologies (*TechInn: Architecture*).

Digital banks are foundational to the banking as a service (BaaS) ecosystem, which provides customer convenience through mobile and online banking (*Agile: Niche Fulfilling*). Digital banks include neobanks and challenger banks, which serve a more tech hungry customer base competing with an increasingly consolidated banking industry. Digital banks are closely connected to Bank API Techs. Digital banks provide APIs to Bank API Techs, that use them to develop mobile and online apps. Incumbent banks have been forced to compete, and have responded by offering APIs.

InsurTech

InsurTechs displace current financial services offered by insurance companies (*FinSvc: Displacing*). InsurTechs provide liquidity for hedgers which was previously difficult to secure through traditional insurance channels. In addition, customers can purchase insurance policies not previously sold by traditional insurers (*FinSvc: Market Creating*).

InsurTechs use machine learning models to perform automatic risk assessment. Additionally, InsurTechs use artificial intelligence, a specific type of machine learning, automating the function of insurance agents. This degree of automation reduces time spent by the client seeking insurance and risk assessment by the FinTech (*TechInn: Nascent*).

InsurTechs create more tailored policies with less reliance on actuarial tables, in deference to more specialized models, by making better use of market signals for niche policies providing

specialized hedging (*Agile: Niche Fulfilling*). InsurTechs emphasize convenience and nearly instant coverage via an app or a website. The speed of policy issuance and finer categories of insurance rating, make these FinTechs attractive to customers. Existing insurance providers have been slow to adapt to the business model of InsurTechs given legacy systems of underwriting and higher risks associated with narrowing actuarial pools of risk.

LendTech

LendTechs are FinTech firms offering lending services without middlemen. LendTechs displace traditional lenders of financial services, often banks (*FinSvc: Displacing*). Without the need for physical locations, LendTechs operate with lower overhead than traditional lenders. LendTech lending also provides access to unique categories of risk that lenders would otherwise not have access to (*FinSvc: Market Creating*). Due to the smaller size of these loans, many LendTechs penetrate markets underserved by traditional banks (Jagtiani and Lemieux, 2018).

LendTechs provide a platform for lenders to lend money, generally, to a specific type of client. This client will have particular risk qualities that the investors find suitable for their portfolio. In this sense LendTechs are an architectural innovation (*TechInn: Architecture*). LendTechs commonly act in conjunction with CreditTechs, covered later in this section, which facilitates automated loan approval processes (*TechInn: Nascent*). As loan brokers, LendTechs do not offer protection from counterparty risk.

LendTechs allow the convenience of online loan submission and provide shorter expected processing time (*Agile: Niche Fulfilling*). Often, a loan will be processed automatically with instant approval or rejection. The LendTech subindustry avoids regulation because they serve a loan brokers, but do not carry the loan assets themselves. Furthermore, LendTechs are not registered as financial firms and there are concerns whether LendTechs follow the Fair Credit Reporting Act (*Agile: Regulation Avoiding*). Finally, Everett (2015) noted that reduced transparency in social lending markets affects the propensity of lenders to transfer savings to customers.

INVESTTECH

This framework groups all the FinTechs related to equities under the category InvestTech. Traditional finance firms these FinTechs compete with are firms engaged in equity valuation, equity issuance, portfolio planning, and advisory services related to financial planning. Although crowdfunding is also a form of intermediation, it is more closely related to the other FinTechs in this category than those listed in the capital intermediation category. There are four categories of FinTech firms within the InvestTech area, including algorithmic trading, crowdfunding, financial intelligence, and investment apps.

Algorithmic Trading

Algorithmic Trading (AT) firms use automated rules to make investment decisions which are placed automatically. Rules may be selected by a human or formulated from a data intensive model. To be considered AT, a majority of the trades should be algorithmically selected and automatically executed. AT includes high frequency trading (HFT), which has experienced regulatory scrutiny (Kirilenko et al., 2017). HFTs are trading firms that operate algorithmically on a combination of

alternative data signals and very short-term trends in asset prices. HFTs place a high volume of trades for very short durations and displace traditional investment firms more reliant on experienced analysts (*FinSvc: Displacing*).

AT, through HFTs, have developed more tech capable exchanges. Exchanges with better tech in combination with higher trade volume may lead to reduced trade latency and improved price discovery (*TechInn: Architecture*). AT automates trading decisions in funds of various sizes by using algorithms to assess risk of the current portfolio with a combination of historic data and real time signals. While AT as a broad group is still a nascent degree of automation, HFTs are already moving close to the *Status Quo* level of technology (*TechInn: Nascent*).

AT must be very data nimble to maintain an investing edge (*Agile: Data Nimble*). To stay ahead of the data intensive securities markets, algo traders specialize in finding relevant data faster, developing unique data sources, and deploying advances in algorithms to extract financial buy or sell signals from data.

