

**International Centre for Digital  
Finance**

Working Paper 01/2023

**TECHNOLOGY DRIVEN INNOVATIONS  
IN FINANCIAL SERVICES**

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Warsaw, February 2023

# TECHNOLOGY DRIVEN INNOVATIONS IN FINANCIAL SERVICES

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***Key words: financial innovations, fintech, bigtech, cloud computing, big data, cybersecurity***

**JEL Classification:** G21, G22, G23.

## **1. Introductory observations**

Financial innovations are nothing new in financial development. They have already had a long history, to recall introduction of a double-entry book keeping, establishment of modern central banking, application of fiat based monetary system, development of local and international payment systems, invention of securitisation, collateralized debt obligation or parametric insurance.

The same is true with the application of technological enablers to financial innovations. Let us remind in this context the role played by the development of telecommunication, in particular the telephone and telegraph, for the financial services, application of ATM or diffusion of high frequency trading.

What is new however since the last ten years or so it is the accelerated pace of technological innovations based on the use of computers and digitalization. They find their application in

financial services and markets and their societal and economic weight is dramatically increased. They are producing ever deeper structural changes in the entire financial system. With the rise of new technology there is the clear switch from the analog to digital world.

Innovations in financial systems and financial services have not attracted particular public attention neither among researchers nor among the policy makers before the outbreak of Global Financial Crisis in 2007. By then they were considered to be the useful and non – controversial component of the financial system, providing, inter alia, more flexibility to established rules, reducing agency costs, completing the markets, allowing for better risk distribution in the financial sector and improving its allocative efficiency. This traditional positive approach to financial innovations was associated with the then dominance of innovation-growth proponents school which considered innovations as an engine of growth. This view was contested after the outbreak of the crisis by the innovation fragility school which was identifying financial innovations as the root cause of the global financial crisis and thus ,at time, detrimental to economic development processes(Beck T, et al, 2012).The driving force in place was the possibility of unprecedented credit growth made available with the application of innovative structured securities products: Mortgage Backed Securities, Credit Default Swaps and Collateralized Debt Obligations(MBSs, CDSs and CDOs) in particular. This has led finally to the unusual boom and bust in US housing market (Henderson, Pearson, 2011; Brunnermeier, 2009; Calomiris, 2009).

Since then these two approaches are coexisting, with an obvious conclusion that innovations may deliver both the dark as well as the bright results. They are inherently risky and may bring individual households, companies, financial institutions to impairment or failure and the whole economy to financial instability. Their influence resembles the one of the medicines, which may be dangerous if taken by wrong patients, in wrong time or in wrong doses. Therefore it is a complex task for the policy makers how to reduce possible negative outcomes of financial innovations while preserving their merits(WEF, 2012; Halliasos, 2013). In our paper we do not enter this complex and controversial area. We simply acknowledge the existence of different views and approaches. Instead we concentrate on sketching the contours of the current situation with regard to the spread of financial innovations in the financial systems and the opportunities and challenges it generates.

We see the role of financial innovations in a positive way, as making financial markets more complete, more effective and more efficient for the households, companies and governments. Their important task is also making financial intermediaries themselves more effective and more efficient. We underline in the course of the discussion the fact that they are not risk free and may produce unwanted effects.

In this paper we intend to review principal components of the current stream of innovations, its basic drivers, major strategic issues that we are facing in this area and their implications.

We argue that current wave of financial innovations, induced largely by the application of technology enablers, has the potential of disrupting financial systems and financial services that we know. It refers to the products on offer, new structure of universe of financial services providers, role of third party services suppliers, governance of the whole financial system and the challenges of new risks as well as the old risks in digitized environment. Finally it is also the way consumer interests are to be protected.

We look in the paper at some of them in a highly synthetic and holistic way. We begin with some definitional clarification and thereafter touch the selected aspects of the development in the area in quest.

## **2. Taxonomy of financial innovations**

There are no universally accepted definitions of financial innovations. Nor are there universally accepted systematics of the phenomenon. The issue has been addressed for the first time at a global level by Bank for International Settlements already back in 1986. It was then when specially established study group of the central banks attempted to propose a systematization of financial product innovations in the banking area (BIS 1986). The Group prepared a broad study in which it proposed a classification system for financial innovations.

In its proposal they were split into three groups:

- risk-transferring innovations, which either reduce the price risk/credit risk, inherent in a particular financial instrument, or alternatively, enable the holder to protect against a particular risk,

- liquidity-enhancing innovations: which enable loans to be sold in a secondary market which

  - offers the lending institution the capacity to change the structure of its portfolio,

- equity-generating innovations, which have the effect of giving an equity characteristic to assets where the nature of the debt-servicing commitment is pre-determined, e.g., a debt-equity swap (Mishra 2008).

This useful attempt of BIS has not been developed later and thus systematization of financial innovations in international community has not been advanced thereafter. Various studies and approaches of individual researchers have not acquired universal acceptance and not produced any meaningful standard for use. This of course hampers the development of empirical studies and comparability of the registered results across time, territory or area. Hence analytically we are today more in the situation of individual studies at micro level than otherwise. It should be noticed perhaps that here the research field with respect to innovations is far behind the state of art respective traditional industries. There, the intellectual property system and in particular patenting system provides ready for use widely comparable data and information. Financial industry has not come that far yet.

