FINANCIAL INNOVATION IN THE DIGITAL AGE: CHALLENGES FOR REGULATION AND SUPERVISION

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Abstract

Banks have always managed to make the most of technology to improve their efficiency and the service provided to their customers, but they now face a new wave of innovation with much wider implications for financial services. Despite the acknowledged benefits, developments in technology and their implications on the efficiency, financial stability, consumer protection and integrity of the financial system require a holistic response by regulators and supervisors.

This paper aims at analyzing the potential benefits of the digitisation of finance, the new risks that digital infrastructures, business and distribution models and customer solutions may pose, and the expected regulatory and supervisory response. The new digital paradigm presents new risks in terms of cyber security, consumer protection, operational continuity and fraud, among others. These are not fully covered by the traditional supervisory and regulatory approach. Hence there is a need for a renewed regulatory and supervisory framework that fully captures the potential of digital innovation and makes the financial system more resilient against future crises. The response should rest, at least, on four pillars: well-defined policies on the control and management of new technological risks in the financial sector, the launch of innovation hubs, the creation of supervised safe environments for market experimentation (regulatory sandboxes) and the acquisition of new digital skills and a collaborative mindset.

1 The digital transformation of the economy and the society

The evolution of economy and society is featured by continuous change. Most of the time, this change is slow and incremental but, every now and then, rapid disruptive changes take place in short periods of time, leading to what are commonly known as "revolutions". We are living now one of these stages of disruption. Massive adoption of digital technologies invented in the second half of the 20th century, namely the Internet and mobile phones, together with the exponential growth in computation and storage capacity at a lower cost, is radically transforming the world, profoundly changing personal relationships, business organisations and, in general, the way economic value is created.

Triggered by technological advances and by other socioeconomic dynamics, a series of trends have emerged related to consumer behavior and business models. The combined effect of these three groups of transformational forces – i.e., those pertaining to consumer behavior, technology and business – have given rise to the so-called *"fourth industrial revolution"* which is already reshaping the economy and society, and will further continue to do so in the future, producing disruptive changes at an unprecedented speed, following an exponential rather than a linear pace.

First, most *consumers are immersed in an information and services continuum* to which they can be constantly connected through their personal ecosystem of devices. In this new environment, customers have more power than ever. They feel they need to be connected, anywhere, anytime. They also want their needs to be met immediately, including the consumption of relevant and useful content. Customers are also becoming increasingly aware of the benefits that smart data can bring.

The changes in consumer behavioural patterns take on special importance in the context of the two new generations: *millennials and centennials.*[1] It is crucial to understand the

1 Millennials or Generation Y are young people born in the 1980s and 1990s and Centennials or Generation Z are people born from 2000 onwards.

services that are being and will continue to be demanded by these younger generations and by older "non-native" generations which are rapidly becoming digitalised. Apart from this, their loyalty to banks is much less evident than that of previous generations. More than 70% of them would use a financial service offered by a company from outside the sector, compared with 50% of older customers.

Second, the growth in *mobile technology* and the development of smartphones has changed the digital landscape to the point that most of our online connections are made in mobility.

Digitisation of interactions, sensorisation and connectivity are driving exponential growth in the volume of generated data. Now the challenge is how to turn this data into actionable knowledge. *Big data technologies* along with the advances in *Artificial Intelligence and Machine Learning* will help to improve interaction in areas such as virtual assistants or automation through algorithms, and to extract this knowledge through the identification of behavioural patterns of consumers, predict future market trends or prevent transactional fraud.

The success in the use of the above-mentioned technologies can nevertheless be weighed down by heavy and rigid legacy infrastructures with a high cost of ownership. Companies are trying to overcome this hindrance by evolving towards *"smart" infrastructures,* like *cloud computing,* which are flexible, agile and efficient, easily manageable in cost and effort.

Third, in this world where technology serves as a basic facilitator, and consumers run away from complexity, forward-looking companies have realised that they have to *change their business model.* A satisfactory customer experience means getting their problems solved in real time through the channel of their choice. The implications of this integrated experience for companies are complex, because it requires the ability to provide tailored solutions, knowing the context in which the customer is, and to orchestrate the necessary channels to deliver them in a transparent way. It also requires profound changes in the talent and culture within the organisation, which must evolve towards structures which are more agile and flexible and less hierarchical within more collaborative environments in which information can flow without unnecessary restrictions.

Moreover, exponential technologies have facilitated the surge of *new digital native competitors* in practically every industry. These competitors are coming from outside established sectors. They have detected trends in customer behaviour and technologies that offer chances of success in competition with incumbents. There are two main types of new digital competitor: big internet players (such as Google, Apple, Amazon or Facebook) and start-ups with a flexible business model and without legacy structures.

All in all, these three forces have been affecting almost every industry in the world for the last 10 years, with a pervasiveness and depth which are transforming every value chain.

2 Digitisation: Reshaping the financial industry[2]

This digital revolution has also arrived in the financial sector. Currently there is no doubt that the financial sector is at a major crossroads. The negative impact of the economic environment on banking, expectations of a prolonged period of low interest rates and the stagnation in lending lead inevitably to the quest for transformation processes that enable costs to be reduced and a boost in revenues. Things become more complicated if we take

2 J. M. González-Páramo (2016), admission speech at the Royal Academy of Moral and Political Sciences "Reinventing banking: from the great recession to the digital disruption", http://www.racmyp.es/R/racmyp/docs/discursos/D90.pdf.

into account two additional factors: the reputational problems still weighing on banks and the assimilation of the aftermath of the regulatory tsunami. Accepting that all the above requires profound changes in the sector; the presence of this radical disruptive force, the *digital revolution, has changed everything.*

Paradoxical as it may sound, technology could become the major gearshift in the financial sector for decades. In fact, banking has always managed to take advantage of technology to improve its efficiency and the service provided to its customers, but it now faces new developments with much wider implications.

Digital disruption may help banks to survive the pressures of low growth, waning profitability and tough regulation, and to solidly re-establish customers' trust and reputation with society. If banks can offer a better user experience, they will again come closer to what customers demand and need to satisfy their aspirations and take advantage of the opportunity of this new age, since they are already being exposed to the digital transformation in nearly every aspect of their daily lives.

The disruption characterising the transition in banking is reflected in irreversible changes in both the demand for and supply of financial services. On the demand side, we are already seeing radical *changes in the patterns of consumption* and savings behaviour of a whole generation. The two new generations of digital natives, the millennials and the centennials, have started joining the labour force, and in the coming years they will become increasingly important customers not just of banking but of a whole range of sectors. In a context of increasing competition such as the current one, it is crucial to understand the services that are being and will continue to be demanded by these younger generations and by older "non-native" generations which are rapidly digitising.

As for the disruptions seen in supply, the sector is facing greater *competition* and *technological* changes that will decisively affect the quantity, quality and price of financial services.

Regarding competition, over the past few years we have seen an increase in the number of new players coming from the digital world, the "fintechs". Their objective is to concentrate on specific segments of the value chain (foreign exchange, payments, loans, trade, asset management or insurance, for example), unbundling or disaggregating the services previously originated and sold by the banking sector. These companies start without the burden of having to maintain a physical distribution network, the rigidities of corporate culture, the upkeep of obsolescent technological systems or tough banking regulations. Also, the sector will have to compete not only with providers emerging in the financial sector, but also with those arriving from other areas, in particular, the major digital companies, Google, Apple, Facebook and Amazon (which we refer to under the acronym GAFA).

And new competition will be joined by technological changes either underway or yet to come. As we have seen, there are a number of exponential technologies interacting with other digital innovations, such as the large-scale use of big data, artificial intelligence, blockchain and cloud computing. All this will open the way to different modes of participating in the digital ecosystem, such as by acquiring or taking equity stakes in "fintechs", by developing internal capabilities or through open innovation.

Thus, the real question is not whether *banking will change radically,* which it undoubtedly will, but rather whether banks will still play a significant role in the new financial ecosystem. Banking would have to adapt its strategies radically to survive this unbridled competition

from new entrants. Success will be determined by the ability to, first, take care of their main asset: the customer experience, secondly re-establish their reputations; and finally, reach keener prices and automation of processes so that customers can devote only the time they consider absolutely necessary to administering their finances.

This model requires profound changes of *talent and culture* within the organisation, which needs to evolve towards structures which are more agile and flexible, and less hierarchical, within more collaborative environments in which information can flow without unnecessary restrictions. The cultural change must favour the process of continuous innovation, which values learning through success, and in which failure is quickly identified and controlled, allowing progress to be made towards the realisation of the bank's strategic vision. Thus it involves a transformation in three areas: technological, strategic and in terms of corporate culture and talent. It is, in short, a complete *reinvention of the banking business.*

In this context of disruptive change, two forces will be fundamental for determining the speed of change and the scenario towards which the sector will move. The first, which is internal in nature, concerns the banks' vision of the future and their technological, financial and organisational capacity for self-transformation. The second is the role of the regulators and supervisors as drivers of or brakes on the changes needed during the transition.

3 Regulation and supervision: financial stability and consumer protection

As mentioned above, regulators and supervisors act as key drivers of, or brakes on, the changes needed during the transformation of the financial industry. As a starting premise, *regulation in the financial sector is necessary, as is more intensive supervision than in other sectors.* This general principle is based on the intrinsic characteristics of the banking business, primarily understood as the means of channelling the savings generated in the economy towards the different participants: individuals, businesses and governments. This process of intermediation is organised broadly through the transformation of maturities and the provision of various financial services that facilitate daily transactional operations by customers, mainly linked to the space of payments.

The recurring crises that have been experienced in the world economy over the past decades have shown that the existence of strong financial systems is crucial for stability and economic growth. The prerequisite for achieving economic stability is to ensure that financial institutions work properly. The aim is to safeguard the stability of the financial system by ensuring that the vital roles played by the banking sector in the economy do not suffer significant disruption or that the institutions do not collapse.

To this end, regulation and supervision in the sector seeks *four objectives:* i) promoting the stability of the financial system, avoiding systemic risk, bank runs and the malfunctioning of payment services; ii) maintaining the safety and solvency of banks; iii) protecting consumers of financial services, and iv) improving efficiency and competition in the system.[3]

Traditional regulation has played an essential role in the development of the financial sector to date. However, often the *promotion of innovation* in the financial sector has been a *secondary objective* for the authorities, if not disregarded altogether. This factor, coupled with the significant barrier to entry posed by banking regulation itself (which has deterred many potential new entrants), explains why the industry has been able to develop its own

3 See for example European Central Bank, *Mission statement of the SSM,* ECB (website), <https://www.bankingsupervision.europa.eu/about/mission-statement/mission-statement-of-the-ssm/html/index.en.html> or Bank of Spain, *Objetivos básicos,* Banco de España (website) <http://www.bde.es/bde/es/areas/supervision/funcion/objetivos_basico/Objetivos_basicos.html>.

pace of innovation in competitive terms to differentiate itself from other banking actors and without fearing the entry of new players with radically different approaches.