Crowdfunding

Crowdfunding offers peer-to-peer (P2P) platforms for pooled funding as an equity-like claim, rather than lending as in LendTech. In this vein, crowdfunding seeks to generate income from transaction fees associated with their platform, are likely to be web-based companies, and provide limited oversight over transactions.

Crowdfunding creates a market that did not previously exist (*FinSvc: Market Creating*). Crowdfunding enables investors to band together to accomplish a financial goal. Assets are as varied as investors demand, and crowdfunding platforms tend to specialize in a particular type of asset.

Crowdfunders serve as automated brokers enabling funders to find each other more easily, and to reach their funding target (*TechInn: Nascent*). This can be jointly buying real estate with the expectation of a positive return. It could also be helping an individual pay for medical bills with no expectation of being repaid like on GoFundMe.

Crowdfunding reflects agility in filling a niche need (*Agile: Niche Fulfilling*). Crowdfunding is the equity corollary to microfinancing. Microfinance provides small amounts of credit to small businesses. Crowdfunding also serves small businesses, but through equity rather than credit. For example, investors can fund camping R&D on Kickstarter for \$100, and if the product reaches production then they would receive the product.

Financial Intelligence

Financial Intelligence (FinIntel) creates new data signals for trading clients. FinIntels gather information from private sources, or aggregate, process and analyze public data with proprietary expertise to create new signals. Customers include financial institutions, HFTs, and fortune 500 companies (*FinSvc: Complementing*). Dugast and Foucault (2018) note FinIntels also compete with established firms like Reuters and Bloomberg providing similar services (*FinSvc: Displacing*).

FinIntels automate data aggregation and processing focused on finding unique data sources, and develop new signals from data that others may already have (*TechInn: Nascent*). The signals may

contain information that yields better price discovery. Firms have been willing to buy these new signals suggesting there is increased explanatory power.

FinIntels focus on creative data sourcing, feature engineering, and use of more advanced models (*Agile: Data Nimble*). FinIntels sell raw data, cleaned data, or investing intelligence created from their unique data. Their business model relies on convincing firms to buy their data over their similar competitors.

Investment Apps

Investment apps include robo-advising services, but offer a broader array of financial services than just robo-advising. Investment apps can be website or smartphone based, and serve retail and institutional investors. Investment apps are applications that facilitate investments and may also offer advice in the platform. For example, a robo-advisor may suggest investors review their fixed income allocation while in the electronic brokerage interface, where the investment app would provide the interface to the platform.

Investment app firms either complement or displace existing financial services. When acting as supporting agents they complement banks or brokerages (*FinSvc: Complementing*). When acting as independent agents they displace brokerages (*FinSvc: Displacing*). Most investment app firms focus on only one of these areas. Robinhood is unique in that it sells order flow to HFTs which complements the HFT industry and simultaneously displaces business of other brokerage firms by providing an alternative trading platform.

Investment app firms reflect nascent technology through high degrees of automation (*TechInn: Nascent*). For example, if an investment platform prompts a customer to revisit their asset allocation, it is likely an investment app firm that created the smart technology for that prompt.

Investment app firms provide brokerage services and the accompanying investor services to customers who prefer their brokerage to be mobile. If the app is not current and user-friendly, they will lose their customer base so they must be very agile and customer focused (*Agile: Niche Fulfilling*).

INFRASTRUCTURE

Infrastructure is comprised of FinTech Firms which fill auxiliary roles related closely to financial services. Unlike Chen et al. (2019) who classify cybersecurity as FinTech, this paper does not identify these as FinTech. FinTech firms must satisfy three dimensions: financial, technological and agile. Cybersecurity is agile and technological, but not primarily financial. Infrastructure FinTech firms which satisfy this definition include: CreditTechs, Financial API Techs, and Financial RegTechs.

CreditTechs

CreditTechs serve an underserved market, permitting loans to be made to customers who do not have traditional credit profiles (*FinSvc: Market Creating*). CreditTechs also give traditional lenders and LendTechs the ability to better assess credit worthiness of potential clients, or may act as middlemen for the bank or LendTechs (*FinSvc: Complementing*).

CreditTechs automate non-traditional sources of consumer data to develop metrics of financial character (*TechInn: Nascent*). For example, using tone, sentence structure, and topics of social media posts to predict default risk, or using spending habits voluntarily offered from one's bank account via a bank API to help a creditor assess their ability to repay a loan.

CreditTechs locate and use sources of data that banks, LendTechs, or other creditors do not. Their data inferences for credit scoring must be accurate to enable repeat business from creditor's purchasing their credit scores (*Agile: Data Nimble*). CreditTechs fill niche markets, providing the opportunity for creditors to take unique risks (*Agile: Niche Fulfilling*). CreditTechs enable borrowers to receive credit they otherwise may not have been able to access.

Financial API Techs

Financial API Techs provide an application programming interface (API) between the financial services firms and external parties (*FinSvc: Complementing*). For example, a Financial API Tech provides the infrastructure between a bank and an investment app, providing a more convenient banking experience. Financial API Techs are an essential part of digital banks.

