Policy analysis
2/2019

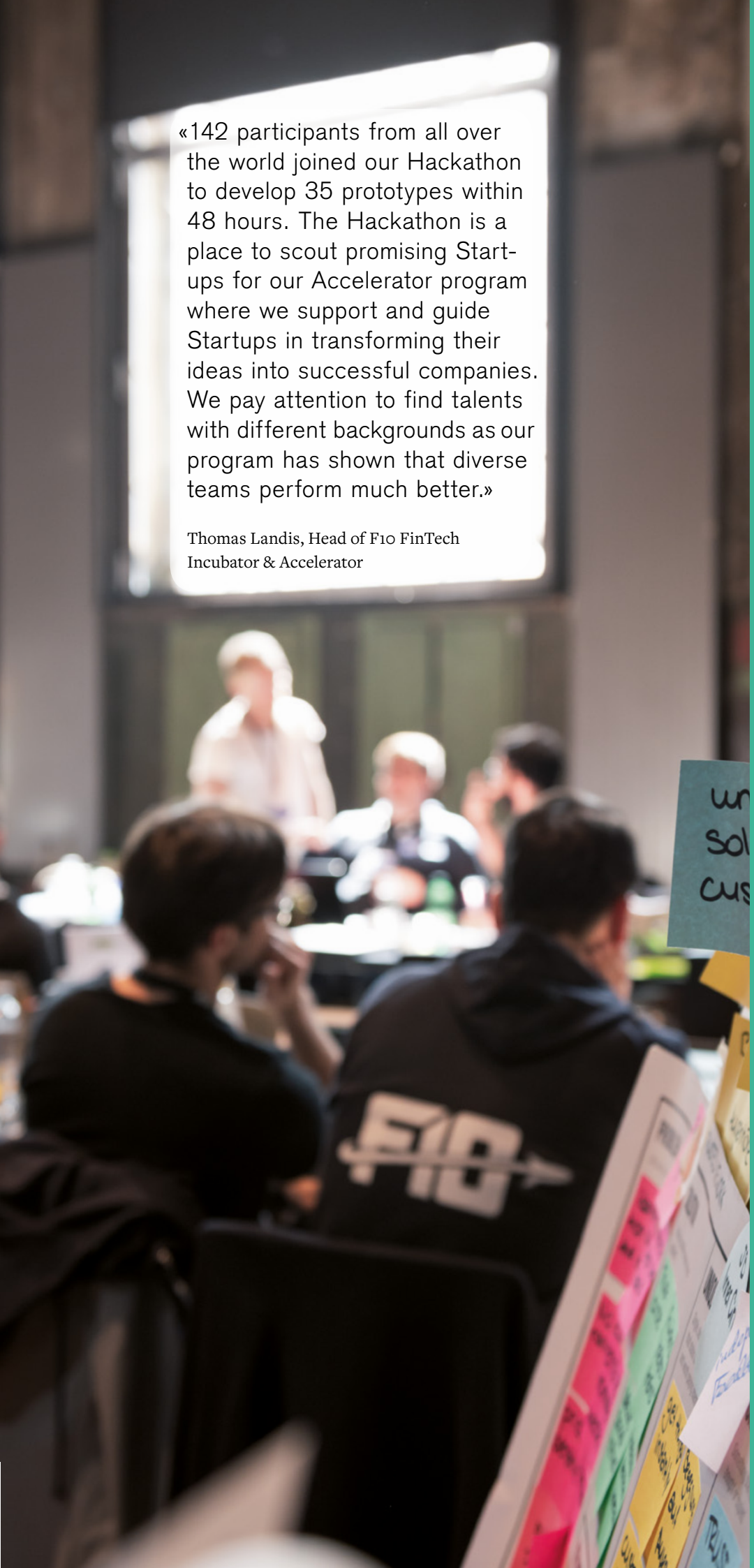
Dealing with disruption – The role of education, research and innovation in shaping financial innovation

Considerations and recommendations by the Swiss Science Council SSC

Multimethod case study on the subject of FinTech conducted by the SSC

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Schweizerischer Wissenschaftsrat
Conseil suisse de la science
Consiglio svizzero della scienza
Swiss Science Council



«142 participants from all over the world joined our Hackathon to develop 35 prototypes within 48 hours. The Hackathon is a place to scout promising Start-ups for our Accelerator program where we support and guide Startups in transforming their ideas into successful companies. We pay attention to find talents with different backgrounds as our program has shown that diverse teams perform much better.»

Thomas Landis, Head of F10 FinTech Incubator & Accelerator

Der Schweizerische Wissenschaftsrat

Der Schweizerische Wissenschaftsrat SWR berät den Bund in allen Fragen der Wissenschafts-, Hochschul-, Forschungs- und Innovationspolitik. Ziel seiner Arbeit ist die kontinuierliche Optimierung der Rahmenbedingungen für die gedeihliche Entwicklung der Schweizer Bildungs-, Forschungs- und Innovationslandschaft. Als unabhängiges Beratungsorgan des Bundesrates nimmt der SWR eine Langzeitperspektive auf das gesamte BFI-System ein.

Le Conseil suisse de la science

Le Conseil suisse de la science CSS est l'organe consultatif du Conseil fédéral pour les questions relevant de la politique de la science, des hautes écoles, de la recherche et de l'innovation. Le but de son travail est l'amélioration constante des conditions-cadre de l'espace suisse de la formation, de la recherche et de l'innovation en vue de son développement optimal. En tant qu'organe consultatif indépendant, le CSS prend position dans une perspective à long terme sur le système suisse de formation, de recherche et d'innovation.

Il Consiglio svizzero della scienza

Il Consiglio svizzero della scienza CSS è l'organo consultivo del Consiglio federale per le questioni riguardanti la politica in materia di scienza, scuole universitarie, ricerca e innovazione. L'obiettivo del suo lavoro è migliorare le condizioni quadro per lo spazio svizzero della formazione, della ricerca e dell'innovazione affinché possa svilupparsi in modo armonioso. In qualità di organo consultivo indipendente del Consiglio federale il CSS guarda al sistema svizzero della formazione, della ricerca e dell'innovazione in una prospettiva globale e a lungo termine.

The Swiss Science Council

The Swiss Science Council SSC is the advisory body to the Federal Council for issues related to science, higher education, research and innovation policy. The goal of the SSC, in conformity with its role as an independent consultative body, is to promote the framework for the successful development of the Swiss higher education, research and innovation system. As an independent advisory body to the Federal Council, the SSC pursues the Swiss higher education, research and innovation landscape from a long-term perspective.

www.wissenschaftsrat.ch

Preface

The Swiss Science Council's working programme 2016–2019 entails the "disruptive change in economy and society by technology and other drivers" as one of its three overarching themes and policy topics. After an initial critical assessment of the notions of disruption in the form of an exploratory study, the Council's working group on disruptive change has decided to investigate whether and how the financial services sector might be affected by potential disruptive innovations and what the role of education, research and innovation (ERI) actors could be. This specifically concerned emerging financial technologies – usually referred to as "FinTech". The Council's considerations and recommendations were approved in the February 2019 plenary meeting (see first part of this publication). The necessary insights which informed the Council in the formulation of its recommendations were gathered in a multimethod case study. This study combined a Delphi survey (commissioned to TU Berlin), expert interviews and a concluding workshop hosted in September 2018. The main findings from this case study are presented in the second part of this publication.

Einleitung

Das Arbeitsprogramm 2016–2019 des Schweizerischen Wissenschaftsrates umfasst unter anderem die «disruptiven Veränderungen in Wirtschaft und Gesellschaft durch Technologie und andere Faktoren» als eines der drei übergreifenden Themen seiner politischen Arbeit. Nach einer ersten kritischen Auseinandersetzung mit dem Thema der disruptiven Innovation in Form einer explorativen Studie beschloss die Arbeitsgruppe des Rates zu untersuchen, ob und inwiefern der Finanzdienstleistungssektor von solchen potenziell disruptiven Innovationen betroffen ist und welches die Rolle der Bildungs-, Forschungs- und Innovationsakteure sein könnte. Besonderes Augenmerk lag dabei auf aktuell aufkommenden Finanztechnologien, welche unter dem Begriff «FinTech» zusammengefasst werden. Die Überlegungen und Empfehlungen des Rates wurden in der Plenarsitzung vom Februar 2019 verabschiedet (erster Teil dieser Publikation). Die inhaltlichen Grundlagen, welche es dem Rat ermöglichten, seine Empfehlungen zu formulieren, wurden in einer Multimethoden-Fallstudie gesammelt. Diese Studie umfasste eine Delphi-Umfrage (durchgeführt durch die TU Berlin), Experteninterviews und einen abschliessenden Workshop, der im September 2018 stattfand. Die wichtigsten Schlussfolgerungen aus dieser Fallstudie sind im zweiten Teil dieser Publikation zusammengefasst.

Préface

Le programme de travail 2016–2019 du Conseil suisse de la science porte notamment sur les «changements disruptifs dans l'économie et la société induits par les technologies et par d'autres facteurs», qui constituent l'une des trois thématiques globales de son travail politique. Après une première analyse critique de la thématique de l'innovation disruptive sous la forme d'une étude exploratoire, le groupe de travail du Conseil a décidé d'examiner si et dans quelle mesure le secteur des services financiers était concerné par les innovations potentiellement disruptives, et quel rôle pourraient jouer les acteurs de la formation, de la recherche et de l'innovation. Une attention particulière a été prêtée dans ce cadre aux technologies financières, également appelées «FinTech», dont l'utilisation se généralise. Les réflexions et recommandations du Conseil ont été approuvées lors de la séance plénière de février 2019 (première partie de la présente publication). Les bases sur lesquelles le Conseil s'est appuyé pour formuler ses recommandations ont été regroupées dans une étude de cas multiméthodes qui comprenait une enquête Delphi (menée par l'Université technique de Berlin), des entretiens avec des experts et un atelier final, organisé en septembre 2018. Les principales conclusions de cette étude de cas sont présentées dans la seconde partie de la présente publication.

Prefazione

Il programma di lavoro 2016–2019 del Consiglio svizzero della scienza verte, fra le altre cose, sui «cambiamenti dirompenti nell'economia e nella società indotti da nuove tecnologie ed altri fattori», una delle tre tematiche preposte dell'attività politica del Consiglio. In seguito a una prima analisi critica del tema delle innovazioni dirompenti sotto forma di studio esplorativo, il gruppo di lavoro del Consiglio ha deciso di appurare se e in che misura il settore dei servizi finanziari sia interessato da tali innovazioni potenzialmente dirompenti nonché di esaminare il possibile ruolo degli operatori attivi nei campi della formazione, della ricerca e dell'innovazione. Particolare attenzione è stata posta sulla neonata tecnofinanza, altrimenti nota con il termine «FinTech» o «tecnologie finanziarie». Le riflessioni e le raccomandazioni del Consiglio sono state approvate durante la riunione plenaria di febbraio 2019 (prima parte della presente pubblicazione). I contenuti fondamentali che hanno permesso al CSS di formulare le proprie raccomandazioni sono stati raggruppati in un case study condotto con un approccio multimetodo. Questo studio comprendeva un'indagine Delphi condotta dall'Università tecnica di Berlino (TU Berlin), interviste a esperti e un workshop conclusivo tenutosi a settembre 2018. Le principali conclusioni emerse da questo case study sono riportate in sintesi nella seconda parte della presente pubblicazione.

Table of contents

Part 1:

Considerations and recommendations by the SSC

Considerations and recommendations by the SSC

The financial services sector includes banks, (re-)insurers, and activities auxiliary to these companies. The sector is vital to Switzerland, from an economic and a systemic perspective alike and achieves above-average productivity compared to other business sectors. To date, Switzerland still is the largest wealth management centre in the world, with about 21% of the international market volume. However, especially banks have seen a lack of growth of productivity in recent decades. This has been mainly due to the lifting of the bank secrecy as well as the low and slow adoption of new technologies. It is these new financial technologies – or, in short, FinTech – the Council is interested in, as they drive the sector's current structural change.

In this policy analysis, the SSC focuses on the development, diffusion and disruptive effects of new financial technologies within the financial services sector. The Council's considerations and recommendations are aimed at actors from the education, research and innovation (ERI) system. Limiting the analysis' scope thus is in conformity with the Council's role as an independent consultative body which analyses the Swiss ERI landscape from a long-term perspective.

New financial technologies form the basis for generating financial innovations. Financial innovation is the act of creating and then popularising new financial instruments as well as new financial institutions and markets. Such innovations are sometimes divided into product or process variants. Product innovation is exemplified by new derivative contracts, new corporate securities or new forms of pooled investment products. Process improvements are typified by new means of distributing securities, processing transactions or pricing transactions.

Main findings

The multimethod case study presented in this publication's second part served the Council in getting a better understanding of ongoing, potentially disruptive technological developments in the financial services sector. The SSC employed a Delphi survey among experts from business, research and education and from governmental and administrative bodies. Insights from the Delphi survey, which was carried out by researchers from TU Berlin, were discussed and deepened with experts in five semi-structured interviews. Finally, the Council hosted a workshop to discuss scenarios and potential fields of action with experts from the Delphi survey and other invited guests. In this project, the Council was ultimately interested in uncovering what the role of education, research and innovation actors is and could be in the most productive exploitation of potentially disruptive technologies. The case study's main findings are subsequently presented and reflected, sorted by the Council's key questions.