However, as mentioned before, the digital transformation of the economy and the society changes everything, thus forcing authorities to adopt an active position. Regulation and supervision are now challenged to provide a regulatory framework that balances the promotion of the new digital value propositions – which benefit the customer and introduce efficiency gains in the market – and protection against the associated risks.

4 The transformation of financial services: benefits and risks

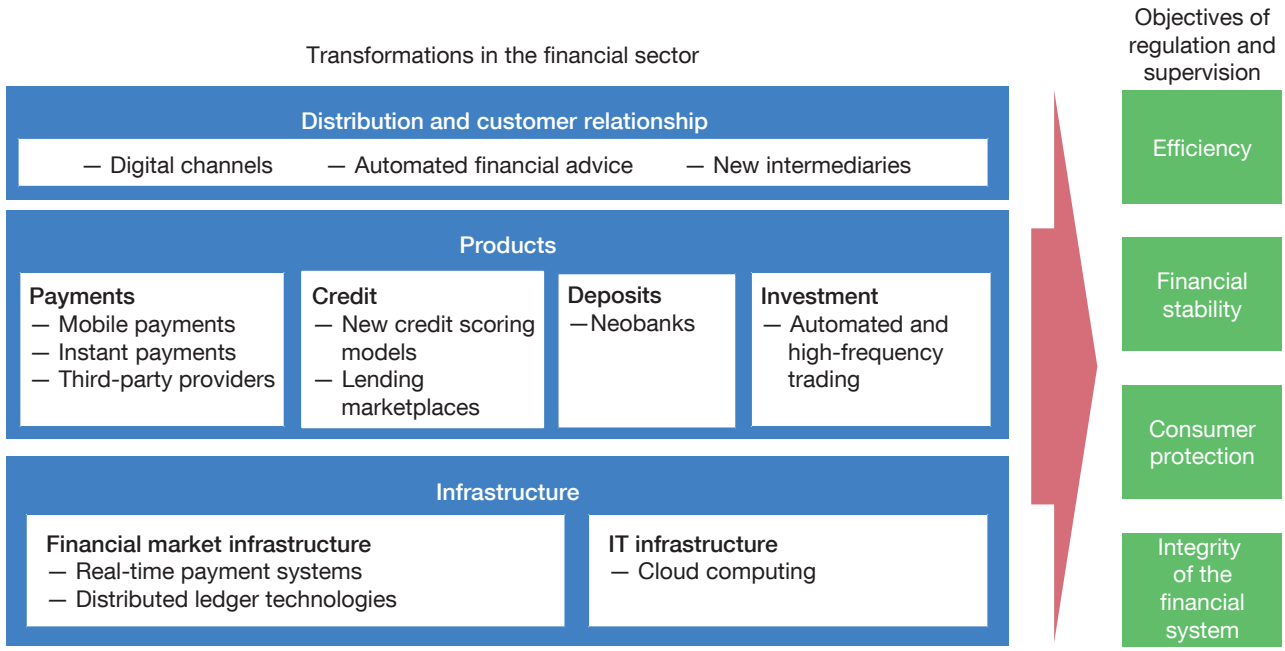
This section provides a framework to analyse how transformation of the financial sector could impact the aforementioned objectives of regulatory and supervisory authorities.

For the analysis to be systematic, the different transformations of the financial sector are categorised into those affecting the *infrastructure,* the *banking products* and the *distribution* – or, more generally, the customer relationship –. The first block comprises both financial market infrastructures – clearing and settlement of payments and securities – and the Information Technology (IT) infrastructure that powers the operations of each financial institution. The products block is subdivided into the usual categories of financial products: payments, credit, deposits and investment. The final block covers the distribution of products, the provision of financial advice and other intermediation services that are involved in the distribution value chain of financial services. The main focus of this analysis is on retail financial services. However, some changes in wholesale and investment banking are also covered, particularly with respect to financial market infrastructure and investment products.

Figure 1 shows the general analytical framework, including the main changes that are taking place in each of the blocks. The following subsections discuss the impact of each of the changes. Efficiency gains are presented first, followed by the implications (positive, negative or ambivalent) for financial stability, consumer protection and for the integrity of the financial system.

GENERAL FRAMEWORK

FIGURE 1



SOURCE: Author's elaboration.

Aside from this framework, it is important to note that technological advances are also directly helping the industry and the authorities to better address the (traditional and new) risks to financial stability, consumer protection and the integrity of the financial system. The so called *"RegTech" solutions* improve risk management functions and facilitate more effective and efficient compliance with regulatory requirements. They do so by focusing on the automation of manual processes and the links between steps in analytical/reporting processes, the improvement of data quality, the creation of a holistic view of data, the automated analysis of data with applications that are able to learn during the process, and the generation of meaningful reports that can be sent to regulators and used internally to improve key business decision making.[4, 5] The potential usage by supervisors of Regtech solution has also been highlighted by De Nederlandsche Bank: "technological innovation offers opportunities for supervisors, for example with respect to the automation of certain supervisory processes."[6]

4.1 INFRASTRUCTURE

Real-time payment systems

Real-time payment systems allow financial institutions to offer instant account-to-account payments to retail and business customers on a near-24/7/365 basis. Spain is already building its own system, that will be interoperable with the European Instant Payments scheme, which is also under construction and should be available by the end of 2017. The Bank of Spain and the European Central Bank are taking a leading role in this process, supporting bank efforts in this field, addressing clearing and liquidity concerns and promoting European interoperability and harmonisation.

Real-time payment systems involve significant initial implementation costs for payment service providers (PSPs). However, they *may lead to efficiency gains* in the future, due to reduced investment costs for the maintenance and upgrade of legacy systems, and lower variable management costs if real-time payments substitute other payment methods such as cash or cheques.[7]

From the perspective of *financial stability,* real-time payment systems introduce new risk challenges when compared to traditional retail payment systems. The continuous availability of the system (including outside normal business hours) makes *operational continuity* and reliability more demanding, both for the payments system and for the participating PSPs. Moreover, given the speed of e-payments, any delay or interruption in the service will be directly observable by end-users, which could lead to a quicker triggering of reputational risk. In traditional retail payments with deferred clearing, some operational incidents may go unnoticed by the customers.[8] Furthermore, *higher fraud risk* may also exacerbate operational risks. Indeed, the immediate availability of funds for the payee may make real-time payment systems a more attractive target for fraudsters.

4 Casadas, V., & Sebastián, J. (2016) RegTech, the new magic word in FinTech. *Digital Economy Outlook,* February 2016, pp. 4-5. BBVA Research. <https://www.bbvaresearch.com/en/public-compuesta/digital-economy-outlook-february-2016/capitulo/regtech-the-new-magic-word-in-fintech/>.

5 Van Liebergen, B. *et al.* (2016) *Regtech in Financial Services: Solutions for Compliance and Reporting.* Institute of International Finance. <https://www.iif.com/system/files/regtech_in_financial_services_-_solutions_for_compliance_and_reporting.pdf>.

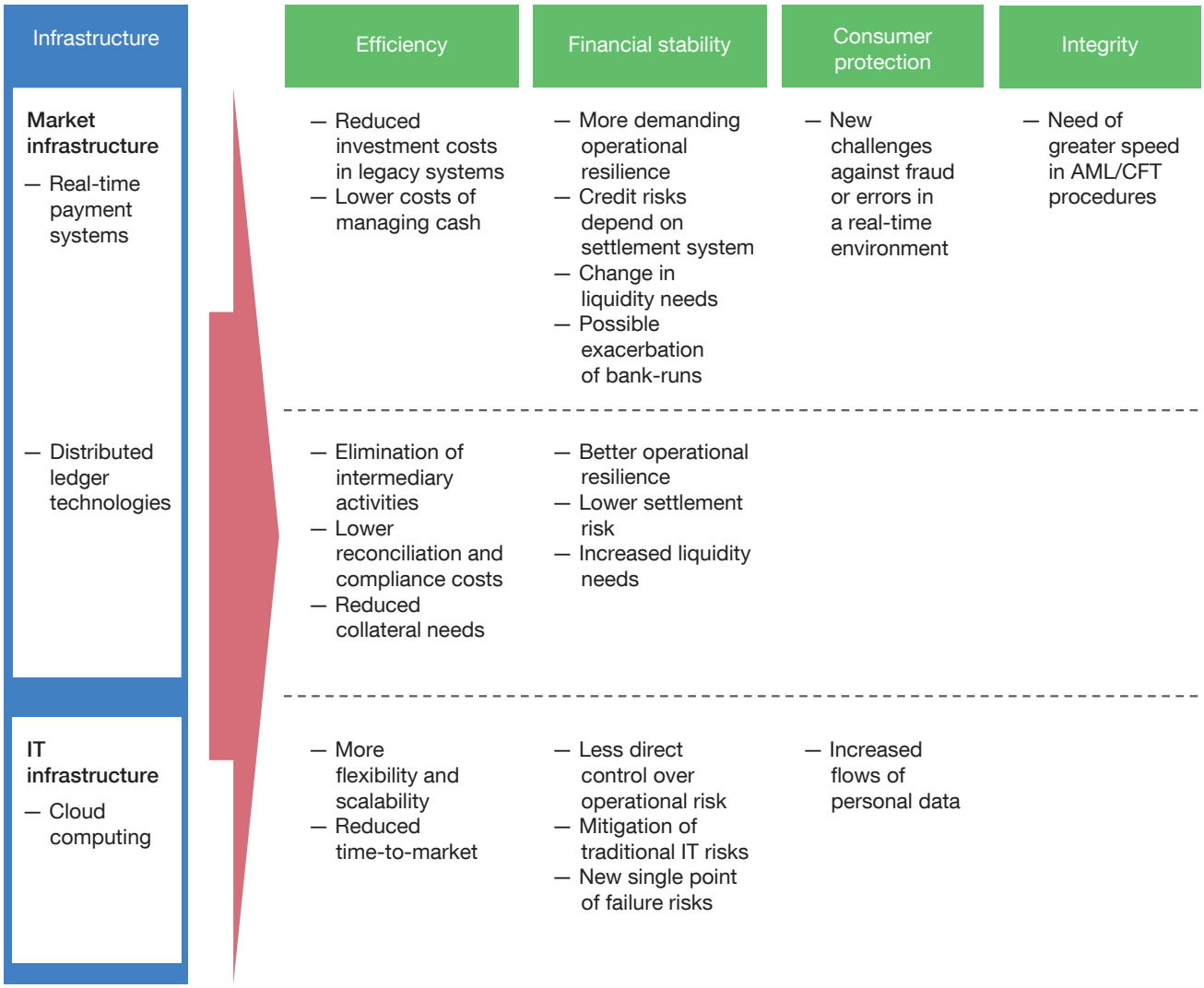
6 De Nederlandsche Bank (2017). *Technological innovation and the Dutch financial sector*.

