SwissFinanceCouncil
Fostering International Dialogue

GETTING READY FOR THE '20s - TECHNOLOGY AND THE FUTURE OF GLOBAL BANKING

Table of content

Foreword

Digital transformation continues to reshape the global financial industry and will do so for years to come. Cutting-edge technologies such as artificial intelligence and robotics, cloud computing, distributed ledger technologies, big data and semantic technology are being adopted at an increasing pace everywhere from client-facing activities to the mid- and deep into the back-office. New, digital-based market entrants are scrambling the competitive environment. Risks in areas such as data and cyber security have increased the need for close dialogue between the industry and the authorities. Consumer preferences are changing, which becomes apparent in the increased use of mobile banking, especially among young consumers. These global drivers will influence how financial institutions and new players deliver financial services to the next generation.

In this year's Discussion Paper "Getting ready for the '20s – Technologies and the Future of Global Banking", we examine the changes in how people consume financial services and invest, and how banks operate in an environment of rapidly evolving digital innovation, based on insights at large international financial services providers as well as from the dialogue with EU and international public authorities. Some developments were already flagged in our previous Discussion Paper "The EU and its Partners: Banks and Investors in a Digital World" back in 2017. We examine what has changed and where we stand today.

Based on our findings, we formulate policy recommendations aimed at harnessing the potential of new technologies to benefit consumers and, ultimately, sustain economic growth. Key among these considerations are 1) the need to enhance planning and legal certainty for all market players; 2) to create a level regulatory playing field based on global standards enabling sound competition; 3) the elimination of unintended regulatory side effects that penalise European banks' investments in new technologies; and 4) enabling broader use of cloud technologies, without jeopardising data security. These considerations are intended to contribute to the discussion about a forward-looking, digital-ready regulatory framework for a strong European banking industry that benefits savers and investors.

We hope this Discussion Paper will stimulate further discussion on how to maximise the benefits of technology in the '20s and deliver them to consumers, businesses and the broader economy.

Peter Derendinger
Chairman,
Swiss Finance Council
Chairman of the Board
Credit Suisse (Schweiz) AG

Lukas Gähwiler
Chairman of the Board
UBS Switzerland AG

Urs Rohner
Chairman of the Board
Credit Suisse Group AG

Axel Weber
Chairman of the Board
UBS Group AG

Introduction: Global Trends changing the European Banking Landscape

Demographic shifts, loose monetary policy and lower projected growth in advanced economies, the spending power and habits of millennials, as well as the growing middle class across developing economies are changing our society and are affecting the supply and the demand for capital, goods and services. These trends also come under the influence of technology and environmental, social and governance (ESG) oriented policies. Financial services are among the impacted services. This is significant as they are an essential element for steering global wealth towards the financing of Europe's transition to a more digital and greener economy while providing solutions to the growing pension gap.

DEMOGRAPHIC CHANGES AND AGEING POPULATION

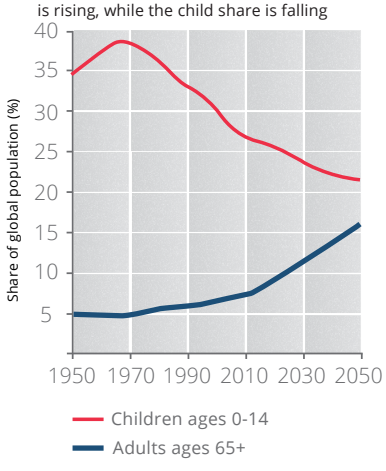
The world population is ageing at unprecedented speed, especially in wealthy economies. Demographic divergences across countries are more pronounced than ever and have a large impact on the global economy (see figure 1)[1].

Population growth, ageing, and urbanisation are robust and predictable long-term trends. They will persist through economic cycles and periods of political uncertainty alike. While in some areas the impact of these trends is foreseeable (no one doubts for example that healthcare services will be in high demand in ageing populations), in other areas the exact economic and financial market impact of these mega-trends will depend on how policymakers, central banks, and societies as a whole respond to these challenges. Given these uncertainties, demographics should influence but not dominate long-term investment decisions.[2]

Among other things, population ageing is leading to a dramatic shift in the population structure putting retirement systems under pressure. On a global scale, the old-age share of the population is rising, while the youth share is falling. Within the European Union (EU), the size of the working-age population is expected to fall once the baby-boom generation will go into retirement (see figure 2)[3]. Complicating matters, population ageing may lower pressure on inflation and keep interest rates low, which in turn makes it more costly to save for retirement[4].

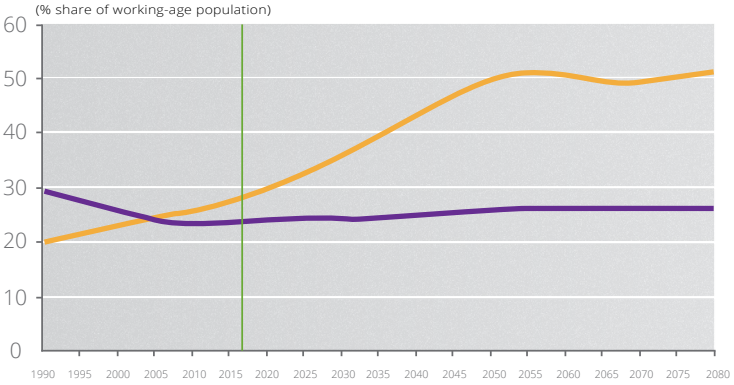
Finance will need to support major changes in working patterns as well as the evolving needs of savers and borrowers[5]. In advanced economies, average life expectancy for children born today is over 90. A recent report of the G30[6] suggests the need for a combination of political and financial measures to prepare for this challenge. Reforms require both policies aimed at improving the efficiency of pension plans (and hence the net return savers receive) and policies to better redistribute responsibility and risks between individuals and pension plans sponsors. Increasing the net return for savers can be achieved by eliminating unnecessary costs through the aggregation of funds and by adding globally diversified capital market products to pension savings portfolios. The use of technology to create scale and better products to suit individual needs are essential in this regard.

Figure 1: The aged share of the global population is rising, while the child share is falling



Source: World Bank Calculations

Figure 2: Young and old-age dependency ratios, EU-28, 1990-2080
(% share of working-age population)



Note: 1990-2000, EU-27. 1998, 2001, 2010-2012 and 2014-2016; breaks in series.
2014-2016: provisional. 2017-2080: projections.
(1) The elderly (65 years and over) in relation to the working-age population (15-64 years).
(2) Children (0-14 years) in relation to the working-age population (15-64 years).

Source: Eurostat (online data codes: demo_pjanind and proj_15ndbims)

LOW GDP GROWTH, LOW INTEREST RATES, LOW PROFITABILITY

A modest global economic outlook coincides with low interest rates, at least in advanced economies, and the situation should not differ in the near future. Gross domestic product (GDP) projections suggest that emerging economies will see their growth accelerate from 2.9% in 2019 to 3.4% in 2021. For advanced economies, growth is projected to stabilise at 1.6% in 2020-21 and the euro area is projected to grow at 1.4% in 2021[7]. By 2030, China is expected to become the world's largest economy (see figure 3)[8].

Figure 3: Nominal GDP growth projections

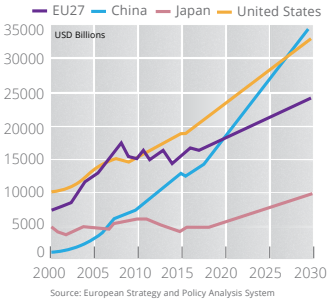
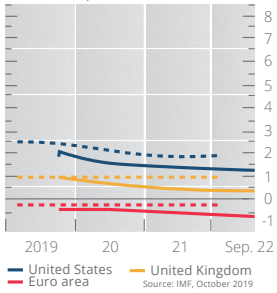
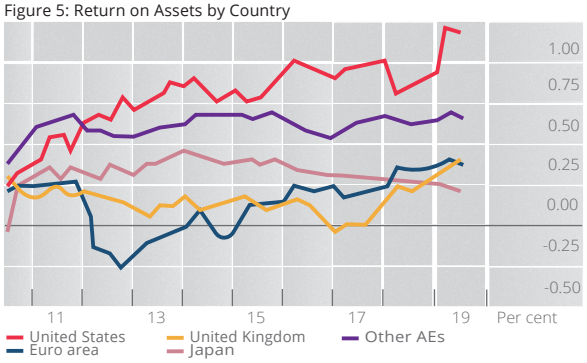


Figure 4: Policy Rate Expectations (Dashed lines are from the April 2019 WEO)



Banks must adapt to this new environment. They need to compensate for the loss in revenues resulting from persisting low interest rates (see figure 4) by other income sources. However, new players like fintech companies and big techs that are moving into payment services and credit are absorbing traditional sources of income like payment fees. In addition, banks are limited in their ability to pass along the costs of negative rates to retail depositors, who can switch into cash. Put together, these factors weigh on the profitability of European banks (see figure 5), with significant institutions earning a median return on equity close to 6% between 2015 and 2018 and about one quarter of institutions achieving less than 3%[9]. European supervisors suggest that profitability can be increased by eliminating excess capacity in the sector, and by addressing legacy issues like non-performing loans. Also, euro area banking business being largely segmented along national lines constitutes an additional drag on bank profitability[10]. In addition to addressing these topics, technological innovation like distributed ledger technology (DLT)-based regulatory reporting can reduce administrative costs if accepted and supported by supervisors.

Figure 5: Return on Assets by Country



AE: Asset-weighted average of AU, CA, CH, DK, NO and SE. Source: BIS

GLOBAL WEALTH DISTRIBUTION AND CHANGING CONSUMER HABITS

One important aspect of demographic changes and economic development is a shift in purchasing power from the western world towards Asia with a newly emerging middle class. Around the world, the middle class is projected to grow by 180% between 2010 and 2040.

This trend is confirmed in the redistribution of global wealth. Since 2000, China's wealth has increased tenfold in real terms, and average wealth in both "Other Emerging Markets" and "Other Countries" has also grown faster than in Europe and North America (see figure 6). This has lifted citizens from the lower rungs of the wealth ladder to the middle ranges, narrowing the gap between the lower middle class and the poor. Catch-up by emerging economies is also evident in the increasing proportion of members in the top segment of global wealth distribution (see figure 7)[11].

Figure 6: Mean wealth per adult by country, type, 2019 USD: 2000-19 (log scale)

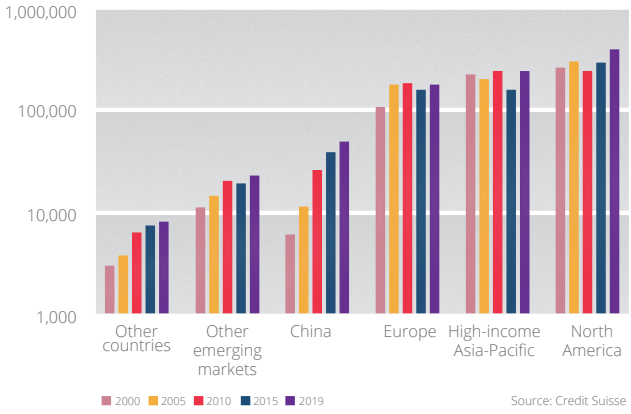


Figure 7: Global middle class statistics - population in millions

	2009		2020		2030	
North America	338	18%	333	10%	322	7%
Europe	664	36%	703	22%	680	14%
Central and South American	181	10%	251	8%	313	6%
Asia Pacific	525	28%	1740	54%	3228	66%
Sub-Saharan Africa	32	2%	57	2%	107	2%
Middle East and North Africa	105	6%	165	5%	234	5%
World	1845	100%	3249	100%	4884	100%

Source: Organisation to Economic Cooperation and Development

The middle class in Asia-Pacific countries is expanding rapidly as incomes rise across the region[14]

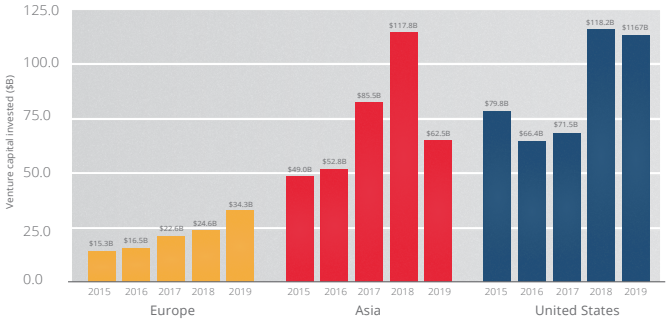
The changing distribution of wealth is directly affecting consumer-spending habits. Higher-income groups, because they have better access to technology, spend a larger share of their disposable income online. The same trend is visible among millennials[12]. Investing into modern technology is a precondition for reaching potential clients around the globe at reasonable cost. As such, financial services companies are looking at new investments into technology to offer their services and products to an emerging class of online consumers.

TECHNOLOGY IS FUNDED GLOBALLY, EUROPE LAGGING BEHIND

Technology is important in terms of growth and employment. The growth of the technology software industry is outpacing the growth of Europe's wider economy by a factor of five. To further incentivise this growth and job creation, the tech sector requires significant funding. At the moment, the majority of sources is coming from outside the EU. For the sixth consecutive year, Europe's digital sector attracted more Foreign Direct Investment (FDI) than any other industry. In the last five years, the number of digital FDI projects has more than doubled, driven by US business, which was responsible for 37% of digital FDI projects in Europe in 2018[13].