1. *What technological changes do experts foresee changing the business (hard-/soft-/wetware)?*

   Based on the outcomes of the Delphi survey, the experts rated the following technologies as the most critical for future business survival:

   i. Cybersecurity technologies and e-identity
   ii. Distributed ledger technology (DLT)
   iii. Algorithms & Artificial intelligence (AI), automation
   iv. Cryptocurrencies.

2. *Which technologies threaten incumbents? Which technologies empower start-ups?*

   According to the experts' opinions, technologies which require large sets of data or number of customers to become efficient favour incumbents or foster collaboration between start-ups and incumbents (AI, DLT). Technologies that lead to fundamental changes in the logic of how a service is delivered to the customers (usually through the elimination of intermediaries) threaten incumbents and thus have big disruptive potential (DLT, cryptocurrencies, automation).

   Although it might prove critical for future business survival, the experts did not agree on the disruptive potential of cybersecurity. While some see it as a simple necessity, others see potential in cybersecurity for the creation of new business models in safeguarding and securely trading data as a new form of asset.

3. *What are the biggest threats/opportunities for the Swiss financial sector (linked to technology, regulation, business models, etc.)?*

   Experts see opportunities in areas where Switzerland can build on its existing good image as a stable and innovative country and a trustworthy partner which values privacy. While some experts see big potential in adopting cryptocurrencies, others see threats in this technology as it might jeopardise Switzerland's image. Shifting business models from safeguarding monetary to non-monetary assets (such as data), based on cutting-edge cybersecurity and encryption might be a future unique selling proposition for Switzerland. While the Swiss regulatory environment is praised by several experts, it needs to keep up with current developments and carefully balance the interests of incumbents and start-ups. Finally, although Swiss companies still have competitive advantages, without better exploiting their data, they might be disrupted by companies coming from outside the financial services sector (such as foreign tech companies).

   Switzerland's current advantages, such as big global financial service providers and very good financial infrastructure, might become a disadvantage in developing and adopting new FinTech. This can be observed by looking at the low technology adoption rate of Swiss consumers, which also creates difficulties for Swiss FinTech start-ups to reach a critical mass of customers. Therefore, not only incumbents in the Swiss financial services sector might be subject to disruption, but the whole sector as an incumbent in the global market.

4. *How do incumbents deal with possible disruption? How are start-ups being disruptive?*

   According to the experts' assessment, incumbents in Switzerland are well aware of the technological developments. However, most of them are hesitant about adopting them or have difficulties in adapting their existing business models, as it might often lead to "self-cannibalisation". Although disruptive innovations can only be observed post hoc, there are strong signs for the presence of technologies with such a potential. Especially technologies which challenge the financial service providers' central role as intermediaries and providers of trust, such as platforms and DLT, may disrupt incumbents. Organisational inertia and path-dependent decisions often hinder agile responses and productive integration of new technologies or changes in business models.

   While start-ups might challenge incumbents through said disintermediation of services and more data-driven, automated and personalised services, most of them rather seek collaboration with incumbents or strive for an early exit.

5. *How do current framework conditions affect the establishment of these potential disruptive technologies and their effects on incumbents and start-ups?*

   Experts often named cultural reasons and regulatory issues as the most relevant framework conditions. As licenses are costly or difficult for start-ups to acquire, room for experimentation is limited. Therefore, these companies are often looking for collaboration with incumbents. Also, although FinTech offer opportunities to grow fast and challenge incumbents, most Swiss start-ups seek more steady growth and collaboration or simply cannot accomplish such growth in a small national market. Most experts see disruption rather coming from foreign tech companies than FinTech start-ups themselves. This might not only challenge Swiss incumbents in their business but also pose challenges for Swiss consumers and their respective data sovereignty and privacy.

   Although Switzerland does not lack the necessary capital for funding innovative start-ups, the venture capital community and culture in Switzerland could be improved according to several experts. Following the Israeli "Yozma" model with federal matching funds and risk insurance, experts in the study did call for more favourable framework conditions to attract foreign venture capital (VC) companies and investors, which in the end would also profit Swiss FinTech start-ups in productively exploiting potentially disruptive technologies.

6. *What does the Swiss education/research system provide to address the mentioned threats/opportunities?*

The collaboration between education and research institutions and businesses is also a question of knowledge and technology transfer. With regard to the productive exploitation of FinTech, education can contribute to better preparing business people to integrate and adapt to new technologies and business models as well as supplying society with the necessary digital and numerical skills to deal with such innovations in a productive way. This also includes the fostering of entrepreneurial and open mindsets and culture. The technologies driving FinTech are not exclusive to the financial services sector. Therefore, competence centres researching either distributed ledger technologies or cybersecurity would not only profit the financial services sectors but others as well. Experts also called for simpler ways of negotiating the commercialisation and funding of research at higher education institutions (HEI).

A critical assessment of financial innovation

The case study's results have shown that the most critical FinTech for business survival predominantly entail process innovations (DLT, automation of services, etc.), but also innovations which combine product and process innovations (such as cryptocurrencies, a digital asset based on decentralised control through the DLT). While the study discusses how the different FinTech innovations affect the involved incumbent and start-up companies, it does only partially address societal and systemic effects. It is almost a truism to say that "innovation" is not always positive, a judgement that applies to any sector but has a particular relevance for the financial sector.[1] Financial innovations are likely to generate a complex web of externalities; uncertain spillover effects which may positively or negatively affect social welfare. Financial innovations, for instance, can promote excessive and even destructive financial intermediation and lead to general and worldwide economic decline, as the 2008 financial crisis has clearly shown.[2]

Some FinTech threaten incumbents in the Swiss financial services sector, as these technologies provide new opportunities for disintermediation. This may render the incumbents' existing business models obsolete. At the same time, these FinTech also provide the opportunity to counteract the intermediaries' strategies of rent seeking that were at the origin of the 2008 financial crisis. Additionally, FinTech may create new markets which allow for an easier and more effective resource allocation.

Thus, there is an ambivalent character to financial innovation. The SSC therefore sees the need for supplying consumers, the workforce and management personnel with the necessary skill-set to conduct a critical assessment of such innovations. At the same time, regulation in the financial services sector also has to address these ambivalent characteristics. Therefore, the challenge is to carefully balance between several factors, such as the protection for consumers, market stability and infrastructure of systemic importance, but also providing room for experimentation and facilitating the emergence of innovations beneficial to the Swiss economy and social welfare.

Notwithstanding the above, Switzerland depends strongly on the provision of competitive financial services. To preserve if not enhance its position, Switzerland needs to invest in FinTech and increase the rate of technology adoption. Such an increase is either driven by "pain" (i.e. the urgent necessity) or can be fostered through education and early adopters leading the way (i.e. through internal and external motivation).

---

1 Simply because there is a market for it does not mean that financial innovation is always good (see for instance Johnson, S. & Kwak, J. [2012]. Is Financial Innovation Good for the Economy? Innovation Policy and Economy, 12 [1], 1–16).

2 For example, the notion that the financial sector was able to reduce risk by selling credit default swaps has led to the mispricing of a range of financial assets and consequent over-borrowing and over-lending by banks and various other financial service providers. This has been a key factor in the 2008's financial crisis development (see for instance Foray, D. & Phelps, E.S. [2011]. The challenge of innovation in turbulent times [MTEI working paper n°2011-002]. Lausanne: EPFL).

Boosting technology development through mission-oriented policy mechanisms

Most western countries – including innovation champions such as the USA – have a tradition of mission-oriented policy. These policies pursue the goal of supporting a particular set of new technologies. As such, they involve preferential interventions towards a certain technological domain and can be characterised by a higher degree of intentionality, prioritisation and centralisation than the standard policies focusing on framework conditions.

Traditionally, Switzerland has not really opted for such a policy logic. It rather prefers relying on strong framework conditions, market forces, spontaneous entrepreneurial initiatives and coordination to meet the technological challenges ahead. The main reason for not pursuing mission-oriented policies involves the well-known arguments about

i. the inability of the state and the government to decide on priorities and establish strategic targets and
ii. the market distortion effects generated by preferential interventions.

These arguments are true in a certain context: If mission-oriented policy is poorly designed, it may easily and quickly become a central planning exercise.[3]

However, mission-oriented policy does not necessarily need to be designed poorly, as insights from national experiences show: Properly designed mission-oriented policy can be very effective in boosting technological domains and achieving specific innovation targets. An excellent example for such a well-functioning programme is the ARPA (Advanced Project Research Agency) model.[4] Its featuring principles are the general organisational flexibility, bottom-up programme design, discretion in project selection and active project management. All these features rely on highly talented, independent and empowered programme staff. As analysed in literature, the stage-gated ARPA model showed that:

- it is possible to efficiently organise research & innovation *around a technology-related mission or a set of overarching goals;*
- it proved to be particularly optimal *for areas where technology exists, is relatively unexplored and has great potential for improvement;*
- it is also useful to solve *friction on markets for ideas and technologies* in sectors where the path from idea to impact is extraordinarily difficult (such as in energy because of so many obstacles, such as large amount of capital for demonstration and scale up, strong infrastructure inertia, etc.).

3 This refers to a principal agent governance, where the principal (i.e. the government) decides from the top what to do and sets the incentives for the agents (i.e. the firms) to execute the plan. This results in very poor information flows from the bottom.

4 Azoulay, P., Fuchs, E., Goldstein, A.P., & Kerney, M. (2019). Funding Breakthrough Research: Promises and Challenges of the 'ARPA Model'. Innovation Policy and the Economy, 19(1), 69-96.

Recommendations

Although the financial services sector is predominantly regulated by actors outside the ERI landscape, ERI actors can substantially contribute to a productive exploitation of potentially disruptive FinTech. Based on the insights gathered in the present case study as well as in its previous work, the SSC recommends the following measures in the three fields of education, research and innovation. As the case study led to a more general understanding of disruptive innovations and ways of dealing with them, the Council is well aware, that much of the subsequent recommendations are rather generic. However, the Council considers this a strength, as change through digital innovations will affect many levels and stakeholders across industries equally. It further is in line with the Council's position that the process of digitalisation has to be shaped and dealt with on a more systemic level instead of isolated, single measures and policies.

Education:

- **Systemic promotion of digital competences and entrepreneurial culture and mindset:**
  In order to increase the rate of technology adoption among market participants and companies alike, the Swiss education system must supply all actors with skill-sets and competences complementary to emerging digital technologies and productive ways of exploiting and using them. This includes the need to bridge the gaps between social sciences and mathematical and computer sciences. Policy makers need to be aware that such a promotion needs to be planned, implemented and coordinated in a systemic way, spanning all levels from basic to tertiary education, including continuing education.[5, 6]

  - *Consumers/citizens:* Consumers and citizens must be equipped with the necessary knowledge and skill-sets to allow them to gain and maintain their data sovereignty. Additionally, technology adoption also depends on consumers' digital literacy and an open mindset and curiosity regarding digital innovation, which all should be fostered through education.

  - *Workforce/management:* To achieve higher productivity through human-machine interaction while building resilience in the face of potentially disruptive technologies, the education system must equip the workforce and management personnel with complementary digital competences. This goes well beyond IT and programming skills and includes scientific, social and creative ways of interacting with new technologies and large sets of data as well as aspects of computational and critical thinking and empathy. Further, hands-on (continuing) education should promote an entrepreneurial culture and mindset, including the training of risk-taking and a culture of failure.

  - *Executives:* Executive personnel need to be equipped with the necessary skill-sets to better integrate emerging technologies into strategies and production processes, and adjust their business models accordingly. Education plays a key role in fostering the strategic understanding and assessment of emerging technologies and their potentials.

Research:

- **Strengthen competences in DLT and cybersecurity:**
  The SSC welcomes that the Federal Council has included FinTech in its updated strategy "Digital Switzerland".[7] Especially with regard to the therein mentioned technological expertise, it is crucial for Swiss research institutions to strengthen competences and define and create strategic positions in the areas of distributed ledger technology and cybersecurity. With regard to aspects related to critical infrastructures and national security such as financial markets, the SSC suggests that Switzerland introduces an appropriate funding mechanism. Such a mechanism could be built on the basis of the existing BRIDGE programme, situated at the intersection of SNSF and Innosuisse. However, BRIDGE currently lacks funding and needs to be strengthened in order to become an effective instrument for an urgently needed technology policy. In order to raise its profile, such an instrument should adopt the key characteristics of a mission-oriented policy, analogous to the one used by the ARPA model (see box above).[8] A stage-gated, ARPA-like model would thus complement Switzerland's existing funding mechanisms. This would benefit all industries and HEI types alike which rely on or are involved in the development of new digital basic technologies (such as DLT, cybersecurity, quantum technologies or artificial intelligence).

- **Guaranteed access to European research funding:**
  To accomplish a specialisation and excellence in digital basic technologies, future access to European research funding is essential (e.g. "Digital Europe" programme).

5 SSIC. (2017). Notions of disruption. Exploratory study 3/2017. Bern: SSIC.

6 SSC. (n.d.). Recommendations of the Swiss Science Council SSC for the ERI Dispatch 2021–2024. [Not yet published].

7 BAKOM. (2018). Strategie "Digitale Schweiz". Biel/Bienne: Geschäftsstelle Digitale Schweiz des Bundes (GDS).

8 SSC. (June 11, 2018). Empfehlungen des Rates zum Thema Cybersicherheit (letter for the attention of Federal Councillor J. Schneider-Ammann, Federal Councillor U. Maurer, Federal Councillor G. Parmelin and Federal Chancellor W. Thurnherr).