7 BIS Committee on payments and Market Infrastructures (2016). Fast payments – *Enhancing the speed and availability of retail payments,* BIS <http://www.bis.org/cpmi/publ/d154.htm>.

8 Fernández, A., & Gorjon, S. (2016). Pagos Inmediatos: ¿Evolución o Revolución?, *Revista de Estabilidad Financiera,* 30. pp. 63-90. Banco de España. <http://www.bde.es/f/webbde/GAP/Secciones/Publicaciones/InformesBoletinesRevistas/RevistaEstabilidadFinanciera/16/MAYO%202016/restfin2016303.pdf>.

IMPACT OF CHANGES IN INFRASTRUCTURE

FIGURE 2



SOURCE: Author's elaboration.

The introduction of credit risk for the participating PSPs depends on whether the settlement of payments transactions takes place in real time (gross) or deferred (net). In the latter case, the payee's PSP will face the credit risk of advancing the funds to its customer before actually receiving the money from the payer's PSP. This credit risk can be mitigated in different ways: by increasing the frequency and timing of settlement cycles, by signing loss-sharing agreements between the participating PSPs, by setting limits on the maximum net debit or credit positions, or by requiring PSPs to pre-fund or collateralize their positions. However, setting limits might result in some payment transactions being rejected if the limits are binding. This might *erode the confidence of customers* on the system.

Regarding liquidity risks, systems with real-time settlement involve continuous liquidity needs, including outside normal business hours. In systems with deferred settlement, liquidity needs are not continuous and are mitigated by the netting of transactions, as in traditional retail payment systems. However, liquidity risks are enhanced if new settlement cycles are introduced, particularly outside normal business hours.

Another impact on financial stability is the potential *exacerbation of the risk of bank-runs,* especially if combined with automated advice or decision making, since depositors could

use real-time payment systems to quickly transfer funds in case of bad news concerning a financial institution.

The continuous operability of real-time payment systems and the immediate availability of funds also raise new challenges for consumer protection, particularly against fraud or errors. Likewise, preserving the integrity of the financial system requires improving and adapting anti-money laundering and combating the financing of terrorism (AML/CFT) procedures to the speed of real-time payment systems. Just like with fraud, the immediate availability of funds may attract illegal economic transactions to real-time payment systems.

Distributed ledger technologies

Another transformation of financial market infrastructures arises from the application of distributed ledger technologies (DLTs) to the clearing and settlement of payments and securities transactions. DLTs facilitate Delivery-versus-Payment (DvP) in these transactions *without the need of an intermediary,* by allowing the simultaneous transfer of cash and securities between parties.[9] Permissioned DLT networks, with access restricted to pre-approved institutions, can lead to *efficiency gains* due to the reduction or elimination of intermediary agents and steps. For instance, in cross-border payments, correspondent banking could no longer be necessary. In securities clearing and settlement, reconciliation costs could be lowered or even eliminated, since DLT networks build an immutable and unique record of transactions, instead of the duplicative records of traditional systems.[10] Compliance costs could also be reduced, since supervisory authorities can become a special node of the DLT network and directly observe the transactions. Moreover, since simultaneity of clearing and settlement in DLT networks reduces credit or counterparty risk, there are also efficiency gains due to reduced collateral needs and capital requirements. For derivatives, further efficiency gains can be materialised if DLT-based smart contracts enable the self-execution of contractual clauses.[11]

From the perspective of financial stability, the application of DLTs to the settlement of payments and securities transactions can *reduce settlement risks.* However, this *increases liquidity needs* and, therefore, liquidity risks. Furthermore, the application of DLTs can *improve the operational resilience* of financial market infrastructures, since the system of multiple validation nodes might make errors or cyber attacks more difficult, as well as making the detection and recovery from incidents faster. Nevertheless, the technology will first have to prove that it is sufficiently safe and robust.

Outside the formal financial system, DLTs are behind *private cryptocurrencies* such as Bitcoin. Although the idea of rule-based monies can be attractive in certain contexts, the public and ownerless nature of many of these cryptocurrencies involves *significant risks* for consumers: fraud, security, volatility, etc. Moreover, the anonymity (or pseudo-anonymity) of these DLT networks poses serious risks for anti-money laundering and combating the financing of terrorism (AML/CFT). For this reason, the European Union will

9 This is true if we assume the existence of a "cash ledger" within the DL network so that both types of assets (cash and securities) are on the same infrastructure. For this reason, so-called "settlement coins" are being defined as a way of putting a cash equivalent in the ledger.

10 Pinna, A., & Ruttenberg, W. (2016). Distributed ledger technologies in securities post-trading. *Occasional Paper Series,* nº 172. European Central Bank. <https://www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf>.

11 Brainard, L. (2016). The Use of Distributed Ledger Technologies in Payment, Clearing, and Settlement at *The Institute of International Finance Blockchain Roundtable,* Washington, D.C., April 14, 2016. Federal Reserve System. <https://www.federalreserve.gov/newsevents/speech/brainard20160414a.pdf>.

include the providers of cryptocurrency exchange and wallet services under the revised AML Directive. Moreover, if private DLT networks and cryptocurrencies grow significantly, outside the formal financial system, several risks for financial stability may arise.

Cloud computing in IT infrastructure

Financial institutions are also transforming their IT infrastructure with the migration of workloads to cloud computing services. When compared to legacy and centralised architectures, *cloud solutions offer multiple opportunities* associated to flexibility and scalability, and allow financial institutions to innovate faster, gain efficiency, reduce time-to-market and improve productivity exponentially. Cloud computing also allows a shift from capital expenditures to operating expenses and offers means for banks to manage computing capacity to satisfy customer demands at peak periods.

The use of cloud computing services has several *implications for financial stability.* For instance, outsourcing part of the IT infrastructure means that financial institutions have less direct control over *operational risks.* Nevertheless, cloud computing providers may be better prepared to deal with security and other technological risks due to their scale and specialisation. In addition, cloud computing may *mitigate traditional IT risks,* such as capacity or resilience. Indeed, it increases the resilience of data due to the "redundancy" system in which data is stored. Since backups can be located in remote places, there is a greater probability that they can be used in the event of a catastrophe. In any case, *Service Level Agreements* (SLA) between financial institutions and cloud computing providers, and the security measures required to the latter, become a key issue for operational risk.

Another impact on financial stability is the possible emergence of *new single point of failure* risk if there is a concentration in the providers of cloud services for the banking sector. This is likely to happen considering the economies of scale in the provision of cloud computing services, as well as the specific and more stringent requirements for providing these services to the financial industry.

From the perspective of consumer protection, the use of cloud computing services increases the *flow of personal data.* Therefore, there is a need to push for strong security measures, such as encryption techniques, and to comply with data location requirements, including international personal data transfers outside the EEA, while securing access to data by competent authorities.

If an adequate *business continuity plan,* exit strategies for the case of termination of the contractual relationship is not put in place, it can have negative consequences both for financial stability and consumer protection.

4.2 PRODUCTS

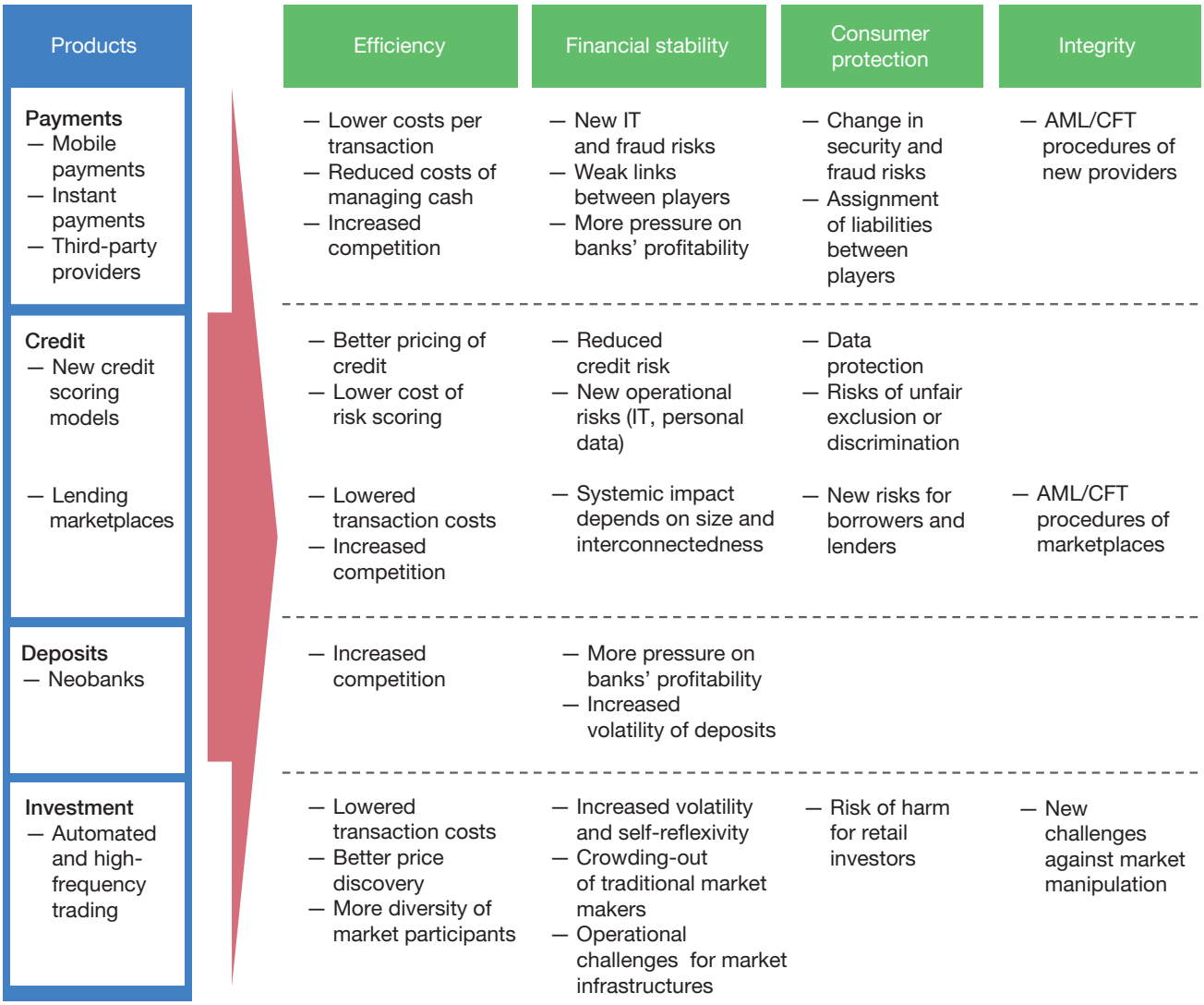
4.2.1 Payments

Retail payments is one of the areas of financial services with the greatest innovation activity, both by banks and new players. This subsection covers innovation in payment products, some of which run over the innovative infrastructures that were explained in the previous section.