Looking at global investments into tech companies, Europe is lagging behind the US and Asia (see figure 8). This development supports the case for a Capital Markets Union that is open and attractive for global funding.

Figure 8: Capital invested ($B) in Europe, US and Asia by year



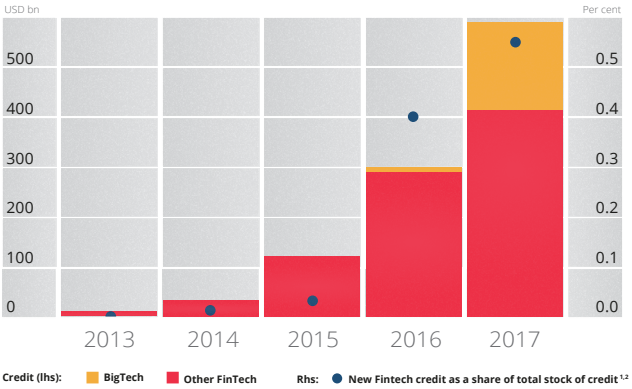
Source: Atomico 2019 report chapter 03.1

THE RISE OF BIG TECHS

Big techs differ from most fintech companies in terms of market capitalisation, a worldwide presence and range of services offered. Their success relies on the large stock of data they have from their wide user base and on the network effects that generate further activity and more data that can be analysed and used[14]. Big techs are also unbundling financial services and dividing them into their core activities.

Big tech companies are currently the largest companies in the world by market capitalisation. If existing financial regulations, e.g. consumer protection rules or prudential requirements, do not apply equally to big techs entering financial services, then this could lead to lower costs and a competitive advantage for them. One of the most notable developments in recent years has been the entry of technology companies with existing platforms into the provision of financial services. To date, these firms have pursued a well-worn strategy of broadening their activities in finance. Starting with payments, they have expanded to the provision of credit, insurance, and savings and investment products[15]. Collectively, the total volume of new credit provided by fintech and big techs in 2017 exceeded USD 500 billion; a tenfold increase from 2014 (see figure 9). However, big tech finance remains quite limited as the total flow of fintech credit in 2017 represents around 0.5% of total stock of private sector credit at the global level. But credit and payments are only two out of a wider range of financial services provided by big tech and fintech firms. Today, when taking the example of ten big tech firms, it becomes evident that they provide a large offer in financial services (see figure 10)[16].

Figure 9: Global volume of new FinTech credit

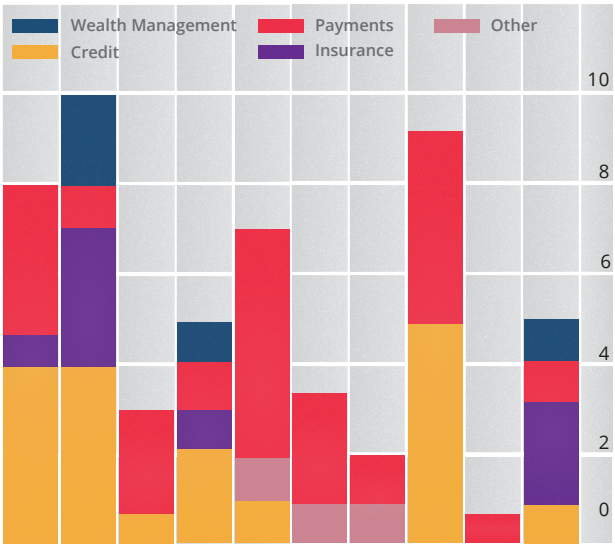


The bars indicate annual global lending flows by BigTech and other FinTech firms over 2013-2017. Figure includes estimates.

[1] Total FinTech credit is defined as the sum of the flow of BigTech and other FinTech credit. This is then divided by the stock of total credit to the privatenon-financial sector. [2] Calculated for countries for which data were available for 2013-2017.

Sources: Cambridge Centre for Alternative Finance and resarch partners; BigTech companies financial statements, authors calculations

Figure 10: Current financial services offered by 10 selected large big tech firms.



Note: The category "other" includes services such as messaging services and venture capital providers.
Source: FSB

European supervisors point out that their guiding principle in this area is technological neutrality and the maintenance of prudential soundness[17]. The Financial Stability Board (FSB) sees benefits but also potential risks to financial stability arising from big tech firms. Benefits include the potential for greater diversification, efficiency and transparency in the provision of financial services, as well as the potential for greater access to those services. Potential risks include those common to other financial activities such as leverage, maturity transformation and liquidity mismatch, operational risks, such as cyber vulnerabilities, as well as poor governance and process control[18].

In this introduction, we have identified key global trends that we believe are changing the European banking landscape: a shift in the demographic structure characterised by an ageing world population and a new generation of digitally savvy millennials, both having a profound impact on the distribution of global wealth; a difficult economic situation which results in low profitability; and technological innovation, investment challenges and the rise of new players like big techs in finance. In the next two chapters, we discuss how these changes impact the digital transformation of banks (Chapter 2) and banks' relations with their clients (Chapter 3).

Banking 2020-2030: Technology and other Impacts on Financial Institutions

HOW GLOBAL BANKING IS ADAPTING TO DIGITAL INNOVATION

BANKS ADAPTING TO TECHNOLOGICAL CHALLENGES

Digital evolution continues reshaping the banking industry at a rapid pace. Consequently, banks are adapting their business models by spending more on technology. Citing figures, the Expert Group on Regulatory Obstacles to Financial Innovation (ROFIEG) mandated by the European Commission states, in its final report published in December 2019, that the largest banks spend globally approximately USD 350 billion in digital technology (almost twice as much as the insurance sector), of which USD 192 billion is spent in Europe (banks and insurances together)[19].

For example, global banks are now adopting Open Banking through the creation of Application Program Interfaces (APIs) for payments. In the EU, that also means increased security through Strong Customer Authentication (SCA) under the EU Payment Services Directive II (PSD II) which requires further technological adaptation. Global banks are partnering with technology firms that supply innovative solutions to support the provision of financial services and to meet new regulatory and security requirements. Global banks are also outsourcing their activities and data to the cloud, or only buying-in the infrastructure. In addition, they are making use of technology to build efficiencies, including for risk management or compliance purposes in know your customer (KYC)/anti-money laundering (AML) checks or for reporting obligations. Finally, global banks are exploring and experimenting with the potential of emerging technologies such as artificial intelligence (AI) and blockchain for their operations, security and customer propositions[20].

All in all, digitalisation allows banks to redefine their business models, contribute to digital banking ecosystems - which are essentially customer-centred - and include new products and services as well as new players or third parties that can add value to the classic banking offering, often in partnership with banks[21]. At the same time, digitalisation forces banks to leverage their strengths such as risk management, trusted relationships, clients' data protection and customer experience to the benefit of the ecosystem and to the interest of regulators and supervisors.

To adapt to the new situation, global banks have boosted their investment in technology. Figures show that US investment banks invest far more than European banks in technology[22], and this remains a small fraction of what big techs invest in research and development[23]. In comparison to their non-EU peers, EU banks are disadvantaged by prudential and accounting rules that oblige them to fully deduct from their Common Equity Tier 1 (CET1) capital intangible assets such as investment in technologies and information technology (IT)[24].

TECHNOLOGY CREATES MAJOR OPPORTUNITIES FOR BANKS

Technology provides greater flexibility as well as more efficiency and economy of scale. It also results in improved competition, aggregation of services and an added focus on security.

Technology helps banks to become more agile in meeting new habits from consumers and strong demands from a new generation of clients.

It is, however, in the mid- and back-office that we see a highest potential for technology, by means of increased operational efficiency, especially as the fintech market continues to mature. Technologies like cloud computing, blockchain, robotic process automation, artificial intelligence and data analytics are emerging to automate routine (but often quite complex) tasks and allow for better and faster decision-making, for instance in risk management, cybersecurity and AML. These technologies are all helping to reduce and/or allocate costs more efficiently and increase the resilience of front-to-back processes.

In addition, technologies such as AI and DLT, supported by cloud computing, can contribute to reducing risks and increasing operational resilience by helping meet regulatory expectations and compliance requirements, through the detection and prevention of irregularities and fraudulent activities, such as money laundering. They can also facilitate client due diligence (CDD) and banks' reporting to authorities in what is called Regulatory Technology (Regtech)[25]. According to research by a consultancy firm cited in the report of the ROFIEG, Regtech spending will grow by 45% per annum globally[26].

Based on the large amounts of data which has become essential to supervisors, technology could also enhance supervisory processes, data collection

and risk analysis by making it easier for supervisors to flag anomalies when monitoring transactions in real time, for example[27]. We then speak of Supervisory Technology (Suptech).

Many processes are already underway in banks to adopt new technologies in order to deliver "more cost effective, better tailored, and more inclusive" financial services, as noted by Bank of England Governor Mark Carney[28]. There is a clear realisation that the greatest strategic risk would be stagnation and a failure to adapt and become a utility-like provider with limited growth potential. However, the persistence of legacy systems, the emergence of cyber risks and issues around governance must be considered.

TECHNOLOGY ALSO POSES NEW CHALLENGES AND RISKS

Transition will pose various challenges. A plethora of legacy IT systems, siloed data platforms and outdated applications that incumbents have had in place sometimes for decades is one of them. These can hinder rapid technological adaptation and making full use of the large amount of data held by banks. Banks are forced to work around these fragmented legacy systems and tools. Replacing them by new integrated technological platforms is not without complexity, cost and time.

Besides well-established legacy IT systems and old infrastructures, several other issues could potentially impede the broad adoption of new technologies, such as the risk of vendor lock-in, where intellectual property for new technology is not shared, as well as new, highly demanded tech-oriented business skill-sets. Fintech and big tech companies, on the other hand, can build new technologies from scratch as they have no legacy systems and they operate less regulated business models which allows them to challenge incumbents and target existing banking activities. Banks can develop new technology systems in-house and migrate to them; they can also partner with fintech or big tech companies; or they can pursue hybrid solutions.

Inevitably, new emerging technologies also engender new risks, including a new generation of cyber operational risks. The annual EY/ International Institute of Finance (IIF) risk management survey shows that cybersecurity risk is the number one priority among senior management of global banks, and the data challenges, whether related to privacy, availability or integrity of data, are considered the biggest emerging risks in the coming years, greater than the risks associated with climate change[29]. These cyber risks have become even more relevant in the context of the increase in outsourcing arrangements and a reliance on third party providers (e.g. through cloud adoption). As a result, global banks continue to invest significantly in cybersecurity and operational resilience. The protection of banks' data and systems is not only critical to banks' operations, but it is also essential to consumer trust and confidence and to the integrity of the financial system as a whole. The topic of cybersecurity and operational resilience thus receives much attention from regulators worldwide.

To future-proof their operations, banks will have to embed operational risk management into their adoption of technologies, in order to be 'secure by design'. Security can no longer be an afterthought or an add-on. Proper governance and dedicated capabilities will be needed to address the operational, regulatory, reputational and ethical challenges around technologies, in particular artificial intelligence, digital identity, cloud computing, and distributed ledger technologies.

Challenger banks have demonstrated how technological advances such as facial recognition and data authentication analytics can enable more mobile, more convenient cost-efficient online banking, but these advances have to be balanced against financial services participants' responsibilities in the context of combatting money-laundering, financial crime and terrorism, as well as reputational risks and data protection concerns. Trust in banking is essential and banks will need to retain their quality of systemic and enterprise–level trust without which it cannot function. Ultimately, regulators and banks will need to work together to strike the right balances between enabling innovation whilst managing the various risks involved.

KEY TRENDS AND TECHNOLOGIES IMPACTING GLOBAL BANKING

THE EMERGENCE OF ARTIFICIAL INTELLIGENCE

Artificial intelligence is one of the key emerging technologies today. It has the potential to provide services and infrastructures in the banking sector. AI is an umbrella term used to cover a confluence of multiple technologies such as machine learning (ML), cognitive computing, natural language processing, etc., combined with automation[30].

The Bank of England's report on the Future of Finance notes that AI will become widespread in financial services over the next 10 years[31].

Complex automation, a precursor for advanced AI, already applies today in global banking for dedicated tasks such as financial markets analysis, risk scenarios and transaction monitoring. Banks are increasing the use of new AI technologies to improve customer support, though currently in a relatively limited capacity, for instance as virtual assistants, or chatbots[32], to capture basic data. However, the level of sophistication is increasing, with uses of AI in marketing, personalisation of services and loyalty programmes, as noted by a recent report from Finextra[33]. AI technology is also being tested to take on more tasks in creditworthiness evaluation[34], or portfolio advisory services (robo-advisory) and investment management, respectively.

Citing figures from McKinsey & Company, the Bank of England's report notes that AI could lead to a 20% uplift in firms' financial performance[35]. A case study on China's financial sector by Boston Consulting Group is even more optimistic in its estimates by projecting that AI will generate a 38% productivity increase within 10 years, which is equivalent to a 27% reduction in hours worked[36].

Even though the complexity of AI implies there are risks associated to its use, machine learning could be eventually deployed to support and integrate any number of complex, repetitive and data-intensive financial services activities, for instance in Regtech and Suptech.