The SSC therefore suggests the creation of an interdepartmental working group which develops internal procedures and measures for federal administration that ensure the coherence of international ERI policy with other fields of public policy in Switzerland, particularly national security, foreign policy, development policy and economic policy (art. 41 para. 3 let. b RIPA). As such, this working group can pro-actively advocate for Switzerland's future cooperation with the 9th EU Framework Programme and the strategic expansion of Switzerland's cooperation to non-European countries.[9]

Retain talents:
Swiss HEI educate excellent scientists and researchers from all over the world. These highly qualified talents often leave Switzerland after finishing their degrees. It is in the interest of the Swiss national economy, incumbents and start-ups alike, to retain these talents. The SSC therefore welcomes ongoing parliamentary initiatives to grant these talents optimal framework conditions to establish their own companies in Switzerland.

Innovation:

Regulation:
To foster the exploitation of emerging and rapidly developing technologies, it is vital to create and shape a productive innovation ecosystem to encourage experimentation with such technologies. Thus, the SSC calls for the careful balancing of regulatory framework conditions guaranteeing the safeguarding of customer rights, system stability, enough room for experimentation and fair chances to both incumbents and start-ups. To stay competitive in the international financial services industries, dynamic, forward-looking regulatory bodies and high standards for data privacy may prove to be very beneficial. Especially with regard to trusted and safe data storage and handling, Switzerland may have competitive advantages, provided it expands its expertise in cybersecurity and takes on a strong position where data-privacy regulations are concerned.

Foster venture capital community:
The SSC welcomes the establishment of the Swiss Entrepreneurs Foundation as an important step in strengthening the Swiss VC community. However, to further foster this community, the SSC calls for similar initiatives on a federal and cantonal level, which should also attract foreign investors and their expertise. Such initiatives might include (partial) matching funds, limited risk insurance and intermediation.

Technology transfer:
To increase and speed up the transfer of technologies and their adoption and commercialisation by businesses, industry and HEI should collaborate in setting up adequate platforms allowing for unilaterally motivated interaction ("technology push" as well as "demand pull").[10] Such technology-centred platforms would allow the productive exploitation of existing expertise and the realisation of "cross-fertilisation" and synergies. An interdisciplinary and trans-sectoral competence centre (such as the UK "Digital Catapult",[11] for instance, a prime example for a multi-sphere institution) could be established in Switzerland in connection with existing innovation parks and Innosuisse innovation schemes such as National Thematic Networks. Additionally, the active inclusion of regulatory bodies into such multi-sphere institutions may prove to be beneficial in fostering innovation. Such an inclusion and active exchange can increase legal certainty and foster the development of adaptive regulation.

Public procurement:
Addressing the need for an increased rate of technology adoption, the SSC also encourages federal and state actors to act as early adopters through public procurement. In doing so, public actors not only promote new technologies to its citizens, but also provide the necessary critical mass of customers and investments for FinTech companies, while making public services more efficient and easier to use.

Standards for research funding and IP rights:
To further facilitate the collaboration between industry and HEI in creating innovative technologies, both parties would profit from transparent, self-defined standards and rules, in which HEI formulate the basis of research funding by industry and how IP rights can be transferred and licensed.

Access to European market:
To overcome the limitations of the small Swiss market, start-ups and incumbents must have access to the European market. In this respect, Switzerland needs to move fast to position itself with regard to the EU GDPR and PSD2 regulation and the aspect of "open banking". This will also create more legal certainty, which will positively contribute to the Swiss innovation ecosystem.

9 SSC. (n.d.). Recommendations of the Swiss Science Council SSC for the ERI Dispatch 2021–2024. [Not yet published].

10 SSC. (n.d.). Recommendations of the Swiss Science Council SSC for the ERI Dispatch 2021–2024. [Not yet published].

11 https://www.digicatapult.org.uk/our-story/

Überlegungen und Empfehlungen des SWR

Der Finanzdienstleistungssektor umfasst Banken, (Rück-)Versicherungen und mit Finanz- und Versicherungsdienstleistungen verbundene Tätigkeiten. Der Sektor ist für die Schweiz wirtschaftlich wie auch systemisch von hoher Wichtigkeit und weist eine überdurchschnittliche Produktivität im Vergleich zu anderen Dienstleistungssektoren auf. Die Schweiz ist derzeit immer noch das weltweit grösste Wealth Management Zentrum mit rund 21 % des internationalen Marktvolumens. Jedoch fiel das Produktivitätswachstum im Bankensektor in den letzten Jahrzehnten unterdurchschnittlich aus. Dies ist einerseits auf die Aufhebung des Bankkundengeheimnisses und andererseits auf die tiefe und langsame Technologieadoption zurückzuführen. Es sind ebendiese Finanztechnologien – oder kurz FinTech –, welche den Rat interessieren, da diese den derzeitigen Strukturwandel im Sektor antreiben.

Der SWR setzt sich im Rahmen dieser politischen Analyse mit der Entwicklung, Verbreitung und den disruptiven Effekten von neuen Finanztechnologien im Finanzdienstleistungssektor auseinander. Die Überlegungen und Empfehlungen des Rates beziehen sich vor allem auf Akteure des Bildungs-, Forschungs- und Innovationssystems (BFI-System). Diese mögliche Einschränkung des Umfangs dieser Analyse ist jedoch in Einklang mit der Rolle des Rates als unabhängiges Beratungsorgan, welches eine Langzeitperspektive auf das BFI-System einnimmt.

Neue Finanztechnologien bilden die Basis, um Finanzinnovationen zu generieren. Unter Finanzinnovation wird die Entwicklung und Verbreitung neuer Finanzinstrumente sowie Finanzinstitutionen und Märkte verstanden. Solche Innovationen können unter anderem in Produkt- und Prozessvarianten unterteilt werden. Produktinnovationen sind beispielsweise neue derivative Kontrakte, neue Unternehmenswertpapiere oder neue Formen von gebündelten Anlageprodukten. Prozessinnovationen sind neue Arten, Wertschriften zu vertreiben, Transaktionen abzuwickeln oder zu bewerten.

Zentrale Erkenntnisse

Die in dieser Publikation präsentierte Multimethoden-Fallstudie (Teil 2) diente dem Rat als Informationsgrundlage, um aktuelle, potenziell disruptive Technologieentwicklungen im Finanzdienstleistungssektor besser abschätzen zu können. Dabei hat der SWR eine Delphi-Studie mit Experten aus Unternehmen, Bildung und Forschung sowie Verwaltungs- und Aufsichtsbehörden durchgeführt. Erkenntnisse aus dieser Delphi-Studie, die durch Forschende der TU Berlin umgesetzt wurde, wurden anschliessend mit Experten in fünf semi-strukturierten Interviews diskutiert und vertieft. Schliesslich veranstaltete der Rat einen Workshop, in welchem Szenarien und mögliche Aktionsfelder mit Experten aus der Delphi-Studie sowie geladenen Gästen diskutiert wurden. Das Hauptinteresse des Rates galt bei diesem Projekt insbesondere der Rolle von Bildungs-, Forschungs- und Innovationsakteuren und der Frage, wie diese zu einer möglichst produktiven Nutzung von potenziell disruptiven Technologien beitragen können. Die Haupterkenntnisse aus der Fallstudie sind nachfolgend zusammengefasst und werden geordnet nach den Kernfragen des Rates kritisch reflektiert.

1. *Welche technologischen Entwicklungen erwarten die Experten, welche die Geschäftstätigkeit in Zukunft verändern werden (hard-/soft-/wetware)?*

   Basierend auf den Resultaten der Delphi-Studie wurden folgende Technologien von den Experten als besonders kritisch für das betriebliche Überleben eingeschätzt:
   i. Cybersicherheitstechnologien und E-Identität
   ii. Distributed-Ledger-Technologie (DLT)
   iii. Algorithmen & künstliche Intelligenz (KI), Automatisierung
   iv. Kryptowährungen.

2. *Welche Technologien bedrohen etablierte Anbieter? Welche Technologien befähigen Start-ups?*

   Gemäss den Expertenmeinungen sind Technologien, die erst mit genügend grossen Datenmengen oder Kundenstämmen effizient werden, für etablierte Anbieter von grösserem Nutzen, beziehungsweise fördern die Kollaboration zwischen diesen Unternehmen und Start-ups (KI, DLT). Technologien, welche jedoch die Logik, wie Dienstleistungen erbracht werden, fundamental ändern (häufig durch das Eliminieren von Intermediären), bedrohen etablierte Anbieter und haben grosses disruptives Potenzial (DLT, Kryptowährungen, Automatisierung).

   Obwohl Cybersicherheit von den Experten als essenziell für das zukünftige Firmenüberleben eingestuft wurde, sind sie sich über das disruptive Potenzial dieser Technologie nicht einig. Während einige darin eine schlichte Notwendigkeit sehen, bietet diese Technologie für andere die Grundlage für die Etablierung neuer Geschäftsmodelle im Bereich der Aufbewahrung und dem Handel von Daten als neues Handelsgut.

3. *Was sind die grössten Gefahren/Chancen für den Schweizer Finanzsektor (hinsichtlich Technologie, Regulierung, Geschäftsmodelle etc.)?*

Chancen sehen die Experten vor allem in Bereichen, in welchen die Schweiz auf ihr bestehendes gutes Image als stabile und innovative Volkswirtschaft bauen kann, was ebenfalls die Rolle als zuverlässigen Partner einschliesst, der Vertrauenswürdigkeit zu schätzen weiss. Während einige der Experten grosses Potenzial in Kryptowährungen sehen, stellt dieser Geschäftsbereich für andere eine Gefahr dar, da diese Technologie das gute Image der Schweiz beschädigen könnte. Die Verschiebung von Geschäftsmodellen von der Aufbewahrung von monetären hin zu nicht-monetären Handelsgütern (wie Daten) könnte ein zukünftiges Alleinstellungsmerkmal des Schweizer Finanzplatzes sein, sofern dieser auf hochmoderne und führende Cybersicherheit und Verschlüsselung aufbaut. Während das regulatorische Umfeld in der Schweiz von mehreren Experten gelobt wird, muss dieses auch in Zukunft mit den technologischen Entwicklungen Schritt halten und die Interessen von etablierten Anbietern und Start-ups vorsichtig austarieren. Die kompetitiven Vorteile, die Schweizer Firmen derzeit noch haben, können schnell verloren gehen, wenn Firmen ihre bestehenden Daten nicht produktiver nutzen. Dann droht ihnen eine Disruption durch Firmen ausserhalb des Finanzsektors (vornehmlich durch ausländische Tech-Firmen).

Die aktuellen Standortvorteile der Schweiz, wie etwa die grossen globalen Finanzdienstleistungsanbieter und die sehr gute Infrastruktur, könnten in Zukunft ein Nachteil bei der Entwicklung und Adoption neuer FinTech sein. Dies kann bereits heute bei der tiefen Technologieadoptionsrate Schweizer Konsumenten beobachtet werden. So ist es auch für Schweizer FinTech-Start-ups schwieriger, eine kritische Masse an Kunden zu erreichen. Insofern laufen nicht nur die etablierten Anbieter Gefahr, disruptiert zu werden, sondern der gesamte Finanzplatz Schweiz als etablierter Akteur im globalen Markt.

4. *Wie gehen die etablierten Anbieter mit der möglichen Disruption um? Inwiefern sind Start-ups disruptiv?*

Nach Einschätzung der Experten sind sich die etablierten Anbieter sehr wohl der technologischen Entwicklungen bewusst. Jedoch zögern viele von ihnen, diese Technologien zu übernehmen oder haben Schwierigkeiten, ihre bestehenden Geschäftsmodelle anzupassen, da dies zu einer «Selbst-Kannibalisierung» führen würde. Obwohl disruptive Innovationen per Definition erst nachträglich als solche erkannt werden können, gibt es starke Anzeichen dafür, dass gewisse FinTech über ein solches Potenzial verfügen. Dies sind insbesondere Technologien, welche die zentrale Rolle der Finanzdienstleister als Intermediäre und in der Vertrauensbildung anfechten, wie beispielsweise Plattformen und DLT. Organisationsträgheit und pfadabhängige Entscheidungen verhindern oft agile Reaktionen und die produktive Integration von Technologien oder die Anpassung der bestehenden Geschäftsmodelle.

Obwohl Start-ups die etablierten Anbieter mittels der genannten Disintermediation und vermehrt datengetriebenen, automatisierten und personalisierten Dienstleistungen herausfordern könnten, streben die meisten eher eine Zusammenarbeit oder einen frühen Exit an.

5. *Wie beeinflussen die aktuellen Rahmenbedingungen die Etablierung von potenziell disruptiven Technologien und deren Effekt auf führende Anbieter und Start-ups?*

Die befragten Experten nannten oft kulturelle und regulatorische Gegebenheiten als die relevantesten Rahmenbedingungen. Da sich der Erwerb von Lizenzen für Start-ups häufig kostspielig oder aufwendig gestaltet, ist der Spielraum zum Experimentieren oft begrenzt. So streben diese Unternehmen häufig die Zusammenarbeit mit führenden Anbietern an. Und obwohl FinTech die Möglichkeit für schnelles Wachstum und Herausforderung von Marktführern bilden, entscheiden sich Start-ups eher für langsamere Wachstumsprozesse und die Zusammenarbeit, beziehungsweise bietet ihnen der verhältnismässig kleine Schweizer Markt zu wenig Wachstumsmöglichkeiten. Die meisten Experten sehen daher die Gefahr einer Disruption eher durch ausländische Tech-Firmen als von Schweizer Start-ups. Dies stellt nicht nur die führenden Anbieter vor grosse Herausforderungen, sondern auch die Schweizer Konsumenten und deren Datensouveränität und -schutz.