Card-based payments are going mobile, thanks to digital wallets – which store and manage cards virtually – and NFC technologies, which enable contactless payments. As well as banks, mobile phone manufacturers and operating systems (Apple, Samsung, Android) are entering into this business as providers of digital wallets.

IMPACT OF CHANGES ON PRODUCTS

FIGURE 3



SOURCE: Author's elaboration.

New payment solutions are also being developed based on account-to-account credit transfers. For instance, real-time retail payment systems are enabling the development of new solutions for peer-to-peer and consumer-to-merchant payments. The immediate and unconditional availability of funds for the payee offers potential for these solutions to partially substitute card-based payments. Moreover, the new EU Payment Services Directive will allow third-party payment services providers (TPPs) to initiate credit transfers on behalf of customers. This will further increase competition in payments, by allowing more players to provide account-based payment services.

Other innovative solutions are arising from the application of distributed ledger technologies (DLTs) to cross-border payments. A number of services are already in the market, based on the public blockchain of bitcoin.

Innovations in retail payments have the potential to *reduce costs per transaction,* particularly in micropayments and cross-border payments, and promote the use of e-payments. This may lead to further efficiency gains for the financial system given the

cost of managing cash. Moreover, the entrance of new players (digital wallet providers, TPPs) increases competition in retail payments.

In terms of *financial stability,* several risks and vulnerabilities may arise from innovative payment solutions. Regarding operational risks, digital and mobile-based solutions increase the relevance of *technological resilience and cyber risks,* and change the nature of fraud risks. Furthermore, increased competition increases pressure on the profitability of banks, both directly (by reducing margins in the payments business) and indirectly, since new players gain access to payments data that is valuable for cross-selling purposes (e.g. credit offerings).

In addition, the greater *interdependency between players,* with "weak links" between banks, other payment services providers (e.g. TPPs), and new players involved in the value chain of payments (e.g. mobile operators or manufacturers), may introduce vulnerabilities for the financial system.[12] The laxer the regulatory framework for these new players, the more severe the vulnerabilities are likely to be.

New digital payment services also raise new challenges for *consumer protection.* For instance, security and fraud risks depend on the technological solutions employed. Moreover, the interrelations between different players require a clear allocation of liabilities in case of fraud or errors, to avoid consumer detriment. Finally, to preserve the integrity of the financial system, new payment services providers must always be subject to the same AML/CFT requirements.

4.2.2 Credit

New credit risk models

The combination of increased availability of data, greater data processing capabilities and new analytical techniques, which is usually referred to as "big data", allows financial services providers to improve their models for *creditworthiness assessment.* New models usually incorporate broader sources of data, such as payment transactions, browsing history or even social networks, and make sophisticated analysis of such data through complex algorithms. Indeed, algorithms form part of any firm's know how assets and are increasingly becoming a source of competitive advantage.[13]

Applying big data techniques to credit risk models may improve the accuracy of the scoring of potential borrowers, which indeed allows providers to make more accurate pricing decisions for loans and other credit products. In addition, the inherent automation of these models may reduce the cost of obtaining risk scorings and, hence, the cost of processing loan applications or making pre-authorised credit offers. This cost reduction, if combined with increased access to external data, may help credit providers to assess the risk scoring of non-customers or low-engaged customers for which they have limited historical data. In this regard, the new Payment Services Directive (PSD2) and the General Data Protection Regulation (GDPR) will enable customers to transfer their personal data between different firms. Furthermore, the use of new sources of data can extend access to credit into segments that were previously excluded due to the inability to assess their creditworthiness. All these effects may significantly increase the efficiency of credit markets, both directly and through increased competition between providers.

12 Pauget, G. (2016). Systemic risk in payments. Financial Stability Review, 20, pp. 37-44. Banque de France. <https://publications.banque-france.fr/sites/default/files/medias/documents/financial-stability-review-20_2016-04.pdf#page=37>.

13 Álvarez Caro, M. (2017). Algorithms challenge the banking industry. *Digital Economy Outlook.* January 2017, pp. 4-6. BBVA Research. <https://www.bbvaresearch.com/wp-content/uploads/2017/01/DEO_Jan17_Cap1.pdf>.

From the perspective of *financial stability,* improved credit scoring models may reduce the credit risk of financial institutions. Nevertheless, the impact of new models must be carefully assessed along a significant period of time, particularly when credit is extended to previously excluded segments. Regarding operational risks, the use of more personal data and the greater reliance on processing technologies and algorithms must be taken into consideration.

New credit scoring models also raise a number of *challenges for consumer protection.* First, the processing of personal data has to be properly authorised by the consumer, as well as being subject to high-level privacy and security standards. Second, consumers might be unfairly excluded from access to credit as a result of outdated or inaccurate data or due to incorrect inferences being made by algorithms.[14] In addition, although big data technologies and algorithms reduce human biases and force decisions onto a more reliable empirical foundation, they might also introduce more complex types of discrimination against certain social groups. To address all these challenges, providers must be subject to requirements on the design of algorithms and the automation of decisions, and consumers must be empowered with transparency and recourse rights.

Lending marketplaces

Lending or crowdfunding marketplaces have entered into the credit business with a completely different business model from that used by banks and other credit providers. Instead of providing credit themselves, with their own capital or through financial intermediation, crowdfunding platforms connect savers and borrowers and facilitate them to directly reach credit agreements. Information and communication technologies have facilitated these direct interactions between individual agents by significantly lowering transaction costs (search, bargaining, etc.). Formally, the European Banking Authority (EBA) defines lending-based crowdfunding as "open calls to the wider public by fund seekers through a third party, typically an on-line platform, to raise funds for a project or for personal purposes, in the form of a loan agreement, with a promise to repay with (or in certain cases without) interest".[15]

In general, digital platforms introduce efficiency gains in the markets where they operate by *lowering transaction costs* and internalising the externalities between the two sides of the market that they connect (e.g. borrowers and savers). As a particular type of digital platform, lending marketplaces can also lead to these benefits. However, for this to be the case, it is essential for them to be able to successfully address the *information asymmetries between lenders and borrowers* and hence mitigate moral hazard and adverse selection problems. In any case, successful crowdfunding platforms may offer an alternative to traditional bank credit and hence *increase competition* in some segments of the financing market, or even extend the market to previously underserved consumers.

Although the amount of credit issued through crowdfunding platforms has rapidly grown in the last decade, it still represents a very small share of total credit volumes. Therefore,

14 European Banking Association (2016). *Discussion paper on innovative uses of consumer data by financial institutions* (EBA/DP/2016/01). <https://www.eba.europa.eu/documents/10180/1455508/EBA-DP-2016-01+DP+on+innovative+uses+of+consumer+data+by+financial+institutions.pdf>.

15 European Banking Association (2015). *Opinion of the European Banking Authority on lending-based crowdfunding* (EBA/Op/2015/03). <https://www.eba.europa.eu/documents/10180/983359/EBA-Op-2015-03+(EBA+Opinion+on+lending+based+Crowdfunding).pdf>.

the *impact of crowdlending on financial stability is still limited.* However, if it is not appropriately regulated and supervised, and high growth rates remain in the future, it could become relevant to financial stability. In particular, systemic risks could arise due to the *interconnections between lending marketplaces and financial institutions,* some of which are already participating as investors in the crowdlending market. Marketplace lending should be monitored as part of the so-called "shadow banking" activity, which is generally defined as "credit intermediation that involves entities and activities fully or partially outside the regular banking system."[16]

From the perspective of *consumer protection,* marketplace lending involves a number of risks for both lenders and borrowers that the regulatory framework has to mitigate. Credit and liquidity risks, lack of *information* or misleading information, and the *operational continuity* of platforms are some of the most relevant risks. Moreover, AML/CFT requirements must ensure that crowdfunding platforms are not used for illicit purposes.

Finally, it is worth mentioning the challenges associated with its *business model.* The immediate issue is whether the platforms can find *the funding to back future lending* at the same kind of clip. Attracting additional money is crucial because the companies' revenues are increasingly reliant on new lending. Platforms receive as much as 90 per cent of their fees on new loans, rather than from existing customers. Without new loans, revenue would plunge. The original P2P model, which matched retail investors with retail borrowers, was straightforward. But platforms struggled to find enough cash from small investors to cope with the rampant demand for credit. So they turned to institutional investors – and increasingly to banks that would repackage loan portfolios in the form of securitisations –. Moreover, as Mark Carney recently highlighted, "how stable this funding will prove through-the-cycle is not yet clear, as the sector's underwriting standards, and lenders' tolerance to losses, have not been tested by a downturn."[17]

4.2.3 Deposits

Taking deposits from the general public is a highly standardised and regulated activity, limited to bank-licensed institutions. This has made deposit products relatively immune from technological changes, particularly when compared to payment or credit products. Nevertheless, competition in deposits – and particularly on current accounts – has increased due to the entrance into the market of new digital-only banks, usually referred to as *neobanks.* Compared to incumbents, these neobanks benefit from greater agility and efficiency, due to the absence of legacy infrastructures and physical distribution networks. In some countries, regulatory authorities have facilitated the emergence of these new banking players. For instance, the UK's Prudential Regulation Authority (PRA) and the Financial Conduct Authority (FCA) jointly launched a "Bank Start-up Unit" in January 2016 to provide information and support to newly authorised banks and to those planning to apply for a banking licence. Previously, in April 2013, they had introduced a "mobilisation" route – also known as "authorisation with restrictions" – to help start-ups in the process of becoming fully operational banks.

