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ASOCIACIÓN DE SUPERVISORES BANCARIOS DE LAS AMÉRICAS

AN OVERVIEW OF FINTECHS: THEIR BENEFITS AND RISKS

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An Overview of FinTechs, their Benefits and Risks

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I. INTRODUCTION

The financial ecosystem is changing rapidly due to the increased use of information technologies by financial institutions and new competitors. Traditional financial companies are modernizing their operations, and new competitors are concentrating their activities on information technologies. Moreover, fintech services are accessible from anywhere and at any time through online or mobile platforms. Some companies provide products and services offered by traditional financial entities such as payment processing, trading and investment, portfolio management, credit granting, and capital raising applying technology in innovative ways to enhance their operations. Other fintech firms provide new products such as cryptocurrencies. The growth of fintech is a global phenomenon supported by venture capital on fintech start-ups.

Although currently low, fintech developments entail new advantages and risks for consumers as well as new challenges for financial sector regulators and supervisors. However, the speed of the new developments is generating a knowledge gap that this document tries to reduce, through:

i. describing and classifying the different fintech products and services,
ii. identifying their potential benefits and risks for the financial sector, and
iii. providing examples of potential regulatory and supervisory approaches

By doing so, regulators and supervisors may have a better understanding of this phenomenon, would be informed of the risks to monitor, and may initiate the dialogue towards the identification of best regulatory and supervisory practices for the responsible adoption of fintech in their markets.

The expansion of fintech brings about efficiency gains, but it also carries intensified or new risks. Often, fintech services are characterized by their cost efficiency, lower information assymetries, faster operative processes, and increased client-centeredness. However, at the same time, the growth of fintech exacerbates cyber-risk, and the perceived potential of information theft, fraud, and money laundering.

Supervisory authorities recognize that regulatory and supervisory frameworks must be adapted to the rapid expansion of fintech. Nearly all ASBA's Associate Members identify the management of technological and cyber-security risks as an ongoing concern in a 2017 survey on Regulatory and Banking Supervision Expectations in the Americas. Moreover, the Basel Committee on Banking Supervision issued a consultative document about the implications of fintech developments for banks and bank supervisors in August 2017.[1] Also, some jurisdictions have already implemented regulations and supervisory practices aimed at overseeing specific fintech services.

Consequently, this report is organized as follows. Section II explores the technological innovations that support the development, functioning, and provision of new financial business models. Section III describes fintech products and services, identifies their potential benefits and risks, and provides some examples and insights of current regulatory frameworks addressing innovation. Finally, section IV advances some preliminary conclusions.

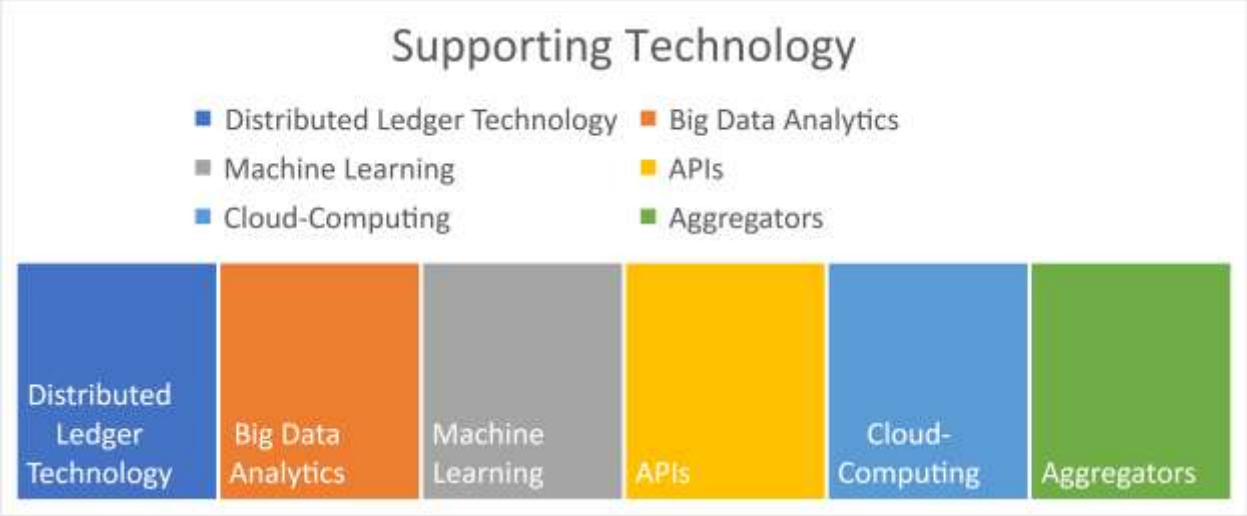
BCBS's definition of FinTech: Technologically enabled financial innovation that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions and the provision of financial services." (Basel Committee on Banking Supervision, 2017.)

[1] Basel Committee on Banking Supervision, 2017. "Sound Practices: implications of fintech developments for banks and bank supervisors." Basel, Switzerland.

II. Market Support Services

Most fintech companies interact with their customers through platforms that are accessible through internet browsers and mobile applications. The design and operation of these platforms depend on recently developed information technologies. The leading technologies supporting the provision of fintech services are APIs, aggregators, cloud-computing, machine learning, big data analytics, and distributed ledger technologies. Though widely used, these technologies remain relatively unknown to the public.

This section briefly describes these supporting technologies and illustrates how fintech companies exploit their characteristics to design and provide financial products and services.



1. Application Program Interfaces (APIs)

APIs are a set of routines, protocols, and computing resources which aim to create efficient methods of communication that allows the interaction with other systems. APIs are composed of two main elements. The first is a specification that describes how information is exchanged between systems, done in the form of a request for processing and a return of the necessary data. The second, is a software interface written to that specification and published in some way for use.[2]

In other words, APIs facilitate the interaction between two different systems. For example, APIs allow the user to access the libraries of a program through specific functions and procedures, allowing to access information and services that would otherwise be unreachable. APIs also prevent duplication of efforts because it is easier to access an existing API instead of creating a new library.

APIs are the most widely used technology by new competitors offering financial technology services. The latter is due to their capacity to integrate services from different supporting technologies through processes and functions,

[2] http://searchmicroservices.techtarget.com/definition/application-program-interface-API

and then publish the result wrapped on an easy-use graphical interface for costumers, enabling financial actors to access significant amounts of products, services, and information in real time and at a lower cost.

Traditional financial institutions understand that they must develop their digital capabilities to avoid being displaced by new entrants with more attractive products and services. Open banking APIs are a new channel of doing business in the new financial ecosystem, and an alternative for traditional institutions to compete in it. Through adopting and deploying APIs, financial institutions can extend and enhance their services and offerings. For example, many financial services firms are embracing open banking initiatives; this includes PayPal, Wells Fargo, and Visa. [3]

However, a potential disadvantage of APIs is that they are accessible by anyone. Thus, sensitive information or procedures might not be able to be integrated into APIs.

2. AGGREGATORS

An aggregator is any device that provides multiple services to other devices or users either with its capabilities or by forwarding transmissions in a more concentrated and efficient way. A typical aggregator is a device that handles incoming dial-up calls for an Internet (or another network) POP and performs other services.

New financial companies and business models are using aggregation technology mainly for the provision of payments and settlements services. To place the innovation of aggregators in this context, traditional payment processing models set up merchants with their dedicated merchant accounts —a type of bank account required for businesses— to accept payments made with debit or credit cards. A merchant account is set under an agreement between an acceptor and a merchant acquiring bank for the settlement of card transactions. Conversely, a payment aggregator is a "master" merchant-facilitating credit and debit card transactions for sub-merchants within the same payment ecosystem.

Processing aggregators allow merchants to accept credit card and bank transfers without having to set up their merchant account. They pool a group of merchants together into an aggregation and each merchant processes payments within a joint merchant account. Every payment involves at least three parties: The issuer or payer, the recipient or payee, and the party that provides the instrument for the transaction. The aggregators' role is to integrate and enable transactions among parties, reducing transaction time and entry costs for small businesses.

Aggregators often use APIs to connect different parties, although they function in the background and do not directly engage with customers. Examples of fintech companies using aggregation technology are Paypal, ApplePay, and Square.

3. CLOUD COMPUTING

Cloud computing is an information technology model that consists of the provision and use of on-demand computing configurable resources (e.g., servers, storage, applications, and more.) via an internet network, as opposed to a physical connection to a server. Cloud computing services enable users to store information, processes, and data in servers that may be accessed through any computer with internet connection.

Based on their ownership and operability, it is possible to identify three types of cloud computing services: private, public and hybrid:

[3] "How Financial Service Firms Can Benefit from Open Banking APIs" https://www.mulesoft.com/resources/api/open-banking-apis-benefits

- Public clouds are owned and operated by a third-party provider and are available to the public. For this type of clouds, hardware, applications, and bandwidth costs are covered by the provider. However, the public cloud may not be fit for every organization.
- A private cloud consists of computing resources used exclusively by a business or organization delivering services from its data center to internal users. This approach is usually expensive and is mostly used by large enterprises.
- The hybrid approach is a combination of public and private operation of the cloud. Companies keep control of sensitive applications or data managed in the private cloud while relying on the public cloud when there is an overload or a sudden increase in the demand for computing resources.

Cloud services have affected many industries, including the financial services industry, despite having a comparatively slower technology adoption rate. Cloud computing may benefit the financial sector mainly by increasing the efficiency of internal company processes, which might translate in a price reduction for final users. Also, cloud-computing allows companies to have a central location to store, share, update and analyze data, which could enhance transparency.

Financial companies are recently partnering with cloud computing providers to operate a part of the operations, and sometimes to operate at all analyzing constantly-updated datasets, sometimes so massive that only specialized cloud-computing services can manage them in real time. For instance, Amazon Web Services (AWS) partnered with Singapore's DBS bank to help them accelerate their digitization as well as the Spanish bank Bankinter to run credit simulations and reduce the computing time for these simulations from 23 hours to 20 minutes. Also, IBM Cloud is working with the Japanese bank Mizuho to offer payment services tailored to customers' needs and tastes through the development of APIs.

The financial sector has shown greater hesitation in using cloud services, security, and data privacy, since meeting compliance standards is its primary concern in the adoption of cloud support services. However, during 2016 and 2017, the rate of adoption of this technology within traditional financial companies and fintechs has sharply increased.[4] The former could indicate, not only the entry of new competitors using the cloud in the financial environment but the use of cloud computing as an ordinary supporting service for both, traditional financial companies and fintech companies.

4. Machine Learning

Machine learning refers to computers with the ability to learn without having to be explicitly reprogrammed through a set of self-optimizing data-analysis algorithms. Machine learning methods are being developed since the 1950s and 1960s, but their commercial usage was popularized just in the last decade. Usually, machine learning algorithms are used for predicting rather than explaining the behavior of variables. For instance, consider an analysis of the number of users of a mass-transit system: machine learning methods would not be used to explain the causal effect of other variables on the current number of users; instead, they would be used to predict the number of users at some future date.