So far, the US and China have established themselves as world leaders in the development and adoption of AI[37]. Europe is not necessarily lagging behind but due to a different cultural context (especially when it comes to approaches to the use of data and impacts of automation on workforce), it is taking a slightly different policy route, by adopting a more human-centric approach to technology and by focusing on the importance of ethics in using AI[38], and on the impact on the European job market. There also seems to be a much stronger emphasis on a high level of trust associated with the use of AI, as illustrated by the EU guidelines as well as the Organisation for Economic Cooperation and Development (OECD) principles on AI. Both advise for the responsible or ethical deployment of trustworthy AI to ensure that privacy and personal data are protected when developing and running AI systems[39].

The development, implementation and adoption of AI is closely associated with big data and advanced/computing analytics. But the use of big data also raises many key questions around the access, use, sharing and protection of customers' data[40]. Banks and other financial institutions should therefore take AI seriously and continue cautiously investing to maintain their differentiation with technology companies[41], whilst at the same time avoiding the pitfalls of implementing "bleeding-edge" technology. They should build trust around using AI through transparency, interpretability and clearly articulated use cases of the technology, as noted in a recent report from the European Banking Authority (EBA)[42], especially where the risks of AI are still misunderstood, or little known.

CLOUD IS BECOMING INCREASINGLY MAINSTREAM THROUGHOUT FINANCIAL SERVICES

Cloud computing has moved beyond experimentation and entered implementation. The Bank of England refers to figures from McKinsey & Company that show that the usage of cloud technology in banking will further accelerate: 25% of the core activities of the largest global banks may already be on public cloud, and 40-90% of banks' workload globally could be on public cloud in 10 years[43]. Finextra has found that financial institutions in Singapore (42%) are front running in moving payments and other activities to the cloud, followed by the US (33%) and the UK (30%).

Cloud computing is a complex ecosystem of different types of interoperating services[44]. Cloud services are typically characterised by i) the type of service model(s) offered by the cloud service provider (CSP), which determines the inherent degree of IT control management sharing; and ii) by the deployment model(s) offered by the CSP, depending on whether control is internal (e.g. private cloud), external (e.g. public cloud) or a combination (e.g. hybrid cloud). A 2018 survey by EY and the IIF shows that most banks (51%) are using a hybrid cloud solution. A third (34%) are still only using a private cloud and only 4% of banks are using public cloud only. Of those banks using cloud services, most (71%) have deployed it for less than 20% of their environment and none have used it for more than half of their business[45]. The IIF believes that the benefits of public cloud will likely attract more banks in that direction[46].

Industry surveys show that banks now recognise the many benefits of migrating core functions from traditional and numerous legacy data centres to CSPs[47], thus making cloud technology increasingly mainstream. As a response, in the EU, the EBA has issued Guidelines on Outsourcing Arrangements which aim to harmonise outsourcing requirements for the use of cloud providers[48].

Cloud computing technology provides greater business agility, speeds up internal processes, creates scalability and offers tailor-made

capacities. This is essential for storing and processing huge amounts of data to reap the benefits of emerging technologies like AI for instance. Cloud services also help reduce costs and increase operational efficiency, by solving vulnerabilities of banks' legacy systems. Finally, cloud outsourcing can enhance operational resilience/cybersecurity by providing effective risk mitigation. In this respect, some observers emphasise that CSPs have more state-of-the art security features than most individual companies and they invest more and on a continuous basis in cyber-defences[49].

While cloud technology offers many advantages, moving to the cloud is also costly and complex, mainly because of legacy IT systems which are often not cloud-ready. Moreover, it is not without operational risks associated with cybersecurity neither because of dependency, concentration and governance issues (see Box). For the time being there is no such thing as a European public cloud infrastructure despite efforts by Germany and France to build such a public utility (Gaia-X)[50]. Today, individual financial institutions have to contract with a limited number of CSPs mostly based outside Europe. The largest providers of cloud services in the world are US big techs such as Microsoft, AWS and Google, thus leading to concentration concerns. In the case of failure or disruption, these large service providers could create systemic risks to the financial market because they have become critical infrastructures[51]. The establishment of industry-wide standards (e.g. on contractual clauses or technical aspects) and best practices could offer some solutions to mitigate potential dependency and concentration risks.

Outsourcing to the cloud also poses crucial questions in terms of data handling such as data localisation, portability of data when moving to another provider and data protection. The IIF notes that following the introduction of the EU's General Data Protection Regulation (GDPR), European banks place a particular emphasis on certain risks, notably regulatory risk, legal risk and the risk associated to the geographic location of CSPs[52]. On the other hand, there are also risks of not moving to the cloud, such as maintaining old security systems or being left behind in the competition for new businesses, new products and services, as well as new clients[53].

Because it connects banks and their multiple partners in a single, integrated and highly secure platform, cloud technology is the foundation of a collaborative fintech ecosystem that can make the most of emerging technologies such as AI and blockchain. For this reason, we expect cloud computing to remain high on banks' and regulators' agendas.

Banks in the Cloud: Another false prophecy or the path to minimal retained IT?

By Patrick Maes

Managing Director, Global Head of Bank User Solutions, Credit Suisse.

Chairman of the European Banking Federation (EBF) Cloud Expert Group and Cloud Forum Drafting member of SWIPO IaaS COC working group.

Having been in banking IT for the last 30 years, I have seen many so-called "new" technologies introduced in banking. We had AI and expert systems in the 1980s, together with client server and end user computing, because of the introduction of the PC. In the 1990s, we got excited about object orientation, distributed computing and UNIX, while we have seen recently the rebirth of AI and machine learning and the broad adoption of open source, DevOps and container technologies. Each of these technologies introduced important concepts to the then current state of technology, but unfortunately, none of them reached the full potential (in terms of the latter part of the S-curve) they promised to deliver.

Why is this the case, what can we learn from this and will this also happen with cloud? There are many contributing factors here, but in particular, I would mention two. First, each technological innovation was overhyped by the technology vendors (creating the new "silver bullet") which produced unrealistic expectations with Chief Investment Officers (CIOs) and management about cost of adoption and benefit realisation. A second important contributor was, in general, poor implementation of these technologies because of insufficient investment in skill development. This resulted in a "pollution" of the new technology with legacy concepts and unrealistic large-scale adoptions programme, which were targeting the migration og legacy assests.

Cloud as the newcomer is not escaping this pattern: it is highly overhyped as the "new" platform, which is so-called more secure, stable, cheaper while offering more functionality.

Adoption seems more difficult and slower than expected. In some cases, early adopters retracted from the cloud because of cost increase and security concerns. Is cloud going to be another of these disillusions?

Before answering this question, we need to ask, what is the future role of the IT department in a financial institution? In the past, the IT team was providing all IT for the bank in a rather captive and monopolistic model, with some managed capacity and service added to this. This is fundamentally changing now towards a brokerage model using APIs and cloud where the IT team acts as a broker between businesses and IT providers providing cloud capabilities such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). This is what Gartner calls a minimal retained IT organisation.

A second question we can ask is, what happened with all these previous technologies, which did not fulfil completely their promises? The good news is that each technology, despite partial success has contributed significantly to the global state of IT today, despite the fact that we did not see many S-curves mature. In addition, technologies are always evolving, as we can see with AI and machine learning between the 1980s and now. Another important observation is that technologies, both existing and advanced (such as AI/ML, DLT, Big Data & Semantics, etc.), are more and more used in a hybrid way[54], which was different in the past where each new technology was often tried to replace the previous one. This level of co-existence where a multitude of technologies can deliver a coherent architecture enabled by the cloud, similar to physical architecture where, for example, the cathedral of Canterbury has components of different architectural styles such as Roman and Gothic. It is just this hybrid technology application where the cloud adds value with its large range of services from infrastructure, containers, platforms and software, which can be consumed as a service. This platform can bring IT closer to "real" engineering and where legacy is not anymore a liability with increasing costs, but an asset in an ever-evolving service landscape. From a change perspective, it is our hope to end the madness of constantly rebuilding systems because there is a new IT paradigm around the corner, but we can build new functionality on a stable platform. It is also the only way we can eliminate ongoing maintenance and upgrade costs, to live in an evergreen environment.

So cloud is not just another technology paradigm, but fundamentally different from its predecessors. In fact, for the first time in 30 years of (banking) IT, we have created the enabling platform for a fundamental different IT operating model, allowing us the integration and combined usage of evolving technologies, without the need to constantly rewrite legacy. This is without any doubt the greatest opportunity for the CIO.

Despite this great promise, there are some impediments we need to overcome here. Without being exhaustive, I like to call out the following four:

Cloud is outsourcing
This is the position of most regulators (as we have seen in Europe with the EBA Guidelines) and authorities[55]. Opposite to typical outsourcing contracts, which are typical large-scale and one-off deals with extensive resources and knowledge transfer, cloud is systematic and broadly used across the bank. Each day our users are using thousands of cloud solutions from virtual machines, cyber tools, virtual desktops, collaboration tools, SaaS, etc. There is a hypothesis that responsibilities are shifting from the bank to the cloud provider, especially when you are moving from Infrastructure to Platform and Software as a Service, which is not correct. Of course some of the basic functions, such as monitoring and logging, are done by the cloud provider but the overall responsibility of the service lies still with the bank, irrespective of the deployment model. This means there is an urgent need to invest in advanced multi-cloud management capabilities to be able to stay on top of this.

Cloud is different (from my legacy environment)
Given most banks will end up in a multi-cloud model, with a combined usage of on premise and cloud capabilities across multiple cloud providers, good cloud architects and cloud brokers will not be sufficient. To prevent we end up in a highly silo model where each cloud is managed in a complete proprietary way with its own monitoring, logging, cyber and operational capabilities, we need to establish a multi-cloud management platform (CMP) that allows the banks to operate their environment in a holistic way. While we see in the industry a growing attention for such a CMP, this is still in its infancy and in fact not yet a point of attention for most regulators.

Cloud is cheaper
Cloud can be cheaper because it offers elasticity of usage as you pay for what you use. This requires applications need to be designed to take advantage of this. Porting legacy applications in a lift-and-shift model to the cloud will, in general, only increase costs as these applications are designed for an always-on philosophy. So, to get the benefits, your applications need to be cloud ready, which means some re-architecture effort.

Cloud is safer

While the cloud providers invest large sums of money in their Information and Cyber Security, this can only be for the benefit of the bank, when this security capability is fully integrated with the bank's security infrastructure in terms of the federation of identities and credentials, the creation of crypto-graphics and the management of the extended network. The cloud can be a safer place when these capabilities are well designed and implemented. Hence the need for experienced and highly skilled cloud security professionals.

I hope I managed to explain the fantastic opportunity we have with cloud as the enabler of probably the most fundamental change in IT we have seen since the mainframe area. In fact, mentioning the mainframe, the paradox is that we are going back to a similar model, with that difference, we do not own the asset anymore, we only pay for its usage (who knows what would have happened if IBM had applied a similar model?).

Realistically as with any new technologies, many companies will fail on their cloud journeys, leaving them in a death-end space they probably cannot recover from. There are many impediments and false prophecies looming, and I hope this article has at least contributed to some awareness. I wish the reader a successful cloud journey.

DLT-BASED DIGITAL CURRENCIES HAVE POTENTIAL FOR FINANCIAL SERVICES

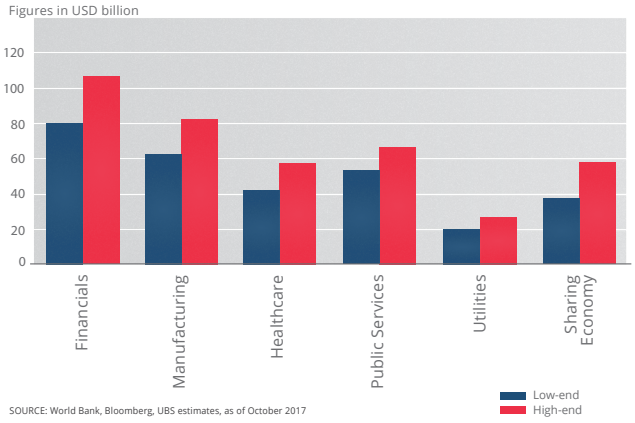
While it is gaining maturity, global banks are still exploring the potential of distributed ledger technology, sometimes referred to as blockchain, and experimenting with its use as a utility that can provide a shared, trusted and efficient infrastructure for exchanging assets and transferring money, contracts, and more. Implementation will, however, take time as the technology remains currently limited to a small community of participants, according to a recent report by the European Commission[56].

There are also operational, legal and regulatory challenges that prevent its quick and widespread adoption, such as legacy IT systems, classification of tokens, consumer protection, AML requirements and vendor lock-in restrictions. Nevertheless, figures from the World Economic Forum (WEF) show that four out of five banks have adopted blockchain technology in some form or another[57]. We note that regulators are also looking at the potential of blockchain: e.g. the EBA, the Committee on Payments and Market Infrastructure (CPMI), International Organisation of Securities Commissions (IOSCO) and the FSB. However, alignment at a strategy level (e.g. internationally coordinated central bank policy for the use of blockchain) still needs to happen.

In an industry that relies traditionally on intermediaries to conduct transactions, the distributed nature of blockchain could be seen as a transformational threat to financial institutions[58]. It could ultimately reshape the role of banks and their value proposition. DLT also has the potential to yield significant cost savings to incumbent financial institutions and could be a key transformative technology as noted by the European Commission[59]. In addition to reducing costs, blockchain has the potential to improve the efficiency, transparency, trustworthiness and security in the life cycle of financial instruments (for issuance, clearing and settlement of securities).