Obwohl es der Schweiz nicht an Kapital fehlt, um in innovative Start-ups zu finanzieren, sollte gemäss mehreren Experten die Venture Capital-Szene und -Kultur gestärkt und verbessert werden. In Anlehnung an das israelische «Yozma»-Modell, mit staatlichen Matching Funds und Risikoversicherung, fordern die Experten attraktivere Rahmenbedingungen, um ausländische VC-Firmen und Investoren anzuziehen. Dies würde auch Schweizer FinTech-Start-ups zugutekommen, um potenziell disruptive Technologien produktiv zu nutzen.

6. *Was kann das Schweizer Bildungs- und Forschungssystem beitragen, um besser mit den erwähnten Gefahren und Chancen umzugehen?*

Die Zusammenarbeit zwischen Bildungs- und Forschungsinstitutionen und Firmen ist stets auch eine Frage von Wissens- und Technologietransfer. Im Hinblick auf die produktive Nutzung von FinTech kann Bildung einen entscheidenden Beitrag leisten. So können Unternehmende einerseits darauf vorbereitet werden, neue Technologien in bestehende Prozesse zu integrieren und die Geschäftsmodelle entsprechend anzupassen. Gleichzeitig kann die Bevölkerung mit den notwendigen digitalen und numerischen Fähigkeiten ausgestattet werden, um mit solchen Innovationen produktiv umzugehen. Dies schliesst

auch die Förderung einer unternehmerischen und offenen Kultur sowie «Mindsets» mit ein. Die Basistechnologien, die FinTech ermöglichen, werden nicht nur exklusiv im Finanzsektor verwendet. Deshalb würden Kompetenzzentren, welche die Distributed-Ledger-Technologie oder Cybersicherheit erforschen, nicht nur dem Finanzdienstleistungssektor zugutekommen, sondern ebenfalls anderen Wirtschaftszweigen. Schliesslich forderten Experten auch eine Vereinfachung der Verhandlungen mit Hochschulen im Hinblick auf Forschungsförderung und die Kommerzialisierung von Forschungsergebnissen.

Eine kritische Einschätzung von Finanzinnovation

Die Resultate der Fallstudie haben gezeigt, dass die FinTech, die für das zukünftige Firmenüberleben am wichtigsten sind, meist Prozessinnovationen darstellen (DLT, Automatisierung von Dienstleistungen etc.), jedoch auch Mischformen von Prozess- und Produktinnovationen beinhalten (wie beispielsweise Kryptowährungen, welche digitale Anlagen sind, die auf dezentralisierter Kontrolle durch DLT basieren). Die Studie diskutiert vorwiegend, wie die verschiedenen FinTech-Innovationen die führenden Anbieter und Start-ups betreffen, spricht jedoch die gesellschaftlichen und systemischen Effekte nur am Rande an. Es ist fast eine Binsenweisheit zu sagen, dass Innovation nicht immer positiv ist, eine Einschätzung, die auf alle Sektoren angewendet werden kann, wohl aber besonders auf den Finanzsektor zutrifft.[12] Finanzinnovationen verursachen sehr wahrscheinlich ein komplexes Netz an Externalitäten; ungewisse Nebeneffekte, welche die soziale Wohlfahrt positiv wie negativ betreffen können. Finanzinnovationen können so beispielsweise exzessive und gar destruktive Finanzintermediation fördern und so umfassenden und weltweiten wirtschaftlichen Schaden anrichten, wie die Finanzkrise 2008 eindrücklich gezeigt hat.[13]

Gewisse FinTech bedrohen die etablierten Anbieter im Schweizer Finanzdienstleistungssektor, da diese Technologien neue Möglichkeiten für Disintermediation schaffen. Dadurch können die bestehenden Geschäftsmodelle der führenden Anbieter obsolet werden. Gleichzeitig bieten diese Technologien die Möglichkeit, den schädlichen rent-seeking Strategien der Intermediäre entgegenzuwirken, welche am Ursprung der Finanzkrise 2008 standen. Zusätzlich können FinTech neue Märkte schaffen, was eine einfachere und effizientere Ressourcenallokation ermöglicht.

Gesamthaft betrachtet haben Finanzinnovationen einen ambivalenten Charakter. Der SWR sieht deshalb den Bedarf, Konsumenten, Arbeitskräfte und Managementpersonal mit den notwendigen Fähigkeiten auszustatten, um solche Innovationen einer kritischen Einschätzung unterziehen zu können. Gleichzeitig müssen die ambivalenten Charakteristiken auch bei der Regulierung des Finanzdienstleistungssektors berücksichtigt werden. Die Herausforderung hierbei ist es, eine Balance zwischen verschiedenen Faktoren zu finden. Während Konsumenten, die Marktstabilität und Infrastruktur von systemischer Wichtigkeit geschützt werden müssen, soll gleichzeitig auch genügend Experimentierraum geschaffen werden, um somit die Entstehung von Innovationen zu fördern, welche der Schweizer Wirtschaft und der sozialen Wohlfahrt zugutekommen.

Ungeachtet dessen ist die Schweiz stark auf die Verfügbarkeit von kompetitiven Finanzdienstleistungen angewiesen. Um ihre Position zu halten oder gar auszubauen, muss die Schweiz in FinTech investieren und die Technologieadoptionsrate erhöhen. Eine solche Erhöhung kann einerseits durch Leidensdruck getrieben sein (d.h. durch dringende Notwendigkeit) oder kann gefördert werden durch Bildung und frühe Anwender, die den Weg ebnen (d.h. durch interne und externe Motivation).

12 Nur weil ein Markt dafür existiert, bedeutet noch nicht, dass Finanzinnovationen stets positive Effekte haben (siehe zum Beispiel Johnson, S. & Kwak, J. [2012]. Is Financial Innovation Good for the Economy? Innovation Policy and Economy, 12[1], 1–16).

13 Zum Beispiel führte die Möglichkeit der Risikoreduktion durch den Verkauf von Credit Default Swaps zu einer Fehlbewertung einer Vielzahl von Finanzanlagen. Dies wiederum verursachte eine überhöhte Kreditvergabe und -aufnahme durch Banken und andere Finanzdienstleister. Dies war ein entscheidender Faktor in der Entwicklung der Finanzkrise 2008 (siehe zum Beispiel Foray, D. & Phelps, E.S. [2011]. The challenge of innovation in turbulent times [MTEI working paper n°2011-002]. Lausanne: EPFL.

Technologieentwicklung durch den Mechanismus der Programmforschung stärken

In den meisten westlichen Ländern – inklusive Innovations-Champions wie beispielsweise die USA – hat Programmforschung («mission-oriented policy») Tradition. Solche Programme verfolgen das Ziel, spezifische neue Technologien zu fördern. Dies beinhaltet bewusste, priorisierende und zentralisierte Massnahmen, die eine bestimmte Technologie fördern – ganz im Gegensatz zu gewöhnlichen politischen Massnahmen, die sich lediglich auf Rahmenbedingungen konzentrieren.

Traditionsgemäss entscheidet sich die Schweiz nur selten für eine solche Interventions-Logik. Vielmehr werden Massnahmen bevorzugt, die sich auf die generelle Förderung optimaler Rahmenbedingungen, Marktkräfte, spontane unternehmerische Initiativen und koordinierende Funktionen verlassen, um zukünftigen technologischen Herausforderungen zu begegnen. Der Hauptgrund, warum Programmforschung nicht verfolgt wird, basiert auf den bekannten Argumenten, dass

i. der Staat und die Regierung nicht fähig sind, Prioritäten zu setzen und strategische Ziele zu etablieren, und
ii. mit solchen bevorzugenden Massnahmen Marktverzerrungen generiert werden.

Diese Argumente sind unter gewissen Umständen sicherlich angebracht. Schlecht konzipierte Programmforschung kann einfach und schnell zur Zentralplanung verkommen.[14]

Solche Programme müssen aber nicht gezwungenermassen schlecht konzipiert sein, wie Beispiele aus anderen Ländern zeigen: Zweckmässig konzipierte Programmforschung kann sehr wohl effektiv sein, um ausgewählte Technologien zu fördern und spezifische Innovationsziele zu erreichen. Ein Beispiel eines gut funktionierenden Programms ist das ARPA (Advanced Research Project Agency)-Modell.[15] Dieses zeichnet sich aus durch organisatorische Flexibilität, Bottom-up-Programmdesign, Ermessensspielraum bei der Projektwahl und aktives Projektmanagement. All diese Eigenschaften setzen gleichzeitig hochtalentierte, unabhängige und selbstbestimmende Projektmitarbeiter voraus. Wie in der Literatur gezeigt werden konnte, beweist das auf dem «Stage-Gate»-Prozess basierende ARPA-Modell, dass

- es möglich ist, Forschungs- und Innovationsprozesse erfolgreich zu organisieren, welche eine *technologiebasierte Mission oder übergeordnete Ziele verfolgen;*
- es besonders gut geeignet ist, um Technologiebereiche zu fördern, wo die Basistechnologie zwar existiert, aber noch *grösstenteils unerforscht ist und grosses Verbesserungspotenzial hat;*
- es auch dazu dienen kann, *Marktfriktionen für Ideen und Technologien abzubauen* in Bereichen, in denen der Pfad zwischen Idee und Wirkung ausserordentlich schwierig ist (zum Beispiel im Energiesektor, wo viel Kapital für Demonstration und Skalierung notwendig ist, oder in Bereichen mit grosser Unbeweglichkeit aufgrund der vorhandenen Infrastruktur etc.).

14 Dies bezieht sich auch auf eine Prinzipal-Agenten-Konstellation, bei welcher der Prinzipal (d.h. die Regierung) «top down» entscheidet, welche Anreize er für die Agenten (d.h. die Firmen) setzt, um einen Plan auszuführen. Dies führt zu einem schlechten Informationsfluss von den Agenten her.

15 Azoulay, P., Fuchs, E., Goldstein, A.P., & Kerney, M. (2019). Funding Breakthrough Research: Promises and Challenges of the 'ARPA Model'. Innovation Policy and the Economy, 19(1), 69-96.

Empfehlungen

Auch wenn der Finanzdienstleistungssektor vorwiegend von Akteuren ausserhalb der BFI-Landschaft reguliert wird, können BFI-Akteure substanziell zu einer produktiven Nutzung von potenziell disruptiven FinTech beitragen. Basierend auf der hier vorliegenden Fallstudie sowie seiner weiteren bisherigen Arbeit empfiehlt der Rat die folgenden Massnahmen in den Bereichen Bildung, Forschung und Innovation. Die vorliegende Fallstudie hat beim Rat zu einem allgemeineren Verständnis der disruptiven Innovationen und damit verbundenen Umgangsmöglichkeiten geführt. Der SWR ist sich folglich bewusst, dass die meisten der folgenden Empfehlungen einen generischen Charakter haben. Dies fasst er jedoch als eine Stärke dieser Analyse auf, da die Veränderung durch digitale Innovationen Stakeholder auf verschiedenen Ebenen in vielen Wirtschaftssektoren gleichermassen betrifft. Dieses Verständnis ist zudem auf der Argumentationslinie des Rates, welcher der Ansicht ist, dass die Gestaltung und der Umgang mit der Digitalisierung auf einer systemischen Ebene stattfinden müssen, statt mittels isolierter Einzelmassnahmen und Programmen.

Bildung:

- **Systemische Förderung digitaler Kompetenzen und unternehmerischer Kultur und «Mindset»:**
  Um die Technologieadoptionsrate der Marktteilnehmenden und Firmen gleichermassen zu erhöhen, muss das Schweizer Bildungssystem sämtliche Akteure mit adäquaten Fähigkeiten und Kompetenzen ausstatten. Diese sollen sich komplementär zu den sich entwickelnden digitalen Technologien verhalten und eine produktive Nutzung ebendieser Technologien ermöglichen. Dies schliesst die Notwendigkeit mit ein, eine Verbindung zwischen den Sozialwissenschaften und der Mathematik und Computerwissenschaften zu schaffen. Politische Entscheidungsträger müssen sich bewusst sein, dass eine solche Förderung einer systemischen Planung, Umsetzung und Koordination bedarf und alle Stufen von Grund- bis zur Tertiärbildung umfassen muss, inklusive der Weiterbildung.[16, 17]

  - *Konsumenten/Bürger:* Konsumenten und Bürger müssen mit dem notwendigen Wissen und den Fähigkeiten ausgestattet werden, die es ihnen erlauben, ihre Datensouveränität zu wahren. Zudem hängt die Technologieadoptionsrate auch von der digitalen Kompetenz («digital literacy»), einem offenen «Mindset» und der Neugier gegenüber digitalen Technologien ab. Dies kann ebenfalls durch Bildung gefördert werden.

  - *Arbeitskräfte/Management:* Um eine höhere Produktivität durch die Interaktion von Mensch und Maschine zu erreichen und gleichzeitig Resilienz in Anbetracht potenziell disruptiver Technologien zu bilden, muss das Bildungssystem Arbeitskräfte und das Management-Personal mit komplementären digitalen Kompetenzen ausrüsten. Dies geht weit über IT- und Programmierfähigkeiten hinaus und beinhaltet wissenschaftliche, soziale und kreative Arten der Interaktion mit neuen Technologien und grossen Datensätzen sowie Aspekte des «computational thinking», kritischen Denkens und Empathie. Weiter sind praktische (Weiter-)Bildungsangebote notwendig, welche unternehmerische Kultur und «Mindset» fördern, einschliesslich einer erhöhten Risikobereitschaft und einer konstruktiven Fehlerkultur.