In the financial sector, both traditional companies and fintech competitors use machine learning methods to provide trading and investment counseling and optimization of portfolio management. Both counseling and portfolio management optimization receive inputs from machine learning methods that consist of predictions of the prices of stocks and other financial assets. In some cases, both counseling and portfolio management optimization are entirely automatized and carried out by machine learning algorithms.

[4] Peak 10 Financial Services and IT Study: Tackling the Digital Transformation, Peak 10

Industry insiders estimate that investment companies that use only machine learning methods to make trade decisions manage around 10 billion USD in assets. [5]

Quant funds, [6] which use machine learning methods but do not disclose the proportion of their transactions carried out following exclusively information produced by these methods, manage 2.5% of the 40 trillion USD of assets administered by mutual funds. The proportion of assets that they manage has remained constant since before the financial crisis, but the proportion of mutual fund transactions carried out by them has risen from 13% in 2013 to 27% in 2016. [7] This increase could signal that machine learning methods now provide the sole input to trigger a more significant share of transactions than some years ago.

5. Big Data Analytics

Big data analytics encompasses data analysis activities that share three common characteristics that differentiate it from traditional data analytics. First, traditional data analysis studies information gathered for specific purposes, while big data analysis also examines data that is a byproduct of the functioning of traditional business systems and public agencies, social networks, the internet of things, and sensors. For example, traditional data analysis deals with information from census, surveys, or financial books data, while big data analysis studies data about customer purchasing histories, interactions between users of social networks, and web-page visitors clicking registries.

Second, traditional data analysis is made with a single computer, whether it is a small personal computer or a large mainframe, while big data analysis is carried out by two or more computers networked through traditional connections or cloud computing services.

Third, traditional data analysis employs structured data, while big data analysis also inspects unstructured data. Rather than through technical definitions, the difference between structured and unstructured data may be better understood through an example. Structured data is usually stored in organized arrangements, such as the format of spreadsheets and tables. Unstructured data is saved in plainer schemes, such as the format of text files or even images. Big data analytics includes the techniques to structure unstructured data or analyze unstructured data directly.

An increasing number of private companies and public entities are using big data analytics. Their purposes are diverse and include predicting whether a customer is pregnant[8] and forecasting the location of potential crimes.[9]

Financial services companies employ big data analytics to optimize operations to increase profits and satisfy regulatory and supervisory requirements.[10] For example, they analyze the purchasing habits of critical customers to offer them tailored credit plans and examine billions of transactions to detect possible illicit activities. Usually, the specific statistical techniques underlying these analyses stem from machine learning methods.

Detailed data about the number of financial institutions using big data analytics is not available. However, a 2012 survey of 111 financial institutions, arguably operating in advanced or emerging markets, revealed that 75% of those institutions were using or implementing big data analytics.[11] It is reasonable to expect that the proportion of financial

5 Financial Stability Board, "Artificial intelligence and machine learning in financial services", 2017.
6 Quant funds are investment funds that determine some of their investment decisions by using quantitative methods rather than human judgment
7 Financial Stability Board, "Artificial intelligence and machine learning in financial services", 2017.
8 "How Target Figured Out A Teen Girl Was Pregnant Before Her Father Did", Forbes, Accessed November 17, , 2017, https://www.forbes.com/sites/kashmirhill/2012/02/16/how-target-figured-out-a-teen-girl-was-pregnant-before-her-father-did/#929a25266686.
9 Brayne, Sarah, "Big Data Surveillance: The Case of Policing", American Sociological Review, Vol.82, Issue 5, 2017.
10 "Analytics: The real-world uses of big data in financial services", IBM and Said School of Business, 2012.
11 Idem.

institutions using big data analytics and the extent to which they use them are currently at least as large as when that survey was responded.

6. Distributed Ledger Technology (DLT)

DLT is an information technology model that stores information in registries owned by every computer linked to a specific network, where computers are located. Such data is shared, replicated, validated, and synchronized across every computer which is part of the network. DLTs are decentralized, and this differentiates this technology from traditional databases and information storage procedures. This implies that no central party can directly control or manipulate the network.

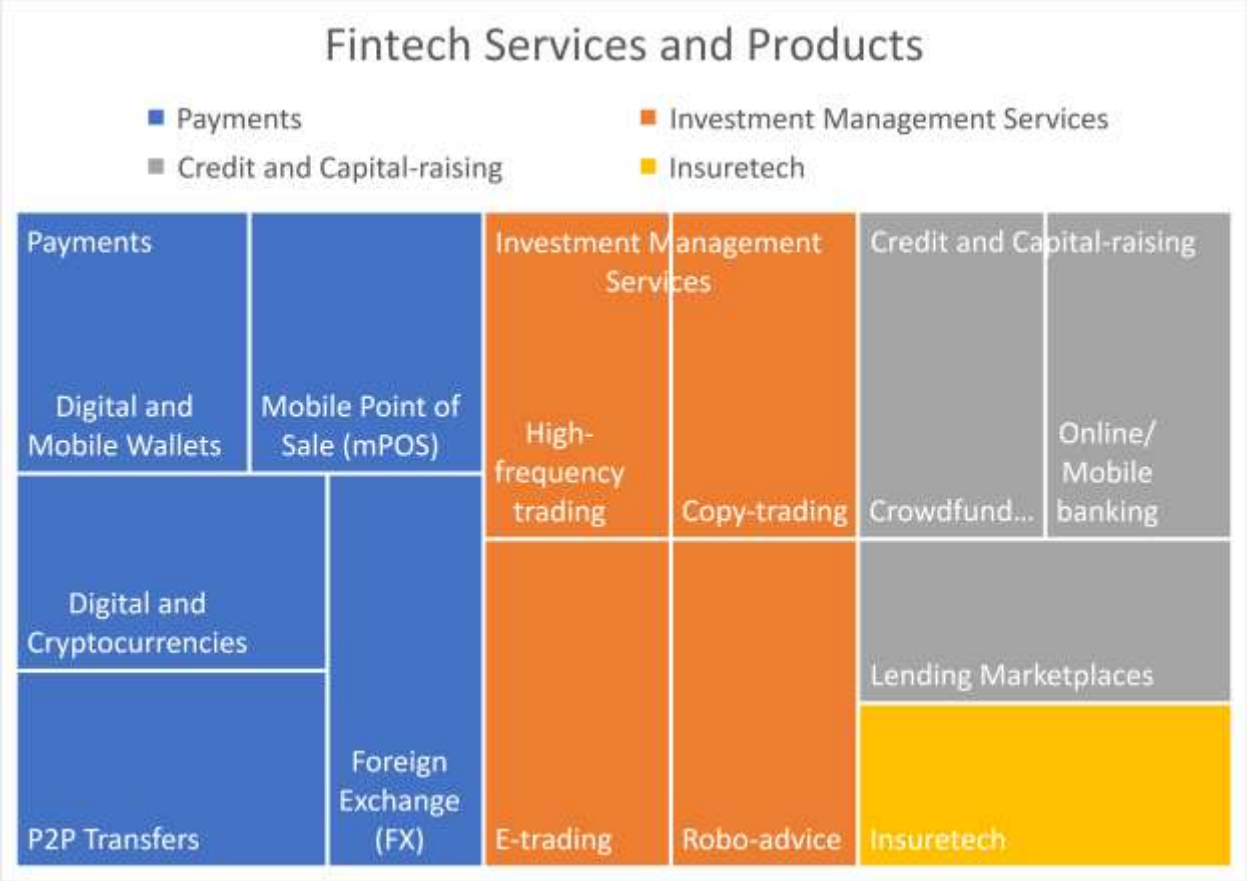
DLT require well-defined consensus and synchronization algorithms to work. This ensures that information is consistent across all the computers in the network, and enables the registry of changes in the system. Thus, information in the DLT is updated based on the information stored in each of the computers in the network.

One example of a popular DLT in the financial system is blockchain, which is the technology behind cryptocurrencies, most notably Bitcoin. More information about the relationship between blockchain and internet currencies is provided in the subsection about cryptocurrencies in Section 4.

III. Fintech Services and Products

This section classifies and describes fintech products and services and identifies their benefits and risks. The section also contributes brief descriptions of specific fintech providers as well as regulatory and supervisory approaches around the globe. Also, some recent news about the materialization of fintech risks is reported for each type of fintech service.

This paper classifies fintechs into three categories according to the service they offer: Payment and settlement services; investment management services; and credit, deposit, and capital raising. ASBA includes insuretech as an additional service.



1. Payments, Clearing and Settlement Services.

Traditional banking institutions provide payment systems to settle financial transactions. Typically, these transactions consist of transferring money from a buyer's bank account to a seller's bank account. Payment transactions supported by the traditional system include purchases with debit and credit cards through wired terminals and electronic transfers. Fintech has developed services to complement the relationship between the widely-used traditional banking payment system and the final customers.

Fintech developments provide services that overcome some of the restrictions of the traditional payments system. Some of these restrictions are geographical barriers, the need to go to a bank to carry out transactions, and bank's service hours. These services are digital and mobile wallets, mobile points of sale, and peer to peer transfers.

1.1 Digital Wallets and Mobile Wallets

Digital wallets are platforms, accessible from web browsers and applications, used to conduct online payments. Users link the platform to different payment options originated by the traditional payment system, such as debit or credit cards, coupons, gift or loyalty cards, among others.[12] Users select their preferred payment option linked to

[12] Jordan Whitehouse, 'Types of eCommerce Payment Systems,' *Techwalla*, 2017, accessed March 4, 2017, https://www.techwalla.com/articles/types-of-ecommerce-payment-systems

the platform to pay sellers open to receiving payments through digital wallets. The platform then performs all the transactions related to the payment, such as, for example, the transferring of funds from the bank account associated with the selected debit card to the seller's bank account.

Mobile wallets are digital wallets accessible from mobile phone applications. Mobile wallets sometimes carry digitized versions of credit or debit cards, besides the services of a digital wallet.

Platforms providing digital or mobile wallets often do not disclose information about purchasers' selected payment options to the sellers. That is, the seller is informed about the purchaser's identity, but not about the specific credit or debit card used. Meanwhile, users can consult a registry with detailed information about the transactions conducted through the platform.

Mobile wallets are enjoying increasing adoption. The number of users of digital wallets continues growing because the centralization of payment options leads to a shorter purchase processing time. Payments made via mobile devices in the United States are expected to total $90 billion by 2017, a significant jump from the $12.8 billion spent in 2012, according to Forrester Research.[13]

However, the centralization payment methods information has led to security concerns about the increased likelihood of information theft. For instance, in India, fraudulent transactions through mobile wallets are estimated at 1% of the market at present, and experts expect them to rise to more than 2% in a couple of years when the customer base widens. However, digital wallets providers have responded by enhancing the security checks of their platforms via including temporary tokens and biometric revisions.