Other promising use cases can be found in cross-border payment systems, regulatory compliance (AML/KYC obligations on digital ID), electronic onboarding of clients, trade finance (using smart contracts), in FX transfers or in insurance claims. UBS expects blockchain to generate an annual economic value worth USD 300-400 billion globally by 2027 across six major industries led by finance (see figure 11)[60].

Figure 11: Blockchain could generate an annual economic value of USD 300-400bn globally by 2027



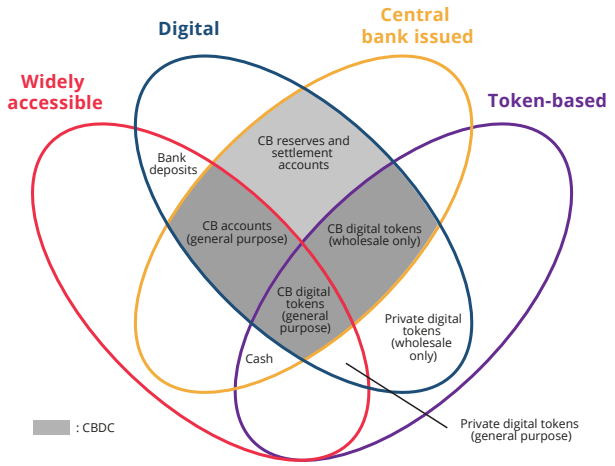
SOURCE: World Bank, Bloomberg, UBS estimates, as of October 2017

So far, the most prominent example of a concrete DLT-based application is in privately issued digital currencies. Cryptocurrencies (or crypto assets) combine new payment systems with new currencies that are not issued by a central bank and can be transferred anonymously. Bitcoin and Ethereum are two well-known examples. Cryptocurrencies should be distinguished from e-money (such as Alipay, WeChat, etc.), which essentially represents a digital component of regulated fiat currency systems[61]. From a regulatory point of view, cryptocurrencies cannot replace fiat currencies for different reasons: they are not a regulated form of money; they lack the characteristics of being a medium of exchange;

many of them greatly fluctuate in value; so far they have proven that they cannot scale with transaction demand[62]; and they are not a widely accepted form of payment. Until recently, global and local regulators have considered that cryptocurrencies do not yet pose a risk to monetary or financial stability.

Cryptocurrencies can pose a risk to investors, and potentially their entire investment, due to their high volatility and lack of a monetary authority acting as a lender of last resort. Regulators have issued warnings to investors in this respect[63]. The crypto discussion recently took a new turn with the Libra project launched by Facebook. Libra is a 'stablecoin' linked to a basket of stable currencies, hence it addresses some of the risks that characterise other cryptocurrencies (e.g. volatility). However, regulators across the globe consider that it poses various regulatory risks as well as a risk to monetary sovereignty and financial stability (see figure 12)[64], given that it is international in its scope whilst central banks and monetary policy is operate at a national level.

Figure 12: The money flower: A taxonomy of money



Note: The Venn-diagram illustrates the four key propreties of money: issuer (central bank or not); form (digital or physical); accessibility (widely or restricted) and technology (account-based or token-based). CB = central bank, CBDC = central bank digital currency (excluding digital central bank money already available to monetary counterparties and some non-monetary counterparties). Private digital tokens (general purpose) include crypto-assets and currencies, such as bitcoin and ethereum. Bank deposits are not widely accessible in all jurisdictions. For examples of how other forms of money may fit in the diagram, please refer to the source.

Source: BIS Annual Economic Report

While some cryptocurrencies are used by fintech start-ups for raising capital outside of the banking system and without intermediation, for instance by issuing tokens for crowdfunding (through Initial Coins Offerings, or ICOs), the BIS acknowledges that the underlying blockchain technology could be promising in other applications such as the simplification of administrative processes in the settlement of financial transactions[65]. Incumbent financial institutions have indeed started experimenting with their own set of currency-backed digital assets that use blockchain technology. For instance, the development of a Utility Settlement Coin (USC) is managed by a consortium called Fnality International with the aim of improving the cross-border settlement system and wholesale payments between banks (see Box). Another example is the US bank J.P. Morgan Chase which created a coin that should enable instantaneous transfer of payments between institutional clients[66].

The Utility Settlement Coin (USC) project

The USC is not a stable coin, as the digital asset is controlled by central banks rather than being a corporate representation of such an asset. The USC is a DLT-based digital cash settlement asset. It is used to settle the tokenised value transactions with finality using a peer-to-peer exchange. It is more akin to a payments system.

Each jurisdiction has its own USC that is 1-1 backed by fiat currency held at the central bank. A unit of USC is the same value as its fiat equivalent. USC initially focused on GBP, USD, CAD, EUR and JPY.

The purpose is to simplify the clearing and settlement process between institutions with a positive impact on capital efficiency and risk reduction (e.g. counterparty, credit, settlement, and systemic risk).

Primary use cases are post-trade cross-border wholesale payments (Payment-versus-Payment settlement) and securities settlement (Delivery-versus-Payment) institutional transactions.

Fnality International was established in April 2019 and is moving towards production and will be responsible for leading the delivery of the USC Minimum Viable Product (MVP) by mid-2020. There are 15 Founding Shareholders/Members in Fnality (including UBS and Credit Suisse).

https://www.fnality.org/

What is USC? PFMI Compliant Payment System to Support Digital 'Tokenized' Settlement

Digital Settlement Asset (USC)

CASH ON LEDGER: Utility Settlement Coin (USC) will support settlement of the cash leg of financial transactions on distributed ledgers across a number of products.

KEY ATTRIBUTES: USC is designed to be a cash-like asset that is credit risk-free, with many of the prosperities of central bank money.

INTEROPERABLE USC CHARACTERISTICS: Accomodating jurisdictional differences in order to set up interoperable systems.

Fnality Payment System

REGULATORY OVERSIGHT: Fnality will be regulated market infrastructure.

DISTRIBUTED INFRASTRUCTURE: Achieved through the establishment of a separate payment system for each jurisdiction. Each payment system maintains its own distributed ledger and will be interoperable with the other systems.

PROTOCOL FOR TECHNICAL INTEROPERABILITY: Protocol supporting atomic settlement of transactions across different ledgers, bringing the opportunity for higher competition in post-settlement services.

INNOVATION ENABLER: A platform with the potential to enable new processes and post-trade business models.

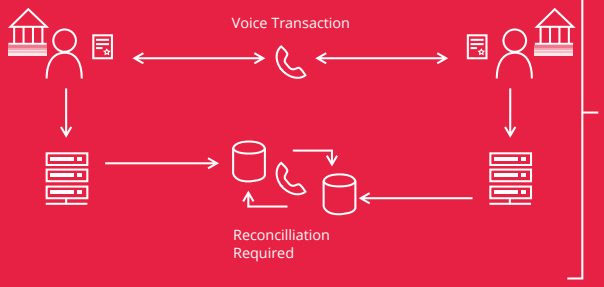
Benefits of Fnality / USC

REDUCING SETTLEMENT RISK: Achieved through atomic settlement of value transfers.
INTEROPERABILITY: Connecting platforms (DvP & PvP)
24/7 INSTANT CROSS CURRENCY CASH SETTLEMENT
SINGLE POOL OF LIQUIDITY from the perspective of Fnality platform participants.
REDUCING SYSTEMIC RISK

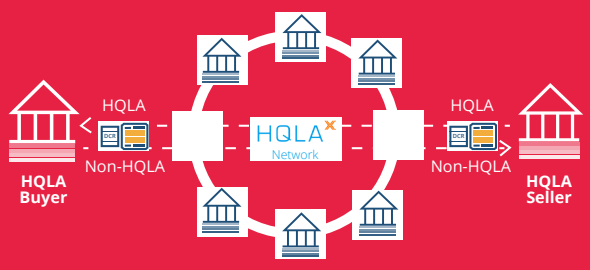
In response to these developments, central banks across the globe are exploring the possibility of networks of central bank digital currencies (CBDCs)[67]. Enabling central banks to issue their own digital currencies goes far beyond simply allowing e-money providers to hold central bank money[68]. Now, central banks are closely monitoring the technologies while taking a cautious approach to implementation. A group of central banks is evaluating potential cases for CBDCs[69], restricted in principle to wholesale transactions among financial institutions. So far, however, experiments with such wholesale CBDCs have not produced a strong case for immediate issuance[70]. To gain in-depth insights into the relevant technological developments affecting central banking, the BIS has recently established a first centre for its Innovation Hub in Switzerland that will examine the integration of CBDC into a DLT infrastructure and will also look at fast-paced electronic payments[71]. A second hub was recently established in Singapore (focusing on digital identity)[72]. Another centre in Hong Kong (focusing on trade finance) will follow.

Deutsche Börse - HQLA DLT solution for frictionless collateral swaps in the securities lending market

Current Process
- High-friction price discovery
- High-touch transactions
- Balance sheet intensive
- Manual reconciliations



New Process Leveraging DLT
- Improved collateral fluidity; securities don't need to be moved across CSDs
- Mitigate systemic risks by enabling orderly default unwinds
- Real-time atomic legal title transfer enabling DvD of baskets of securities
- Enhanced tansparency with a "Collateral Tracking" view for regulators



In December 2019, Credit Suisse and UBS executed the first live transactions on the Deutsche Börse-HQLAX securities lending platform. As part of these transactions, ownership of a basket of German government bonds and a basket of corporate bonds was swapped between UBS and Commerzbank, both using Clearstream Banking S.A. as custodian. This was followed by a cross-custodian swap between UBS and Credit Suisse, in which ownership of a basket of corporate bonds at Clearstream Banking S.A. and a basket of German government bonds at Euroclear Bank was exchanged without the need for securities to be physically moved between the collateral agents. Instead, the change in ownership was recorded on the digital collateral blockchain registry[73].

Another illustration of the new possibilities that DLT technology offers can be found in the area of collateral management. The repair of the financial system has led to new bank regulations for liquidity, mandatory clearing, and margin requirements for over-the-counter (OTC) derivatives. These new rules have caused a significant increase in demand for High Quality Liquid Assets (HQLA). Exchanging non-HQLA with HQLA in the current process requires the exchange to pass through a cash instrument such as dollars or euros and this in turn has caused banks to increase their daily intraday cash needs. Credit Suisse and UBS along with four other banks helped establish a first of its kind DLT-enabled repo trading exchange called HQLA (see Box).

IMPLICATIONS OF BIG DATA

THE EMERGENCE OF THE DATA ECOSYSTEM AND ITS BIAS

The volume of data generation is growing fast. Every 18 months, the data generated since the beginning of mankind is said to double. 40 ZettaBytes of data (which equals to 40 000 billion billion) produced today will grow to 175 ZettaBytes (or 175 000 billion billion) of data in 5 years[74].

Firms are leveraging data like never before to enhance customer experience, develop new products and services, and improve their operations[75]. Data is essential to take advantage of emerging technologies such as AI. But data only has a real and tangible economic value if it is assessed, processed and exploited.

Big data analytics broadly describes the storage and analysis of large amounts and/or complicated sets of data using techniques or technologies such as AI. It allows us not only to reduce repetitive tasks but also to train machines to think and algorithms to suggest, for instance, where clients should invest, who might be a rogue trader, what our carbon footprint will look like in five years and help us reduce it. However, great ability comes with great responsibility. Many critical questions arise: is the data we are feeding into our machines biased; who owns this data; is it ethical; can we share it?

A key feature of the complexity relevant in big data sets analytics often relates to the amount of unstructured or semi-structured data contained in the datasets (i.e. text information in opposition to concrete numbers)[76]. As noted in the Report from the ROFIEG, some forms of data may be more or less relevant to a decision-making process and some may induce bias or lead to undue weighting of a particular source or type of data. Data collected from the internet and social media may be invalidated and potentially manipulated through reviews and 'likes' or referring to parameters which could be regarded as unfair, for example counting in data of family, friends and colleagues of the relevant data subject[77].

Among other problems we face in this super-automated digital age is also a data vacuum from developing countries leaving them unbanked and perpetuating a life that is underprivileged and ostracised from the great developments that will come in the digital age because their data is not used and they remain invisible. According to the World Bank's Global Findex, 56% of all unbanked adults are women[78], due to barriers such as the lack of ID, insufficient collateral, mobility constraints, or little financial literacy. The lack of data perpetuates gender gap in financial inclusion and could translate into bias in using AI. A huge data divide is opening as we collect more data from developing countries which are being pushed further down and away from any ability to become sustainable. The lack of reliable data in poor countries thwarts both development and disaster relief.

The gender data gap, as Caroline Criado Perez discusses in her book *Invisible Women*[79], is a real thing and another big problem since 49.6% of humanity is female. An example she gives is of the facts around female heart attack symptoms, which we have all grown to believe are gender neutral such as pain in the chest and down the left arm. Criado Perez explains that these are not the symptoms experienced by many women when they are having a heart attack; only 1 in 8 women experience chest pain. Women mostly suffer from fatigue, nausea, indigestion, restlessness. This leads not to more women having heart attacks but more women dying from them. Why does this happen? Women's data is not factored into the research and the drug trials. The results are only as good as the data.

We believe the first requirement to achieve data balance is for interoperable digital identities which would then allow collection and processing of data to make the invisible a part of our global ecosystem. A data repository where data can be shared horizontally by all, cleaned and labelled, will allow for better healthcare, the attainment of sustainable goals, tailored insurance, micro loans, weather forecasting for crops, sharing of information, tailored products based on gender, lifestyle and other important factors. We can only have ethical AI if we have contribution of data from a varied source.