  - *Führungskräfte:* Führungskräfte müssen mit Fähigkeiten ausgestattet werden, die es ihnen erlauben, sich entwickelnde Technologien besser in Unternehmensstrategien und Produktionsprozesse zu integrieren und die Unternehmensmodelle entsprechend anzupassen. Bei der Förderung des strategischen Verständnisses und der Einschätzung von sich entwickelnden Technologien und deren Potenzial spielt Bildung eine Schlüsselrolle.

Forschung:

- **Kompetenzen im Bereich DLT und Cybersicherheit stärken:**
  Der SWR begrüsst, dass der Bundesrat das Thema FinTech in die aktualisierte Strategie «Digitale Schweiz» aufgenommen hat.[18] Speziell mit Blick auf die erwähnte technologische Expertise ist es von zentraler Bedeutung, dass Schweizer Forschungsinstitute ihre Kompetenzen im Bereich Distributed-Ledger-Technologie und Cybersicherheit ausbauen und strategische Nischen definieren und etablieren. In Bezug auf Infrastrukturen, welche von kritischer Bedeutung für die nationale Sicherheit sind (wie die Finanzmärkte), schlägt der SWR vor, einen neuen Fördermechanismus einzuführen. Ein solcher Mechanismus könnte auf der Basis des bestehenden BRIDGE-Programms aufgebaut werden, an der Schnittstelle zwischen SNF und Innosuisse. Derzeit fehlt BRIDGE nicht nur die nötige Finanzierungsbasis, sondern es sollte auch strategisch gestärkt werden, um ein effektives Instrument der dringend benötigten Technologiepolitik zu werden. Um sein Profil zu schärfen, sollte sich dieses Instrument an den Eigenschaften der Programmforschung orientieren,

16 SWIR. (2017). Notions of disruption. Explorative Studie 3/2017. Bern: SWIR.

17 SWR (s.d.). Empfehlungen des Schweizerischen Wissenschaftsrates SWR für die BFI-Botschaft 2021–2024. [Noch nicht veröffentlicht].

18 BAKOM. (2018). Strategie «Digitale Schweiz». Biel/Bienne: Geschäftsstelle Digitale Schweiz des Bundes (GDS).

wie beispielsweise des ARPA-Modells (siehe Kasten oben).[19] Ein auf dem «Stage Gate»-Prozess basierendes, ARPA-ähnliches Modell würde die bestehenden Schweizer Fördermechanismen optimal ergänzen. Davon würden alle Wirtschaftsbereiche und Hochschultypen profitieren, welche von den neuen Basistechnologien betroffen sind oder sich an deren angewandter Entwicklung beteiligten (wie beispielsweise DLT, Cybersicherheit, Quantentechnologien oder künstliche Intelligenz).

— **Zugang zu europäischer Forschungsförderung sichern:**
Um eine Spezialisierung und Exzellenz in digitalen Basistechnologien zu erreichen, ist der zukünftige Zugang zur europäischen Forschungsförderung essenziell (z.B. das «Digital Europe»-Programm). Der SWR schlägt deshalb die Schaffung einer interdepartementalen Arbeitsgruppe vor, welche interne Verfahren und Massnahmen für die Bundesverwaltung entwickelt, die auf transversalere Weise die Kohärenz zwischen der internationalen BFI-Politik und anderen Bereichen der öffentlichen Politik in der Schweiz sicherstellen. Dazu zählen insbesondere nationale Sicherheit, Aussen-, Entwicklungs- und Wirtschaftspolitik (Art. 41 Abs. 3 Bst. b FIFG). Diese Arbeitsgruppe wäre ein mögliches Instrument, um die zukünftige Zusammenarbeit der Schweiz mit dem 9. EU-Rahmenprogramm und den strategischen Ausbau ihrer Zusammenarbeit mit aussereuropäischen Ländern proaktiv zu fördern.[20]

— **Talente halten:**
Schweizer Hochschulen bilden exzellente Wissenschaftler und Forschende aus, die aus der ganzen Welt stammen. Diese hochqualifizierten Talente verlassen nach dem Abschluss ihrer Diplome oft wieder die Schweiz. Es ist im Interesse der Schweizer Volkswirtschaft, führenden Anbietern wie Start-ups diese Talente im Land zu erhalten. Der SWR begrüsst deshalb die aktuellen Bestrebungen im Parlament, diesen Talenten optimale Rahmenbedingungen zu bieten, um in der Schweiz ihre eigenen Unternehmen zu gründen.

Innovation:

— **Regulierung:**
Um die Nutzung neu entstehender und sich rapide entwickelnder Technologien zu fördern, ist es unerlässlich, ein produktives Innovations-Ökosystem zu schaffen, welches Anreize setzt, um mit solchen Technologien zu experimentieren. Der SWR ruft deshalb zu einer ausgewogenen Regulierung des Bereichs auf, die einerseits Konsumentenrechte und Systemstabilität wahrt, aber andererseits genügend Experimentierraum schafft und etablierten Anbietern wie auch Start-ups faire Chancen bietet. Um in der internationalen Finanzdienstleistungsindustrie wettbewerbsfähig zu bleiben, sind dynamische, vorausschauende Regulierungsakteure und hohe Standards beim Datenschutz vorteilhaft. Speziell mit Blick auf die vertrauenswürdige und sichere Aufbewahrung und Verwaltung von Daten könnte die Schweiz kompetitive Vorteile aufweisen. Dies bedingt aber den weiteren Ausbau der Expertise im Bereich der Cybersicherheit und eine starke Positionierung im Rahmen der Datenschutzregulierung.

— **Die Venture Capital-Szene stärken:**
Der SWR begrüsst die Gründung der Swiss Entrepreneurs Foundation als einen wichtigen Schritt bei der Stärkung der Schweizer Venture Capital (VC)-Szene. Um das VC-Ökosystem aber noch weiter zu stärken, ruft der SWR zur Umsetzung ähnlicher Initiativen auf Bundes- und kantonaler Ebene auf, speziell um auch ausländische Investoren und deren Expertise anzuziehen. Solche Initiativen könnten (teilweise) Matching-Funds, beschränkte Risikoabsicherung und Intermediation beinhalten.

— **Technologietransfer:**
Um die Geschwindigkeit des Technologietransfers und der Adoption und Kommerzialisierung dieser Technologien durch Unternehmen zu erhöhen, sollten Firmen und Hochschulen zusammenarbeiten, um Plattformen zu etablieren, die eine beidseitig motivierte Interaktion fördern («Technologie Push» und «Demand Pull»).[21] Solche technologie-zentrierte Plattformen ermöglichen eine produktive Nutzung der bereits existierenden Expertise und die Realisierung von Synergien und Technologieaustausch. Die Schaffung eines interdisziplinären, branchenübergreifenden Kompetenzzentrums (wie beispielsweise das «Digital Catapult» in Grossbritannien,[22] ein Paradebeispiel einer «multi-sphere»-Institution) könnte in Zusammenarbeit mit bestehenden Innovationsparks und neuen thematischen Netzwerken der Innosuisse geschehen. Zusätzlich könnte der Einbezug von Regulierungsbehörden im Rahmen solcher «multi-sphere»-Institutionen innovationsfördernd sein. Ein solcher Einbezug und aktiver Austausch würden rechtliche Unsicherheiten reduzieren und die Weiterentwicklung von Regulierungsgrundlagen fördern.

19 SWR (11. Juni, 2018). Empfehlungen des Rates zum Thema Cybersicherheit (Brief zuhanden von Bundesrat J. Schneider-Ammann, Bundesrat U. Maurer, Bundesrat G. Parmelin und Bundeskanzler W. Thurnherr).

20 SWR (s.d.). Empfehlungen des Schweizerischen Wissenschaftsrates SWR für die BFI-Botschaft 2021–2024. [Noch nicht veröffentlicht].

21 SWR (s.d.). Empfehlungen des Schweizerischen Wissenschaftsrates SWR für die BFI-Botschaft 2021–2024. [Noch nicht veröffentlicht].

22 https://www.digicatapult.org.uk/our-story/

- **Öffentlicher Konsum:**
  Basierend auf der Notwendigkeit einer erhöhten Technologieadoptionsrate ermutigt der SWR Bundes- und Kantonsakteure, durch das öffentliche Beschaffungswesen die Rolle von Erstanwendern zu übernehmen. So würden Bürgerinnen und Bürger nicht nur zur Nutzung neuer Technologien angeregt, sondern es würde auch die Basis für eine kritische Masse von Konsumenten und Investitionen für FinTech-Firmen geschaffen. Gleichzeitig könnten öffentliche Dienstleistungen effizienter und anwendungsfreundlicher gestaltet werden.

- **Standards für Forschungsförderung und geistiges Eigentum:**
  Um die Zusammenarbeit zwischen der Industrie und Hochschulen rund um innovative Technologien weiter zu erleichtern, würden beide Akteure von selbst-definierten Standards und Regeln profitieren. Darin können Hochschulen transparent darlegen, unter welchen Bedingungen industrielle Forschungsförderung zustande kommen kann und wie Rechte an geistigem Eigentum übertragen und lizensiert werden können.

- **Zugang zu europäischen Märkten:**
  Um die Einschränkung der kleinen Marktgrösse zu überwinden, müssen Start-ups und führende Anbieter Zugang zu den europäischen Märkten haben. Unter diesem Aspekt muss sich die Schweiz schnellstmöglich bezüglich den EU GDPR- und PSD2-Regulationen und der «open banking»-Diskussion positionieren. Dies führt ebenfalls zu mehr Rechtssicherheit, was dem Schweizer Innovations-Ökosystem zuträglich ist.

Réflexions et recommandations du CSS

Le secteur des services financiers comprend les banques, les (ré)assureurs ainsi que les activités en lien avec des prestations financières et d'assurance. Avec une productivité supérieure à la moyenne des autres secteurs de services, il revêt une grande importance économique mais aussi systémique pour la Suisse. Le pays, qui représente environ 21% du volume de marché international, reste le plus grand centre de gestion de fortune au monde. La productivité du secteur bancaire a toutefois connu une croissance inférieure à la moyenne ces dernières décennies, d'une part, à cause de la levée du secret bancaire et, d'autre part, en raison de la faible et lente adoption des nouvelles technologies. Ce sont justement ces technologies financières (ou FinTech), moteur du changement structurel à l'œuvre dans le secteur, qui intéressent le Conseil.

Dans le cadre de son analyse politique, le CSS se penche sur le développement, la diffusion et les effets disruptifs des nouvelles technologies financières dans le secteur des services financiers. Les réflexions et recommandations du Conseil concernent surtout les acteurs du système de formation, de recherche et d'innovation (système FRI). Cette restriction du champ de l'analyse correspond toutefois au rôle du CSS en tant qu'organe de conseil indépendant qui envisage le système FRI dans une perspective à long terme.

Les nouvelles technologies financières servent de terreau aux innovations financières. On entend par là le développement et la diffusion de nouveaux instruments financiers ainsi que de nouveaux établissements et marchés financiers. De telles innovations peuvent parfois prendre la forme de produits ou de processus. Les nouveaux contrats dérivés, les nouveaux titres d'entreprise et les nouvelles formes de produits de placement groupés sont des exemples d'innovations de produits. Les innovations de processus désignent de nouvelles façons de distribuer des titres ou encore d'exécuter ou d'évaluer des transactions.

Principaux résultats

L'étude de cas multiméthodes décrite dans la présente publication (2de partie) a fourni au Conseil les informations nécessaires pour mieux évaluer les évolutions technologiques potentiellement disruptives qui sont d'actualité dans le secteur des services financiers. Le CSS a mené à cet effet une enquête Delphi auprès d'experts issus de l'économie, de la formation et de la recherche ainsi qu'auprès d'autorités administratives et de surveillance. Les résultats de cette enquête mise en œuvre par des chercheurs de l'Université technique de Berlin ont ensuite fait l'objet d'une discussion et d'un approfondissement avec des experts au cours de cinq entretiens semi-structurés. Enfin, le Conseil a animé un atelier lors duquel différents scénarios et possibles champs d'action ont été débattus avec des experts impliqués dans l'enquête ainsi qu'avec des invités. Dans le cadre de ce projet, le CSS s'est surtout intéressé au rôle des acteurs de la formation, de la recherche et de l'innovation, et à la manière dont ceux-ci pouvaient contribuer à une utilisation aussi productive que possible des technologies potentiellement disruptives. Les principaux résultats de l'étude de cas sont résumés ci-après, sous forme de réponse aux questions clés soulevées par le Conseil, et donnent lieu à une réflexion critique.

1. *D'après les experts, quelles évolutions technologiques devraient à l'avenir transformer l'activité commerciale (hardware, software, wetware)?*

   Les résultats de l'enquête Delphi montrent que les experts considèrent les technologies ci-dessous comme essentielles pour la survie de l'activité:

   i. Technologies de cybersécurité et identité électronique
   ii. Technologie des registres distribués (*Distributed Ledger Technology,* DLT)
   iii. Algorithmes et intelligence artificielle (IA), automatisation
   iv. Cryptomonnaies

2. *Quelles technologies menacent les prestataires établis? Quelles technologies profitent aux start-up?*

   De l'avis des experts, ce sont les technologies efficaces seulement à partir d'une certaine quantité de données ou d'un certain nombre de clients qui présenteront un grand intérêt pour les prestataires établis ou favoriseront leur collaboration avec des start-up (IA, DLT). Au contraire, les technologies qui changent radicalement la logique selon laquelle les services sont fournis (souvent en supprimant des intermédiaires) possèdent un fort potentiel disruptif et constituent une menace pour les prestataires (DLT, cryptomonnaies, automatisation).