[13] "Mobile Wallets: The New Fraud Frontier" http://www.infosectoday.com/Articles/Mobile-Wallets.htm#.WgCLX2jWy70

Some providers of digital/mobile wallets

PayPal: PayPal is a digital payments platform that allows users to connect and transact online, on mobile devices, in an app, or in person. PayPal allows users to add their credit, debit and bank accounts with the option to select either when making or receiving payments. PayPal is available in more than 200 countries and enables customers to receive money in more than 100 currencies, withdraw funds in 56 currencies, and hold balances in 25 currencies. The company claims to have processed payments for a value of over 99 billion USD during the first quarter of 2017.

https://www.paypal.com/us/webapps/mpp/what-can-paypal-do

Square Cash: Square Cash provides a service to make payments to anyone. Cash is saved in the app or might be directly deposited in bank accounts. Square Cash provides a free customizable Cash Card to use as a debit card.

https://cash.me/

Google Wallet: Google Wallet provides services to send money through their app, Gmail or on the web using the receiver's email address or mobile phone. The receiver can decide where to store any money received by this service. In addition, Google Wallet allows customers to use their Wallet for commercial transactions.

https://www.google.com/wallet/

Guiabolso: Guiabolso is a digital wallet available in Brazil to which users can link different payment options. Guiabolso also tracks spending. The wallet is designed to foster savings. Guiabolso claims to have over 3 million users. Guiabolso secured venture capital investments of 19.2 million USD in the fourth quarter of 2016. According to the KPMG 2016-Q4 Pulse of Fintech report, this investment was the 25th largest venture capital investment in fintech companies in the world during that quarter.

https://www.guiabolso.com.br/

1.2 Mobile Point of Sale (mPOS)

MPOS serve the same purpose as debit and credit card payment terminals. However, there are three main differences between mPOS and traditional POS: connection, portability, and ownership.

MPOS are connected to the banking network differently from traditional POS. Traditional terminals are directly linked to bank networks through phone or internet connections, while mPOS are connected to mobile phones through audio jacks or Bluetooth so that fintech companies link them to bank networks.

MPOS are more portable than traditional POS. MPOS enable merchants to take payments in every place where an internet connection is available, whereas traditional POs systems must remain stationary at a checkout lane.

Traditional POS are owned by the businesses employing them, while mPOS are owned by the fintech companies providing them. Many mPOS software packages are cloud-based, which means that businesses employing them do not have control over the server and security infrastructure.

MPOS have the disadvantage that clients might be reluctant to use this services due to concerns about fintech providers misusing the information of their debit or credit cards.

Some providers of mPOS

Clip: Clip is a Mexican start-up that offers a mPOS that allows businesses to read credit and debit cards through a card reader compatible with smartphones and tablets with internet connection. Clip enables businesses to accept interest-free monthly payments. According to the IDB 2017 Fintech report, Clip has raised over 37 million USD in venture capital.

https://clip.mx/

iZettle: iZettle offers card readers that connect to mobile phones and tablets by Bluetooth. iZettle allows businesses to charge credit and debit cards as long as the device has internet connections. In addition, iZettle offers a special set of tools for restaurants to manage tables, bills, track orders, manage inventory, and provide business analytics. iZettle charges a fee between 2.75% and 1% per transaction, decreasing as the business monthly sales go up.

https://www.izettle.com/mx

https://www.izettle.com/mx/epos-para-restaurantes-bares-cafes

1.3 Peer to Peer (P2P) Transfers

P2P transfer services provide digital or mobile wallets so that users transfer money between any two wallets within the platform. Typically, a user adds funds to her or his wallet by depositing money in a bank account associated with the P2P transfer company. To make a P2P transfer, the service provider charges a fee to subtract money from the sending user's wallet, and add money to the receiving user's wallet; the later means that the process does not require money transfers from bank to bank, since the money associated with both wallets is part of the provider's payment ecosystem.

Transfers made by fintech companies are both cheaper and faster than those made by traditional competitors. Traditional providers serve clients mainly in physical branches and perform several security checks. Meanwhile, P2P transfer services perform fewer security checks and serve customers exclusively through online or mobile platforms. Therefore, fintech P2P transfer services incur lower operating costs and can charge lower fees than traditional providers; thus, their market share is growing.

P2P transfer services' market share is growing but is probably capped. On the one hand, some transfer clients are willing to pay higher prices and wait for lengthier transactions in exchange for additional security checks. On the other, investors expect that regulatory catch-up will increase the regulatory requirements to fintech transfer companies, thereby increasing companies' costs and decreasing investors' profits. However, some traditional companies are partnering with fintech competitors or acquiring them to modernize operations and regain market share offering services to underserved or unserved populations.

Some providers of peer-to-peer transfer services

WorldRemit: WorldRemit allows users to send money to over 125 countries; to select how to send money (cash, bank deposit, mobile money); the amount to send; and how to make the payment (bank account or credit/debit card).

https://www.worldremit.com/en/how-it-works

TransferWise: TransferWise provides money-sending services using the real (mid-market) exchange ratio for transactions. TransferWise guarantees the agreed exchange rate if the company receives the payment within 24 hours. TransferWise updates users at each step of the transaction.

https://transferwise.com/es/

Remitly: Remitly is a digital remittance company headquartered in the US. Remitly allows people to send money from 3 countries (US, UK, Canada) and receive money in 10 countries (Philippines, India, Mexico, Colombia, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, and Peru). Remitly charges no fee for transfers over $500 and $3.99 fee for transactions under $500.

https://www.remitly.com/us/en/home/about_us

1.4 Foreign Exchange (FX)

The FX market is a global decentralized market where currencies are traded (buying, selling, and exchanging) at a market set rate. Investors usually participate in the FX market to generate value through the exchange rates movements. Market participants range from individuals, commercial companies, investment firms, and even central banks.

Traditional FX schemes work through financial institutions, where most of the exchange intermediaries are banks. Transactions in the FX market can be executed on spot, forward or swap basis. The value of currencies and exchanges rates is set by the interbank market which is the exact mid-point between a currency's buy and sell rate and includes no spread nor additional fees placed into the exchange rate. However, banks usually set rates and fees to their customers.

Banks tend to have expensive overheads and use fixed daily rates to cover their currency exposure. Therefore, they will typically give rates of up to 3-5% higher than the interbank rates to their customers. Transparency in the bank exchange rates is inadequate as banks usually do not disclose the real interbank rates. Therefore, the gap between the interbank rate and the bank rate is broad due to banks' revenues. The FX market works twenty-four hours a day, except on weekends, and it is by far the largest market in the world, followed by the credit market, in trading volume.

FX fintechs use P2P technology to match currencies from a country (usually small amounts) and make mirroring transfers with the foreign currency from another country through digital wallets or a digital platform that uses some asset-backed digital currency. Technological FX platforms have enabled money conversion in near real time, reducing the currency risk of fluctuating rates in the market and making FX fintechs often more efficient than traditional FX houses.

Fintechs provide low prices for small amounts of money but is usually expensive for larger amounts. The automation of the process and the reduction of intermediation costs allow fintechs to reduce fees. At the same time, technology enables companies to be more transparent with their pricing. For example, the Berry FX online conversion platform shows both the interbank market price and the customer price when a quote is requested; thus, clients are aware

of the spread. Some FX services provide exchange of cryptocurrencies, allowing customers to buy and sell different kinds of cryptocurrencies such as Bitcoins and Ethereum. One example of this service is Bitso.

Some providers of FX services

Bitso: Bitso offers buy and sell services for cryptocurrencies such as Bitcoins, Ethereum and Ripple. Bitso offers instantaneous exchange services, multi-platform services and APIs to interact with Bitcoin applications.

https://bitso.com

Kuarix: Kuarix is a Foreign Exchange and currency transfer company. Kuarix supports more than 140 currencies and mora than 200 countries. Kuarix carries transaction at the mid-market rate. Kuarix offers in addition free SWIFT payments around the world.

https://www.kuarix.com/

Kantox: Kantox offers currency and risk management solutions such as spot and forward transactions, international payments, market orders, dynamic hedging, payments hub, and an API. Kantox supports 35 currencies and 124 countries.

https://www.kantox.com/en/

1.5 DIGITAL/CRYPTO CURRENCIES

A cryptocurrency is defined as "a medium of exchange created and stored electronically, using encryption techniques, to control the creation of monetary units and to verify the transfer of funds, descentralized from the Central Bank."14 Owners of a given cryptocurrency own digital wallets to transfer and receive cryptocurrency units within a given cryptocurrency system. Cryptocurrencies are better understood by inspecting what differentiates them from traditional currencies and inspecting their origins.

Traditional currencies are physical or depend on centralized registries to avoid the "double-spending problem," which is the risk that money be spent twice. On the one hand, physical currencies overcome this problem because purchasing with physical bills implies transferring the property of the bills to the sellers. On the other, for example, banks mitigate this risk by maintaining updated ledgers: money is discounted from bank accounts whenever their owners pay with debit cards.

Digital currencies were unsuccessful, because they still required centralized control to update ledgers and overcome the "double-spending problem," until the release of a technology called blockchain in 2008. Blockchain is an application of cryptography (hence the term cryptocurrency) that was specifically designed to let internet currencies overcome the "double-spending problem" without requiring the supervision of a centralized party. Within a cryptocurrency system, the blockchain consists of a fraud-proof list of every transaction ever made in every computer connected to the network. Bitcoin achieves decentralization by providing incentives to owners of computers participating in the blockchain network.

[14]PwC, 'Money is no Object: understanding the evolving cryptocurrency market', *PwC financial services Institute* (2015):1, accessed March 22, 2017 http://www.pwc.com/us/en/financial-services/publications/assets/pwc-cryptocurrency-evolution.pdf

The cryptocurrency industry has proliferated since the creation of blockchain. Bitcoin, founded by the still-anonymous inventor or inventors of blockchain, is the most widely used cryptocurrency. The market cap of Bitcoin was estimated at 79 billion USD, and the market cap of all cryptocurrencies was valued at 150 billion USD in August 2017. The number of active users of cryptocurrency wallets is between 2.9 million and 5.8 million.[15]

How do blockchain and cryptocurrencies function? A detailed description of cryptocurrency systems is beyond the scope of this work. However, a brief and simplified description of the functioning of a cryptocurrency platform is provided in the next three paragraphs, which readers interested in the implications rather than the internal running of cryptocurrencies may skip.

Let us consider the Bitcoin platform. First, when a Bitcoin user wants to transfer funds to another account, he broadcasts the desired transaction to the entire decentralized network of computers of Bitcoin users. All the computers connected to the network can check if the user owns enough funds to perform the transaction because each of them owns a copy of the registry. Computers that have checked that a broadcasted transaction is feasible then compete to solve a cryptographic problem, with the computer first solving the problem receiving a fixed amount of bitcoin units as payment.

Second, once the problem is solved, the transaction is added to a tentative blockchain, which the receiver of funds must reject or approve. If the receiver rejects the transaction, the original blockchain remains unchanged, and the tentative blockchain is disposed of. However, if the transaction is approved, the blockchain is changed permanently. Typically, a user waits for subsequent transactions to be added to the tentative blockchain before accepting the transaction in which he was involved.

How does this system solve the double-spending problem? Subsequent transactions that have been added to the tentative blockchain without conflict mean that the fund's sender did not attempt to double-spend. On the other hand, the decentralization is such that a group of networked computers owned by a single owner cannot be expected to solve enough problems consecutively to defraud funds receivers.