Increased competition in deposits benefits consumers and creates incentives for financial institutions to gain *efficiency.* However, from the perspective of *financial stability,* it may add pressure on the profitability of banks – as a result of lower margins – and could

16 Fraile, A,, Romero, A. & Segovia, A.I., Turning the spotlight on shadow banking: pros and cons of the darkness, *Digital Economy Outlook,* January 2017, pp. 10-12, BBVA Research. <https://www.bbvaresearch.com/wp-content/uploads/2017/01/DEO_Jan17_Cap31.pdf>.

17 Carney, M. (2017) "The Promise of FinTech – Something New Under the Sun?", <http://www.bankofengland.co.uk/publications/Documents/speeches/2017/speech956.pdf>.

increase the volatility of deposits. Regarding consumer protection and AML/CFT, neobanks are subject to the standard rules and requirements.

4.2.4 Investment

The use of algorithms to determine trading decisions has grown considerably in a number of financial markets (notably equity and foreign exchange markets), amid advances in computing power and the speed of information processing. The Bank of International Settlements (BIS) defines automated trading as a trading technology in which order and trading decisions are made electronically and autonomously.[18] High-frequency trading (HFT) is a subset of automated or algorithmic trading that has become particularly common. In HFT, orders are submitted and trades executed at high speed and a very tight intraday inventory position is maintained.[19] These strategies benefit from quickly processing of information on market conditions and from the ability to react instantaneously to such information. Estimates suggest that HFT currently accounts for up to three-quarters of equity trading volumes and around 40% of FX.[20]

HFT may improve market *efficiency* by lowering transaction costs, helping price discovery and increasing the diversity of market participants. However, it has complex implications for *financial stability,* given the heterogeneous externalities that it introduces for other market participants.[21] For instance, HFT may increase volatility in stressed market conditions. Algorithmic traders are usually more active in periods of low volatility, but they may suddenly withdraw liquidity in periods of disruption, when it is needed most (see footnote 20). Indeed, some *"flash crashes"* have been held to stem from black-box trading combined with high-frequency trading.

Other implications for financial stability arise from the increased "self-reflexivity of markets" – price changes are increasingly driven by prices themselves – and the *risk of crowding-out traditional committed market-makers,* whose presence is particularly necessary in adverse market conditions. These market-makers may migrate their activities to other trading venues if they perceive they are at a disadvantage with respect to high-frequency traders. A final implication for financial stability is that market infrastructures must be prepared to deal with the surging speed of messaging and trading (see footnote 21).

From the perspective of investor protection, common or retail participants may be harmed by some of these trading strategies. Indeed, some HFT tactics may be designed to obscure their actual trading intent, which might increase the *risk of market manipulation.* In general, preserving the integrity of the financial system faces new challenges in the context of automated and high-frequency trading.

4.3 DISTRIBUTION AND CUSTOMER RELATIONSHIP

Digital channels

The basis of all the changes has been the development of digital channels (mobile apps, web pages, etc.), which are increasingly gaining relevance in the relationship of consumers with financial services, particularly for accessing information and conducting operations.

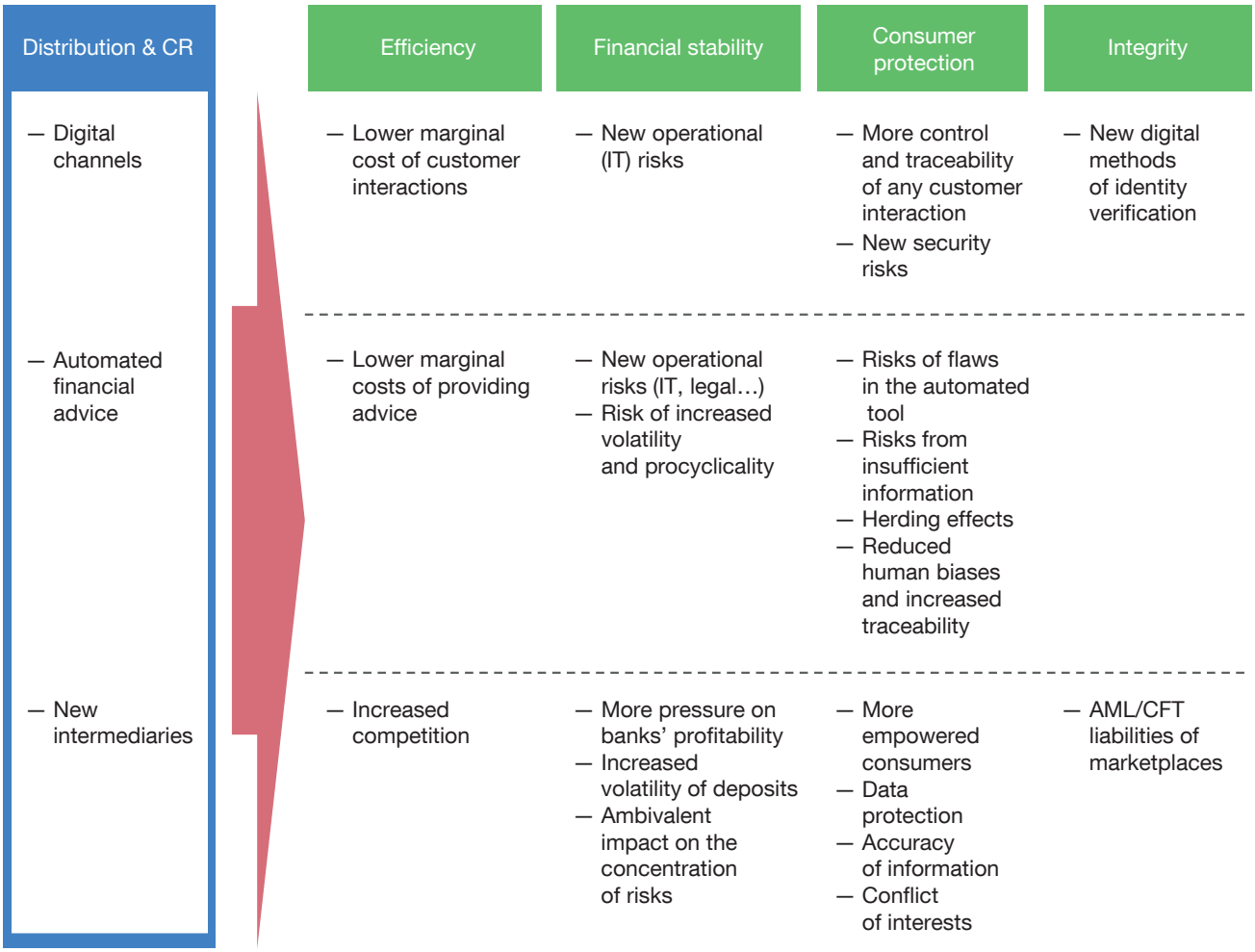
18 BIS Markets Committee (2011), *High-frequency trading in the foreign exchange market,* Basel: BIS. <http://www.bis.org/publ/mktc05.pdf>.

19 BIS Markets Committee (2016). *Electronic trading in fixed income markets,* Basel: BIS. <http://www.bis.org/publ/mktc07.pdf>.

20 Carney, M. (2017). The Promise of FinTech – Something New Under the Sun?, [Speech] Deutsche Bundesbank G20 conference on *"Digitising finance, financial inclusion and financial literacy".* Wiesbaden, 25 January, <http://www.bankofengland.co.uk/publications/Documents/speeches/2017/speech956.pdf>.

21 European Central Bank (2016). *Financial Stability Review,* ECB. May 2016, pp. 54-56, <https://www.ecb.europa.eu/pub/pdf/other/financialstabilityreview201605.en.pdf>.

IMPACT OF CHANGES IN DISTRIBUTION AND CUSTOMER RELATIONSHIP FIGURE 4



SOURCE: Author's elaboration.

Due to automation and economies of scale, digital channels allow financial institutions to gain efficiency in comparison to branch networks or even telephone channels. In terms of financial stability, they change the nature of some operational risks *from physical to cyber security,* and increase the relevance of *technological resilience* and continuity.

Digital channels allow firms to control more directly and retain traceability of any information they provide to consumers. In non-digital channels, communication with customers can suffer from human biases or errors that it is difficult for firms to identify and avoid. Therefore, new digital channels may contribute to *enhancing consumer protection* by improving information transparency and accuracy. Nevertheless, they also introduce new security risks.

When digital channels are used to acquire and onboard customers, new challenges arise for anti-money laundering and combating the financing of terrorism. Traditionally, the identity of new customers was verified by banks' employees, face-to-face, against national identity documents. Fully digital onboarding processes rely on new methods of identity verification, such as video conferences, e-ID documents or biometric solutions. As in general with digital channels, these solutions may lead to cost savings in the onboarding of new customers, particularly when fully automated methods – without human intervention – are used. However, the technologies employed have to be robust and reliable enough to minimise *AML risks,* as

well as the potential risks to consumer protection (fraud, identity theft, privacy) and the operational risks related with the increasing reliance on technology.

Automated financial advice

Beyond the digitisation of distribution and customer relationship channels, another area of innovation is the automation of financial advice, which is usually referred to as "robo advice". An increasing number of firms are providing advice to consumers without – or with limited – human intervention, making use of computer-based algorithms and/or decision trees. According to the Joint Committee of the European Supervisory Authorities (ESAs), this automation of advice is currently more prevalent for securities than for banking products.[22]

Automation leads to significant economies of scale and can therefore decrease the marginal cost of providing financial advice. These *efficiency gains* make financial advice accessible to previously excluded or underserved consumers, which in turn will have access to a wider range of financial products. Moreover, the independent intermediation of "robo advice" services might increase competition between the providers of financial products, creating incentives for further efficiency gains in the financial system.

From the perspective of financial stability, automation tools involve *technological and cyber risks* that have to be included into the framework of operational risks. Indeed, faults or errors in automated tools might affect a large number of customers and increase the exposure of firms to legal and reputational risks. Moreover, the extension of automated advice could lead to increased *market volatility and procyclicality.* If automated advice services are based on similar algorithms, a significant number of customers may end up making similar investment decisions. Depending on its size, this herding effect might lead to losses for consumers, trigger reputational risks and even have systemic consequences.