Traditionally the concept of innovations was applied to the introduction of changes in technology, techniques and organizational solutions into the production processes taking place in the economic systems.

Originally the concept became widely popularized in economic sciences by J. A. Schumpeter, a renown Austrian economist, at the beginning of the XX th century (Schumpeter 1934). He claimed that it is precisely innovation creation which constitutes the essence of entrepreneurship and the social reason for the existence of entrepreneurs. It was contrary to the belief widely held before his arrival that it was their ability to create profits and reproduction of the capital.

Schumpeter not only provided theoretical base for the study of the role of innovation in the process of economic development but introduced also a specific systematics in this regard. It became used later by international community to distinguish four principal classes or types of

technical innovations (OECD,2018). They included product innovations, process innovations, marketing innovations and organizational innovations. They became also applied for the build up of specialized statistical data base covering technical innovations area in the world run by OECD. The Oslo Manual, which became a central international document in this regard, provided detailed explanations regarding typology of innovations, repeating principal ideas of Schumpeter.

It defined thus product innovation as the introduction of a good or a service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.

Process innovation is defined as the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.

Marketing innovation is defined as the implementation of a new marketing methods involving significant changes in product design or packaging, product placement, product promotion or pricing.

Finally organizational innovation is defined as the implementation of a new organizational methods in the firm's business practices, workplace organization or external relations (Oslo Manual, 2018).

As far as financial innovations are concerned generically this term is used for the description of the ongoing process of changes taking place in the financial systems, covering a variety of elements, including financial services, financial markets, financial products, financial institutions, financial supervisors, financial infrastructure and last but not least financial regulations. They may represent the said changes on a stand alone basis or, which is, by and large, more frequent situation, they may interact with each other. It is for these reasons that financial systems belong to complex objects and financial innovations add to their complexity and produce additional challenges.

We will use this generic understanding of financial innovations throughout our paper without going deeply into the semantic discussion. We believe that intuitive understanding is a more pragmatic solution for our analysis.

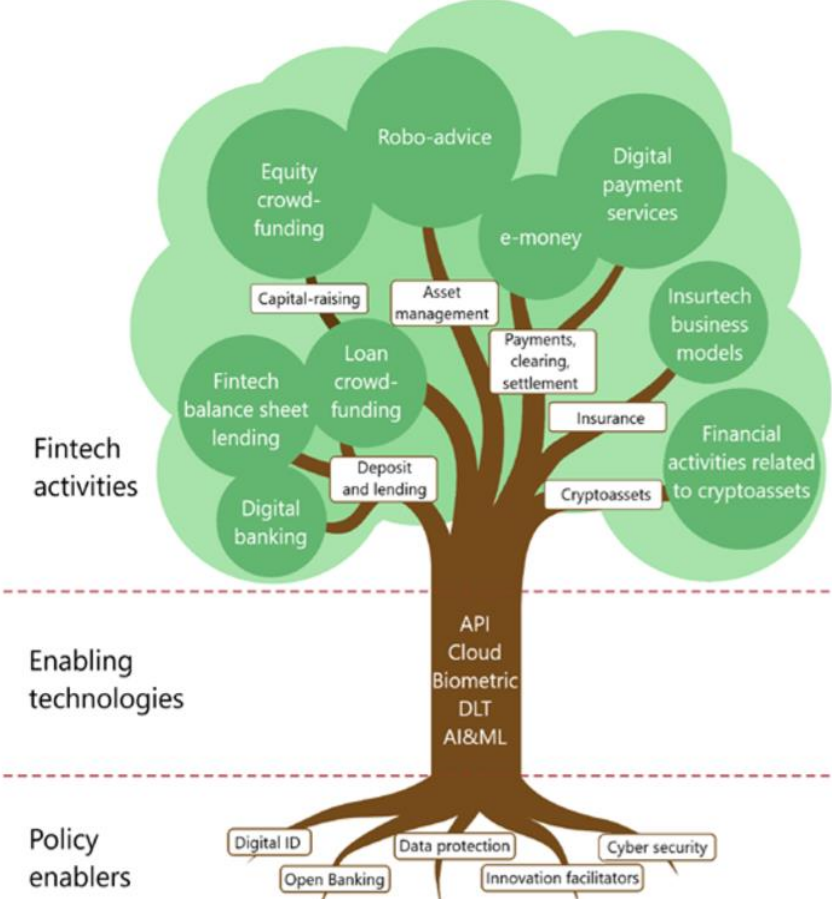
### **3.Main drivers of current financial innovations**

Financial innovations in general respond to the needs of the users of the financial systems and the opportunities available to their stakeholders, both the financial institutions, regulators as well as economic agents, including the customers. What is specially visible nowadays is that financial innovations are under a growing pressure of new technologies developed few years ago or still up coming. These new technologies transform the shape and the way financial systems are operating and financial services that are provided.

These new technologies have their roots in the development and spread of internet and the digitalization and datafication of social and economic life.

This wave of financial innovations is referred to as fintech and most frequently defined as “technology 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” (FSB, 2017, p.7).