Bien que la cybersécurité soit fondamentale à leurs yeux pour la pérennité d'une entreprise, les experts ne sont pas unanimes sur le potentiel disruptif de cette technologie. Tandis que certains y voient une simple nécessité, d'autres considèrent qu'elle est à la base de nouveaux modèles commerciaux dans les domaines de la conservation et du négoce du véritable bien que sont devenues les données.

3. *Quels sont les principales opportunités et les principaux risques pour le secteur suisse de la finance (en matière de technologies, de réglementation, de modèles commerciaux, etc.)?*

Les experts distinguent surtout des opportunités dans les domaines où la Suisse est considérée comme une économie stable et innovante, et notamment comme un partenaire crédible pour lequel la fiabilité est importante. Si les cryptomonnaies possèdent un fort potentiel selon certains experts, elles présentent un risque pour d'autres dans la mesure où elles pourraient nuire à la bonne image de la Suisse. La transformation des modèles commerciaux due à la transition de biens monétaires à des biens non monétaires (comme les données) pourrait constituer une particularité future de la place financière helvétique, pour autant que cette dernière puisse compter sur une cybersécurité de pointe et un cryptage ultramoderne. Tandis que plusieurs experts louent le cadre réglementaire de la Suisse, celui-ci devra continuer à se développer en fonction des évolutions technologiques et à bien peser les intérêts des prestataires établis et des start-up. Les entreprises helvétiques peuvent rapidement perdre les avantages concurrentiels dont elles bénéficient encore si elles n'utilisent pas les données qu'elles détiennent de manière plus productive. Elles seraient alors menacées par une disruption venue d'entreprises extérieures au secteur de la finance (principalement d'entreprises technologiques étrangères).

Les actuels avantages que présente la Suisse, tels que les prestataires de services financiers d'envergure mondiale et l'infrastructure de très bonne qualité, pourraient se muer en inconvénients pour le développement et l'adoption de nouvelles FinTech. On le constate d'ores et déjà avec le faible taux d'adoption des technologies par les consommateurs helvétiques. Il est donc plus difficile pour les start-up recourant aux FinTech de toucher une masse critique de clients. De ce point de vue, la disruption constitue un danger non seulement pour les prestataires établis, mais aussi pour la place financière suisse dans sa globalité en tant qu'acteur reconnu du marché mondial.

4. *Comment les prestataires établis gèrent-ils la possibilité d'une disruption? En quoi les start-up sont-elles disruptives?*

D'après les experts, les prestataires établis ont beau être très au fait des évolutions technologiques, ils hésitent souvent à se les approprier ou peinent à adapter leur modèle commercial, car cela équivaudrait à de l'«autocannibalisme». Par définition, les innovations disruptives ne peuvent être qualifiées comme telles qu'a posteriori; pourtant, il y a tout lieu de penser que certaines FinTech possèdent le potentiel nécessaire. C'est notamment le cas des technologies qui remettent en cause le rôle central joué par les prestataires financiers en tant qu'intermédiaires et pourvoyeurs de confiance, comme les plateformes et la DLT. L'inertie propre aux grandes organisations et les longs processus décisionnels empêchent souvent de réagir avec flexibilité pour intégrer les technologies de manière productive ou adapter son modèle commercial.

Bien que les start-up soient en mesure de concurrencer les prestataires établis en procédant à la désintermédiation susmentionnée et en proposant des services toujours plus axés sur les données, automatisés et personnalisés, la plupart d'entre elles préfèrent la perspective d'une collaboration ou d'une sortie précoce.

5. *Comment les conditions-cadre actuelles influencent-elles l'établissement de technologies potentiellement disruptives et leur effet sur les prestataires établis et les start-up?*

Les experts mentionnent fréquemment les conditions culturelles et réglementaires comme étant les plus pertinentes. L'achat de licences se révélant souvent complexe et coûteux pour les start-up, leur marge de manœuvre expérimentale est limitée. Nombre d'entre elles cherchent donc à collaborer avec des partenaires établis. Et, même si les FinTech offrent la possibilité de croître rapidement et de concurrencer les leaders du marché, les start-up suisses ont plutôt tendance à privilégier la croissance lente et la collaboration, ou y sont-elles contraintes en raison de la taille relativement petite du marché suisse. Pour la plupart des experts, le danger de la disruption réside plutôt dans les entreprises technologiques étrangères que dans les start-up helvétiques. Cela pose des défis de taille non seulement aux prestataires établis, mais aussi aux consommateurs suisses ainsi qu'en matière de souveraineté et de protection des données de ceux-ci.

Bien que les capitaux ne manquent pas en Suisse pour financer les start-up innovantes, plusieurs experts soulignent la nécessité de renforcer et d'améliorer le marché

et la culture du capital-risque. À l'instar du modèle israélien «Yozma», qui comprend des fonds complémentaires étatiques et une assurance risque, les experts réclament des conditions-cadre plus attractives pour faire venir les sociétés de capital-risque et les investisseurs étrangers. Cela aiderait aussi les start-up helvétiques recourant aux FinTech à utiliser de manière productive les technologies potentiellement disruptives.

6. *Comment le système suisse de formation et de recherche peut-il contribuer à une meilleure gestion des opportunités et des risques susmentionnés?*

La collaboration entre les établissements de formation et de recherche et les entreprises soulève inévitablement la question du transfert de savoir et de technologie. La formation peut contribuer de manière décisive à l'utilisation productive des FinTech. D'une part, elle peut préparer les entreprises à intégrer de nouvelles technologies à leurs processus et à adapter leur modèle commercial en conséquence. D'autre part, elle peut permettre à la population d'acquérir les compétences numériques et mathématiques nécessaires à l'utilisation productive de ces innovations. Cela implique aussi l'encouragement d'une culture et d'un esprit d'entreprise ouverts. Les technologies qui se trouvent à la base des FinTech ne sont pas utilisées uniquement dans le secteur de la finance. Par conséquent, la mise sur pied de centres de compétences effectuant des recherches sur la DLT et la cybersécurité profiterait au secteur des services financiers, mais aussi à d'autres branches économiques. Enfin, les experts appellent de leurs vœux une simplification des négociations avec les hautes écoles au sujet de l'encouragement de la recherche et de la commercialisation des résultats obtenus.

Évaluation critique de l'innovation financière

Les résultats de l'étude de cas montrent que les FinTech les plus importantes pour la pérennité d'une entreprise sont généralement des innovations de processus (DLT, automatisation de services, etc.) et parfois des formes mixtes, c'est-à-dire mêlant innovations de produit et de processus (p. ex. les cryptomonnaies, qui sont des placements numériques reposant sur un contrôle décentralisé par DLT). L'étude examine surtout les conséquences des diverses innovations FinTech pour les prestataires établis et les start-up, mais passe rapidement sur leurs répercussions sur le système et la société. Dire que l'innovation n'est pas toujours positive revient presque à faire une lapalissade. Mais si cela se confirme dans tous les secteurs, c'est probablement encore plus vrai pour le secteur de la finance[23]. Les innovations financières engendrent très vraisemblablement un réseau complexe d'externalités s'accompagnant d'effets incertains qui peuvent s'avérer positifs ou négatifs pour le bien-être social. Elles peuvent par exemple encourager une intermédiation excessive, voire destructrice et, partant, provoquer des dégâts économiques à l'échelle mondiale, comme l'a bien montré la crise financière de 2008[24].

Certaines FinTech menacent les prestataires établis du secteur des services financiers suisse, car elles créent de nouvelles possibilités de désintermédiation et peuvent ainsi rendre obsolète le modèle commercial de ces acteurs reconnus. Parallèlement, elles permettent de contrer les stratégies nocives de recherche de rente des intermédiaires, qui ont été à l'origine de la crise financière de 2008. Les FinTech peuvent en outre créer de nouveaux marchés, rendant de cette manière l'allocation des ressources plus simple et plus efficace.

Dans l'ensemble, les innovations financières sont à double tranchant. Le CSS estime donc qu'il faut doter les consommateurs, les collaborateurs et les cadres des aptitudes nécessaires à l'évaluation critique de telles innovations. Il convient par ailleurs de prendre en compte cette ambivalence dans le processus de réglementation du secteur des services financiers. Le défi consiste à trouver un équilibre entre les différents facteurs. L'obligation de protéger les consommateurs, la stabilité du marché et l'infrastructure d'importance systémique se heurtent à la nécessité d'aménager une marge de manœuvre suffisante pour encourager l'innovation bénéfique à l'économie et au bien-être social dans le pays.

Quoi qu'il en soit, la Suisse est fortement tributaire de la disponibilité de prestations financières compétitives. Pour pouvoir tenir, voire renforcer sa position, le pays doit investir dans les FinTech et accroître leur taux d'adoption soit par la pression (cas de nécessité absolue), soit par la formation et l'exemple des utilisateurs précoces (motivation interne et externe).

---

23 L'existence d'un marché ad hoc n'implique pas que l'innovation financière aura forcément des effets positifs (voir Johnson, S. & Kwak, J. [2012]. Is Financial Innovation Good for the Economy? Innovation Policy and Economy, 12[1], 1–16).

24 Ainsi, la possibilité de réduire les risques par la vente de *Credit Default Swaps* a donné lieu à une mauvaise évaluation de quantité de placements financiers, laquelle a permis un octroi excessif de crédits par les banques et les autres prestataires financiers. Ce phénomène a été déterminant dans la naissance de la crise financière de 2008 (voir Foray, D. & Phelps, E.S. [2011]. The challenge of innovation in turbulent times [MTEI working paper n°2011-002]. Lausanne: EPFL).

Renforcement de l'évolution technologique par les programmes de recherche

Dans la plupart des pays occidentaux, dont des champions de l'innovation comme les États-Unis, les programmes de recherche (*mission-oriented policy*) jouissent d'une forte tradition. Ils visent à encourager de nouvelles technologies bien spécifiques à l'aide de mesures prioritaires, ciblées et centralisées, contrairement aux mesures politiques habituelles, qui se concentrent uniquement sur les conditions-cadre.

Par tradition, la Suisse n'opte que rarement pour un tel interventionnisme et privilégie la plupart du temps des mesures reposant sur la promotion générale de conditions-cadre optimales, les forces du marché, les initiatives entrepreneuriales spontanées et les fonctions coordinatrices pour relever les défis technologiques à venir. La renonciation aux programmes de recherche s'appuie sur les arguments suivants, bien connus:

i. L'État et le gouvernement ne sont pas en mesure de fixer des priorités et des objectifs stratégiques.
ii. De telles mesures peuvent entraîner une distorsion du marché.

Il est vrai que ces arguments se révèlent pertinents dans certaines circonstances. Lorsqu'elle est mal conçue, la recherche sous forme de programmes peut en effet facilement et rapidement se transformer en planification centralisée[25].

De tels programmes ne sont toutefois pas obligatoirement mal conçus, comme le montrent des exemples dans d'autres pays; ils peuvent même se montrer très efficaces pour encourager certaines technologies et atteindre des objectifs d'innovation spécifiques. Fondé sur le processus *stage-gate*, le modèle américain ARPA (Advanced Research Project Agency) est un exemple de programme qui fonctionne bien.[26] Flexibilité dans l'organisation, conception selon l'approche *bottom-up*, latitude dans le choix des projets et gestion de projet active sont ses principales caractéristiques, qui requièrent des collaborateurs doués, autonomes et indépendants. La documentation relative au modèle ARPA met en évidence les points suivants:

- Il est possible d'organiser avec succès les processus de recherche et d'innovation *qui remplissent une mission fondée sur les technologies ou qui poursuivent des objectifs supérieurs.*
- Le modèle ARPA se prête particulièrement à l'encouragement de secteurs technologiques *dotés de technologies de base qui restent pour l'essentiel inexplorées et possèdent un fort potentiel d'amélioration.*
- Le modèle ARPA peut également servir à *supprimer les frictions de marchés autour d'idées et de technologies* dans les domaines où le chemin entre l'idée et sa mise en œuvre est parsemé d'embûches (dans le secteur de l'énergie, où démonstration et mise à l'échelle nécessitent un capital élevé, dans les domaines à forte inertie en raison de l'infrastructure existante, etc.).

25 Cela concerne aussi les constellations principal-agent, dans lesquelles un principal (le gouvernement) décide selon l'approche *top down* comment il incite les agents (les entreprises) à mettre un plan en œuvre. Le flux d'informations au niveau des agents est donc mauvais.

26 Azoulay, P., Fuchs, E., Goldstein, A.P., & Kerney, M. (2019). Funding Breakthrough Research: Promises and Challenges of the 'ARPA Model'. Innovation Policy and the Economy, 19(1), 69-96.

Recommandations

Bien que le secteur des services financiers soit principalement réglementé par des acteurs extérieurs au système FRI, ceux qui en font partie peuvent contribuer de manière substantielle à l'utilisation productive des FinTech potentiellement disruptives. En s'appuyant sur l'étude de cas présentée ici ainsi que sur les autres travaux qu'il a réalisés jusque-là, le CSS recommande les mesures ci-dessous dans les domaines de la formation, de la recherche et de l'innovation. L'étude de cas lui a permis de mieux comprendre les innovations disruptives et les différentes manières de les aborder. Le Conseil est donc conscient que la plupart des recommandations qui suivent revêtent un caractère générique, mais il considère que c'est l'un des points forts de la présente analyse étant donné que les changements dus aux innovations numériques concernent au même titre des acteurs à différents niveaux dans de nombreux secteurs économiques. Ce fait s'inscrit en outre dans l'argumentaire du CSS, qui est d'avis que l'organisation et la gestion de la numérisation doivent avoir lieu de manière systémique plutôt que par le biais de mesures et programmes isolés.