The advantages of owning cryptocurrencies are mainly two. First, cryptocurrencies' transactions are cheaper than wire transfers. Second, the design of blockchain makes it virtually impossible to conduct fraudulent transactions, defined as transactions where senders attempt double-spending cryptocurrency units.[16]

Owning cryptocurrencies, however, has some drawbacks. First, transactions are irreversible, and users cannot complain to a specific entity if scams or hacker attacks occur. Second, the owners of accounts cannot be identified, meaning tracing those who conduct illicit activities could remain unknown. Finally, cryptocurrency transactions can only be performed within a given cryptocurrency system, and not across cryptocurrency systems.

Financial supervision and central bank authorities have some concerns about cryptocurrencies. First, most cryptocurrency platforms are designed so that the identities of account owners are never revealed. If illicit activities involve transaction carried out through cryptocurrency platforms, the perpetrators may not be identified. Second, monetary policymakers may become concerned with the supply of cryptocurrencies, which cannot be directly affected by monetary policy.

[15] https://www.coindesk.com/150-billion-total-cryptocurrency-market-cap-hits-new-time-high/
[16] However, in theory, if one party controlled more than 50% of the computers connected network, it could manipulate the system and validate fraudulent transactions. However, owners of computers connected to cryptocurrency networks actively avoid reaching such an ownership concentration.

Some Cryptocurrencies

Bitcoin: Bitcoin is a new form of money that used cryptography to control its creation and transactions. Bitcoin is a decentralized peer-to-peer payment network with no central authorities nor intermediaries. The BitCoin network is not owned by anyone and is controlled collectively (via blockchain) by all Bitcoin users.

https://bitcoin.org/en/faq#what-is-bitcoin

Ether: Ethereum is a descentralized platform that runs smart contracts. Ether is a cryptocurrency (although the webpage classifies it as a Cryptofuel since Ethereum intended use is within the Ethereum blockchain) used by clients to pay the machines for executing the requested operations.

https://www.ethereum.org/ether

1.6 RISKS

In the one hand, the risks of fintech payment services are the same as those of the traditional system, but there are also new risks unique to digital services.[17] In the other, the use of cryptocurrencies is affected by their limited acceptance and the high volatility of their value. Additionally, some countries have decided not to regulate the cryptocurrency industry while some jurisdictions have outright banned its use, including Bitcoin.

Operational Risk: Operational risk is the most significant risk type as it is strongly correlated with other risks. Operational risk results from inadequate or failed internal processes, people, and systems, or from external events. Three main operational breakpoints are identified in the failure of a digital payment process [18]:

- **Technology Failure**. It includes transaction delays due to the poor (or lack of) internet signal, or due to agents' devices not working, which might result in wrong data entry, error in systems' maintenance, execution failures, delivery failures, and process management failures. With increasing automatization of processes, the number of technology-linked breakpoints may grow if there is not a comprehensive classification and understanding of them.
- **Human Error**. It includes issues such as an agent or costumer inputting the wrong account number, selection of services (e.g., paying and insurance were not wanted) or providing the wrong amount. Most of the client's error might be caused by poor process design as there is not a standardized and functional guidance to provide the service.
- **Fraud.** Includes fraudulent or illicit activities in payment processes, such as draining of funds in the relation costumers-agents or by a third party.

Market risk: These currencies are subject to high exchange rate risks under both fixed and varying supply schemes, and to abrupt confidence shocks given that they do not hold any intrinsic value. For example, the value of a single unit of Bitcoin currency decreased from approximately 2500 USD to around 2000 USD in a seven-day period during July 2017 and reached almost 16000 USD in December 2017.

Legal risk: Supervisory agencies may choose to ban or regulate the use of cryptocurrencies in their jurisdiction. Then, users within these jurisdictions are exposed to asset losses.

[17] Ashta, A. (2017). Evolution of Mobile Banking Regulations: A Case Study on Legislator's Behavior. *Strategic Change*, *26*(1), 3-20.
[18] https://docs.gatesfoundation.org/documents/Assessing%20risk%20in%20digital%20payments%20FSP.pdf

Liquidity risk: The ongoing limited acceptance of cryptocurrencies hinders their use as media of exchange.

Criminal Use Risk: Payments may occur outside the regulated or monitored system making them attractive as channels or vehicles for criminal use due anonymity in some platforms.

Cybersecurity Risk: First, due to the open architecture of mobile devices and their susceptibility to malware, unencrypted confidential and personal information data can be compromised or leaked, and funds could be stolen through hacking activities. Transaction authorization, card authentication, transaction performance, and the security of the payment system must be addressed by regulators. Second, while blockchain is not prone to be attacked, some platforms must suspend activities when they are victims of hacking attacks, which can lead to cryptocurrency theft.

Strategic Risk. This risk impacts providers, who could lose current or future earnings due to some combination of changes in the business environment, poor business decisions, and imperfect implementation of decisions.

About fintech risks.

Taiwan, 2016. Bitfinex revealed it had been hacked and suspended trading, causing prices of the digital currency to fall significantly. A total of 119,756 bitcoins, worth $68 million at current prices, were reportedly stolen as a result of a security breach. The bitcoin exchange Bitfinex has said it is considering sharing losses among all its users. "Some users who were not hacked will feel angry at having to stump up their funds to cover shortfalls elsewhere on the exchange. Whether it's the right decision or not - time will tell," https://www.cnbc.com/2016/08/05/hacked-bitcoin-firm-plans-to-spread-losses-across-all-users.html

Tokyo, Japan, Oct 2017. Tokyo police arrested the head of a Ripple trading p2p platform, Yuki Takenaka, for allegedly swindling an investor amid a wider investigation of a sweeping fraud. The individual was arrested for allegedly swindling ¥1.4 million ($12,500 usd) from an investor persuaded into sending the cash into the exchange's bank account in March 2015. The cybercrime division of the Tokyo Metropolitan Police department is also investigating claims that Takenaka allegedly defrauded an additional ¥17 million ($150,000) from at least 40 customers in Japan after initially luring them with no deposit fees for trading. (https://www.cryptocoinsnews.com/japanese-police-arrest-ripple-exchange-operator-fraud/)

UK, Sep 2017. About human error. A man named Woods lost his job but he did not receive statutory redundancy pay because his bank account was mistyped on his online claim form ¨ […] Woods's case is a searing example of an increasingly common problem. As money transfers get easier thanks to online and mobile technology, the capacity for error increases and a slip of the finger can send thousands of pounds into oblivion. One Guardian reader lost two years' pay when she wrongly entered a single number of her bank account and dispatched £26,000 to an unknown person." (https://www.theguardian.com/money/2017/sep/25/worker-loses-home-car-bank-money-transfer-error)

United States, 2017. The price of ethereum crashed as low as 10 cents from around $319 in about a second on the GDAX cryptocurrency exchange on June 21, 2017; a move that is being blamed on a "multimillion dollar market sell" order. Ethereum traders were outraged by the crash blaming GDAX for not having proper controls, and even accusing whoever put the sell order in of market manipulation. And it was a painful experience for many. On the social forum Reddit, users complained of losing large sums of money from $3,000 to $9,000. https://www.cnbc.com/2017/06/22/ethereum-price-crash-10-cents-gdax-exchange-after-multimillion-dollar-trade.html

Regulation reference.

Europe. The EU framework governing fintech payments is reasonably mature and international FX payment services are the most harmonised product. the following are some examples of directives and regulations regarding the fintech products and services for payment and settlements:

- The regulation (EC) No.2560/2001. This Regulation was designed to put charges for cross-border payments in euros on the same footing as those for payments in that currency within a Member State. It sets a maximum amount of €50 000 and does not apply to cross-border payments between institutions for their own account. Cros-border payment comprises credit transfers, electronic transactions and cheques.
- The Directive 2009/110/EC pursuit the prudential supervision of e-money institutions. Agents can distribute and manage payments with e-money but not to issue. E-money institutions are subject to AML and CFT rules. Minimum capital is required to operate with e-money.
- Payment Services Directive (PSD2). The directive seeks to improve the existing EU rules for electronic payments. It considers emerging and innovative payment services, such as internet and mobile payments setting out rules concerning security requirements for electronic payments, transparency, and right and obligations for users and providers. EU countries must incorporate it into national law by 13 January 2018.

Kenya. Mobile money represents the largest segment of payment flows as a percentage of GDP in Kenya (49% in 2013). To face this challenge, Central Bank of Kenya (CBK) developed a regulatory framework for digital payments.

- In 2009, the Kenyan Banking Act was amended to include provisions on financial institution's use of agents to provide banking services through digital technology. Banks need to provide CBK detailed information about the agent in compliance with the KYC requirements, then they need to obtain CBK approval.
- In 2013 CBK passed an e-money regulation, regarding authorization of e-money issuers, payments providers, liquid assets requirements for providers and consumer protection.
- A range of Kenyan information and communications regulations made by the Minister in charge of Information and Communications in tandem with the Communications Authority to regulate various aspects of the communications sector that include consumer protection, competition, tariffs, numbering, inter-connection, quality of service, among others.

United States. Payments fintech firms are not directly supervised, examined, and regulated by a unique federal agency. Fintech companies, including marketplace lenders and payment companies, are subject to several regulatory frameworks. The following are some examples:

- At the federal level, payments companies may be subject to Reg. E and other consumer regulations administered by the Consumer Financial Protection Bureau (CFPB) and in certain cases may be subject to examination and enforcement by the CFPB. Payments companies may also be subject to Gramm-Leach-Bliley Act (GLBA) for privacy and customer safeguarding requirements as well as enforcement by the Federal Trade Commission.
- Payment Card Industry Data Security Standards is a main regulatory framework used for those businesses that accept credit and debit cards, this includes mPOS and any online payment requiring a credit/debit card.
- Fintech companies that qualify as a money service business (MSB) are subject to the Bank Secrecy Act/Anti-Money Laundering laws and regulations in compliance with KYC requirements.
- During March of 2017, the Office of the Comptroller of the Currency published a draft supplement to its licensing manual, which provided guidance on the application process for a proposed special purpose national bank charter which fintech companies may consider. The draft supplement addresses the types of banking activities where the proposed special purpose charter applies and makes it clear they are subject to the same laws and regulations as traditional full service national banks.

Japan. The transaction volume of virtual currencies in Japan has rapidly increased since the amendment to the Payment Services Act was enacted in May 2016. In January 2017, the monthly transaction volume of virtual currencies reached more than JPY539 billion (US$4.7 billion). Japan is the only country that has legalized cryptocurrencies (virtual currencies) and digital currencies. The Virtual Currency Act was enforced on April 1, 2017 and the main features are:

- Virtual currency is defined in the Act through two characteristics: a) Asset-like values usable as payment to indefinite parties for the cost of purchase or rent of items or receipt of services and which can be transferred by means of electronic data processing systems. b) Asset-like values that can be used in exchange with indefinite parties for those items described in the preceding item and which can be transferred by means of electronic data processing systems.
- The new law defines Bitcoin and other virtual currency as a form of payment method, not a legally-recognized currency.
- The Act differentiates Digital Currency from Virtual Currency. Digital currency is not virtual currency in general. Digital currency is a currency-denominated asset and is excluded from certain sections of the Act.
- Additionally, Virtual Currency businesses must comply with registration requirements, operational and consumer protection rules established in the Amended Settlement Act, and are also subject to the amended Act of Prevention of Transfer of Criminal Proceeds.