Bank for International Settlements (BIS) and specifically its associated Financial Stability Institut (FSI) proposed recently a useful systematization of the relevant area in a form of fintech tree. It splitted fintech environment into three distinct parts: fintech activities, enabling technologies and enabling policies (see Figure 1)



Source: BIS (2020) p.7

Figure 1. Fintech tree: a taxonomy of the fintech components

Among fintech activities nowadays one could mention particularly digital banking and loan crowdfunding, capital raising, telematics and internet of things in insurance, robo advice in asset management, issuance of cryptoassets and e-wallets and digital payment systems. We should not forget additionally digital infrastructure facilities as well. Of course this list is only exemplary and evolving continuously.

Among technology enablers we should mention particularly artificial intelligence and machine learning, distributed ledgers technology, biometric based identification and authentication, big data and cloud computing and last but not least application programming interfaces which enable cooperation of various financial applications at the same time.

Last but not least there are the policy enablers of fintech which principally entail relevant regulatory solutions and physical infrastructural elements. They provide the base and the framework for fintech activities. They rest foremostly on the shoulders of national states. They may entail for example creation of a proper national broadband internet network,

development of digital authentication systems, defining the data protection rules and systems and finally addressing the cyber security issues.

**4. Financial services providers and fintech**

Fintech developments facilitate new entrants arrival into the financial system which have the potential of changing its composition, concentration, organization and the modus operandi.

They comprise at least three distinct classes of entities (FSB, 2019, pp.2-5).

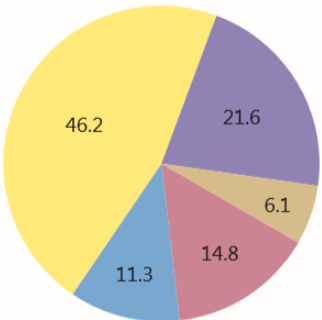
The first ones are fintech companies themselves,-bank like or insurance like or asset like companies-which rely on their ICT technological supremacy in some areas and may offer financial services in selected areas on their own, competing against existing incumbents. This is by far the most populous fraction of newcomers, bringing more diversity, volatility and competition to financial services provision. They are also bringing additional risks from the regulatory stand point as well as the market stability implications due to their competitive pressure on financial institutions margins. Its population is difficult to measure precisely as we are lacking their precise definition. According to the study prepared for the European Parliament in 2018 the global fintech sector was made up at that moment by circa 3.800 companies. Around 1.500 of them were domiciled in the US,1.000 were registered in EU,250 in India and about 100 hundred in China (European Parliament, 2018, p.33).

The second class of entities are Big tech companies which are most commonly defined as large, technology based entities, whose primary activities encompass provision of digital services. Financial services are, unlike in fintech companies, their secondary product so far. It is estimated that Big tech revenues in 2018 were coming foremostly from communication services(above 46%) and only around 11% represented revenues from financial services.

Financial services in Big tech portfolio presented in Figure 3.

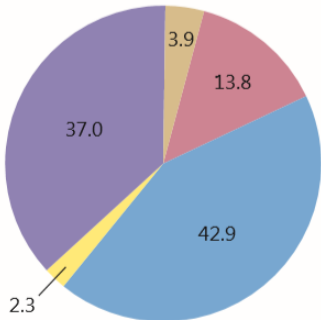
In per cent

Big techs' revenues by sector of activity<sup>1</sup>



- Communication services
- Consumer goods
- Information technology<sup>2</sup>
- Financials
- Other<sup>3</sup>

Regional distribution of big techs' subsidiaries<sup>4</sup>



- Europe
- Asia-Pacific
- Africa and the Middle East
- North America
- Latin America and the Caribbean

The sample includes Alibaba, Alphabet, Amazon, Apple, Baidu, Facebook, Grab, Kakao, Mercado Libre, Rakuten, Samsung and Tencent.

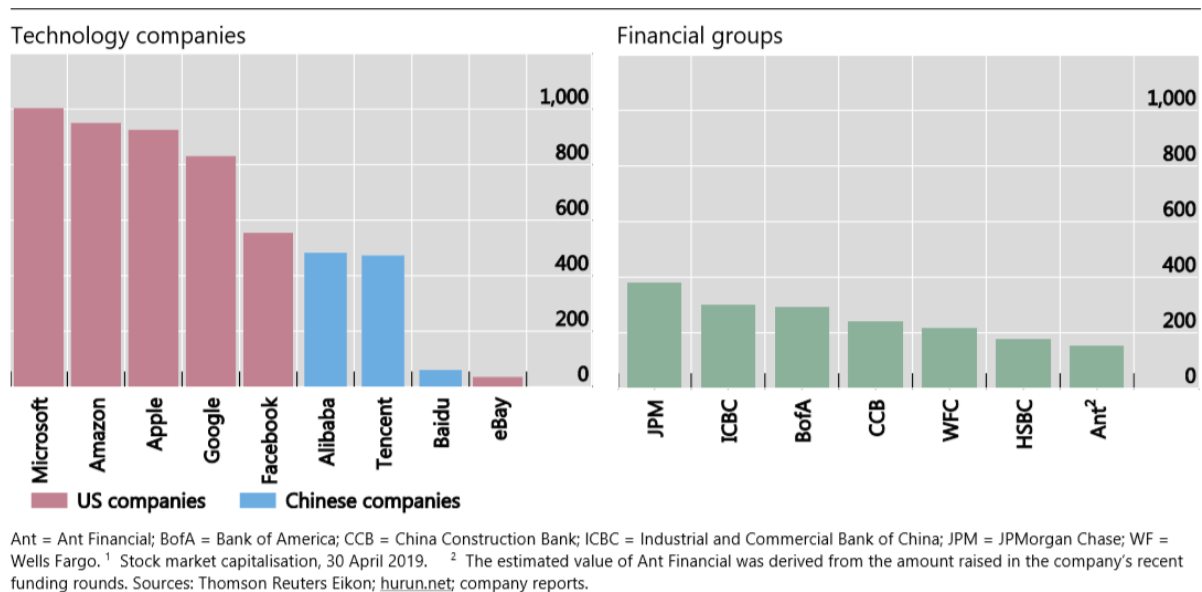
<sup>1</sup> Shares based on 2018 total revenues, where available, as provided by S&P Capital IQ; where not available, data for 2017. <sup>2</sup> Information technology can include some financial-related business. <sup>3</sup> Includes health care, real estate, utilities and industrials. <sup>4</sup> Shares are calculated on the number of subsidiaries as classified by S&P Capital IQ.