Formation:

- **Encouragement systémique des compétences numériques ainsi que de la culture et de l'esprit d'entreprise:**
  Pour accroître de manière similaire les taux d'adoption des technologies chez les acteurs du marché et chez les entreprises, le système suisse de formation doit doter ces derniers d'aptitudes et de compétences adéquates, lesquelles s'inscrivent en complément aux technologies numériques émergentes et en permettent une utilisation productive. Cela implique la nécessité de créer un lien entre sciences sociales d'une part et mathématiques et informatique d'autre part. Les décideurs politiques doivent être conscients qu'un tel encouragement demande une planification, une mise en œuvre et une coordination systémiques, et doit englober tous les niveaux, de la formation élémentaire à la formation tertiaire, formation continue y comprise[27, 28].

  - *Consommateurs/citoyens:* Il convient de doter les consommateurs et citoyens des connaissances et aptitudes qui leur permettent de garantir la souveraineté de leurs données. Le taux d'adoption des technologies dépend aussi de la compétence numérique (*digital literacy*) ainsi que de l'état d'esprit et de la curiosité. Là encore, la formation est un précieux outil de promotion.
  - *Collaborateurs/cadres:* Pour parvenir à une meilleure productivité grâce à l'interaction entre l'homme et la machine et, parallèlement, créer une résilience vis-à-vis des technologies potentiellement disruptives, le système de formation doit munir les collaborateurs et les cadres de compétences numériques qui vont bien au-delà de la simple maîtrise des outils et de la programmation informatiques. Il s'agit de développer les dimensions scientifiques, sociales et créatives de l'interaction avec de nouvelles technologies et d'importants volumes de données ainsi que les aspects de la pensée computationnelle (*computational thinking*), de la réflexion critique et de l'empathie. Il faut également des formations (continues) pratiques qui promeuvent la culture et l'esprit d'entreprise, notamment en incitant à prendre des risques et à apprendre de ses erreurs.
  - *Dirigeants:* Les dirigeants doivent acquérir des aptitudes pour mieux intégrer les technologies émergentes à la stratégie d'entreprise et aux processus de production, et pour adapter leur modèle commercial en conséquence. La formation joue un rôle clé dans l'encouragement de la compréhension stratégique et de l'appréciation de ces technologies et de leur potentiel.

Recherche:

- **Renforcement des compétences dans les domaines de la DLT et de la cybersécurité:**
  Le CSS salue la décision du Conseil fédéral d'intégrer le thème des FinTech à la version actualisée de la stratégie «Suisse numérique»[29]. En particulier au regard de l'expertise technologique susmentionnée, il est primordial que les établissements de recherche étendent leurs compétences dans les domaines de la DLT et de la cybersécurité, et qu'ils y définissent et établissent des niches stratégiques. En ce qui concerne les infrastructures cruciales pour la sécurité nationale (comme les marchés financiers), le CSS propose la mise en place d'un nouveau mécanisme d'encouragement, éventuellement fondé sur le programme BRIDGE, à mi-chemin entre le FNS et Innosuisse. Actuellement, il faudrait à BRIDGE des financements, mais aussi un renforcement stratégique, pour devenir un instrument efficace en faveur de la très urgente politique en matière de technologies. Afin d'affiner son profil, cet instrument devrait s'inspirer des programmes de recherche, p. ex. du modèle ARPA (voir encadré plus haut)[30].

27 CSSI. (2017). Notions of disruption. Étude exploratoire 3/2017. Berne: CSSI.

28 CSS. (s.d.). Recommandations du Conseil suisse de la science CSS relatives au message FRI 2021–2024. [Non encore publié].

29 OFCOM. (2018). Stratégie «Suisse numérique». Biel/Bienne: Direction opérationnelle Suisse numérique (GDS) de la Confédération.

30 CSS. (11 juin, 2018). Empfehlung des Rates zum Thema Cybersicherheit (lettre à l'attention du conseiller fédéral J. Schneider-Ammann, conseiller fédéral U. Maurer, conseiller fédéral G. Parmelin et chancelier de la Confédération W. Thurnherr).

Un modèle de ce genre, fondé sur le processus *stage-gate*, compléterait idéalement les mécanismes d'encouragement qui existent déjà en Suisse. Il profiterait à l'ensemble des secteurs économiques et des types de hautes écoles concernés par les nouvelles technologies de base ou participant à leur application (DLT, cybersécurité, physique quantique, IA, etc.).

— **Garantie de l'accès à l'encouragement de la recherche au niveau européen:**
Pour se spécialiser dans les technologies numériques de base et y atteindre l'excellence, il faut pouvoir accéder à l'encouragement de la recherche au niveau européen (p. ex. au programme «Europe numérique»). Par conséquent, le CSS propose la création d'un groupe de travail interdépartemental qui élaborerait pour l'administration fédérale des processus et mesures internes garantissant de manière transversale la cohérence entre la politique internationale FRI et les autres domaines de la politique publique helvétique, dont font notamment partie la sécurité nationale ainsi que la politique étrangère, économique et de développement (art. 41 al. 3 lit. b LERI). Ce groupe de travail permettrait de promouvoir de façon proactive la collaboration future de la Suisse avec le 9e programme-cadre de l'UE et l'élargissement stratégique de sa collaboration avec les pays non membres de l'UE[31].

— **Conservation des talents:**
Les hautes écoles suisses forment d'excellents scientifiques et chercheurs venant du monde entier qui, bien souvent, quittent le pays une fois leurs diplômes obtenus. Il est dans l'intérêt de l'économie suisse, prestataires établis comme start-up, de retenir ces talents. C'est pourquoi le CSS salue les efforts actuellement déployés au sein du Parlement pour offrir à ces personnes des conditions-cadre optimales lorsqu'elles créent leur entreprise en Suisse.

Innovation:

— **Réglementation:**
Afin d'encourager l'utilisation des technologies émergentes et de celles qui se développent rapidement, il est indispensable de créer un écosystème propice aux innovations productives, c'est-à-dire qui incite à expérimenter lesdites technologies. Le CSS appelle donc de ses vœux une réglementation équilibrée de ce secteur qui garantisse les droits des consommateurs et la stabilité du système, mais aussi qui laisse une marge de manœuvre suffisante et offre les mêmes opportunités aux prestataires établis qu'aux start-up. Pour rester compétitif à l'international dans le secteur des services financiers, il vaut mieux pouvoir compter sur des acteurs dynamiques et prévoyants dans le domaine de la réglementation et sur des normes élevées en matière de protection des données. En particulier en ce qui concerne la conservation et la gestion des données, la Suisse offre des garanties de sécurité et de fiabilité qui lui conféreraient un avantage concurrentiel. Cela nécessite toutefois de poursuivre le développement de l'expertise du pays en matière de cybersécurité et d'affirmer sa position dans le cadre de la réglementation sur la protection des données.

— **Renforcement du marché du capital-risque:**
Le CSS salue la création de la Swiss Entrepreneurs Foundation, qui constitue à ses yeux une étape importante dans le renforcement du marché suisse du capital-risque. Cependant, pour pouvoir aller encore plus loin dans la consolidation de cet écosystème, le Conseil appelle à mettre en œuvre des initiatives similaires aux niveaux fédéral et cantonal susceptibles d'attirer les investisseurs étrangers et leur expertise. Ces initiatives pourraient inclure des fonds (en partie) complémentaires, une assurance-risque limitée et une intermédiation.

— **Transfert de technologie:**
Afin d'accroître la vitesse du transfert de technologie ainsi que l'adoption et la commercialisation de ces technologies, il faudrait qu'entreprises et hautes écoles collaborent à la création de plateformes incitant les deux parties à interagir (*technology push* et *demand pull*)[32]. Ces plateformes centrées sur la technologie permettent une utilisation productive de l'expertise existante ainsi que l'exploitation des synergies et l'échange de technologies. La création d'un centre de compétences interdisciplinaire et intersectoriel (comme la Digital Catapult au Royaume-Uni[33], exemple emblématique d'établissement «multisphères») pourrait avoir lieu en collaboration avec des parcs d'innovation existants et des systèmes d'innovation tels que les réseaux thématiques nationaux d'Innosuisse. En outre, l'implication d'autorités de régulation dans le cadre de tels établissements «multisphères» favoriserait l'innovation; des échanges nourris avec ces autorités permettraient de réduire les zones d'ombre juridiques et contribueraient à étoffer les bases réglementaires.

31 CSS. (s.d.). Recommandations du Conseil suisse de la science CSS relatives au message FRI 2021–2024. [Non encore publié].

32 CSS. (s.d.). Recommandations du Conseil suisse de la science CSS relatives au message FRI 2021–2024. [Non encore publié].

33 www.digicatapult.org.uk/our-story

- **Consommation publique:**
  Face à la nécessité de relever le taux d'adoption des technologies, le CSS demande aux acteurs fédéraux et cantonaux de jouer le rôle d'utilisateurs précoces via les marchés publics. Ainsi, non seulement on inciterait les citoyens à utiliser les nouvelles technologies, mais on parviendrait également à atteindre la masse critique de consommateurs et d'investissements nécessaires aux sociétés FinTech, tout en rendant les services publics plus efficaces et plus conviviaux.

- **Normes relatives à l'encouragement de la recherche et à la propriété intellectuelle:**
  Pour faciliter davantage la collaboration entre industrie et hautes écoles concernant les technologies innovantes, ces deux parties devraient bénéficier de normes et de règles définies par leurs soins. Les hautes écoles y indiqueraient de manière transparente à quelles conditions s'effectuerait l'encouragement de la recherche industrielle et comment les droits de propriété intellectuelle seraient transférés et feraient l'objet de licences.

- **Accès aux marchés européens:**
  La petite taille du marché suisse représente une contrainte que l'accès des prestataires établis et des start-up aux marchés européens peut permettre de surmonter. Compte tenu de ce fait, la Suisse doit prendre position le plus rapidement possible sur le RGPD et la PSD2 de l'UE ainsi que dans le débat relatif à l'*open banking*. La sécurité juridique s'en trouvera améliorée, ce qui sera bénéfique à l'écosystème suisse de l'innovation.

Riflessioni e raccomandazioni del CSS

Il settore dei servizi finanziari comprende banche, società di (ri)assicurazione e attività legate ai servizi finanziari e assicurativi. Questo comparto assume per la Svizzera grande rilevanza sia dal punto di vista economico che sistemico e, rispetto ad altri settori dei servizi, presenta una produttività superiore alla media. Attualmente il nostro Paese si conferma al 1° posto nell'ambito del Wealth Management a livello mondiale, con circa il 21% del volume del mercato internazionale. Tuttavia, negli ultimi decenni la crescita della produttività nel settore bancario è stata inferiore alla media. Tale trend è da ricondursi, da un lato, all'abolizione del segreto bancario e, dall'altro, alla timida e lenta adozione delle tecnologie. Sono proprio queste tecnologie, raggruppate sotto il concetto di tecnofinanza (in breve FinTech), a interessare il Consiglio, in quanto elementi trainanti dell'attuale cambiamento strutturale nel settore.

Nel contesto di questa analisi politica, il CSS esamina lo sviluppo, la diffusione e gli effetti dirompenti delle nuove FinTech nel settore dei servizi finanziari. Le riflessioni e le raccomandazioni si riferiscono principalmente agli attori del sistema dell'educazione, della ricerca e dell'innovazione (sistema ERI). Questa possibile restrizione dell'ambito su cui verte l'analisi è tuttavia in linea con il ruolo del CSS di organo consultivo indipendente che guarda al sistema ERI in una prospettiva globale e a lungo termine.

La nuova tecnofinanza costituisce il trampolino di lancio per generare innovazioni finanziarie, concetto con il quale si intende lo sviluppo e la diffusione di nuovi strumenti e istituti finanziari e mercati. Peraltro, tali innovazioni possono riguardare sia prodotti che processi. Sul piano dei prodotti, ad esempio, costituiscono un'innovazione nuovi contratti derivati, nuovi titoli aziendali o nuove forme di prodotti d'investimento raggruppati. Sul fronte dei processi, invece, si intendono nuovi metodi per vendere i titoli e per gestire o valutare le transazioni.

Conclusioni principali

Il case study multimetodo presentato in questa pubblicazione (parte 2) è servito al Consiglio come riferimento per poter valutare meglio gli attuali sviluppi delle tecnologie potenzialmente dirompenti nel settore dei servizi finanziari. In tale contesto, il CSS ha condotto uno studio Delphi con esperti di aziende, dei settori della formazione e della ricerca nonché con enti amministrativi e governativi. In seguito, le conoscenze emerse da questo studio, realizzato da ricercatori dell'Università tecnica di Berlino, sono state discusse e approfondite con esperti nel corso di cinque interviste semi-strutturate. Infine, il Consiglio ha organizzato un workshop dedicato alla discussione dei vari scenari e dei possibili ambiti d'intervento con esperti che hanno preso parte allo studio Delphi e ad altri ospiti. Nell'ambito di questo progetto, il CSS era interessato principalmente a esaminare il ruolo degli operatori della formazione, della ricerca e dell'innovazione nonché a valutare se e come tali attori possano contribuire a un utilizzo il più possibile produttivo delle tecnologie potenzialmente dirompenti. Di seguito sono riportate le conclusioni principali emerse dal case study, ordinate in base alle domande chiave poste dal Consiglio.