For consumers, *the ESAs have identified several risks from "robo advice"* services.[23] Some risks are related to consumers having limited access to information or limited ability to process that information or seek clarifications. This might lead consumers to make unsuitable financial or investment decisions. Other risks are related to flaws in the functioning of the automated tool, due to biases, errors, hacking or manipulation of the algorithm. Moreover, if the use of automated tools becomes widespread, 'herding effects' might lead to consumer detriment, as previously explained. On the positive side, automation avoids human biases and eases the traceability of the advice provided, which may help consumers to enforce their rights.

"Robo-advice" services present different degrees of automation and human intervention, which indeed condition the intensity of the risks that have been explained. An extreme level of automation, that goes further than simple advice, is the automated management of financial assets. The risks involved in these services are similar in nature to the ones in the automated advice, but usually greater.

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22 Joint Committee of the European Supervisory Authorities [2016]. *Report on automation in financial advice.* EBA <https://esas-joint-committee.europa.eu/Publications/Reports/EBA%20BS%202016%20422%20%28JC%20SC%20CPFI%20Final%20Report%20on%20automated%20advice%20tools%29.pdf>.

23 Joint Committee of the European Supervisory Authorities (2015). *Joint Committee Discussion Paper on automation in financial advice (JC 2015 080).* EBA <https://www.eba.europa.eu/documents/10180/1299866/JC+2015+080+Discussion+Paper+on+automation+in+financial+advice.pdf>.

New intermediaries

Finally, another relevant change in the distribution of financial services is the disintermediation of the relationship between customers and providers. Traditionally, customers had a direct, close – and usually exclusive – relationship with their bank. Indeed, for the majority of retail clients, their bank was the only point of contact for any financial need. Nowadays, a number of new players are offering different types of "intermediation services": account information services which, apart from aggregating data from different bank accounts, provide personalised suggestions; comparison sites which allow consumers to shop around and look for the financial product that best suits their needs; or marketplaces in which consumers can directly sign up to products from different providers. Crowdfunding platforms constitute a particular type of the latter, but their particular impact on the financial system has already been covered. The new EU Payment Services Directive (PSD2) will facilitate the flourishing of intermediation services since it will allow customers to directly share their bank account data with third-party payment service providers.

Intermediation services *increase the comparability* of financial products and services and *lower the cost of switching* between providers. Therefore, they promote more intense competition between financial services providers and can lead to efficiency gains in the financial system.

From the perspective *of financial stability,* this increased competition might increase pressure on the profitability of financial institutions, by lowering margins and threatening the existing cross-selling and cross-subsidy strategies. Moreover, these new services, together with advice and automation tools, can contribute to increase the volatility of deposits and exacerbate liquidity risks and bank runs.

The impact of intermediation services on the *concentration of risks* is complex. On the one hand, comparison sites or marketplaces could reduce the cost of customer acquisition for new or small players. However, more intense competition could lead to market concentration on a reduced number of players that would be able to benefit from large economies of scale. This effect is likely to be prevalent for highly commoditisable products, and might lead to increased concentration in financial stability risks.

Account aggregators, comparison sites or marketplaces can empower consumers and help them to have more control over their personal finances. However, they also raise new challenges for consumer protection. For instance, preserving the protection of personal data in a framework in which more players have access to such data, ensuring accuracy of the information provided to customers and requiring intermediaries to properly disclose their incentives to recommend particular products or services. Finally, regarding AML/CFT, there must be a clear assignment of liabilities when marketplaces allow customers to directly sign up to products from different providers.

5 Seeking a balance between innovation, financial stability and consumer protection

As mentioned before, innovation and digitalisation offer an unprecedented opportunity for the financial sector to improve its efficiency, better manage its risks and provide more value to customers. Furthermore, the introduction of digital innovations benefits the whole financial system, and these innovations improve the quality and variety of banking services, facilitate risk sharing, complete the market, and improve allocative efficiency.[24] However *innovations*

24 Shalhoub, L. (2017). Bahrain aspires to become a FinTech hub. *Arab News.* 1 March 2017 <http://www.arabnews.com/node/1061351/business-economy>.

do not arise in isolation; they require an appropriate environment to promote them. Among all the deterrents to innovation, environmental uncertainty is probably the most important one, and regulation is a key ingredient of this habitat.[25] This is because the successful introduction of something new into the market already has an intrinsic high degree of uncertainty. In some dimensions there are explicit prohibitions, but in many others, it is precisely the absence of a specific regulatory and supervisory framework which risks stifling innovation. There are projects that do not fit squarely into the existing regulatory framework. This means that they face an uncertainty which is either delaying projects (awaiting the approval of the authorities) or blocking them before their launch onto the market to avoid regulatory risks, as a result of the legal uncertainty and lack of trust being generated.

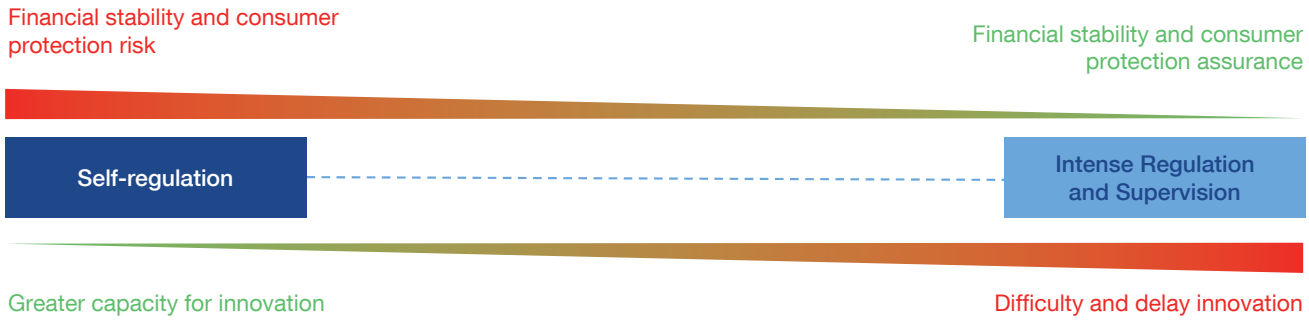
Tackling the above mentioned regulatory challenges appropriately requires a breadth of vision on the part of all concerned, both public authorities and the private sector, with a view to taking advantage of these opportunities, overcoming the obstacles that currently exist. The *best way forward is to adopt a holistic approach* to seeking a balance between the promotion of the new digital value propositions with protection against the risks involved. *How can we find the balance between both worlds?*

As shown in Figure 5, there are two extreme scenarios:

— On the one hand, one could think of a *self-regulatory approach* where the financial institutions and new players from FinTech set their own rules of operation and control based on the risk appetite that each is willing to assume. In this environment, the private sector would have a high capacity for innovation, but without a doubt would take on *more risks.*

  This approach has a significant handicap. The increased competition due to the entrance of new digital native players adds pressure on the banks' profitability. The absence of a standard regulation may imply that weaker banks and new competitors simply have little incentives to comply with their self-imposed rules. In the absence of regulation, the unique incentive is the market discipline. However, market discipline, understood as an "external control", cannot be seen as an effective tool for limiting excessive risk-taking in an

TWO POLAR OPTIONS TO REGULATE AND SUPERVISE THE FINANCIAL SYSTEM FIGURE 5



SOURCE: Author's elaboration.

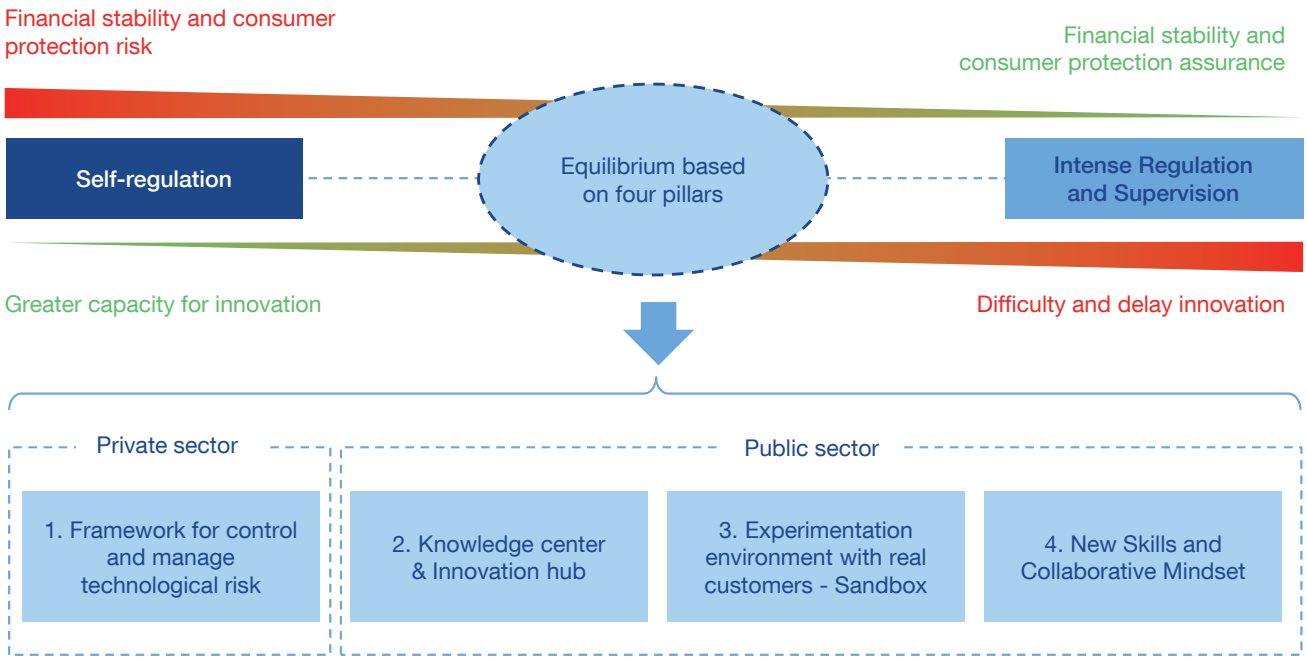
25 Edquist, C., & Chaminade, C. (2006). Industrial policy from a systems-of-innovation perspective. *EIB papers,* 11(1), pp. 108-132, <https://www.econstor.eu/bitstream/10419/44862/1/51566457X.pdf>.

environment of low regulation and supervision. In this way, the system would be taking on a high risk in terms of financial stability and consumer protection that lay beyond the control of the authorities.