Figure 2. Financial services in Big tech portfolio

The population of Big tech companies in comparison to fintech entities is very limited and global players include currently mainly American and Chinese corporations. We could mention here in terms of example the names of Alibaba, Amazon, Apple, Baidu, Facebook, Google, Microsoft, Samsung or Tencent.

The core business of these companies is information technology and business model of these companies rests on providing for direct interactions among a large number of users. Side effect of their business activities are established customer data and networks and advanced software development.

The future competitive impact of Big tech on the financial services market may be substantial. With their established customer networks and name recognition, technological lead as well as strong financial position they could become a real challenger to the existing incumbents. To put it into the financial perspective available statistics indicate that in 2019 stock market capitalization of the first seven largest Big tech have surpassed by far the stock market capitalization of the seven largest financial groups in the world. (see Figure 3)



Source: FSB (2019), p. 4

Figure 3. Stock market capitalization of Big tech versus major financial groups

The first Big tech on the list-Microsoft-have recorded market capitalization 2,5 times higher than J. P. Morgan-the leader of the financial institutions list (FSB, 2019, p.4)

The third population of entities are the ones that are composed of third party service providers to the world of financial institutions, and which role is quickly growing. Part of them belong currently to Big tech and another part to fintech companies. New emerging trend is the



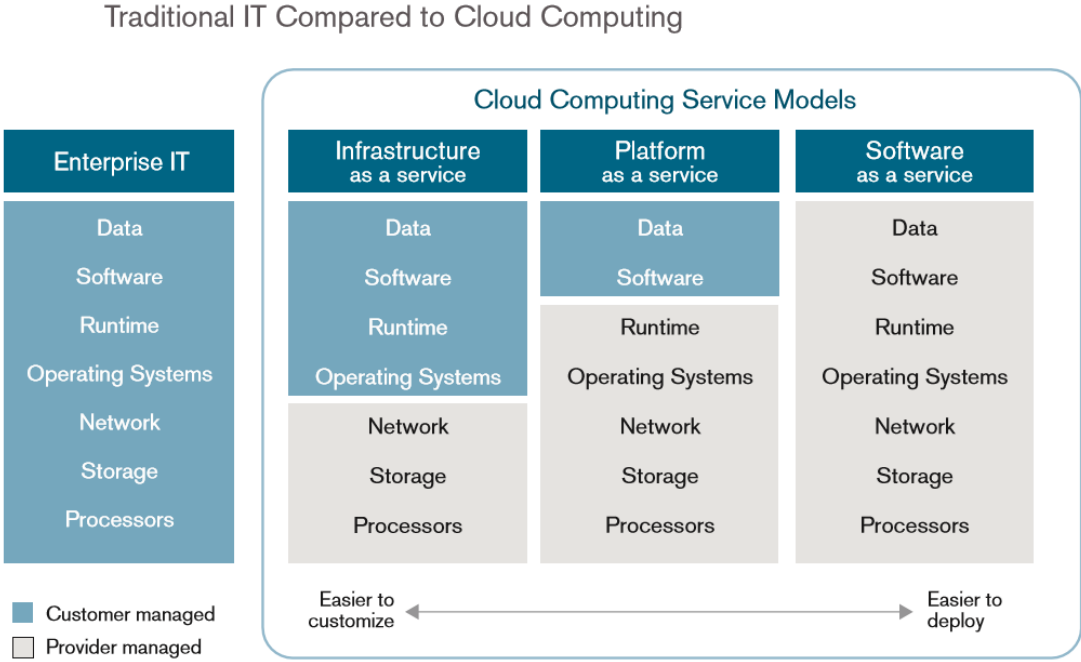
presence here of government sponsored establishments which reflects growing security concerns and the search for national digital sovereignty.

Financial institutions rely on third-party service providers inter alia for data provision, physical connectivity, and cloud services. Particular relevant today are cloud computing services.

Cloud computing refers in principle to the practice of using a network of remote servers, typically accessed over the internet, for the provision of IT services. It offers more convenient and frequently cost effective access to computing resources compared to the in house approach. Principal advantages are economies of scale, flexibility, operational efficiencies and cost effectiveness.

The overall spending of financial institutions on cloud services is estimated to reach in 2020 the level of \$55 billion, up from \$37 billion in 2017(Gartner, 2017).