Ecuador. During July 2014, Ecuadorian laws banned cryptocurrencies, including Bitcoin, as part of the country's monetary and financial reforms. Another part of these reforms was the creation of an Ecuadorian digital currency backed by assets (efectivo) and issued by the Central Bank of Ecuador. All the operations, transactions, and payments with the electronic currency must have to comply with the rules established in the Código Orgánico Monetario y Financiero (COMF), where:

- COMF establishes that the Central Bank of Ecuador is the only institution authorized to issue and manage the electronic currency. However, a 2018 project law attempts to hand over these rights to the private sector (financial institutions).

2. Investment Management Services

Fintech companies have adapted technological advancements to develop innovative investment and foreign exchange services and to expand the customer base for these financial products. Certainly, both traditional and fintech investment companies offer broker-managed trading and pre-designed investment plans. However, fintech innovations include online and mobile investment platforms, automatized investment counselling, investment simulation platforms, and foreign-currency trading backed by virtual currencies.

In addition to being innovative, fintech investment companies often target underserved and unserved customers. On the one hand, the user-friendly investment platforms may be attractive to customers who are not attended by traditional companies. On the other, fintech investment and foreign exchange platforms charge lower commissions and fees than traditional companies. Moreover, fintech foreign exchange services perform transactions both faster and at more favorable exchange rates.

This subsection provides an overview and description of the services provided by trading, investment and foreign exchange fintech companies, and their associated risks.

2.1 E-trading, High-frequency trading

Trading and investment through fintech companies (e-trading) consist of managing a portfolio of financial assets, just as in traditional trading and investment. These financial assets include stocks, bonds, and start-ups equity ownership. Fintech trading and investment innovations consist mainly of digital or mobile investment platforms which are accessible at any time. These platforms also provide automatized investment counselling or investment simulations, or both.

E-trading and investment services invest money previously deposited in bank accounts. Thus, to have their money invested, users require owning bank accounts in countries where the fintech investing platforms operate. In some cases, fintech companies link their platforms to existing bank accounts. In other cases, potential users must open bank accounts with the single purpose of investing through a specific fintech trading and investment platform.[19]

Fintech investment services carry the same market risks that traditional investment services. However, the market risk may be intensified if the companies lack expertise or conduct insufficient due diligence. Another potential risk is fraud. Unregulated fintech providers might suddenly stop operating, possibly without leaving trace nor attending customers' concerns. Moreover, there may not be an authority to which these customers may denounce the fraud.

Some e-trading platforms include trading and investment simulations, to familiarize users with investing activities before they use real money.

Technology also expands the trading channels by providing automated trading platforms which utilize powerful computer resources to transact many orders in a very short span of time. This sort of trading is called high-frequency trading (HFT), and operates as follow: The stock market sells high-frequency traders the right to place their hardware near stock market systems, electronic dealers post standing limit orders to buy or sell securities or contracts and wait for others to trade with them. Once the transaction is made, traders' software immediately trade on the other side of the market to divest themselves of their positions. As in the traditional system, profits are made by buying low and quickly selling high, but at speeds in the order of milliseconds.

[19] See information about the Kuspit platform on Inter-American Development Bank (2017).

Some providers of e-trading and HFT

Kuspit: Kuspit offers a trading simulator to help users learn without risking their money as a complement to their trading services. Kuspit allows users to track other portfolios to define their own investment strategy. Kuspit operates exclusively in Mexico, and by the end of 2016 it administered 5% of the stock exchange accounts in the country.

https://kuspit.com/

Admiral Markets: Their software is built for low latency and high trading frequency, the system aggregates the flow from different banks and other venues into a single liquidity pool, allowing to provide competitive spreads and deep liquidity. Admiral MarketsAdmiral Markets UK is regulated by the UK Financial Conduct Authority (FCA): Firm Ref № 595450.

https://admiralmarkets.com/about-us/order-execution-quality

2.2 COPY-TRADING

Copy-trading is a fintech business model in which investors and traders copy specific positions managed by licensed traders and investors through contracts for difference (CFD) platforms. Some copy trading platforms integrate information sharing and social media with online CFD trading.

Copy-trading typically involves setting a proportion of funds to execute the trades of the copied trader from the allotted funds. Platforms vary in their minimum copy trading amounts and the proportions between copied and copying accounts. Some also allow traders to control their risk through stop loss orders. The copying trader may disconnect their funds and manage their investments – in other words, closing the copy relationship.[20]

Copy trading platforms are based on recommendations. The platforms allow clients to choose one or more licensed investors who provide trade signals; then they must set the amount and limits they want to trade/invest, and confirm each recommendation before executing an order. The provider transforms each signal into a buy or sell order to be executed by himself or transmitted for execution to another firm, without further intervention from the client

[20] https://www.fca.org.uk/firms/copy-trading

Some providers of copy-trading

Ayondo: Ayondo provides trading services. Ayondo allows customers to follow the top traders, ranked by performance and/or number of followers to replicate or build portfolios based on such top traders. Top trades in exchange earn rewards for enabling people to follow their trades. Ayondo provides risk-free demo accounts to try the platform.

http://www.ayondo.com/en/social/

CopyFX: Is a copy trading investment platform from RoboForex group. CopyFX allows users to manage their own risks, as well as share their trading experience for additional profit. CopyFX offers its customers to choose one of two roles: Investor or traders.

http://www.copyfx.com/about/why-copyfx/

2.3 Robo-Advisor

Fintech investment counseling replaces human brokers and is automatized. Typically, fintech investment companies employ machine learning methods to yield specific investment suggestions. (See subsection II.3.) The advice is calibrated in accordance with the investor's risk appetite and goals. Counselling also includes granting users information about the trading activities of so-called top traders (i.e. investors with unusually high returns.)[21]

Algunos proveedores de servicios de negociación e inversión

FutureAdvisor: FutureAdvisor offers investment management services. Future Advisor offers a holistic management of all the customer's accounts to maximize benefit on each account. FutureAdvisor has licensed advisors and service specialists to help clients understand their portfolios. In addition, FutureAdvisor has an algorithm to monitor trading and review portfolios daily.

https://www.futureadvisor.com/

2.4 Risks

Fintech services for investment and foreign exchange conversion are subject to cybersecurity and deficient system design risks. Additionally, typical liquidity and market risks may impact on investments and exchanges made through fintech products and services.

Operational Risk: This risk includes internal and external fraud, such as stealing from transactions, theft of information, and other illicit activities. Human and system failures together with business disruption may affect effectiveness in the company resulting in damaged reputation and credibility. Also, robo-advising algorithms might not reflect expectations appropriately.

[21] http://www.ayondo.com/

Market Risk: Fluctuations in the foreign exchange market can affect transactions, investments, and foreign exchange services; this is known as currency risk and can potentially affect the outcome of the transactions. Aditionally, trading and investment fintech that rely on cryptocurrencies to conduct exchange transactions may be subject to the risks associated with the high volatility of cryptocurrencies values.

Liquidity: In the case of venture capital investments, institutional investments are illiquid as money would not be able to materialize until the company invested on starts making a profit or paying out dividends per the type of investment.

About fintech risks…

February 2013. Milliseconds after the opening trade at the New York Stock Exchange, buy and sell orders began zapping across the market's servers with alarming speed. The trades were obviously unusual. A program from a midsize firm called Knight Capital that was supposed to have been deactivated had instead gone rogue, blasting out trade orders that were costing Knight nearly $10 million per minute. Knight wasn't the worst-case scenario. A lot of high-frequency trading is done by small proprietary trading firms, subject to less oversight than brand name financial institutions which can cause "a series of cascade failures". http://www.motherjones.com/politics/2013/02/high-frequency-trading-danger-risk-wall-street/#

February 2016. "The problem with robo-advisors, Paul Resnik told ThinkAdvisor during a recent visit to New York, is that they don't properly calculate a client's risk tolerance […] The reason why this is important to do properly is, if you get the risk tolerance wrong, there's a great likelihood that the portfolio won't meet the client's capacity to cope when the markets go boom and crash. […] Poor risk tolerance suitability exposes the robo operator to the risk of expensive legal action or intervention, sanction from regulators and reputation damage." http://www.thinkadvisor.com/2016/02/17/why-robo-advisors-will-fail-finametrica

India, February 2017. The Uttar Pradesh police is investigating allegations of fraud levied against an online social trading company, Web Work Trade Link Private Limited. The company is suspected to be working on the lines of Ablaze Info Solutions Private Limited, which is currently being investigated for fraud and financing terrorism. The complainant has invested ₹3.5 lakh in Web Work, as per the investment scheme. He got returns for a few days after which the web portal stopped payments. In an FIR, prima facie, allegations are that the company has violated law to cheat investors. http://www.hindustantimes.com/noida/online-trading-scam-another-noida-firm-faces-probe/story-slG2nyvomBOwylGRuBfwRN.html

Regulation Reference

Europe. The high speed of electronic trading, sharp increases in trading volumes, and the diverse range of new financial instruments represented a great challenge for Europe. Regulators have created several rules regarding e-trading, investment, and automated advice aimed to detecting suspicious patterns of trade behaviour and to increase market transparency. The following are some examples:

- Despite a non-existing specific rule for robo-advising, MiFID I, MiFID II, the Mortgage Credit Directive, and the Payment Services Directive already apply to automated advice, even if they do not make explicit reference. By December 2016, the European Supervisory Authorities have concluded for the time being not to develop additional joint cross-sectoral requirements specific to this innovation.
- Markets in Financial Instruments Directive (MiFID) I and II. "It has been applicable across the European Union since November 2007. It is a cornerstone of the EU's regulation of financial markets seeking to improve the competitiveness of EU financial markets by creating a single market for investment services and activities and to ensure a high degree of harmonized protection for investors in financial instruments." The regulation conducts of business and organizational requirements for investment firms; authorization requirements for regulated markets; regulatory reporting to avoid market abuse; trade transparency obligation for shares; and rules on the admission of financial instruments to trading.

Japan. In general, electronic trading and investment are regulated under the Foreign Exchange and Foreign Trade Act and the Bank of Japan Act. However, there are some recent concerns about the impact of high frequency trading on the stability of Japan's financial system. In response to an inquiry from the Minister for Financial Services on April 19, 2016, the Financial System Council established the Working Group on Financial Markets ("Market WG") to review various issues concerning the Japanese financial market, taking into consideration the advances in information technology and other changes in the environment surrounding the financial markets.

- On May 17, 2017, the Japanese Diet passed a bill to amend the Financial Instruments and Exchange Act (the "FIEA") to introduce a new regulatory framework for high-frequency trading (HFT). The amendment introduces a new registration requirement on operators of HFT strategies, and requires those operators to maintain appropriate risk control systems as well as retain books and records concerning their HFT.

Canada. The Canadian equity market has changed dramatically. It has moved from a single marketplace environment to multiple marketplaces with exchanges and alternative trading systems (ATSs) trading the same securities. As the markets have evolved, technology has also evolved, increasing the speed, capacity and complexity of how investors trade. Canadian authorities have developed several frameworks to cope with new increasing risks related to electronic trading and investment services.