— On the other hand, the opposite approach is an environment of *intense regulation and supervision* where all new developments must be covered by pre-existing regulation and approval processes, with supervisory monitoring on each case. Undoubtedly, this approach significantly reduces new risks, but the speed and degree of development of the system would lag well behind the demands of customers.

Recognising that both alternatives pose advantages but also disadvantages, there is a need to find a *compromise solution* that is consistent with the current regulatory framework the life cycle of innovation, with the participation of public and private institutions and taking into account the idiosyncrasies of each country. In fact, the financial sector is highly regulated and there is a strong link with the national environment, as all players must be authorised to operate in only certain jurisdictions, but are not automatically allowed to provide services in other countries. Besides, we must understand that the level of bancarisation and the maturity of the financial sector varies among regions. Finally, there are other factors that could affect the introduction of new services, such as the existence of venture funding, the potential market size, and the literacy level of the population. All of these issues must be taken into account when deploying any mechanism to improve the financial system, as some new ideas will fit some countries or regions but would not be suitable for others. However, *although there is no magic formula to foster foolproof innovation, there are different approaches with some elements in common* which are being introduced in different countries, and all of them agree that it is of paramount importance to improve the relationship between regulators and the industry. These different paths have some common practices which can be seen in the more detailed analysis below.

A COMPREHENSIVE AND HOLISTIC REGULATORY AND SUPERVISORY APPROACH FIGURE 6



SOURCE: Author's elaboration.

On the one hand, the *private sector needs to have well-defined policies on the control and management of technological risks* (cybersecurity, data protection, etc.) associated with the new value propositions. These policies must be integrated into the governance of the entity in order to set down and measure the risk appetite that it is acceptable to take on. It is therefore not only necessary to know and understand the risks that the new digital environment poses, but there also needs to be an internal policy of measurement, setting of limits and monitoring of technological risks that will allow the entity to perform a self-assessment of the risks involved in adapting to this new change.

On the other hand, the *public sector is currently being challenged* to find ways to support innovation, in order to alleviate uncertainty, sum up the efforts of the different agents while retaining knowledge that can be used to improve their regulatory tasks. As a response to this demand, a significant number of regulatory and supervisory authorities from different countries are already launching initiatives to promote digital financial ecosystems. Those initiatives may be grouped into *three categories:* A) an innovation hub, B) a regulatory sandbox, and C) new skills and collaborative mindset.

Overall, these initiatives allow authorities to have early and direct knowledge of these innovations, which is essential for the regulatory and supervisory framework to be kept up-to-date and to face any new challenges effectively. The main characteristics of the three initiatives will be described below.

Innovation hub

Regulation is usually regarded as one of the main stoppers of financial innovation. This perception is based on the strict obligations to provide financial services, and on the conservative interpretation of some of those principles. In order to become more accessible, financial authorities are implementing different *initiatives to move closer to the industry* and to provide more *efficient and timely response to its needs.*

Regarding this issue, it is important to mention the first steps taken by the Financial Conduct Authority (FCA)[26] in the UK, which in 2014 launched a specific programme called Project Innovate that has resulted, among other things, in an Innovation Hub which gives direct support to innovative companies and organises activities to bring the FCA closer to the innovation ecosystem. In Spain, in December 2016 the Comisión Nacional del Mercado de Valores (National Stock Market Commision, CNMV) launched a similar *FinTech Hub* initiative pursuing the same objectives. Additionally, a *Technical Committee on Financial Innovation* has been created with the participation of the Spanish Treasury, the Bank of Spain, the CNMV, the Dirección General de Seguros y Fondos de Pensiones (General Directorate of Insurance and Pension Funds, DGSFP), the Agencia Española de Protección de Datos (Spanish Agency for Data Protection, AEPD) and the Comisión de Prevención de Blanqueo de Capitales e Infracciones Monetarias (Commission for the Prevention of Money Laundering and Monetary Offense, SEPBLAC) that meets regularly to discuss issues related to technological innovation in financial services.[27]

This concept of the Innovation Hub represents a *contact point for regulators and industry* to share common views and gather advice to better navigate legal issues. It can be a

26 Financial Conduct Authority (2016). Fintech and innovative businesses. FCA *(webpage).* <https://www.fca.org.uk/firms/fintech-and-innovative-businesses>.

27 This concept of the Innovation Hub is also followed by other States, there are examples of established initiatives like the Monetary Authority of Singapore (MAS) FinTech Lab, the Australian Securities & Investments Commission (ASIC) Fintech Hub or the United States Office of the Comptroller of the Currency (OCC) Innovation Office.

digital service or a physical venue and represents a contact point for companies and public services. The idea is to collaborate in the initial phases of new value propositions by providing a common space in which to exchange needs, thoughts, and ideas.

Setting up a structure to understand and encourage financial innovation brings further benefits, like the possibility of *establishing links abroad with other hubs* in order to enlarge the geographical scope of those initiatives. At this point, it is worth highlighting two illustrative examples of how proactive regulators are signing cross-border agreements. The Singapore MAS[28] has signed cooperation agreements with the United Kingdom, South Korea, Switzerland, and India. And the Australian ASIC[29] already has agreements with the United Kingdom, Canada, and Kenya. These agreements focus on helping business to expand to other geographical areas safely and easily. Additionally, there is an interest in the exchange of knowledge in order to better understand the new trends and how they may impact existing regulations. Although this exchange of know-how is still at a very early stage, future evolutions might potentially lead to the creation of a legal figure similar to the Financial Services Passport that already exists in the European Union.

Although the recent proliferation of these hubs shows that it is an interesting practice, other authorities have just *improved their access channel without launching a concrete innovation hub* yet, such as Germany, which provides information and a contact for FinTech through the Federal Financial Supervisory Authority (BaFin),[30] or Dubai,[31] which has taken its first steps with a dedicated portal that provides guidance to FinTech participants, although it expects to evolve into a deeper collaboration, building strategic partnerships with relevant stakeholders.

In the same field, some authorities have entered a *period of reflection to identify new channels to interact* with the private sector and to accompany them in the digital transformation journey. A clear example is France,[32] which is aiming at improving its legislation and, simultaneously, creating better communication channels to cater to industry enquiries. The French financial authorities are aiming to provide what they call "FinTech-friendly regulation", that eases the requirements to start a FinTech business and a programme to allow fast-track registration and authorisation for foreign start-ups. This programme has been boosted by the creation of several incubators and the FinTech, Innovation and Competitiveness (FIC) division within the Autorité des Marchés Financiers (AMF).

All in all, it is important to note that different players could have diverse needs based on the different levels of technological development and risks. Therefore, there may be approaches focused only on new entrants and start-ups, but most initiatives launched by most advanced authorities are intended to serve all stakeholders. *A comprehensive approach with different options is probably the best approach, as it will benefit the whole ecosystem and ensure that there are positive spillovers to all participants.*

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28 Monetary Authority of Singapore (2016). *Fintech Regulatory Sandbox Guidelines. Singapore: Singapore Government.* <http://www.mas.gov.sg/~/media/Smart%20Financial%20Centre/Sandbox/FinTech%20Regulatory%20Sandbox%20Guidelines.pdf>.

29 ASIC (2016) Innovation Hub. ASIC *(webpage).* <http://asic.gov.au/for-business/your-business/innovation-hub/licensing-and-regulation/>.

30 BaFin (2016) Company start-ups and fintech companies. *BaFin (webpage).* <https://www.bafin.de/EN/Aufsicht/FinTech/fintech_node_en.html>.

31 Dubai International Financial Centre (2017). Dubai International Financial Centre Launches 'FinTech Hive at DIFC', the Region's First FinTech Accelerator, Supported by Accenture. Dubai International Financial Centre Pfress Relase, 10January 2017. <https://www.difc.ae/news/difc-launches-fintech-hive-difc-regions-first-fintech-accelerator-supported-accenture>.

32 ACPR (2016) *La conférence de l'ACPR.* Paris, 25 November 2016. <https://acpr.banque-france.fr/fileadmin/user_upload/acp/Communication/Conferences/20161125-Presentation-Fintech.pdf>.

Regulatory sandboxes

The new digital landscape poses significant challenges for authorities, as its embryonic stage makes it difficult to determine how it will be affected by the current regulatory framework and, therefore, makes it is difficult to decide whether specific initiatives should be allowed or not. As a response to these concerns, authorities could take a conservative approach denying the authorisation in order to preserve the financial system. As an alternative, *the creation of a supervised safe environment for testing with real customers before entering the market emerges an option that allows the leveraging of innovation and systemic stability.* This experimental space involves a close control provided by the financial authorities with a regulatory relief for all participants, while ensuring protection for customers and for the economy as a whole. This solution was provided by the British FCA in 2015 with the creation of the Regulatory Sandboxes, an idea that has attracted the interest of several organisations and that has recently led to the emergence of similar initiatives in other countries.

In order to improve the conditions that can lead to innovation, the regulatory sandboxes propose an space where regulators and entities are better able to grasp each other's point of view, strengthening communication and increasing common understanding, and thus contributing to a significant reduction of bottlenecks. It is of interest to mention that their *implementation can add significant value to regulators, consumers and entities,* by allowing them to understand how the ecosystem works, the opportunities as well as the risks inherent in all the initiatives. Firstly, companies are expected to be keener on trying out new products and services that could potentially improve competition and ultimately benefit consumers. Secondly, the regulatory framework can also benefit from the use of these sandboxes, as they permit a better understanding of the costs, benefits and risks of new propositions. And, lastly, consumers will enjoy the benefits of efficiency gains and obtain access to more competitive financial services.

In order to achieve a common definition of regulatory sandboxes, *some degree of homogeneity is needed in the setting of criteria* to enter this controlled space, in the internal operations and, finally, in the conditions under which the exit will take place. There are common attributes in all of the sandboxes that have already being released or are being planned. The nature of this concept makes it an exceptional process that should not be used as a shortcut to avoid regulation.

- First of all, the *project should be innovative.* The rationale behind this concept is that if a similar product has already been introduced in the market, there is previous knowledge of how it is being affected by the current regulatory framework and, therefore, allowing a sandbox would work against level playing field principles. However, one question arises regarding the way we define innovation. Although there is no single definition, we understand that it is "something *new* introduced into the market".

- Secondly, while in the sandbox, there is a *strict monitoring by the authority* in charge, which will be closely following all the improvements and helping when required. For its part, the company that has started the project must achieve certain milestones and implement any changes demanded by this authority. Thoughtfully following these procedures is vital for the success of the sandbox.