Financial API Techs extend the reach and usefulness of financial institution's internal data (*TechInn: Architecture*). The API is a new structure that enable more seamless communication of data to customers in an intelligent and secure manner.

Financial API Techs reflect agility through niche fulfillment of individuals and institutions (*Agile: Niche Fulfilling*). For example, if a Bloomberg customer downloads data from Bloomberg, the coding used in Excel to accomplish this is a Finance API. Similarly, a bank that implements a suite of FinTech investment apps, could do so through a Financial API Tech as the intermediary. APIs must be maintained to serve the information currently relevant to the customers niche interests.

Financial RegTech

Financial RegTechs (FinRegTechs) offer services to businesses and financial services firms to help them with their regulatory needs related to finance. FinRegTechs focus on data collection, storage, and reporting. Protocols such as software-as-a-service (SaaS), Anti-Money Laundering (AML), and Know Your Customer (KYC) are provided by FinRegTechs. FinRegTechs serve existing financial service firms automating regulatory tracking and compliance (*FinSvc: Complementing*).

For large firms, entire units of employees are devoted to compliance with financial regulation. For large incumbents, FinTechs automate a very data intensive and sensitive compliance process (*TechInn: Nascent*). FinRegTechs automatically parse new regulation to help find potentially relevant changes faster than humans can. Although, FinRegTechs do not eliminate the need for regulatory compliance, it automates processes related to regulatory changes, and streamline the regulatory reporting process.

FinRegTechs quickly process numerous new regulations, often from multiple regulatory bodies (*Agile: Data Nimble*). FinRegTechs assist firms in data analysis and reporting in response to new financial regulation, assisting firms in defending data collection and analysis practices that may be called into question.

6 Discussion

This section now addresses topics commonly thought to be associated with FinTech: blockchain technology, light regulatory touch, and the disruptive nature of FinTech. Assumptions about FinTech often center around these topics and while intuition might suggest they are necessarily associated with FinTech, this section addresses why this is not necessarily so. This section also addresses why Business-to-Consumer firms do not satisfy the definition of FinTech firms.

Some FinTech studies consider blockchain to be a necessary technology to qualify as a FinTech. The only FinTechs that operate primarily with blockchain technology are cryptocurrency firms. Cryptocurrency firms qualify as FinTechs based on more than a mere use of blockchain technology. Blockchain technology is FinTech applied to a fraction of FinTech firms, and is not a necessary technology to qualify as a FinTech.

The FinTech industry initially escaped the notice of regulators. Perhaps because the industry may not have been viewed as financial in nature, but rather purely technological, financial regulation was not applied. Regulators have caught up, as noted by the involvement of the Financial Standards Board, the Financial Industry Regulatory Authority, the Commodity Futures Trading Commission, and numerous industry self-regulatory bodies (The International Token Standardization Association, the Association for National Numbering Agencies, and the Global Digital Finance Group.)

It is commonly thought that FinTech firms are disruptive. However, this paper asserts that disruption is not necessarily an aspect of FinTech, showing that FinTechs serve finance in three ways: complementing existing financial services, displacing existing financial services, and creating new markets. While some FinTech firms have displaced existing financial services not all FinTech firms displace. Rather, those that have displaced, have spurred existing financial services to adopt technology which serves the markets rather than damaging them. Indeed, Teixeira and Piechota (2019) assert that technologies *per se* are not disruptive, but rather changing customer behavior and demand is the real disruptor.

This paper did not consider Business-to-Customer (B2C) payment systems to be a FinTech subindustry. The service provided is financial, but the larger firms presently serving this market segment (Apple, PayPal, and WeChat) have business models which do not exist primarily in the *Bleeding Edge* level of technology, a necessary attribute of being FinTech

7 Conclusion

FinTech is technology used to provide financial markets a financial product or financial service, characterized by sophisticated technology relative to existing technology in that market. The sophisticated technology is characterized as *Bleeding Edge* technology. Firms that primarily use FinTech are classified as FinTech firms. Based on these definitions, this paper offered an organization for the FinTech industry and a description of each FinTech subindustry. This classification approach uses the definition of FinTech to categorize and classify FinTech firms ultimately offering an industry organization for this emerging area. This framework provides a foundation for further research on FinTech firms and the FinTech industry.

Finally, it is natural to consider whether it is true that, “Once a FinTech, always a FinTech?” Firms that this paper classifies as FinTech in 2020 may not survive as FinTechs over the longer term, as they must maintain their technological agility to remain classified as FinTechs. While very large FinTechs do not yet exist (indeed most FinTechs are not even public yet) there is precedence in the technology industry for the possibility of their creation. Indeed, multi-line technology conglomerates from the tech industry (AMD, Intel, Nvidia, and TSMC) maintain technological agility as large cap firms. It is feasible FinTechs will grow into large firms, as long as they maintain agility by expanding operations through new *Bleeding Edge* technologies.

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