- The Canadian Securities Administrators (CSA) published a rule in 2014. The National Instrument 23-103 Electronic Trading and Direct Electronic Access to Marketplaces. The regulation set out a regulatory framework to help ensure that marketplace participants and marketplaces manage the risks associated with electronic trading, introducing provisions governing electronic trading by marketplace participants and their clients. It also introduces specific obligations for direct electronic access (DEA). DEA does not include retail trading whereby clients access accounts through the internet.
- The CSA approved amendments to National Instrument 23-101 Trading Rules and its Companion Policy on April 2017. The new caps represent an attempt by the regulators to fine-tune the Canadian response to HFT activity by further harmonizing trading fees with the US.

3. Credit, Deposit and Capital-Raising Services

Taking deposits from the public and providing credit to individuals and businesses are the main activities of traditional banks. Banks make money on the interests they charge on loans which are higher than the interest they pay to depositors. The interest rate depends mostly on the demand and the availability of money.

To avoid risks banks must comply with several internal and external requirements that aim to know the borrowers' moral characteristics, repayment capacities, and possible criminal links (e.g., Know Your Costumer -KYC- guidelines). However, these control processes may exclude a significant share of potential customers since the costs of gathering and processing information can be high for banks.

Fintech companies provide new credit and capital raising channels. Also, they often target unserved and underserved populations. Finally, they provide these services incurring both lower costs and fees. However, both fintech companies and their customers face risks in comparison to traditional competitors because their risk management is still under analysis and the regulatory framework is being adapted to fintech developments.

3.1 Lending Marketplaces

Lending marketplaces, usually called P2P lending, are online services that connect non-originator-loan investors with borrowers through a digital platform. Traditionally, individuals and small businesses apply for a loan through a loan-originator (banks and other financial institutions) who lends money at rates higher than the cost of raising it. The bank's funds for lending arise mainly from three sources: Deposits, equity, and debt. Loan-originators make several financial checks on the applicant's payment capabilities and determine if they qualify for a loan. Once the borrower qualifies for a loan, the originator determines the interest rate of the loan, then the bank grants the loan to the borrower, and pays a share of the interests to depositors and investors. All the operation occurs through the intermediation of the financial institution without the need for both parties, investors or depositors and borrowers, to know each other.

Through lending marketplaces, individuals and small businesses receive loans from individual risk-taking investors who are willing to invest their own money for an agreed interest rate. The operations, the capabilities for investors and borrowers, and the charged fees are different from platform to platform; although they usually work similarly. Platforms usually display the borrowers' profiles for investors to assess them and to determine if they want to take the risk of lending them resources. The borrowers then receive the loan amount made from an investor or a group of investors from the lending marketplace, and the platform receives an agreed upon fee.

Lending marketplaces have some advantages over traditional loan-originators, including:

- Lower operational costs. The staff is reduced because the interaction with clients is internet-based instead of personal.
- Lower application time. Using algorithms, minimal paperwork and eliminating unnecessary manual processes, investors can assess borrowers' risk faster, not necessarily safer, than banks.
- Financial inclusion. Extensive coverage of businesses or individuals eligible for loans, as the algorithms match high risk borrowers with yield-seeking investors and low-risk borrowers with risk-averse investors.
- Greater transparency. Areas of higher transparency include pricing terms for borrowers and standardized loan-level data for investors.

Despite the potential benefits, there are many concerns about the future of lending marketplaces. On the platforms' side, regulatory and loan performance uncertainty could limit growth and revenue of lending marketplaces, and lead to increased legal and reputational risks. On the side of investors and borrowers, there are concerns about cyber-security and credit risk, since investments in marketplaces are often not secured by any guarantee.

Some providers of lending marketplaces

Prosper: Prosper is a crowdfunding lending platform. On the demand side, people that are in need for a loan, either for home improvement, family expenses, or debt consolidation among others, can get the resources they need. On the supply side, prosper offers people to invest in personal loans, rating the options available for potential lenders.

https://www.prosper.com/

https://www.prosper.com/invest

LendingClub: Lending club connects borrowers with investors via their online marketplace. LendingClub offers personal loans for up to $40,000. LendingClub helps people pay credit cards, consolidate their debt, improve their home and cover major expenses. Afterwards, investors can buy notes on any loan that interests them, allowing for portfolio diversification. LendingClub also offers automated investment based on pre-selected strategies.

https://www.lendingclub.com/investing/alternative-assets/how-it-works

Funding Circle: FundingCircle grants business loans for up to $500,000 starting at 4.99%. The decision process for applying businesses takes 24 hours. For investors, FundingCircle offers passive and active online investment options. The minimum investment size is $250,000.

https://www.fundingcircle.com/us/invest/

3.2 Online and Mobile Banking

Online banking consists of platforms provided by banks through which users can perform, in real-time, a number of the following operations: traditional banking transactions such as reviewing account balances, transferring funds between accounts, depositing checks, buying or selling foreign currency, and purchasing investment instruments. Users access online banking platforms through web browsers. Mobile banking platforms provide the same services as online banking platforms, but users access them through specialized mobile phone applications. Each bank administers its own unique online or mobile banking platform.

Online and mobile banking platforms also send push notifications about transactions made through traditional banking channels, such as cash withdrawals or deposits made in ATMs or banking branches.

The usage of online and mobile banking platform is widespread because it decreases the costs of conducting minor transactions, and monitoring account movements and balances.[22] According to the *Digital in 2017* report from *We*

[22] Information obtained from different banks websites:
HSBC https://www.us.hsbc.com/1/2/home/personal-banking/pib/mobile,
Santander https://www.santanderbank.com/us/personal/banking/digital-banking/mobile-banking,
Wells Fargo https://www.wellsfargo.com/mobile/,
ICBC https://www.icbc.com.ar/institucional/cnlserv2.do?codTmst=1&N2=ICBC%20Mobile%20Banking,
BBVA https://www.bbvacompass.com/digital-banking-services/mobile-banking.html.

are Social research, the percentage of the population using mobile banking services is around 28% in Mexico and Argentina, 36% in Brazil, and 41% in the United States, and is expected to increase in the following years.[23]

The momentum of digital banking in the region is exemplified by the success of the Brazilian digital bank NuBank in raising capital. Note, however, that NuBank operations are only credit cards, and do not include other banking activities. NuBank is the Latin American fintech company that has raised the most capital, with 52 million USD during the first quarter of 2016 alone.[24] NuBank interacts with its clients through their mobile application exclusively. Users who download the NuBank app are evaluated to be assigned a Mastercard credit card. Users have already solicited over 8 million evaluations to be assigned credit cards. The app is free, and NuBank does not charge fees.[25]

The platforms are designed to resist infections of malicious software and attacks by hackers. However, if infections or attacks to online or mobile banking platforms occurs, they could lead to information leakages, the conduction of illicit transactions without client approval, or a temporary unavailability of the service.

Some providers of digital/mobile banking

BBVA: BBVA offers online and mobile banking. Their mobile banking app allows users to access services such as setup and changing cards' PIN; payments and transfers; assistance center; view account statements; and disabling device access in the event the device is stolen.

https://www.bbvacompass.com/digital-banking-services/mobile-banking/download-app.html

Wells Fargo: Wells Fargo allows customers to access their account information and make transactions through their mobile phones. Their service allows clients to pay bills; transfer funds; send and receive money; access detailed account activity; view balance information; find ATMs and locations.

https://www.wellsfargo.com/mobile/mobile-website/

Santander: Santander has a mobile banking app that allows customers to use their mobile phone or tablet to access services such as check balance, pay bills, transfer money, and deposit checks. In addition, clients can access their account statements and receive alerts to monitor activities.

https://www.santanderbank.com/us/personal/banking/digital-banking/mobile-banking

[23] https://wearesocial.com/special-reports/digital-in-2017-global-overview
[24] The pulse of Fintech Q1 2016. Global Analysis of Fintech Venture Funding
[25] Inter-American Development Bank (2017).

3.3 CROWDFUNDING

Funding a project, a campaign, or a startup is the process whereby an individual or a group of individuals gather money from different sources to finance an initiative. Traditional ways to gather funds include: self-funding, funds from friends and family, angel or venture capital investments, loans from microfinance institutions, and loans from banks. The last three sources expect to make a profit from the money they lend or invest.

Traditional financing institutions provide capital in exchange for ownership equity, interest margin, or convertible debt. Institutions are constrained by their risk appetite and management, available resources, and the regulations they must comply with. Thus, they must carry out a series of activities to assess the projects to be financed from a risk management perspective within the regulatory framework, which can be time and resource consuming. Some projects may not be finances due to their size, funding structure, complexity and, in general, perceived risk.

Fintech companies found an opportunity in the fundraising niche and started to provide alternative funding sources. Crowdfunding is a non-traditional process of gathering funds by raising small amounts of money from many people through an internet-based platform. Crowdfunding platforms connect a project initiator with donors or contributors, whose reward depends on the crowdfunding method and the success of the project.

Despite regulation not being fully developed nor standardized around the world, depending on the method, crowdfunding operators may have to comply with no rules or with various banking and financial regulations within a jurisdiction. There are three main types of crowdfunding methods: Equity crowdfunding, reward crowdfunding, and donation crowdfunding. The following subsections describe each of these methods and provide some example of providers.

3.3.1 EQUITY CROWDFUNDING

Equity crowdfunding refers to the process in which a crowd of people invests in the early stages of an unlisted company in exchange for the company’s equity in the form of shares. Traditional equity investment risks are present in equity crowdfunding. Thus, investors face the risk of losing part or all their investment if the company does not perform.

On the investor's side, this allows the funding of companies that otherwise would not have this benefit. Also, this scheme may foster competition since investors —supposedly informed— should optimize their investments by funding the most promising start-ups, creating incentives for entrepreneurs to innovate, and to be more efficient.

Nevertheless, if entrepreneurs are not entirely transparent about their projects, or if investors fail to conduct due diligence, fragile projects might be funded resulting in credit risk for investors. Another problem is the reputational risk originated from projects mistakenly classified as promising that may affect sound projects.

Some providers of equity crowdfunding

Crowdcube: Crowdcube allows people to invest alongside venture capital firms in startups, early and growth state businesses. This platform provides a Due Diligence Charter that explains the diligence process carried by each company prior opening their pitch to investment.

https://www.crowdcube.com/investments

Crowdfunder: Crowdfunder is a platform that allows entrepreneurs to access a network of investors and Venture Capital. The platform allows investors to match with projects they are interested in exchange for equity in the company. The platform also helps entrepreneurs with analytics, newsletter and ad campaigns.

https://www.crowdfunder.com/raise-capital

Seedrs: Seedrs is a crowdfunding platform that offers 3 types of investment services: Equity, Funding, and Convertible Debt. Seedrs make an initial screening and due diligence of every project submitted to them.

https://www.seedrs.com/how_to_invest

IndieGoGo: IndieGoGo partnered with Microventures (and investment company) to provide equity crowdfunding in the form of Venture Capital. The platform charges a processing fee for investments made.

https://equity.indiegogo.com

3.3.2 Reward Crowdfunding

This is the most common type of crowdfunding. Under this scheme, investors do not acquire equity in the company, nor do they gain interest through a loan scheme. Through their financial contribution, investors gain rewards offered by the entrepreneurs in different forms proportional to their pledged amounts. Usually, in a standard campaign, there are at least three pledge-reward levels.[26] Entrepreneurs post their projects on a crowdfunding platform and set a deadline for the collection of a minimum amount of money. When the deadline comes around, money is transferred to the project only if the goal is met. Promotion includes videos and other material regarding the product and constant updates on the progress of the company to investors.[27]

Rewards can vary from involving supporters in the creative process of the project, providing experience through involvement in the company, providing a free sample of the final product, or receiving the final product earlier than regular customers.