Another key element in the sandboxes is to *allow regulatory exceptions* while the project is being tested and is still unsure what its impact will be in the current framework.

Nonetheless, not all geographical areas are relaxing the same requirements at this stage. There are examples of sandboxes that only contemplate the relief of licensing requirements, as is the case of the Swiss Fintech Supervisory Sandbox released in 2016, while other nations are open to the customisation of the set of rules that should apply, like Abu Dhabi's RegLab[33] programme or the creation of waivers to permit exceptions, which is one of the options that the FCA could provide. Nevertheless, it is important to mention that there are limitations for this legal alleviation: the *regulation that is relaxed must fall under the sphere of competence* of the authority in charge of the sandbox, and Anti-Money Laundering or Combating the Financing of Terrorism regulations should fully apply along with consumer protection safeguards that need to be applied in order to ensure that the testing is not done at the expense of individuals rights.

Additionally there are different views among authorities regarding *who should participate in the regulatory sandbox.* Although most initiatives are open to all players, Hong Kong's Fintech Supervisory Sandbox[34] has started conducting pilot schemes only for banks while the Indonesian[35] plans to provide support for developers are targeted more to new entrants. In all cases, the need to establish a sandbox must be carefully reviewed on a case-by-case basis, taking into account the potential benefits for consumers, regulators and companies. This "on demand" approach arises from the fact that innovation is uncertain and there is no information about what potential business models or products might require this service. All in all, limiting the different options to *a single list of potential use cases could deter future projects.*

Finally, we must underscore that the regulatory sandboxes concept is quite recent, and new initiatives are currently being deployed. Nevertheless, there are more mature models that have already entered their first cohort of projects. Good examples come from the United Kingdom,[36] Singapore[37] and Australia.[38] Other initiatives are currently in the definition process of how these safe spaces should be, like Bahrain[39] and Kenya.[40] In the near future, we are likely to see the emergence of new regulatory sandboxes, as this idea has already captured the interest of several organisations and authorities.

New skills and collaborative mindset

To achieve success in launching regulatory sandboxes and innovation hubs requires two prerequisites: first, authorities should embark on the establishing of a *transparent and*

33 Abu Dhabi Global Market (2016). Abu Dhabi Global Market Sets Out Proposal for *FinTech Regulatory Framework in the UAE.* Abu Dhabi Global Market Press Release, 10 May 2016. <https://www.adgm.com/mediacentre/press-releases/abu-dhabi-global-market-sets-out-proposal-for-fintech-regulatory-framework-in-the-uae/>.

34 Hong Kong Monetary Authority (2017). Fintech Facilitation Office (FFO) *Hong Kong Monetary Authority (webpage),* <http://www.hkma.gov.hk/eng/key-functions/international-financial-centre/fintech-facilitation-office-ffo.shtml>.

35 Bank Indonesia launches fintech office. (2016) *Outlaw. 21 November 2016,* <https://www.out-law.com/en/articles/2016/november/bank-indonesia-launches-fintech-office/>.

36 Financial Conduct Authority (2016). Fintech and innovative businesses. FCA *(webpage).* <https://www.fca.org.uk/firms/fintech-and-innovative-businesses>.

37 Monetary Authority of Singapore (2016). *Fintech Regulatory Sandbox Guidelines. Singapore: Singapore Government.* <http://www.mas.gov.sg/~/media/Smart%20Financial%20Centre/Sandbox/FinTech%20Regulatory%20Sandbox%20Guidelines.pdf>.

38 ASIC (2016) Innovation Hub. ASIC *(webpage).* <http://asic.gov.au/for-business/your-business/innovation-hub/licensing-and-regulation/>.

39 Shalhoub, L. (2017). Bahrain aspires to become a FinTech hub. Arab News. 1 March 2017, <http://www.arabnews.com/node/1061351/business-economy>.

40 Capital Markets Authority (2017). *Kenyan and Australian regulators sign agreement to support fintech innovation.* Press Release 21 October 2016, <http://asic.gov.au/about-asic/media-centre/find-a-media-release/2016-releases/16-359mr-kenyan-and-australian-regulators-sign-agreement-to-support-fintech-innovation/>.

collaborative environment with all stakeholders, and, second, authorities should endeavour to increase the *knowledge and capacity of their staff* in relation to digital and technical innovations.

Collaboration among all public sector authorities is paramount. The speed and complexity of technological innovation demands regular knowledge sharing and close dialogue with other stakeholders, such as market participants, supervisors and legislators. In this regard, given the organisational complexity of some organisms, it is desirable that within them there should be a *figure responsible for ensuring the coordination and consistency* of the institution as a whole in regard to all the activities relating to innovation and digital transformation.

In this strategy, it is also essential to have active involvement by the various private and public actors. In the case of the *private sector,* it is obvious that all stakeholders should be involved – banks, technology companies, start-ups, etc. – while preserving a level playing field for all them. As regards the public sector, the collaboration should be extended to all authorities and not only to supervisors and policy-makers. This would include market authorities, financial supervisor, AML watchdogs, financial and industrial ministry, etc.

For this dialogue and cooperation to be effective, regulators and supervisors *need to invest in new skills* (such as expertise in cybersecurity or big data). It is important for the institutions to build up a solid base of knowledge to allow them to understand and manage the types of issues that could arise in the new environment in the most efficient manner possible, as often these are new topics for which there is simply no previous experience to call upon. As the De Nederlandsche Bank highlighted recently,[41] this can be achieved through training of staff and a targeted recruitment policy.

Developing new skills and capabilities would also allow authorities to maximise the new opportunities that technological innovation offers. *Supervisors may benefit from the new Regtech solutions,* which use new technology propositions in the context of regulatory monitoring, reporting and compliance.

An ecosystem in which suppliers and authorities are in permanent contact, and in which the latter are aware of technological innovations at an early stage, will lead to a rejuvenated framework of regulation and supervision which will facilitate innovation, while addressing the risks in the most effective way possible.

The transformation of the sector will necessarily produce occasional errors that will be committed as a normal result of an innovative process in which not just companies, but also regulators and supervisors, will be leading the way. In this regard, it is extremely important that the answers given by the authorities to these unintended consequences are proportionate. This will mean that financial institutions can continue making progress without fear in the innovation process that is so needed by the sector.

6 Conclusion

Banks have always managed to make the most of technology to improve their efficiency and the service provided to their customers, but they now face a new wave of innovation with much wider implications for financial services. *Digital disruption may help the financial sector to survive* the pressures of low growth, waning profitability and tough regulation, and to solidly re-establish trust among its customers and reputation within society. If

41 De Nederlandsche Bank (2017). *Technological innovation and the Dutch financial sector.*

banks can offer a better user experience, they will again come closer to customer demands and needs. To satisfy their aspirations and bring them the opportunity of this new age, since they are already exposed to the digital transformation in all aspects of their lives, banking must experience its reinvention.

Despite the aforementioned acknowledged benefits, developments in technology and new market dynamics *pose challenges in financial stability, consumer protection and integrity of the financial sector* – key objectives of regulators and supervisors –. From the perspective of financial stability, operational IT and cyber security risks have become a key concern among authorities. Cyber threats may create huge economic damage, but also if there is lack of confidence in the safety and security of digital technologies, the adoption of new technologies will falter even if they offer substantial benefits. Additionally, automated tools and services, such as electronic trading platforms and robo advisors, may increase the risk of market volatility and procyclicality. New players are often subject to laxer regulation and supervision, and increased competition adds pressure on the banks' profitability. Incumbent banks need to change radically; otherwise they are at risk of disappearing as we know them today.

From the perspective of consumer protection, the application of new technologies involves new security risks, and greater access to and use of customers' data increases the relevance of personal data protection. Moreover, some risks arise from automated tools, but they also allow for more control and traceability of the customer relationship. Finally, regarding the integrity of the financial system, the anonymity of virtual currencies and the greater speed of payments entail new risks related to money laundering and terrorism financing.

BENEFITS AND RISKS FROM THE TRANSFORMATION OF FINANCIAL SERVICES FIGURE 7

EFFICIENCY

+ Automation of processes
+ Disintermediation (blockchain)
+ Flexible and scalable IT infrastructure
+ Increased competition
+ Lower costs of managing cash

FINANCIAL STABILITY

– New operational IT risks
– New providers subject to laxer controls
– More pressure on banks' profitability
– Interconnections and third-party reliances
– Increased volatility and procyclicality
? Change in the concentration of risks
+ New tools to manage risks

CONSUMER PROTECTION

– New security risks
– Greater access to and use of personal data
– Risks from automated tools
– New providers subject to laxer rules
+ Control & traceability of customer interactions

INTEGRITY

– Anonymity of virtual currencies
– Greater speed of payments
+ New tools to monitor & analyse transactions
? Digital methods of identity verification

SOURCE: Author's elaboration.

The *aforementioned new risks* are not fully covered by the traditional supervisory approach (i.e. capital or liquidity requirements). So regulators and supervisors must tackle them without hindering the transformation of the financial industry. It is worth highlighting that new digital proposition is at an early stage and it certainly does not pose significant financial stability and consumer risks so far. However, the *exponential nature* of the new digital infrastructures, business and distribution models and customer solutions allows them to go from "too small to care to too big to fail" in a very short period of time, requiring authorities to have a far-reaching and anticipated perspective.

In this context, further *regulatory and supervisory work still lies ahead of us* to fully capture the potential of digital innovation and to prepare the financial system for future crises. In this regards, it is welcomed the work that the IMF High Level Advisory Group on Fintech the FSB Fintech Working Group have been carried out since last year. Although there is not a magic regulatory and supervisory formula, any solution should rest on *four key pillars:*

— The private sector needs to have well-defined policies on the control and management of new technological risks.

— Knowledge centers and innovation hubs are key contact points for regulators and industry to share common views and gather advice to better navigate legal issues.

— The creation of supervised and safe pre-market testing environments, the so-called regulatory sandboxes, emerges as an option that fosters innovation while preserving systemic stability.

— Authorities should work to increase the knowledge and capacity of their staff in relation to digital innovation, as well as develop a collaborative mindset.

To sum up, every decision that public and private stakeholders make from now on must be approached with a great sense of responsibility, taking into account *three key guiding principles.* First, the customer must be put at the center of any initiatives with ambition to succeed. Second, as future developments in technology and the competitive landscape remain uncertain, we need to pay special attention to the rise of new challenges. And finally, collaboration and communication among all stakeholders is vital in order to make the most of digitisation in finance, while preserving financial stability and ensuring adequate consumer protection.

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