DATA IN FINANCIAL SERVICES

We believe that this changing environment requires a revised data framework that works for businesses, protects consumers and promotes banks competitiveness against the new big tech players.

Traditionally, banks and other financial services firms have been reluctant to leverage on the data they hold, mainly due to privacy concerns. However, the entry of new players such as big techs - whose business model is built on the use of big data - into financial services, however, creates a new situation and may put banks and other financial institutions at a competitive disadvantage. It is therefore essential for them to have a clear understanding of the applicable legal and regulatory parameters.

The GDPR and the PSD II are built on the premise that data ownership lies with the customer. This is the correct starting point. Data has become an essential resource for economic growth, job creation and societal progress. Personal data has an economic value, which increases as more data is combined. The data economy is increasingly characterised by an ecosystem of different types of market players collaborating to generate additional value[80].

PSD II has created a data asymmetry, however: banks are unable to access on equal terms (and conditional on customer consent) the data of the new players. For the benefit of consumers this asymmetry could, in our view, be addressed by horizontal data sharing that would allow customers to share information not only to third party providers from banks but from other platforms to banks to allow for a level playing field[81].

EVOLVING COMPETITIVE ENVIRONMENT: BIG BANKS AND BIG TECHS

THE EMERGENCE OF BIG TECHS IN FINANCE

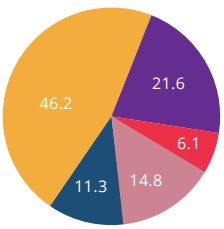
Global banks need to adapt their business models to the new competitive environment characterised by the emergence of non-financial institutions providing banking-like and other financial services. The FSB is of the opinion that the entry into finance of big techs may have a significantly higher impact than that of fintech firms in terms of competition and concentration in the financial sector[82]. Big techs are intrinsically linked to the rise of big data and data analytics and the opportunities it offers, which are key to the development of automated decision-making based on technologies like artificial intelligence.

The competition between banks and big techs is already fully visible in the area of payments where the market share of non-bank electronic payment providers, which offer alternatives to traditional credit and debit cards, is growing. Nearly 60% of retail banking transactions worldwide are now estimated to go through mobile and online providers, which offer alternatives to traditional credit and debit cards, is growing. Nearly 60% of retail banking transactions worldwide are now estimated to go through mobile and online channels[83]. Asia is the most striking example: in 2016, traditional banks and payment processors lost an estimated USD 30 billion fees to mobile payment giants[84]. Mobile payments have exceeded cash payments in China[85].

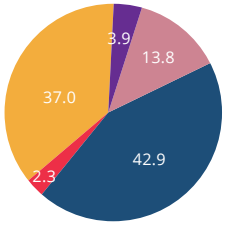
Figure 13: Financial services are a small part of big tech business

In per cent

Big techs' revenues by sector of activity[1]



Regional distribution of big techs' subsidiaries[4]



Communication services
Consumer goods
Information technology[2]
Financials
Other[3]
Europe
Latin America and the Caribbean
North America
Asia-Pacific
Africa and the Middle East

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

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

Source: S&P Capital IQ; BIS calculations

Some big techs have also examined creating digital money like Facebook's Libra which could ultimately replace cash and bank deposits as an attractive mean of payment, especially for cross-border transactions. Although Facebook's effort stalled amid intense pushback from regulators and legislators, the idea behind Libra will likely remain. Asian markets once again offer a case in point: the value of e-money transactions in China surpasses those worldwide of Visa and Mastercard combined[86]. There are however jurisdictional differences: the penetration of big techs in payments is more prominent in jurisdictions where the use of other cashless means of payments (e.g. credit cards) is low. For instance, big tech mobile payment services account for 16% of GDP in China[87].

While the majority of big tech firms offer payment services, many are also active in other areas such as lending and asset management. Here too there are geographical differences. For instance, the provision of credit by big techs has expanded more strongly than other fintech credit in those jurisdictions with lighter financial regulation and higher banking sector concentration. These lending services have mainly been developed to sustain big techs' e-commerce platforms, and the data derived from e-commerce transactions have become a powerful tool for big techs in providing loans to consumers. Big techs' expansion into asset management is mainly driven by their payment platforms and takes the form of short-term investment in e.g. money market funds from customers' accounts' balances[88].

Yet financial services are only a small part of the global business of big techs despite them already having a strong presence in some markets (see figure 13)[89]. But given their size, global customer reach, network effect, access to information and broad-ranging business models, big techs can profoundly and rapidly change the financial sector[90].

HOW BIG TECHS IMPACT BIG BANKS

Until now, the emergence of big techs has not led to the disintermediation of the banking system. Big techs mainly act as distribution channels relying on existing infrastructures like bank accounts or correspondent banking for cross-border transactions[91], or they provide infrastructures that create utilities in the banking sector, such as cloud computing or AI/machine learning. Banks remain dominant in lending, deposit-taking, wealth and asset management services[92]. For regulatory and reputational reasons, banks have thus far not been as effective as big techs in harnessing data, and network externalities. The key question is, however, not whether big techs will enter banking – they already did – but the extent to which they will eat into big banks' revenue share and profit margins[93].

As noted by the BIS, big techs' low-cost structure business can easily be scaled up to provide basic financial services, especially in places where a large part of the population remains unbanked[94], as in many emerging and developing market economies. In advanced economies, big techs still depend on big banks to access customers' accounts. In return, big banks can benefit from big techs' network effect to expand their customer base. Competition from big techs also forces large incumbent financial institutions to invest even more in technologies to keep pace with expanding technical requirements.

Big techs will, however, likely focus on the consumers' side of financial services by enhancing the customer's experience in areas open to competition, such as payments. Specifically, in a world where technology companies are making it continuously easier and more convenient for consumers to spend, someone will make it easier for them to save. And this is an opportunity for banks to create new products and services that improve customers' finances.

Among other factors, big techs are much more agile and responsive than big banks in building new technologies since they have no legacy IT systems. Additionally, their operational cost is much lower than big banks which face high capital requirements, massive and complex regulations and stringent compliance (AML/KYC) and security (data, cyber) obligations. Finally, big techs have access to, generate and make use of big data in an almost unrestricted way, and they can attract talent in a way that most banks cannot. Big techs' cost advantage of circumventing the current regulatory system may undermine the regulatory objective of having a more diverse and competitive financial system.

The BIS has summarised the main competitive advantages and disadvantages of big banks versus big techs (see figure 14)[95]. Looking at the table, one can assume that cooperation between banks and big techs seems inevitable.

Figure 14: Banks versus big techs - competitive advantages (+) and disadvantages (-)

	Large banks	Big techs
Data	+ Verified/reliable customer data with a long history "soft" information from personal interactions with customers; high importance of data privacy to support customer trust.	- Mixture of verifiable and potentially less reliable data; shorter history of customer data; lower priority placed on data privacy and protection.
	- Small number of customers and limited range of non-financial activities to collect data from; transactional data often "one-sided" (eg. counterparty of transactions with another bank); legacy technology limits data processing capabilities.	+ Data on a very large number of customers; technology and business model built to collect and merge data; network of customer interactions is a key data dimension.
Network	+ Large number of financial activities and services already provided.	- Need to reach a large customer base to exploit network externalities.
	- Strict regulatory limits on activities and use of data; higher marginal costs of serving additional customers.	+ Significant network externalities due to wide range of non-financial activities; captive ecosystem with potential high exit costs.
Activities	+ Advantages in high margin and complex products requiring personal interaction (eg corporate finance, investment banking); wider range of financial services; access to large and relatively cheap funding sources; experience in risk management.	+ Thus far limited or no footprint in key financial services (eg mortgages, loans to medium and large firms, insurance); funding limitations; lack of regulatory and risk management experience and expertise.
	- Legacy IT systems are a barrier to using existing data to offer new services (low economies of scope); activities limited to financial services.	- Commoditisable services can be provided at near zero marginal costs; pre-existing commercial activities yield data that can be used to support new services (high economies of scope).

Source: BIS.

COLLABORATION IN INNOVATION

Big techs both compete and cooperate with big banks[96]. In advanced economies, which have well-established financial institutions, big techs mainly rely on banks' existing processing and settlement infrastructures to offer their users payment services or credit provisions often in relation to their e-commerce platforms (partnering of Apple with Goldman Sachs for credit card provision is one example). The use of proprietary systems developed by the big techs themselves is mostly seen in emerging market economies which are not characterised by a long-standing, well-developed financial sector and where mobile phone penetration is high (Alipay in China), but not only (WePay in the US). In this case, users anyway need a bank account or a credit/debit card to bring money in and out of the network. However, while big techs' payment platforms compete with those of banks, they still largely depend on the banking network and require collaboration with banks[97].

Partnerships between big techs and big banks will potentially increase. Firstly, within banks: typically, big techs act as a service provider to incumbent financial institutions by providing them with technological infrastructures such as cloud computing for data storage and processing. Secondly, funding: big tech firms fund themselves from financial markets and financial institutions like banks[98]. Finally, externally, where banks offering connections with other non-banking firms in addition to their own are gaining momentum. In this new business model, banks, pushed by declining margins on banking products and low profitability, refocus on distribution and seek partnership. By partnering with licensed banks, big techs can offer financial services to their customers without having to accept deposits and become subject to strict banking regulation[99]. The most well-known example of such a collaborative platform is to be found in payments with the widespread adoption of APIs. But other forms of partnerships between global banking and big techs are emerging in, for instance, banks' loans to technology firms' customers such as small and medium-sized companies (SMEs).

In conclusion, the rapid entry of big techs into EU financial services warrants a comprehensive policy approach.

Banking 2020-2030: Technology and Impact on Consumers

TECHNOLOGY ENABLING CMU ACROSS BORDERS

In the previous chapter, we explained how banks are adapting to the technological transformation, and we described the technologies that are having considerable impact on their business model and operations, and we discussed how banks consider new entrants like big techs. In this chapter, we highlight how technology changes client expectations, thereby opening ways for new services, products and interaction, which in turn enable a more dynamic and transparent market for banking services.

Digitalisation is a key ingredient to create economies of scale and to establish a more sophisticated and transparent market for retail investment across borders. On average, 30% of household savings in the EU are kept in deposits or cash[100]. In an ageing society with low interest rates and public pensions under strain, households' funds could be used more productively in capital markets. This highlights the need for a system that works for consumers across the EU and beyond, providing them with access to the best financial services and transparent product offerings enabling comparisons. Technology can play an important role in incentivising consumers to participate in capital markets and to do so outside of their home country. Global banks can facilitate this process.

New opportunities for technology deployment are most evident in retail financial services, particularly payments. However, new approaches to acquiring and engaging a customer base increasingly appear in wealth and investment management, driven by consumer preferences for convenience, cost and speed. Mass consumer wealth and fractional investment applications as well as robo-advisors have begun to democratise portfolio investment to demographic groups that previously had no access to it. Technology can also have important cost-optimisation features such as automatic portfolio rebalancing, which can be beneficial for the net yield earned on pension assets by reducing administration and asset management expenses. Artificial intelligence, big data analytics or blockchain can facilitate consumer access to information about suitable investment products in a reliable and user-friendly way. Educational tools can boost financial literacy and investor confidence, while improving consumer engagement with their financial service providers.

To summarise, the key building blocks for a digitalised retail investment market are consumer trust in secure services, data protection, easy onboarding, cost efficiency and financial literacy.

CHANGING CLIENT EXPECTATIONS OPENING WAYS FOR NEW SERVICE MODELS

Client expectations are a key driver of banks' digital offerings. UBS research has confirmed that investors demand digital capabilities. A recent survey showed that 78% of clients would find receiving notifications through digital channels about market movements relevant to their investment very valuable. Moreover, over two thirds of respondents would find receiving information and ideas via their preferred channel (e.g. WhatsApp, e-mail) very or extremely valuable, as well as being able to have a full picture of all their assets and liabilities in one place regardless of which bank they are held with. A majority of respondents would also welcome having online tracking of the account opening process and using self-service for defining and changing goals online. These findings illustrate a clear demand for an integrated technology-enabled package of consolidated online account information, portfolio management, transactional banking, and fast investment insights and updates. Amid increased competition, banks must take these trends seriously and ensure that they reflect them by offering innovative, high quality and trustworthy products to keep (and increase) their client base. A survey by Bain revealed that the key elements behind loyalty in banking are quality (leading by a large margin), followed by saving time, reducing anxiety, simplifying and heirloom (a good investment for future generations)[101].

By lowering search costs, technology enables consumers to easily get information about alternative products and services[102]. Empowered by digitalisation and self-service offerings, consumers are increasingly willing to switch providers or shift assets for better value. While customers are willing to pay for quality advice, they have grown reluctant to pay for transactions[103]. New generations, less experienced with commission-based fee models, are much more prone to regularly discuss fees than other investors.

Understanding customers' preferences is vital for banks to develop a targeted multichannel strategy. Three out of four customers expect that they will not need to re-enter information or re-infrom bank representatives when switching channels[104]. Banks must therefore facilitate seamless switching between online and offline touchpoints. Frictionless experience and the most cutting-edge digital tools are considered a must, especially by millennials who have grown up with superior customer experience and are most willing to switch providers.