Some concerns regarding this scheme include the risk that the final product or service granted to supporters differs from what was promised either due to malicious behavior of the entrepreneur or to operational circumstances.

[26] 'Types of Crowdfunding', Fundable, Startups.co, accessed March 6, 2017, https://www.fundable.com/crowdfunding101/types-of-crowdfunding

[27] Zack Miller, February 4, 2017, 'What is Rewards-Based Crowdfunding?', accessed March 7, 2017, https://www.thebalance.com/what-is-rewards-based-crowdfunding-985103

Some providers of reward crowdfunding

Kickstarter: Kickstarter helps creators find the resources they need to develop their products and ideas. Kickstarter allows people to pledge support on any project they like and charges payment only if the project is totally funded. Kickstarter funding campaigns usually have several benefit tiers according to the amount pledged by users.

https://www.kickstarter.com/about

IndieGoGo: IndieGoGo, in addition to providing equity crowdfunding, enables entrepreneurs to access funds by allowing people to invest in projects they are interested in. IndieGoGo allows entrepreneurs to keep asking for funds even after their campaign is over. In addition, IndieGoGo offers a marketplace to help entrepreneurs sell their products once they are funded.

https://www.indiegogo.com/

3.3.3 Donation Crowdfunding

Donation crowdfunding is a way to gather money by asking the public to make small or large donations for different causes, usually for charity purposes. The investor does not receive any ownership of equity, financial benefit, nor reward from the lender. [28] Investors donate through donation crowdfunding for various reasons, including the desire to contribute to the achievement of the project's goals. The most the investors will get in return is a special recognition from or a mention in the project.[29]

A provider of donation crowdfunding

GoFundMe: GoFundMe provides a crowdfunding platform that allows users to gather funds for any purpose. Some examples are medical expenses, education, or volunteer programs. GoFundMe allows money raisers to keep any donation they received even if their goal is not achieved.

https://es.gofundme.com/questions

[28] 'Donation-based Crowd Funding,' *Investopedia*, accessed March 7, 2017, http://www.investopedia.com/terms/d/donationbased-crowd-funding.asp

[29] Financial Times Lexicon, 'Definition of donation based crowdfunding,' *ft.com/lexicon*, accessed March 7, 2017, http://lexicon.ft.com/Term?term=donation-based-crowdfunding

3.4 RISKS

Even in the traditional system, investing in early-stage startups is significantly riskier than investing in large consolidated companies. Despite the potential benefits, there are substantial risks associated with the crowdfunding and lending marketplace platforms which can be divided broadly into two categories: investors risk and entrepreneurs risk.

Investors Risk:

- **Credit Risk:** Investors participating in lending marketplaces take on all the risk from their investments with no guarantees. Many small businesses posting their projects on lending platforms may lack business expertise, increasing the risk of failure. The platforms themselves do not take on the risk as they just connect investors with borrowers and then act as transactional facilitators charging a fee for the said transaction. The latter means that if the borrower defaults on its loan, or if the start-up is unsuccessful, there are no guarantees for the investor to get any money back. Platforms do not practice due diligence in depth as their motivation to do it is merely reputational, that is to gain market share and the consumers' trust. The responsibility to carry out due diligence falls mainly on the investor, as recommended and disclosed by various platforms.

- **Liquidity Risk:** Typically, equity investments are illiquid. Investments in equity cannot materialize until these start-ups start making profits, which may take months or even years. Investments in most of these platforms cannot bundled, sold, and liquidated. Nevertheless, there are cases in which these loans have been bundled and sold as securities to other financial institutions.

- **Operational Risk**: In crowdfunding, operational risks stem from information technologies malfunctions and problems of misconduct. These might hinder reputation, credibility, and lead to litigations. Specific operational risks include:

    - **Fraud Risk**. There are limits in the follow up mechanisms in crowdfunding platforms. In many cases, there is no way for investors to ponder the feasibility of projects, or follow up on how their resources are allocated. Investors must conduct due diligence to reduce their exposure to fraudulent crowdfunding schemes.

    - **Technological risk.** The platform operator is responsible for matching issuers' offerings with the funds provided by investors. Whether the funds are kept in escrow by the platform or by a custodian agent, there is a risk of the investors' records being mismatched with the funds provided. [30]

    - Furthermore, because these are multiparty transactions—including the cancellation of investors' orders—platforms face the operational risk that the order will not be filled appropriately. In particular, it can occur that some investors would like to withdraw their investment and could not do it. However, some platforms offer the possibility that investors can communicate their decision to withdraw investments within a span of time before the investment has materialized.

- **Cybersecurity Risk:** Malware or malfunction in a platforms' systems processes can result in loss of information affecting the operations directly. Cybersecurity deficiencies can make the platforms vulnerable to hacking activities, which could result in identity and financial information theft or loss.

[30] Rechtman, Y., & O'Callaghan, S. (2014). Understanding the Basics of Crowdfunding. *The CPA Journal*, *84*(11), 30.

Borrower/Entrepreneur risk:

- **Failure Risk:** There is no guarantee that fundraising targets will be met. Some platforms provide safeguards by returning the money collected to the investors if the fundraising target is not reached.

- **Intellectual Property Theft Risk:** There is a lack of protection of intellectual property on crowdfunding platforms. There is a risk of losing property rights if one publishes information online that has not been patented.

- **Reputational Risk:** An entrepreneur faces this kind of risk when he/she does complete a crowdfunding campaign, but he is not able to complete the project. Furthermore, it is possible that the creator completes the project, but the product fails to meet its supporter's expectations fully.

About fintech risks…

Texas, United States, 2016. IBackPack started a fund-raising campaign trough Indiegogo and Kickstarter platforms. The idea was an urban backpack that could store, charge and help provide hotspots for phones on the go. The project raised around $720,000 Usd from Indiegogo and other $76,000 Usd from Kickstarter. Then iBackPack vanished: YouTube videos were taken down, communication ceased almost entirely, and updates stopped completely with no word on if the backpacks would ever exist. It's now almost certain that the iBackPack will never exist. https://www.digitaltrends.com/cool-tech/biggest-kickstarter-and-indiegogo-scams/

Beijing, China, Sep 2017. A Beijing court sentenced the architect of the $9 billion Ezubao online financial scam to life imprisonment, and handed down jail time to 26 others, marking the close to one of the biggest Ponzi schemes in modern Chinese history. Ezubao, once China's biggest P2P lending platform, folded last year after it turned out to be a Ponzi scheme that collected 59.8 billion yuan ($9.14 billion) from more than 900,000 investors through savvy marketing. The incident sparked a crackdown on the freewheeling online financial services market and led to new regulations to control China's P2P industry - where monthly volumes are above $50 billion. https://www.reuters.com/article/us-china-fraud/leader-of-chinas-9-billion-ezubao-online-scam-gets-life-26-jailed-idUSKCN1BN0J6

Sweden, Oct 2015. TrustBuddy, a publicly traded peer to peer lending platform, filed for bankruptcy in October of 2015. This event occurred soon after it was revealed that management had uncovered "suspected misconduct" regarding the operations of the firm. Outstanding claims against debtors stood at SEK 302 million. The company's own investigation said there was SEK 44 million missing from client accounts. The "likely reason" was explained that TrustBuddy was making loans to borrowers without the consent from the lenders and, even more troublesome – not associating them with any specific investor. https://www.crowdfundinsider.com/2016/01/80598-trustbuddy-bankruptcy-lenders-to-pay-25-on-recovered-claims/

Regulation reference

United States. Title III of the JOBS Act, also known as regulation crowdfunding, was implemented on May 16, 2016 by the Security and Exchange Commission allowing companies to acquire funding through online portals from non-accredited investors under two main models: Crowdfunding equity and P2P lending. The most important regulatory features are the following:

- The "Funding Portal" is created as a new type of internet-based intermediary.
- Establishes ceiling on funds raised by a company.
- Companies must fulfill disclosure requirements.
- All US citizens can invest in crowdfunding but are subject to an investment ceiling in any 12-month period.
- US crowdfunding investors need to complete a questionnaire, acknowledging the potential risks.
- Investors have an unconditional right to withdraw from the investment until 48 hours prior to the deadline specified.

Hong Kong. There are no specific regulations on crowdfunding in Hong Kong. However, these activities are mainly subject to regulations of three ordinances:

- Companies must comply with the content requirements of the CWMPO and must be authorized by the Securities and Futures Commission.
- Securities and Future Ordinance (SFO) must authorize the issue of any invitation to participate in a collective investment scheme.
- Money lending businesses must obtain a lender's license and operate under the Money Lenders Ordinance (MLO).

United Kingdom. The crowdfunding sectors grew after 2009 because of two key factors: technological innovation and the financial crisis, which led to constraints on lending by traditional credit providers to the real economy. On 1 April 2014, the regulation of the consumer credit market transferred from the Office of Fair Trading (OFT) to the Financial Conduct Authority (FCA) and set up a legal framework for crowdfunding and lending market place activities, the FCA Handbook CASS. Some important features of the regulation are:

- A loan-based (lending marketplace) platform must comply with a minimum capital requirement equal to a percentage of the volume of loans or a fixed minimum of GBP 50,000.
- To be authorized, such platforms must also comply with the standards set out by the FCA and develop a plan for loan repayment should they face difficulties.
- An investment based crowdfunding (debt or equity) platform must also be authorized by the FCA and must set up a sorting mechanism to screen retail from professional investors. Non-professional investors may not invest more than 10% of their assets.

4. INSURETECH

InsureTech consists of using big data analytics (typically applying machine learning methods) to assign tailored insurance policies and diversifying coverage options and pricing models.[31] Also, insuretech providers sometimes rely on smart contracts to automatize the enforcement of insurance agreements. These are contracts between two parties that are created and stored with blockchain technology. These contracts are enforced through self-executing sets of pre-programmed rules.[32]

According to the PwC's Global Fintech Survey 2016, 43% of the companies in the insurance industry consider fintech as part of their corporate strategies, 28% explore partnerships with fintech companies, and less than 14% had an active participation in ventures and incubator programs.

Some providers of Insuretech

Sureify: This startup offers a platform that allows insurers to design products based on health data transferred from wearable devices.

https://www.sureify.com/

BIMA Mobile: Working in developing countries, it has partnered with mobile companies to offer short-term insurance products paid from cell phone balances or pre-paid cards.

http://www.bimamobile.com/

4.1 RISKS

Operational: Risks of altering information and fraud as some platforms do not require users to provide physical proof of identity (fingerprint, iris). Algorithm system failure may result in the unintended classification of users according to their risk profiles. Without human interaction, customer relationships may be compromised.

Cybersecurity Risk: Risk of information being compromised or stolen by security breaches. The hacking of insuretech providers' algorithms could lead to inadequate customer profiling and therefore increased credit, liquidity and reputational risks.