The service could be offered in different constellation and different business models.(US Dept Of Treasury, 2018, pp.44-47). It should be noted perhaps that as of now outsourcing services in cloud computing for financial sector entities are in most cases subject to regulatory consent. Traditional IT Compared to Cloud Computing presented in Figure 4.



Source: US Department of Treasury (2018), p.46

Figure 4. Traditional IT Compared to Cloud Computing

Cloud computing is strongly associated with the big data issue. Technological advances lead to increasing amounts of data collected, processed, shared and used in digital form at lower cost and on a larger scale. Big data generally refers to technological developments related to the area of data collection from a varied sources, storage, processing, verification, analysis and applications. It is often characterized by the increased volume, velocity and variety of data being produced. It typically refers to data coming from the internet, but of course it is not limited to them (EBA, 2020, p.12).

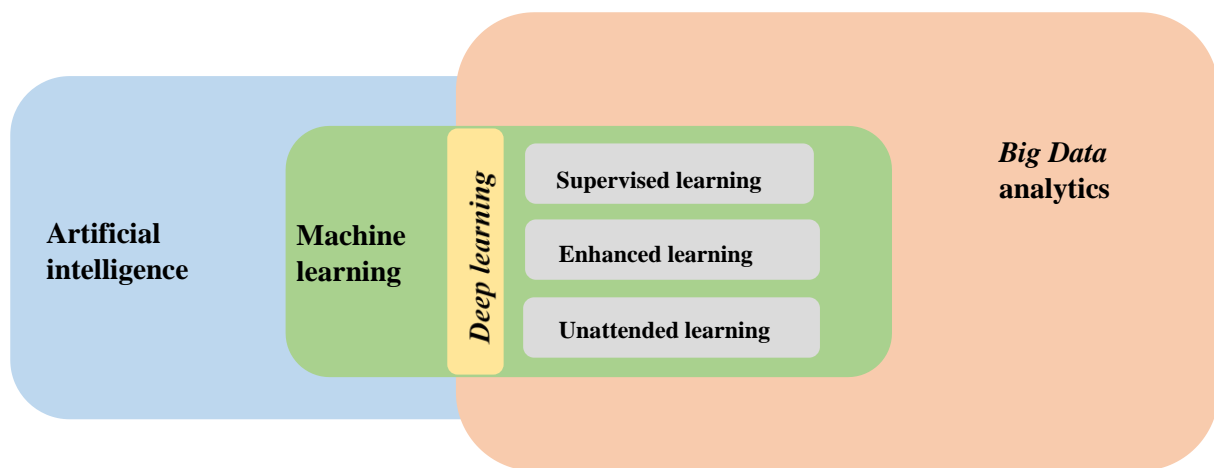
Big data offers particular advantages when processed with the advanced analytics tools, that is with the autonomous examination of data or content using sophisticated artificial intelligence techniques. Advanced analytics techniques, based on artificial intelligence, may include a number of tools like text mining, machine learning, forecasting, visualization, semantic analysis, sentiment analysis, network examination of data or content, etc. This may assist in forecasting the future behavior of financial market participants, while transaction analysis may help in detecting some repetitive patterns. This may lead to the development of the technology of smart contracts and their automatic self execution, when ex ante defined conditions are met. This may result in lowering the total transaction costs and accelerate its implementation.

Big data analytics seem to be nowadays particularly well developed in the insurance sector which has a long tradition and a strong demand for the use of statistics for business purposes, including underwriting policies, claims settlement or fraud detection. In the recent thematic study of European Insurance and Occupational Pensions Authority (EIOPA) on the use of big data analytics in medical and motor insurance in EU, it was revealed that traditional data sources such as demographic data, loss data, hazard data, mortality and morbidity rates are in a growing degree supplemented with other data coming from car telematics, internet of things, social media exploration, web searches and web comparators, data generated from third party vendors, bank accounts data or health genetic data (EIOPA, 2019, p.12-13).

It creates a completely new reality for the insurance companies and their risk assessment possibilities, applied business models and market pricing.

Progress in big data analytics is closely linked with the digitalization and datafication of economic and social life as well as the development of artificial intelligence and its important component-machine learning. Particular advantages are offered by natural language processing technologies that allow for automatic processing of factual texts.

Machine learning provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Deep learning on the other hand, is a subset of machine learning, which uses the neural networks to analyze different factors with a structure that is similar to the human neural system. It is particularly useful for the analysis of unstructured data. Figure 5 presents the field of AI and its interactions with ML and *Big Data* analytics.



Source: Kabza M. (2020)

.Figure 5. Interactions between AI, machine learning and *Big Data* analytics

There are three major recognized categories of machine learning: supervised learning, unsupervised learning, and reinforcement learning, depending on the human involvement into the process.

Artificial intelligence is generating concurrently high level of start up activities and is becoming increasingly an object of geostrategic competition worldwide. Potential impact of this innovation on global economy by 2030 is estimated to reach the level of 13-16 billions of US dollars. (EU Monitor, March, 2020).

### **5. Financial innovations and the governance of the financial systems**

Financial innovations are impacting not only the composition of intermediating institutions offering financial services. They are providing additionally a possibility of decentralizing financial systems by eliminating or reducing the need for intermediating activities or centralized processes in the delivery of financial services. They are also effectively questioning the future role of the central banks and their monetary policy. In practice this means a democratization of the whole system and growth of mutual reliance of the market participants on their own actions and decisions.