Millennials are driving the industry expectations for all client segments. Millennials' digital but also environmental, social and governance preferences in investing doubled when compared with the generation X and baby boomers. 67% of millennials want AI generated recommendations and real-time financial data as a basic component of the service, compared with only 30% of investors in previous generations. Gamification as a means to learn about investing and keeping more engaged with the portfolio is expected by 65% of millennials and only 39 % of their (grand)parents. While millennials tend to be more confident about their investment knowledge, 59% are interested to learn more about cash flow management and budgeting[105]. Millennials are also much more likely to invest in cryptocurrencies and crowdfunding (23% and 12% respectively)[106] and twice as likely than baby boomers to invest in ETFs. Impact oriented digital investment platforms are also gaining traction, in particular among millennial women, who tend to invest more of their cash with sustainability objectives in mind[107].

TRUST AND USE OF DATA AS KEY TRENDS

Trust, content, know-how and expertise will remain the hallmarks of banking. The effects of trade, economics, politics and the unprecedented pace of change in the next decade will require more advice built on global expertise. A key differentiating factor for banks in wealth management will be the ability to maintain and build on their reputation as a trusted partner and tailor information to clients. Adopting a big tech-like approach built on data analytics, having a single client profile or partnering with big techs to leverage their unparalleled customer data (e.g. as recently demonstrated by Apple's partnership with Goldman Sachs on the Apple Card), will be among the key factors for banks to maintain and grow their client base[108]. Whether it is operational, transactional or market data, the challenge as well as an opportunity for banks is how to manage and extract value from the data they have at their disposal. However, for the benefits to be realised, customers need to trust that their data will be used appropriately[109]. Consumers demand greater control over all aspects of their online lives and want clarity about which data is given to a third party under which conditions. Knowledge and experience with applicable regulation, combined with a prudent approach and strong emphasis on the ethical use of data, puts banks in a lead position to use data management and analytics innovations to create highly competitive client offerings, while ensuring appropriate risk control. The banking industry has given a lot of thought to the appropriate use of client data in the face of technology advances. One recent example is the collaboration with the WEF in developing 'Principles for the appropriate use of customer data in financial services'[110].

The penetration of big techs into financial services is often motivated by the desire to use their huge data trove to expand in new business areas. However, trust and expertise – not to mention a personal and emotional connection – will continue to remain an important factor in banks' value proposition. The more information a bank has about its client, the easier it is to catalogue, analyse and interpret the client's actions and provide services that are genuinely relevant. At the same time, it is clear that banks will have to be very adaptable and agile with their offerings. In Bain & Company's recent survey of 151,894 consumers in 29 countries, 54% of respondents said that they trust at least one tech company more than banks in general, albeit with large jurisdictional differences – in Switzerland the trust in at least one tech company was only 28%[111].

Examples of how technology is augmenting client experience include:

- Natural Language Processing chat boxes that answer technical support questions from clients and can make recommendations to improve their day-to-day digital experience.
- Using AI to build 'virtual agents' that can perform investment research by scanning market data, filings, and performing a company valuation with the same inputs that a human analyst would use.
- Intelligent dashboards that adapt following every interaction that advisors have with their customers to make critical information accessible.
- Virtual avatars of banks' chief investment officers – clients can ask questions and have the answers delivered by the avatar of the chief economist.

AUTOMATED DIGITAL INVESTMENT PLATFORMS

As we said earlier, AI and its other applications (automation, machine learning, robotic process automation) are some of the most powerful trends emerging not just in the financial services sector, but across the entire technology industry. Robo-advising, or algorithm-based investment management platforms for self-directed investors, represent the main fintech proposition aimed at spurring competition in wealth management (see Box). Robo-advisors simplify onboarding processes and provide a suite of automated capabilities with reduced fees and minimal investment requirements compared to traditional alternatives. Robo-advisory has opened portfolio investment to a retail client segment that previously had no access to it. However, as noted by Bain, *"the disruptive threat from robo advisors has not occurred, and the promise of vastly more assets under management by robo programs has not materialised"*[112]. Robo-advising has *"an almost negligible market share in the industry"*[113].

"While robo-advisors appear particularly strong in the areas of account opening, enrolment and investment management, they seem to lag behind in areas such as customer relationship management, wealth planning and client servicing"[114]. Combining the best of both worlds, a platform with automatic rebalancing and AI powered expertise with periodic access to a human advisor is emerging as the most preferred scenario across a range of investor profiles.

So-called Wealthtech is gaining traction in the next generation of hybrid advisor-based solutions[115]. By reducing the time spent on data entry and investment management, robo-advisors help traditional advisors focus on more complex and nuanced client issues such as legacy planning, personal sustainability preferences or risk appetite. *"Robo-advice will likely continue as a channel, in parallel with touch-heavy channels such as in-person and virtual experiences and supported by technology such as augmented reality and virtual reality. As the landscape continues to evolve, it will leverage technology enablers to enhance and integrate aspects across the value chain."*[116]

Artificial Intelligence - a cutting-edge technology for business transformation

Digitalisation is not a choice. It is the backbone of 21st century business architecture. The integration of advanced technologies such as data science, artificial intelligence and distributed ledger technology, continues to materially improve operating efficiencies and risk management capabilities for banks. The benefits of AI for banks are identified mainly in three core areas: 1) client service, by continuously finding better ways to deliver value to our clients through technology 2) effectiveness, by optimising our internal processes and 3) risk reduction, by enhancing controls and improving risk profile. A hybrid approach is pursued, where existing IT capabilities are complemented with advanced technologies. One of the most complex areas where innovative technologies play a key role is compliance.

Definition of AI

At Credit Suisse, we define Artificial Intelligence as the field of creating intelligent systems, which can think or act either humanly or rationally through self-correcting mechanisms. When we are talking about AI we are not talking about Robotic Process Automation (RPA), which is automating and connecting systems that are not integrated and need a human being to bridge the gap. The following three AI subfields are considered as particularly relevant. Machine Learning (ML), in which systems can learn from experience to perform some taks, i.e., improve their performance through experience. Deep Learning (DL), which leverages ML techniques through neural networks to allow processing at hyper speed for matrix type calculations. Natural Language Processing (NLP), in which computers are programmed to process and analyse large amounts of natural language data and which is equivalent to a human understanding text.

Spotlight on use cases

1. Compliance: Single Client View

Single Client View is a tool that helps the bank's employees to get a global and thorough understanding of our clients and their networks, enabling us to mitigate risks in a timely and effective manner. Fully data-driven and powered by a machine learning matching algorithm, Single Client View pulls together data from across the globe and groups client records accordingly – autonomously and (almost) instantaneously. Manually grouping such information, on the other hand, could take days or even weeks for a single client and would be virtually impossible for the entirety of Credit Suisse's client population.

Launched in December 2016, Single Client View currently covers more than 99% of our Private Banking clients and we are in the process of integrating our Investment Banking clients. Already today, the results from this model are leveraged in various other programs and have reshaped the way we think about our clients and processes.

Furthermore, our compliance function also makes use of machine learning methods in the area of anti-money laundering (transaction monitoring). With the industry having struggled with low effectiveness of rule-based legacy systems in this space, we strongly believe that recent methods in data science have the potential to improve the efficiency and effectiveness of transaction monitoring significantly. Under the Client Holistic Surveillance program, Credit Suisse is internally developing machine-learning based transaction monitoring models, supplemented by a suite of investigative tools that support our compliance staff. We are currently rolling this program out across the globe, and have seen some very promising results.

2. Private Banking: Big Data, Machine Learning and Natural Language Processing initiatives

In Asia Pacific Private Banking, Credit Suisse has Big Data and Machine Learning initiatives focused on client analytics and investment recommendations. Based on client, portfolio and transactional data and using open source big data technologies, we are able to identify the most popular products and trade recommendations to present clients appropriate opportunities. Furthermore, the use of Natural Language Processing enables automatic Client Relationship Management Product Tagging, which determines products discussed during a sales meeting or call by parsing notes. This tagging was previously done manually and was highly ineffective. It has significantly increased data quality and MI reporting capabilities.

Looking Forward: Opportunities and Threats

The scalability and agility of such initiatives across banks remain key for further AI developments. Given the rate of technological change, the trend is to focus on open source, remain platform agnostic and avoid vendor lock-ins where possible. Therefore, banks need to enable agile change, a very different proposal to the way this industry has operated historically. Centralised platforms and governance bodies which build on a core product extendable with open source modules are possible ways to foster business transformation through AI. However, it has to be noted that AI is a double-edged sword. Strong data governance is key to ensuring that the usage of AI results in actual value creation. With regard to data protection, companies have to be very cautious how they use their clients' data and they need to be diligent with whom they share any conclusions they draw. For banks in particular, it is critical to protect clients' data from unauthorised access and misuse. With the employees as one of the most valuable resources, organisations have to provide them opportunities in order to undergo the transformation towards a more automatised environment. Considering these aspects, the collaboration with regulators to harmonise data regulations and support cross-border data access respectively transfer will be needed in order to find a balance between privacy, convenience and control.

IDENTITY MANAGEMENT / E-ID

The emergence of a truly secure, reusable and interoperable (i.e. cross-border as well as between the public and the private sector) digital identity might offer a solution that effectively links convenience with added security and helps banks to meet the diverging expectations of their various client segments. The eIDAS Regulation enables member states to give access to the private sector to online authentication of government electronic identification (e-ID). As noted by the ROFIEG, the main potential advantages of digital identities are improved onboarding, enhanced risk scoring and data privacy considerations. The ability to enrich data with known identities can also help perform KYC checks and AML/CFT controls[117]. The following Box shows how electronic identification works in Switzerland.

Electronic Identity System in Switzerland

As technology continues to progress, more and more business processes and transactions are being conducted digitally. Just as in the physical world, some of these transactions are more sensitive than others and require trust in the identity and the authenticity of the counterpart. Self-declared digital identities, which have become quite common nowadays, cannot provide this certainty and level of trust.

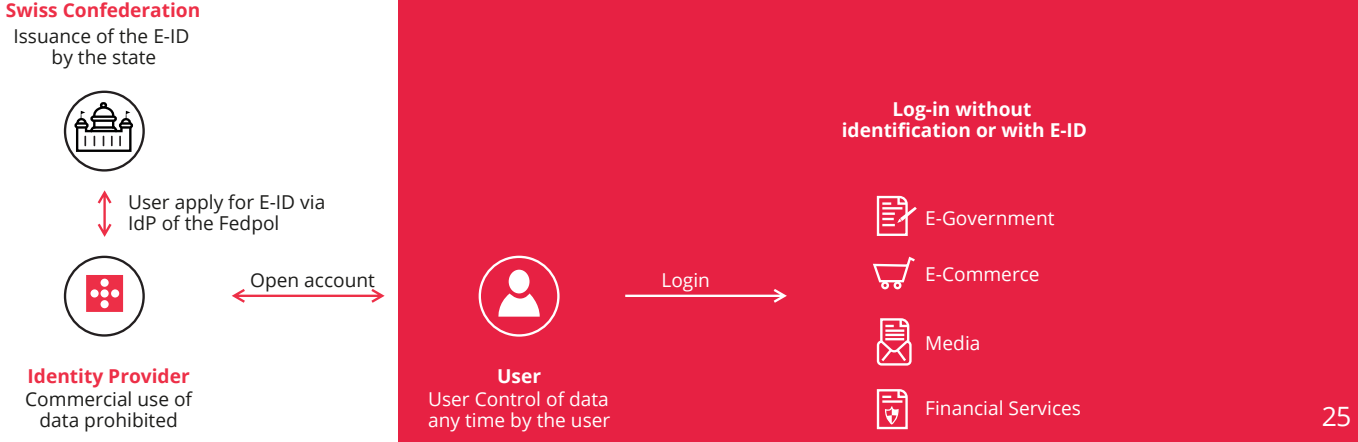
As a result, the Swiss government has undertaken to create the legal foundations for an electronic identity system that will enable verified digital identities that are state-approved. This e-ID will allow users to identify themselves online in a unique, secure and user-friendly manner. It will be available to all residents of Switzerland. It will act as a catalyst to further digitise services both in the private and the public sector, while maintaining a high level of security and data protection.

The system put forward by the Swiss government is based on a distribution of labour between the private and the public sector. Combining the strengths of both sides, this approach promises to meet three goals: security, data protection as well as rapid implementation of the system.

The role of the private sector is key in this endeavour and both Credit Suisse and UBS are part of the leading e-ID consortium in Switzerland, SwissSign. The private sector seems better positioned than the public sector to ensure the rapid distribution of the new system, thanks to its technological know-how, its use cases and its understanding of client behaviour. All of this will help to ensure that citizens do not just use their e-ID once a year to submit their tax statement but can use the e-ID with a large number of companies and for a plethora of services on a daily basis. Some of the characteristics of the new system are:

- Having an e-ID is voluntary. Simple online transactions will not require an e-ID and more com plex transactions can still be concluded physically. However, the new system should be quite compelling.
- While the e-ID is issued by a private company (such as SwissSign), this company is certified and audited by the government. In addition, it is the government that confirms the identity of the applicant for an e-ID based on the applicant's consent.
- The user is also always in control of his data, which are only exchanged when authorised by the user and based on a need-to-know basis. For example, if an e-ID is used to access an online casino or buy alcohol online, rather than providing the date of birth as is common today, the system will just confirm that the customer is of legal age.
- The private Identity Provider (IdP) will not have access to state-owned databases, as the state only provides the necessary information on request and with the user's consent. In addition, the state is not involved when e-IDs are used, and no data is provided to the state on how and for what the e-ID is used.
- For the user this means that the distribution of labour and separation of data between public and private entities enhances the security of the system, preventing a single, all-encompassing data pool. Combined with a user-friendly ecosystem of public and private sector services that can be accessed in a convenient manner, the new system will create a win-win-win situation for Switzerland.