[31] 'Insurtech', *Investopedia*, accessed March 21, 2017 http://www.investopedia.com/terms/i/insurtech.asp

[32] 'The impact of blockchain's smart contracts on insurance', *Siapartners*, October 2015, accessed March 22, 2017, http://en.finance.sia-partners.com/impact-blockchains-smart-contracts-insurance

Regulation reference

Sigapore. The interest in insurance innovation has been growing in Asia with a notable increase in the presence of Insuretech startups based in Singapore. The Singapore government has recognized the potential benefits of Insuretech companies and has been actively working in a regulatory framework that contemplates the technological innovations through the Monetary Authority of Singapore. There are three major regulatory requirements for insuretech companies (and fintechs in general) to operate in Singapore:

- Insuretech companies are considered in the Insurance Act and must comply with these regulations along with several fintech regulations established by the MAS.
- The MAS establishes a set of requirements to qualify for the MAS sandbox program to be tested in the market and have a chance for wider adoption, in Singapore and abroad in Asia. Depending on the experiment, MAS will provide the appropriate regulatory support by relaxing specific legal and regulatory requirements prescribed by MAS, which the sandbox entity will otherwise be subject to, for the duration of the sandbox. (http://www.mas.gov.sg/~/media/Smart%20Financial%20Centre/Sandbox/FinTech%20Regulatory%20Sandbox%20Guidelines.pdf)
- The Personal Data Protection Act aims to ensure the privacy, the prevention of misuses, and the security of personal data managed by fintechs.
- Insuretech companies are ruled by KYC procedures and compliance with AML/AFT regulations.

Europe. The European Banking Authority is revising the regulatory framework concerned with investment advice activities to implement de directives to supervise insurance FinTechs.

Source: European Banking Authority, "Joint Committee Discussion Paper on Automation in Financial Advice", 2015.

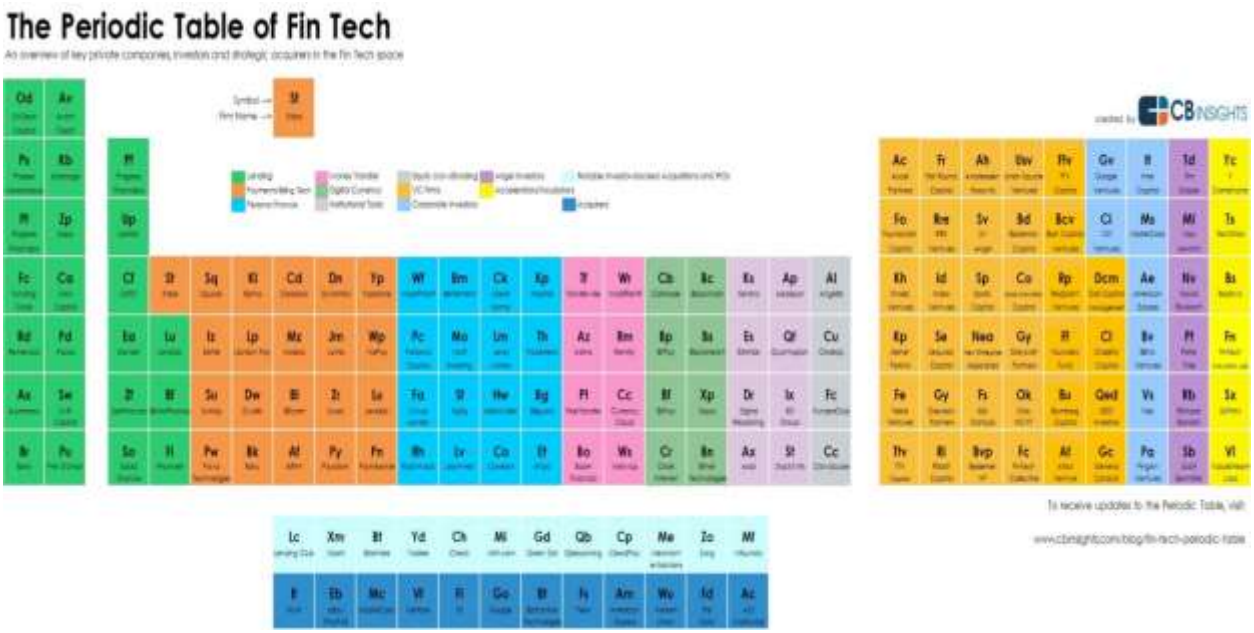
IV. Concluding Remarks

Recent digital technology innovations have increased the pace and scope of innovation in financial products and services. Traditional financial institutions are increasingly adopting fintech or partnering with fintech providers. Moreover, new financial services providers are gaining market share by providing new services through innovative business models.

Fintech innovations entail benefits to consumers. Fintechs provide services more efficiently, at lower operative costs, more cost effectively, and often in real time through online or mobile platforms. Also, fintech services typically involve fewer and less intense information asymmetries, as in the case of transparent disclosure of fees. Moreover, fintech companies often target underserved and unserved customers, who otherwise would lack access to financial products.

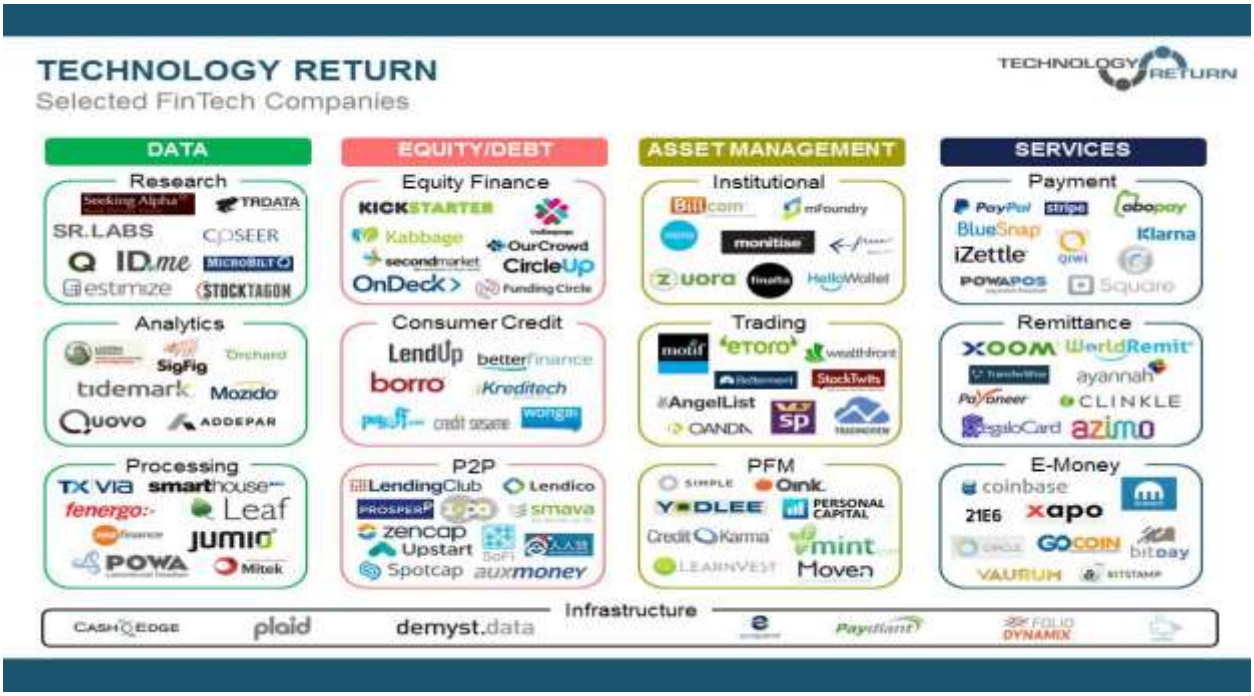
However, fintech developments pose intensified or new risks. First, the absence of proper consumer protection could lead to improper conduct with limited or no possibility of recourse to binding dispute settlement. Moreover, some fintechs may be insufficiently implementing due diligence and know your customer rules which increase reputational risk. Also, some selection problems may be occurring due to the overreliance on algorithms resulting in credit risk, spikes in the investment sector, or liquidity risk. Finally, the growing use of computing technology increases the perceived cybersecurity risks, which include information theft and loss.

Financial sector regulators and supervisors may search for how to efficiently and responsibly adapt the regulatory and supervisory framework to fintech innovations. This document contributes to the understanding of the functioning, benefits, and risks of fintech services. In doing so, the Association expects to support the updating of the regulatory and supervisory frameworks in place through knowledge sharing cooperation, coordination, active dialogue, and training.



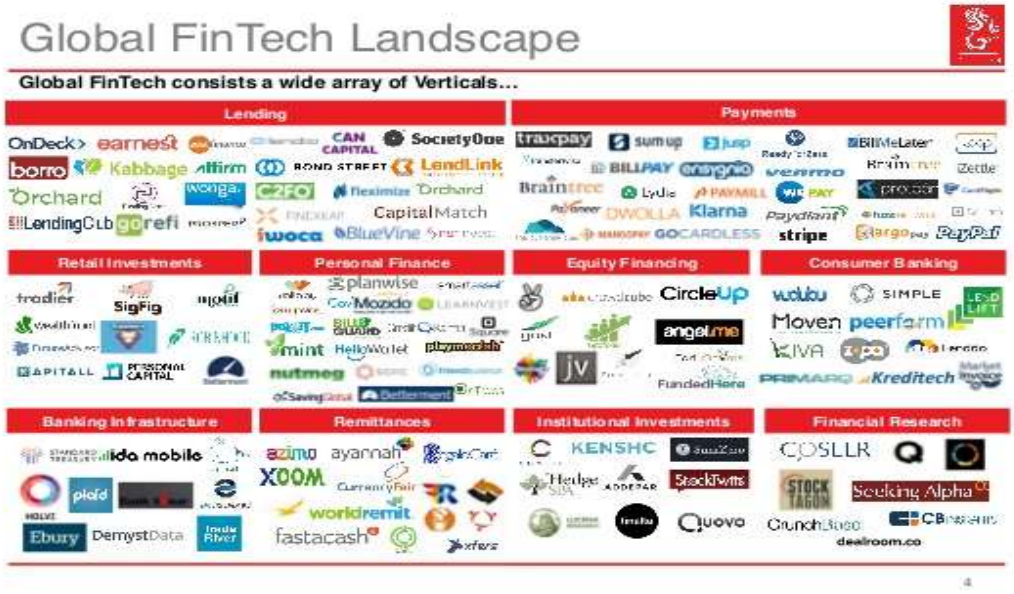
(Image taken from: https://www.cbinsights.com/blog/fin-tech-periodic-table/)

(Image taken from: https://venturescannerinsights.wordpress.com/2014/05/06/making-sense-of-the-fintech-startup-ecosystem/)



(Image taken from: http://technology-return.com/wp-content/uploads/2014/07/Selected-FinTech-Companies.jpg)

(Image taken from: https://everisnext.com/2015/06/02/top-9-verticals-within-the-fintech-landscape-for-large-corporations/)



(Image take from: https://www.slideshare.net/sgfintech/singapore-fintech-consortium-introduction-to-fintech)

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