From the systemic point of view there are different types of decentralization in financial services which may effectively take place. In principle it may take three broad forms (FSB, 2019a):

- decentralization of decision-making, which involves a move away from a single trusted financial intermediary or infrastructure. Their powers are taken by systems in which a set of users is able to make decisions about the relevant financial transactions. Distributed ledger technology is a good example of the situation.
- decentralization of risk-taking, which involves the shift from the retention of risk on the balance sheets of individual financial intermediaries towards direct matching of individual users and providers of financial services. P2P services or crowdfunding may be quoted as an example.

- decentralization of record-keeping, which involves a move away from centrally held data and records, towards systems in which the ability to store and access data is given away to broader group.

There are currently two leading technologies effectively enabling decentralization of the financial systems: distributed ledger technology(DLT),or blockchain, and on line peer to peer platforms (P2P) (FSB, 2019a).

Distributed ledger technology (DLT) enables the decentralization of record-keeping and processing by organizing a network of cooperating computers, governed consistently by the adopted rules. Online peer-to-peer (P2P) or user matching platforms, allow users to interact directly and decentralize their risk-taking and decision making.

A vital component of decentralized finance are cryptocurrencies. Bitcoin was the first currency that was not issued by any country but through a decentralized technology. It led essentially to the situation in which central banking is considering a number of innovations in their activities, including introduction of their own digital currencies.

Traditionally, financial institutions used to play an important role in the economy by reducing transaction costs, connecting market participants and spreading the risk. Application of DLT and on line peers to peers platforms is creating entirely new situation in this respect. They can eliminate the need for intermediaries to facilitate financial transactions. Financial system becomes decentralized while it reduces the use of centralized institutions and processing and replaces them with decentralized autonomous networks.

Decentralized finance may signal the beginning of a shift away from industrial-era finance, based predominantly on big centralized financial institutions and systems, which remained basically unchanged for the last centuries (Lippel S ,2019). We are heading nowadays into the new era of network-based finance. Diffused and decentralized financial systems may be dominating the scene because of the advancement of the new technology.

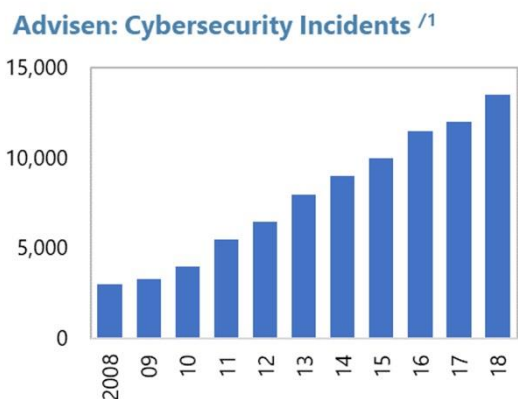
## **6.Cybersecurity and data protection: new risks and challenges**

Financial innovations enabled by fintech related to the digitalization and datafication of financial activities are introducing important changes into the current risk agenda. Cybersecurity,data protection and technological risks are coming to the front of the risk agenda in financial systems(Buckley R, et al, 2019, p.1).

Cyber risk in a wide sense refers most often to the risk of financial losses, disruption or reputational damage to the organization resulting from the failure of IT systems. Most dangerous are cyber attacks where the harm is done intentionally(BIS, May, 2020)

Financial institutions are relying today broadly on digital assets and financial services are among the most-digitized sectors of the economy (Gandhi, et al, 2018).They are therefore highly exposed to cyber risk and cyber incidents. The financial services sector also owns a lot of sensitive personal information, which makes it highly attractive sector for data breaches. Cybersecurity incidents are growing in severity and frequency. As indicated by a recent study of IMF the number of incidents recorded worldwide in the financial services have tripled in the last 10 years and that, judging from Singapore experience, they were affecting various parts of the financial sector, but banks and securities in particular (IMF, 2020).

Frequency of cybersecurity incidents in finance (number of events) presented in Figure 6.



Notes: 1/ Number of cybersecurity incidents from international data collected by Advisen and are approximately transcribed from the Bank of Canada's 2019 Financial System Review.

Source: IMF (2020), p.15

Figure 6 Frequency of cybersecurity incidents in finance (number of events)