Issuance and application of state - governed E-ID



UNLOCKING ESG AND SUSTAINABLE INVESTMENTS

Technological advances will also continue to underpin efforts to tackle climate change and support the integration of ESG considerations in investment products, advice and decisions. According to the 2019 UBS global survey of institutional asset owners[118], most European investors believe that within the next five years, environmental factors could be playing a more material role in their investment processes than financial factors. Climate change also was the single most supported cause among wealth management clients[119], who expected sustainable investing to become a norm within 10 years. Additionally, the UN-sponsored Principles for Responsible Investment (PRI) estimates that achieving all the United Nations (UN) Sustainable Development Goals (SDGs) will require annual investment worth USD 5-7 trillion until 2030[120].

Private investment will play an instrumental role in achieving SDGs and tackling climate change. Technology has the potential not only to reduce the information asymmetries and bring more clarity to modelling climate change, it also helps banks deliver personalised investment content and thereby mobilise private wealth towards a climate-smart future. Investors find it difficult to use generic ESG information to identify particular investment solutions that suit both their financial and sustainability goals. By means of an example, digital tools can be used to capture clients' sustainability preferences and combine them with simplified company sustainability data (see Box). More than 20 000 equity and fixed income instruments are screened to produce a client-personalised hierarchy of potential investment instruments. Technology can also bring green bond market, environmental funds and green company equity to a wider group of private investors. The UBS Foundation together with IXO, a Swiss DLT platform, have been looking at designing smart impact bonds and funds for social and environmental benefit, where participation and payments are tokenized, allowing for broader participation and transparency.

Fintech for Sustainable Finance

Fintech holds the potential to improve, complement or change the existing offering and functioning of financial institutions through innovations like mobile payment systems, virtual currencies or AI. The SFC members see potential for combining Fintech with sustainable finance to foster a better alignment of the financial system with global sustainability agendas like the Paris Climate Agreement or the UN SDGs[121]. Specifically, the successful implementation of forthcoming sustainable finance regulatory requirements, such as the EU Taxonomy, hinge on the availability and quality of ESG data. Fintech can play a key role in improving the collection, processing and disclosure of ESG data and, hence, in scaling sustainable finance globally. Credit Suisse is exploring the use of sustainability-oriented Fintech in the following areas:

Firstly, Fintech provides the data and innovations necessary to scale Credit Suisse's impact investing business. In the area of financial inclusion, Fintech creates investment opportunities for bringing previously un-banked clients into the financial sector. The SFC members consider financial inclusion a central driver for economic growth and for mobilising funding towards the SDGs. Fintech enhances access to financial services by, for example, creating digital identities, automating KYC processes or speeding up online credit assessments. Credit Suisse, for example, works with Accion, a US microfinance institution, and its Mexican partner Konfio, a Fintech start-up developing innovative credit algorithms and alternative data analysis to fully digitise credit assessment and hence to provide affordable credit for local SMEs. Moreover, a key obstacle for scaling impact investing is the difficulty in measuring an investment's impact. The SFC members, signatories of the Operating Principles for Impact Management, are committed to improving the way it monitors, measures and reports the impact performance of investments and are exploring the use of Fintech to support this.

Secondly, consideration of ESG risks is an integral part of SFC members' risk management process. AI and ML can support ESG integration in risk management by accelerating the processing and evaluation of ESG data points from traditional and novel sources. For example, Credit Suisse routinely uses data from an organisation providing transparency about a potential investment's ESG-related business conduct risk using innovations in AI like auto-linking and relevancy-scoring to process hundreds of thousands of unstructured data sources. An additional new source of data is satellite images that, in combination with intelligent data processing, are used to monitor location-based physical risks such as deforestation and bushfires in remote areas. Credit Suisse uses cartography tools to identify protected conservation areas and World Heritage Sites. With external partners, Credit Suisse explores how such tools could integrate data on oil and mining concessions to identify projects that are operating in protected areas.

Thirdly, Fintech could revolutionise the reporting and disclosure of ESG data, which is central to much regulatory action in sustainable finance. For the moment, ESG disclosure remains largely voluntary. Credit Suisse, for example, has been publishing environmental corporate social responsibility reports for over two decades and is committed to implementing the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) for reporting climate risk impacts. A large number of ESG data providers have emerged to supplement corporate self-disclosure by collecting relevant data from sources like media articles or social media, but data quality remains an issue. With help from AI, digital data on ESG factors could become more cost-efficient and real time, thus filling persisting data gaps and improving the overall quality and correlation of ESG data. Many companies are exploring the use of blockchain technology to improve transparency, traceability and hence sustainability of their supply chains. When banks can combine self-disclosure with high-quality external data sources, an even more reliable picture of ESG risks and impacts emerges.

The opportunities of Fintech must be weighed against potential challenges and unintended consequences like data protection, privacy issues or the elevated energy consumption of data processing and cryptocurrency. The SFC members are fully supportive of further research in this area.

Key Policy Recommendations

INCREASING EUROPE'S COMPETITIVENESS

CLOSING THE INNOVATION FUNDING GAP BY LEVERAGING ON GLOBAL CAPITAL MARKETS

The transition to a digital economy requires a balanced regulatory framework, public acceptance and innovative entrepreneurs that have easy access to finance. Global technology companies now rank among the most valuable corporations in terms of market capitalisation. In recent years, the technology industry has largely outpaced the growth of Europe's wider economy in terms of investment. However, Europe lags behind the US and Asia in the creation of technology companies. If the EU wants to close the gap, it will have to step up its efforts to attract more investment towards this sector. Steering retail savings into investments is an objective of the Capital Markets Union. However, it may take time to convince EU citizens to put less money into savings accounts and more into investment products. The CMU should leverage global capital and funding that is available and ready to invest. To successfully contribute to the CMU, global finance needs a global alignment of the regulatory framework underpinned by global standards and robust supervisory cooperation while ensuring a level playing field.

USING TECHNOLOGY TO INCREASE EUROPEAN BANKS' PROFITABILITY IN A CHALLENGING MACROECONOMIC CONTEXT

The overhaul of the global financial system has led to much-improved capitalisation, better liquidity planning, enhanced resolvability and a better overall management of risks in the banking sector. However, the macro-economic situation in which banks operate is a difficult one, with low growth perspectives in advanced economies and continued low or even negative interest rates in the Eurozone. This is a challenge to bank profitability, weighing on market capitalisation and on the capacity to invest in the technology. To bring back profitability to the EU banking sector, a combination of various actions is appropriate. First, structural impediments like market fragmentation along national lines and continued excess capacity in the banking sector should be addressed. Completing the Banking Union rapidly, elimination of national ring-fencing opportunities, the introduction of a bank insolvency regime and decisive actions towards banks being assessed as failing or likely to fail are some core elements. Also, an easily accessible, substantial and credible European facility for liquidity in resolution is still lacking. Putting these features into place may not only reduce the regulatory costs within the Banking Union, but also provide incentives for cross-border mergers by supporting capital and liquidity management at the consolidated level and facilitating banks to realise economies of scale. Second, the banking sector must continue eliminating legacy assets and adjusting the business models to the economic context. Finally, new technologies and digitalisation are ways to achieve efficiency gains.

SETTING AN INNOVATION-ENABLING FRAMEWORK FOR GLOBAL BANKS

ENHANCING REGULATORY CERTAINTY FOR FINANCIAL INSTITUTIONS

Global banks and other financial institutions need planning certainty to execute their strategy, to adapt to the new challenges and to enable sustainable growth of the banking sector for the benefit of the EU economy and its consumers. To facilitate this, we need a technology-neutral regulatory framework that reacts flexibly to ever-evolving innovation. Particular attention should be paid to clarity and legal certainty on the collection, processing, and sharing of data and how the implementation of the respective EU legislation works together. In parallel, the global reach of borderless technologies requires further cooperation between public and private sector actors in order to identify regulatory and supervisory issues in using new technologies.

FACILITATING MARKET ACCESS TO HARNESS THE FULL BENEFITS OF TECHNOLOGY FOR EU CONSUMERS AND SUSTAINABLE INVESTMENT

Global banks and other financial institutions need market access to exploit the full potential of technology in delivering new investment solutions to retail clients and to contribute to delivering a more sustainable economy overall.

Technology exists today (e.g. e-ID, blockchain, AI) but cannot be fully deployed because of cross-

border regulatory and supervisory fragmentation and obstacles to access the EU market. The ROFIEG recommended in its December 2019 report a swift action to put an end to regulatory fragmentation which still imposes challenges for a truly integrated digital single market that is seamlessly interconnected with non-EU financial centres, such as Switzerland[122]. Principle-based equivalence decisions are key for market access in financial services which are becoming more and more digitised. Considering the borderless nature of technology, global cooperation and better connection with the EU's closest partners should form part of a comprehensive approach that encourages financial innovation and sustainable investment.

ENSURING A LEVEL PLAYING FIELD WITHOUT STIFLING INNOVATION

Regulators should create the necessary framework conditions for banks and other financial institutions to adapt to competition from new players such as big techs. Regulators should promote a level playing field guided by the overall principle of 'same risk, same regulation'. The aim should be fair competition on innovation between incumbents and new entrants, ensuring a high degree of consumer and data protection, compliance with applicable AML/KYC security rules, as well as safe and stable financial markets by limiting the scope for regulatory arbitrage. Regulatory action should include coordination between the different authorities active on financial regulation, competition aspects and data protection, in order to avoid the risk of impact on the structure competition and stability of the financial system. Regulators should also address concentration risks by diversifying third party providers (e.g. big tech cloud providers). All of these efforts should be based on globally agreed standards with the EU leading in shaping these standards, in close collaboration with industry. The aim should be to facilitate interoperability of technology solutions across jurisdictions with harmonised EU rules.

EMPOWERING CONSUMERS TO BENEFIT FROM TECHNOLOGY

INCENTIVISING SAVERS TO BECOME INVESTORS

The EU should create conditions stimulating long-term market-led solutions that respond to citizens' financial needs[123]. Simultaneously, the EU should aim at enhancing savers' investment ability, raising investors' digital capabilities and knowledge, rather than restricting their access to certain products and services. While digitalisation can help consumers reduce complexity in accessing services and making investment decisions, the cumulative investor protection provisions across various legislative pieces may offset this effect with information overload and result in investors' uncertainty. Ultimately, this increases the need for human interaction and lowers the potential of digital solutions. We see a need to review whether the regulatory framework and, in particular, the information and investor protection requirements, are fit for purpose in a digital age.

SUPPORTING INCREASED FINANCIAL LITERACY AND DIGITAL SKILLS

Financial literacy is a key pillar of a sustainable financial system, playing a critical role in the empowerment of consumers and investors as well as in the success of the entrepreneurship ecosystem. The European Commission, together with international bodies such as OECD and IOSCO, should strive to coordinate initiatives aimed at increasing digital and financial literacy. The Ecofin Council rightly called on the Commission and member states to facilitate the exchange of best practices and views on national measures in this regard. In order to educate future generations about the appropriate use of digital financial services and to raise their awareness of risks posed by technology, a common EU framework could be built with a view to ensuring that personal finance management is a basic component of the school curricula. The EU should also build on and leverage the availability of quality education and research, including the creation of an academic network that supports a European talent pool for financial services and expertise to grow business within Europe and beyond.

SUPPORTING DIGITAL IDENTIFICATION, AN EU-WIDE E-ID SYSTEM AND APPROPRIATE STANDARDISATION

Digital identity is a key prerequisite for the digital single market and should therefore be a priority for policymakers. Portability of e-ID would simplify consumers' access to services across borders and across multiple parties for different regulatory purposes. By providing an EU-wide legal framework, the eIDAS Regulation has major implications for the use of e-ID in the private sector. The terms of access to the online authentication of government e-IDs by the private sector is however determined by the member states. Therefore, the national e-ID systems should be made rapidly interoperable among member states and third countries while accessible to the private sector.

The EU should engage with other jurisdictions with a view to develop a broad-based global standard on portable and interoperable e-IDs.

FOSTERING CONSUMERS' TRUST BY SECURE AND ETHICAL USE OF DATA

Consumers' reliance on technology can lead to an erosion of their privacy, especially because they are often unaware of the trade-offs in using free digital services. Cross-sectoral cooperation is therefore needed between regulators and other relevant authorities, such as competition authorities and data protection agencies, to ensure a comprehensive regulatory framework for the use of data and achieve a level playing field through horizontal data sharing. Emphasis should be put on data privacy, data protection and cybersecurity, as well as the ethical use of data where, as noted by the ROFIEG and the EBA[124], the origin, use case and availability of data should be considered to avoid manipulation and bias that could lead to misguided investment decisions.

List of abbreviations

AI	Artificial Intelligence
AML	Anti-Money Laundering
API	Application Program Interface
BIS	Bank for International Settlements
CBDC	Central Bank Digital Currency
CDD	Client Due Diligence
CET1	Common Equity Tier 1
CIO	Chief Investment Officer
CMP	Cloud Management Platform
CPMI	Committee on Payments and Market Infrastructure
CSP	Cloud Service Provider
DLT	Distributed Ledger Technology
EBA	European Banking Authority
EBF	European Banking Federation
ECB	European Central Bank
e-ID	Electronic Identification
ESG	Environmental, Social and Governance
EU	European Union
FCA	Financial Conduct Authority (UK)
FDI	Foreign Direct Investment
FSB	Financial Stability Board
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
HQLA	High Quality Liquid Assets
IaaS	Infrastructure as a Service
ICO	Initial Coins Offering
IIF	International Institute of Finance
IOSCO	International Organisation of Securities Commissions
IT	Information Technology
KYC	Know Your Customer
ML	Machine Learning
MVP	Minimum Viable Product
OECD	Organisation for Economic Cooperation and Development
OTC	Over-the-Counter
PaaS	Platform as a Service
PSD	Payment Services Directive
ROFIEG	Expert Group on Regulatory Obstacles to Financial Innovation
SaaS	Software as a Service
SCA	Strong Customer Authentication
SDGs	Sustainable Development Goals
SMEs	Small and medium-sized companies
UN	United Nations
US	United States
USC	Utility Settlement Coin
WEF	World Economic Forum

Endnotes & references

1 World Bank, *Global Monitoring Report 2015/2016*.

2 UBS, *Demographic Change*, November 2018.

3 Eurostat, *Being young in Europe today - demographic trends*, December 2017.

4 ECB, *On secular stagnation and low interest rates: demography matters*, Working Paper Series no 2088, July 2017.

5 Bank of England, *The Future of Finance*, 20 June 2019.

6 G30, *Fixing the Pensions Crisis,* November 2019.

7 IMF, *World Economic Outlook – Update*, January 2020.

8 European Strategy and Policy Analysis System, *Global Trends to 2030*, April 2019.

9 ECB, *Euro Area Bank Profitability*, November 2019.

10 https://www.bankingsupervision.europa.eu/press/interviews/date/2019/html/ssm.in191113~1a94fc6dde.en.html.

11 Credit Suisse, *Global Wealth Report*, October 2019.

12 Deloitte, *The consumer is changing, but perhaps not how you think A swirl of economic and marketplace dynamics is influencing consumer behaviour*, May 2019.

13 EY, *Attractiveness Survey Europe*, June 2019.

14 BIS, *Big tech in finance: opportunities and risks, Annual Economic Report*, 23 June 2019.

15 BIS, *Working Papers No 779 – Big Tech and the changing Structure of Financial Intermediation*, April 2019.

16 FSB, *Big Tech in Finance*, December 2019.

17 https://www.bankingsupervision.europa.eu/press/speeches/date/2019/html/ssm.sp191126~0a1bb2038c.en.html

18 FSB, *Big Tech in Finance,* December 2019.

19 Expert Group on Regulatory Obstacles to Financial Innovation (ROFIEG), *30 Recommendations on Regulation, Innovation and Finance*, Final Report to the European Commission, December 2019.

20 *Top Global Banking Technology Trends*, a research paper from Finextra in association with Virtusa, July 2019.

21 World Economic Forum, *Beyond Fintech: A Pragmatic Assessment of Disruptive Potential In Financial Services*, 22 August 2017.

22 https://www.bloomberg.com/news/articles/2019-05-10/banks-waking-up-to-fintech-threat-throw-billions-into-digital

23 UBS Q-Series, *Big banks and the bigtech, fintech & digibank incursion. What is at stake?* 18 June 2019.

24 AFME Position Paper CRD 5/CRR2: *Capital Treatment of Software,* May 2018.

25 Several technologies can contribute to these advancements: see e.g. IIF, *Deploying RegTech against Financial Crime*, March 2017.

26 ROFIEG, *Final Report*, December 2019.

27 ROFIEG, Final Report, December 2019; see also: BIS, Financial Stability institute, *Innovative technology in financial supervision (suptech) – the experience of early users*, Insights No 9, 16 July 2018; ECB Newsletter, *Bringing artificial intelligence to banking supervision*, 13 November 2019.

28 *Enable, Empower, Ensure: A New Finance for the New Economy*, speech given by Mark Carney, Governor of the Bank of England, London, 20 June.

29 10th Annual EY/IIF Global Bank Risk Management survey, 2019.

30 ROFIEG, *Final Report*, December 2019.

31 Bank of England, *The Future of Finance*, 20 June 2019.

32 UBS, *Longer Term Investments series, Fintech*, 20 August 2018.

33 *Top Global Banking Technology Trends*, a research paper from Finextra in association with Virtusa, July 2019.

34 See for instance IIF, *Machine Learning in Credit Risk: 2nd Edition Summary Report*, 22 August 2019.

35 Bank of England, *The Future of Finance*, 20 June 2019.

36 Bank of England, *The Future of Finance*, 20 June 2019.

37 McKinsey & Company, *Two global leaders in artificial intelligence: China and the United States*, June 2018.

38 Commission Work Programme 2020, *A Union that strives for more,* COM(2020) 37 final, 29 January 2020.

39 High Level Expert Group on Artificial Intelligence, *Ethics Guidelines for Trustworthy AI*, 8 April 2019; Recommendations of the OECD Council on Artificial Intelligence, 22 May 2019.

40 Bank of England, *The Future of Finance*, 20 June 2019

41 UBS, *Longer Term Investments series*, Fintech, 20 August 2018.

42 EBA, *Report on Big Data and Advanced Analytics*, January 2020. The first recommendation of the ROFIEG supports the principles of explainability and interpretability and invites the European Commission to develop standards to implement them.

43 Bank of England, *The Future of Finance*, 20 June 2019.

44 See for instance EBF Cloud Banking Forum; AFME, *The Adoption of Public Cloud Computing in Capital markets*, November 2019.

45 9th Annual EY/IIF Global Bank Risk Management survey, 2018.

46 IIF, *Cloud Computing in the Financial Sector* (Part 1), August 2018.

47 See for instance the Finextra research paper on *Top Global Banking Technology Trends*, 2019; the Annual EY/IIF Global Bank Risk Management survey, 2018.

48 EBA, *Guidelines on outsourcing arrangements*, 25 February 2019.

49 See for instance Bank of England, *The Future of Finance*, 20 June 2019.

50 Politico, *Germany's plan to control its own data,* 12 September 2019.

51 EBA, *Guidelines on outsourcing arrangements*, 25 February 2019.

52 9th Annual EY/IIF Global Bank Risk Management survey, 2018.

53 IIF, *Cloud Computing in the Financial Sector* (Part 1), August 2018.

54 Hybridization is when the implementation of a new technology is polluted by legacy concepts, such as using long procedures in object oriented code.

55 EBA, *Guidelines on outsourcing arrangements*, 25 February 2019.

56 European Commission Joint Research Centre, *Blockchain now and tomorrow. Assessing multidimensional impacts of distributed ledger technologies,* October 2019.

57 UBS, *Longer Term Investments series, Fintech*, 20 August 2018.

58 UBS, *Longer Term Investments series, Fintech*, 20 August 2018.

59 European Commission Joint Research Centre, *Blockchain now and tomorrow. Assessing multidimensional impacts of distributed ledger technologies,* October 2019; see also ROFIEG, Final Report, December 2019.

60 UBS, *Longer Term Investments series, Fintech,* 20 August 2018.

61 IMF Fintech Notes, *The Rise of Digital Money*, July 2019.

62 BIS Annual Economic Report, *Cryptocurrencies: looking beyond the hype*, 2018.

63 See for instance *ESAs warn consumers of risks in buying virtual currencies,* 12 February 2018; *FCA consumer warning about the risks of ICOs,* 27 February 2019; *FINMA guidelines on ICO,* 16 February 2018.

64 Source for the figure: BIS Annual Economic Report, *Cryptocurrencies: looking beyond the hype,* 2018.

65 BIS Annual Economic Report, *Cryptocurrencies: looking beyond the hype,* 2018.

66 https://www.jpmorgan.com/global/news/digital-coin-payments.

67 See for instance *The Growing Challenges for Monetary Policy in the current International Monetary and Financial System,* speech given by Mark Carney, Governor of the Bank of England at the Jackson Hole Symposium, 23 August 2019.

68 IMF Fintech Notes, *The Rise of Digital Money,* July 2019.

69 BIS, *Central bank group to assess potential cases for central bank digital currencies,* 21 January 2020.

70 BIS Annual Economic Report, *Cryptocurrencies: looking beyond the hype,* 2018.

71 https://www.bis.org/press/p191008.htm

72 https://www.bis.org/press/p191113.htm

73 https://deutsche-boerse.com/dbg-en/media/press-releases/Commerzbank-Credit-Suisse-and-UBS-execute-first-live-transactions-on-the-Deutsche-B-rse-HQLAx-securities-lending-platform-1631518.

74 Thierry Breton, *Europe has everything it takes to lead the technology race,*

75 Linklaters, *Technology Legal Outlook* 2020, 2019.

76 FSB, *Artificial intelligence and machine learning in financial services. Markets developments and financial stability implications,* 1 November 2017.

77 ROFIEG, *Final Report,* December 2019.

78 World Bank Group, *The Global Findex Database 2017, Measuring Financial Inclusion and the Fintech Revolution*, 2017.

79 Caroline Criado Perez, *Invisible Women: Exposing Data Bias in a World Designed for Men*, 2019.

80 ROFIEG, *Final Report*, December 2019.

81 An example is the Australian proposed Open Data framework which will also see telecoms and utilities sharing data in addition to financial services.

82 FSB, *BigTech in finance: Market developments and potential financial stability implications,* 9 December 2019.

83 Bank of England, *The Future of Finance*, 20 June 2019.

84 UBS, *The road to cashless societies*, April 2018.

85 UBS Q-Series, *Big banks and the bigtech, fintech & digibank incursion. What is at stake?* 18 June 2019.

86 IMF Fintech Notes, *The Rise of Digital Money,* July 2019.

87 FSB, *BigTech in finance: Market developments and potential financial stability implications,* 9 December 2019.

88 FSB, *BigTech in finance: Market developments and potential financial stability implications,* 9 December 2019.

89 BIS Annual Economic Report, *Big tech in finance: opportunities and risks,* 23 June 2019.

90 Nicolas Véron, Kathryn Petralia, Thomas Philippon, Tara Rice, 22nd Geneva Report on the World Economy: *Banking Disrupted? Financial Intermediation in an Era of Transformational Technology,* 24 September 2019.

91 BIS Annual Economic Report, *Big tech in finance: opportunities and risks,* 23 June 2019.

92 22nd Geneva Report on the World Economy, September 2019.

93 UBS Q-Series, *Big banks and the bigtech, fintech & digibank incursion. What is at stake?* 18 June 2019.

94 BIS Annual Economic Report, *Big tech in finance: opportunities and risks,* 23 June 2019.

95 BIS Annual Economic Report, *Big tech in finance: opportunities and risks,* 23 June 2019.

96 BIS Annual Economic Report, *Big tech in finance: opportunities and risks,* 23 June 2019.

97 BIS Annual Economic Report, *Big tech in finance: opportunities and risks,* 23 June 2019.

98 FSB, *BigTech in finance: Market developments and potential financial stability implications,* 9 December 2019.

99 FSB, *BigTech in finance: Market developments and potential financial stability implications,* 9 December 2019.

100 European Commission Joint Research Centre, *Development of EU Ecolabel criteria for Retail Financial Products*, December 2019.

101 Bain & Company, *In Search of Customers Who Love Their Bank*, November 2018.

102 OECD, *Financial markets, insurance and pensions: Digitalisation and Finance*, April 2018.

103 Euromoney, *Wealth Management: The Next Generation,* February 2019.

104 Accenture, *Millennials & money: Next era of wealth management,* December 2017.

105 Accenture, *Millennials & money: Next era of wealth management,* December 2017.

106 Schroders, *Global Investor Study Investor behaviour: do people have control of their personal finances?,* 2019.

107 Accenture, *Millennials & money: Next era of wealth management,* December 2017.

108 Capgemini, *Top-10 Trends in Wealth Management: 2019,* December 2018.

109 WEF, *The Appropriate Use of Customer Data in Financial services,* September 2018.

110 WEF, *Principles for the appropriate use of customer data in financial services,* June 2019.

111 Bain & Company, M*any Consumers Trust Technology Companies More than Banks,* January 2019.

112 Bain & Company, *Robo Advice Has Stalled, but Wealth Technologies Still Hold Promise,* July 2019.

113 UBS, *Longer Term Investments, Fintech*, August 2018.

114 EY, *The evolution of Robo-advisors and Advisor 2.0 model,* June 2018.

115 Bain & Company, *Robo Advice Has Stalled, but Wealth Technologies Still Hold Promise*, July 2019.

116 EY, *The evolution of Robo-advisors and Advisor 2.0 model,* June 2018.

117 ROFIEG, *Final Report*, December 2019.

118 UBS, *ESG: Do you or Don't you?,* June 2019.

119 UBS, *Becoming climate aware,* January 2020.

120 UBS, *Awareness, simplification, and contribution,* January 2019.

121 SFC members' understanding of sustainable finance is the integration of ESG criteria in the business and investment decisions of financial institutions

122 ROFIEG, *Final Report,* December 2019.

123 *The Next CMU High-Level Group, Savings and Sustainable Investment Union*, Report to Ministers and presented to the Finnish Presidency, October 2019.

124 ROFIEG, *Final Report, Recommendation* 30, December 2019; EBA, *Big Data and Advanced Analytics*, January 2020.

SwissFinanceCouncil
Fostering International Dialogue

Swiss Finance Council
EU Representative Office
Square de Meeûs 23, B-1000 Brussels
T +32 2 430 37 00
www.swissfinancecouncil.org