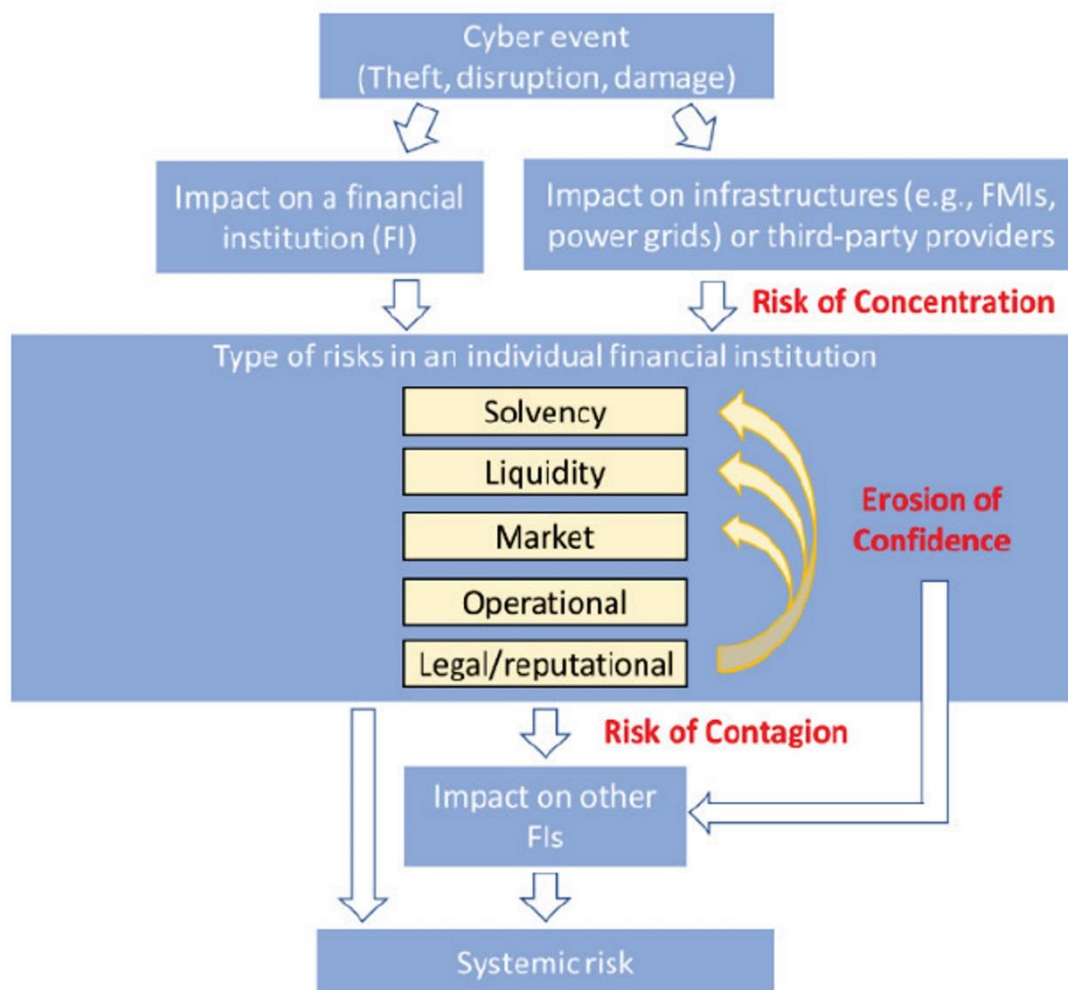
Recently recorded cybersecurity incidents have raised the public profile and public interest in this area. The most publicized cyberattacks globally were Wanna Cry and Not Petya. The WannaCry ransomware attack of 2017 affected computer systems in more than 150 countries, while the most destructive in financial terms cyberattack until now, NotPetya, cost at least US\$10bn (IMF, 2020, p.4).

Cybersecurity risk could be regarded as a new form of traditional risk related to economic crime, espionage and service disruption, and as entirely new form of risk((Buckley R, et al, 2019, pp.9-11).It is indicated that cyber risk is emerging as the new source of financial systemic risk and therefore needs to be monitored by relevant financial regulatory authorities.

Cyber events can be classified into different types, depending on the harm that they cause. First, theft-related cyberattacks extracts such items as funds, monies, customer credentials, intellectual property or market-valuable information. Second, disruption-related cyberattacks endanger business functionality. Third, cyberattack can also affect data integrity, or damage system hardware or software (IMF, 2020).

With respect to financial institutions successful cyberattacks can cause to experience various microprudential risks, including solvency, liquidity, market, operational, legal, and reputational risks.

Apart from microprudential risks for individual financial institutions, cyber events can also diffuse these risks through the entire financial system and cause systemic risk. This could be developed through different transmission channels, such as risk concentration, risk contagion, and risk of loss of confidence (IMF, 2020, pp.8-9).The first one arises when a cyber attack affects a key financial market infrastructure, important cloud services provider or systemically important financial institution. This could lead to the loss of critical services that could not be easily substituted or replaced. Cyber risk and systemic risk presented in Figure 7.



Source: IMF (2020), p.9

Figure 7. Cyber risk and systemic risk

The second one takes place if a cyberattack on a financial institution would lead to financial difficulties that spill over to other financial institutions. The third one comes in a situation that widespread attack triggers a loss of confidence across several financial institutions or the financial system which endangers overall financial stability.

Additionally datafication and digitalization of the financial services and their growing dependence on technology leads to the creation of new sources of systemic risks related to IT systems, applied algorithms(model risk) and human failure (Buckley R, et al, 2019, p.19).

Last but not least it should be stressed that new features of financial services coming from automation, usage of big data and digitalization result in the faster movement of the risk through the financial system than in the analog world (Brummer, Yadav, 2017, p.4).

Apart from cybersecurity issues generated by current wave of digitalization and datafication in financial services increasingly important role relates to data security and privacy risk which is in principle related to the proper handling of data. It refers to the issue of what data in computer systems and under what conditions could be collected, stored, processed and shared with third parties.

Its importance is reflected in a growing regulatory output in this regard. The most comprehensive data protection legislation enacted to date is the [General Data Protection Regulation \(GDPR\)](#), governing the collection, use, transmission, and security of data coming from residents of the European Union, regardless of the location of the entity collecting the data. According to its rules data subjects must be given the opportunity to give clear consent prior to the collection of personal data. Organizations are required to notify supervisory authorities and data subjects within 72 hours in the event of a data breach affecting users' personal information in most cases. Data subjects must be notified of their rights with regard to their personal data, including the right to access, correct and delete personal information. The regulation establishes new important rights for individuals, like data portability, the right not to be profiled or the right to be forgotten.

## **7. Financial innovations and consumer protection**

From the financial consumers' point of view fintech based financial innovations are in the first instance transforming the way they interact and access financial market. They enable better access to financial services and enhance financial inclusion process (Consumers International, 2017). They also change the ways consumers are interacting with financial services providers. It is shifted to online channels and frequently to e-money, with particular application of mobile devices like smartphones and feature phones. It also includes the use of non incumbent, new market players to satisfy better consumers' needs, expanding competition and market choice.

With the rise of fintech retail financial market is increasingly demonetized and mobile wallets are gaining in importance.

Fintech are offering different applications which also increase consumers' awareness of their financial activities. It provides for example means for analysing personal incomes and expenditures, using consolidated data coming from various sources and all of users' account providers in one place. It may additionally offer a power point presentation of this numerical analysis. In effect it may play a role of automated personal financial advisor.

Fintech is bringing to consumers not only opportunities and pleasures but also new risks, concerns and consumer protection challenges. Key among them are data and privacy protection, management of cybercrime, fight against financial inclusion, questions of liability and systemic risk.

As a data intensive ecosystem fintech alert security concerns with respect to hacking and data breaches, identity theft and theft of assets. As financial institutions are increasing the amount and variety of data they possess, ownership and control of data will become a key issue for all stakeholders. Data security will play fundamental role in maintaining trust with the financial institutions and the development of new business models.

It is therefore very natural that the issue became recently a global theme. In its recent document the G20/OECD Task Force on Financial Consumer Protection is offering financial consumers' protection global guidelines in the context of digital financial services (G20/OECD, 2018). They define digital financial services (DFS) as "financial operations using digital technology, including electronic money, mobile financial services, on line financial services, e-teller and branchless banking, whether through bank or non-bank institutions. DFS can encompass various monetary transactions such as depositing,

withdrawing, sending and receiving money, as well as other financial products and services, including payment, credit, saving, pensions and insurance. DFS can also include non-transactional services, such as viewing personal financial information through digital devices” (G20/OECD, 2018, p. 13).

Additionally the guidelines define also major risks of digital financial services. They see them in four main areas:

- market driven risks-which may include inter alia a misuse of unfamiliar products, offers delivered to uninformed and unprepared consumers, new types of market fraud, lack of security and privacy of data, excessive use of digital profiling to exclude inter alia unwanted customers, rapid access to high cost credit and distribution of speculative products.

- technology driven risks-which may include misuse of small and big data, unreliability of mobile networks and digital finance platforms, cybersecurity risks, excessive use of algorithms affecting financial decisions in an inappropriate manner or implying wrong correlations.

- consumer driven risks-increased digitalisation of daily life and personal financial decisions not necessarily matched by adequate financial literacy levels, greediness of financial institutions.

- regulation and supervision driven risks, which may encompass, inter alia, inadequate disclosure or redress mechanisms, existence of regulatory arbitrage, missing coordination arrangements of supervisory bodies concerned, etc..

If these problems can be properly resolved, fintech's new opportunities will deliver great potential in providing financial services tailored to the needs and preferences of consumers and available through mobile devices.

## **8. Concluding remarks**

As indicated in our analysis financial systems worldwide are increasingly experiencing the mounting pressure of the new technology based financial innovations. Some of these developments are generating alternative financial reality, existing parallelly to the “old” one whereas some of them are replacing the “old” one. Alternative intermediating institutions are gaining ground vis a vis incumbents, relying on their technological and market supremacy. Some technological solutions provide on the other hand for the disintermediation of the finance and thus removing unnecessary transaction costs and matching directly economic agents. Digitalization and datafication, coupled with artificial intelligence, are offering new immense operational opportunities and economic benefits. On the other hand they are also the source of new risks to the financial and economic systems which need to be properly addressed. Technology based innovations in the private financial systems are accompanied by numerous innovative developments in the public sector: regulations, supervision, monetary systems, tax collection systems, critical financial infrastructure, etc. We have kept silence with this regard but it is obvious that the two parts of the financial systems must be in equilibrium in order to be able to communicate with the help of the financial instruments.

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# International Centre for Digital Finance

## **Aims:**

1. Developing activities promoting socially responsible digital finance
2. Initiating activities for better understanding and use of digital finance and financial innovations
3. Organising platforms for cooperation of digital finance stakeholders , its institutions, investors, consumers, public sector agencies and academic community .

## **Forms of activities:**

- undertaking theoretical and applied research in the area of digital finance
- undertaking educational activities in the area of digital finance
- organising of seminars and conferences ,national and international
- supporting domestic and international cooperation in the area of digital finance
- monitoring of digital finance developments and its social and economic implications
- undertaking other actions and initiatives which relate to its aims

## **Strategic partners:**

Fundation for the Promotion of Education, Chamber of Insurance and Risk Assessment, Interrisk.