1. *Secondo le previsioni degli esperti, quali sviluppi tecnologici determineranno in futuro cambiamenti nel business (hardware / software / wetware)?*

   Alla luce dei risultati dello studio Delphi, gli esperti ritengono che le seguenti tecnologie rivestiranno un ruolo cruciale per la sopravvivenza delle imprese:

   i. Tecnologie nell'ambito della cybersicurezza e dell'identità elettronica (eID)
   ii. Tecnologie di registro distribuito (Distributed Ledger Technologies, DLT)
   iii. Algoritmi e intelligenza artificiale (IA), automazione
   iv. Criptovalute

2. *Quali tecnologie costituiscono una minaccia per i fornitori affermati? E quali favoriscono le start-up?*

   Secondo il parere degli esperti, le tecnologie la cui efficacia dipende soprattutto da quantità di dati o basi clienti sufficientemente grandi risultano più utili per i fornitori affermati e favoriscono la collaborazione tra questi e le start-up (IA, DLT). Per contro, le tecnologie che modificano radicalmente la logica della fornitura di servizi (spesso attraverso l'eliminazione di intermediari) costituiscono una minaccia per le imprese storiche e hanno un elevato potenziale dirompente (DLT, criptovalute, automazione).

   Sebbene la cybersicurezza sia ritenuta dagli esperti un elemento essenziale per la futura sopravvivenza delle aziende, non tutti sono d'accordo sul suo potenziale dirompente. Mentre alcuni la vedono come una pura e semplice necessità, altri ritengono che offra le basi per la creazione di nuovi modelli di business nell'ambito della conservazione e dello scambio di dati intesi come nuovo asset.

3. *Quali sono i rischi/le opportunità principali per il settore finanziario svizzero (dal punto di vista della tecnologia, della regolamentazione, dei modelli di business ecc.)?*

Gli esperti intravedono delle opportunità specialmente nei settori in cui la Svizzera può contare sull'immagine positiva di economia stabile e innovativa nonché di partner affidabile che attribuisce grande valore alla fiducia e alla credibilità di cui gode tuttora. Mentre alcuni esperti scorgono nelle criptovalute un enorme potenziale, altri le ritengono rischiose, in quanto potrebbero compromettere la buona reputazione del nostro Paese. Spostare i modelli di business dalla custodia di beni monetari alla conservazione di beni non monetari (come i dati) potrebbe rappresentare in futuro un punto di forza distintivo per la piazza finanziaria svizzera, purché si ricorra a tecnologie di codifica e di cybersecurezza all'avanguardia. Sebbene il contesto normativo della Svizzera sia apprezzato da diversi esperti, in futuro anch'esso dovrà tenere il passo con gli sviluppi tecnologici soppesando attentamente gli interessi dei fornitori affermati da un lato e delle start-up dall'altro. Se non inizieranno a utilizzare in maniera più produttiva i propri dati, presto le aziende svizzere potrebbero perdere i vantaggi competitivi di cui godono attualmente. Ad avere un effetto dirompente su queste realtà saranno allora imprese non appartenenti al settore finanziario (soprattutto aziende tecnologiche straniere).

Gli attuali vantaggi competitivi della Svizzera, come ad esempio la presenza di grandi fornitori globali di servizi finanziari e di un'eccellente infrastruttura, potrebbero trasformarsi in futuro in uno svantaggio nell'ambito dello sviluppo e dell'adozione di nuove FinTech. È un effetto già evidente se si osserva il ridotto tasso di adozione delle tecnologie da parte dei consumatori svizzeri. Anche per le start-up FinTech svizzere è quindi più difficile raggiungere una massa critica di clienti. Sotto questo punto di vista, a cadere vittima dell'effetto dirompente non saranno solo i fornitori storici, bensì l'intera piazza finanziaria svizzera in quanto operatore affermato sul mercato globale.

4. *Come gestiscono i fornitori storici l'eventuale effetto dirompente? In che misura le start-up sono dirompenti?*

Secondo gli esperti, i fornitori storici sono ben consapevoli degli sviluppi tecnologici. Tuttavia, molti di essi esitano ad adottare le nuove tecnologie o hanno difficoltà ad adeguare i propri modelli di business, in quanto così facendo s'innescherebbe un processo di «autocannibalismo». Sebbene, per definizione, gli effetti delle innovazioni dirompenti si possano osservare solo a posteriori, forti indizi lasciano presupporre che determinate FinTech abbiano questo potenziale. Ci riferiamo in particolare alle tecnologie che vanno a intaccare il ruolo centrale dei fornitori di servizi finanziari intesi come intermediari e «costruttori di fiducia», come ad esempio le piattaforme web e le DLT. L'inerzia organizzativa e iter decisionali complessi e tortuosi spesso impediscono reazioni rapide e l'integrazione produttiva di tecnologie o l'adeguamento di modelli di business esistenti.

Sebbene le start-up potrebbero mettere alla prova i fornitori affermati attraverso la citata disintermediazione e puntando sempre più su servizi personalizzati, automatizzati e basati sui dati, la maggior parte di esse cerca una collaborazione o abbandona la partita prima del tempo.

5. *In che modo le attuali condizioni quadro influenzano l'affermarsi delle tecnologie potenzialmente dirompenti e i relativi effetti su start-up e fornitori con una posizione dominante?*

Spesso gli esperti intervistati indicano, tra le condizioni quadro più rilevanti, gli aspetti culturali e il contesto normativo. Poiché non di rado l'acquisto di licenze si rivela oneroso o difficoltoso per le start-up, esse non hanno margine a sufficienza per la sperimentazione. Così queste aziende tendono perlopiù a cercare la collaborazione con i fornitori consolidati. E sebbene le FinTech offrano l'opportunità per crescere rapidamente e competere con i leader di mercato, le start-up preferiscono puntare su processi di crescita più lenti e sulla cooperazione, senza contare inoltre che il mercato svizzero relativamente piccolo offre loro scarse possibilità di sviluppo. La maggior parte degli esperti, quindi, intravede il pericolo di effetti dirompenti non tanto nelle start-up svizzere bensì nelle aziende tecnologiche straniere. Tale rischio non mette a dura prova solo i principali fornitori, ma anche i consumatori svizzeri e, con essi, la sovranità e protezione dei dati che li riguardano.

Benché al nostro Paese non manchino i capitali per finanziare start-up innovative, secondo diversi esperti andrebbero maggiormente promossi e rafforzati il settore e la cultura del «venture capital». Prendendo spunto dal modello israeliano «Yozma» basato su un meccanismo di co-investimento pubblico-privato e assicurazioni di rischio, gli esperti ritengono che andrebbero create condizioni quadro più allettanti per attirare investitori e aziende di venture capital straniere. Ne gioverebbero anche le start-up FinTech svizzere, che potrebbero utilizzare in modo produttivo le tecnologie potenzialmente dirompenti.

6. *In che modo il sistema della formazione e della ricerca svizzero può contribuire a gestire meglio i suddetti rischi e opportunità?*

La collaborazione tra gli istituti di formazione e di ricerca e le aziende è sempre legata anche al trasferimento di conoscenze e tecnologie. Nell'ottica di un utilizzo produttivo delle FinTech, il settore della formazione può fornire un contributo considerevole. Ad esempio può preparare le imprese a integrare nuove tecnologie in processi esistenti e ad adeguare opportunamente i modelli di business; allo stesso tempo può dotare la popolazione delle necessarie risorse digitali per far fronte in maniera produttiva a tali innovazioni. In tutto ciò è compresa anche la promozione di una cultura e di «mindset» all'insegna dell'apertura e

dell'imprenditorialità. Le tecnologie di base che rendono possibili le FinTech non sono esclusive del comparto finanziario. Pertanto, la creazione di centri di competenza specializzati nello studio delle tecnologie DLT o della cybersicurezza andrebbero a vantaggio non solo del settore dei servizi finanziari, ma anche di altri rami dell'economia. Infine, gli esperti hanno sottolineato l'esigenza di snellire le negoziazioni con le scuole universitarie nell'ottica della promozione della ricerca e della commercializzazione dei relativi risultati.

Un'analisi critica delle innovazioni finanziarie

Secondo quanto è emerso dai risultati del case study, le FinTech più importanti per la futura sopravvivenza delle aziende sono perlopiù innovazioni sul fronte dei processi (DLT, automazione di servizi ecc.), ma includono anche forme miste di innovazioni che abbracciano sia processi che prodotti (come ad esempio le criptovalute, che si configurano come investimenti digitali basati sul controllo decentralizzato attraverso le DLT). Lo studio esamina prevalentemente il modo in cui le diverse innovazioni FinTech hanno un impatto sui fornitori principali e sulle start-up, ma affronta solo in modo marginale gli effetti di tali tecnologie sul piano sociale e sistemico. È quasi lapalissiano affermare che le innovazioni non sono sempre positive, un giudizio che si applica a tutti i settori, ma che vale in particolare per quello finanziario.[34] È molto probabile che le innovazioni finanziarie creeranno una complessa rete di esternalità, effetti collaterali incerti che possono influenzare in positivo o in negativo il benessere sociale. Le innovazioni finanziarie, ad esempio, possono promuovere un'eccessiva se non addirittura distruttiva intermediazione finanziaria e arrecare così danni economici globali di enorme portata, come ha dimostrato chiaramente la crisi finanziaria del 2008.[35]

Determinate FinTech costituiscono una minaccia per i fornitori affermati del settore svizzero dei servizi finanziari, in quanto queste tecnologie offrono nuove possibilità di disintermediazione, con il rischio di rendere obsoleti gli attuali modelli di business dei fornitori stessi. Al tempo stesso, esse offrono l'opportunità di contrastare le dannose strategie di «rent seeking» attuate dagli intermediari, che sono state all'origine della crisi finanziaria 2008. Inoltre, le FinTech possono dar vita a nuovi mercati, consentendo così un'allocazione delle risorse più semplice ed efficiente.

Analizzate nel complesso, le innovazioni finanziarie presentano quindi un carattere ambivalente. Il CSS ritiene pertanto indispensabile dotare consumatori, forze lavoro e quadri dirigenti delle risorse necessarie per poter sottoporre tali innovazioni a un'analisi critica. Al tempo stesso, occorre tenere conto delle loro caratteristiche ambivalenti anche in materia di regolamentazione del settore dei servizi finanziari. La sfida in questo senso consiste nel trovare un equilibrio tra i diversi fattori. Se da un lato occorre tutelare i consumatori, la stabilità del mercato e le infrastrutture di rilevanza sistemica, dall'altro bisognerebbe anche creare un margine d'azione maggiore per la sperimentazione, al fine di favorire la nascita di innovazioni che andrebbero a beneficio dell'economia svizzera e del benessere sociale.

A parte tutto ciò, la Svizzera dipende fortemente dalla presenza di servizi finanziari competitivi. Per preservare la propria posizione, o per rafforzarla, il nostro Paese deve investire nel settore FinTech e accrescere il tasso di adozione delle nuove tecnologie. Tale accrescimento può essere raggiunto sotto la spinta di fattori esterni (ossia necessità impellenti) oppure favorito attraverso la formazione e fruitori precoci che spianino la strada (ossia attraverso processi di motivazione interna ed esterna).

---

34 Il fatto che esista un mercato ad esse riservato, non significa che le innovazioni finanziarie producono sempre effetti positivi (si veda ad esempio Johnson, S. & Kwak, J. [2012]. Is Financial Innovation Good for the Economy? Innovation Policy and Economy, 12[1], 1–16).

35 Ad esempio, la possibilità di ridurre i rischi attraverso la vendita di credit default swap ha portato a un'errata valutazione di numerosi investimenti finanziari, il che, a sua volta, ha determinato un numero eccessivo di concessioni e assunzioni di credito da parte delle banche e di altri operatori finanziari. Ciò è stato un fattore decisivo della crisi finanziaria del 2008 (si veda ad esempio Foray, D. & Phelps, E.S. [2011]. The challenge of innovation in turbulent times [MTEI working paper n°2011-002]. Losanna: EPFL.

Rafforzare lo sviluppo tecnologico attraverso il meccanismo della ricerca programmatica

Nella maggior parte dei Paesi occidentali – inclusi quelli ritenuti vere e proprie fucine di innovazioni come gli Stati Uniti – la ricerca programmatica («mission-oriented policy») ha una tradizione consolidata. Tali programmi puntano a promuovere nuove, specifiche tecnologie. A differenza delle solite politiche che si limitano a concentrarsi sulle condizioni quadro, essi prevedono misure chiare, centralizzate e priorizzate volte a promuovere una determinata tecnologia.

Per tradizione, la Svizzera non persegue quasi mai simili logiche «interventistiche». Nel nostro Paese vengono più che altro privilegiate misure focalizzate sulla promozione generale di condizioni quadro ottimali, sugli operatori di mercato, su iniziative imprenditoriali spontanee e su funzioni di coordinamento con l'obiettivo di far fronte alle future sfide tecnologiche. Il motivo principale per cui la ricerca programmatica non viene perseguita è legato ad argomentazioni ben note riguardanti

i. l'incapacità dello Stato e del Governo di definire delle priorità, stabilire obiettivi strategici e
ii. il fatto che misure di promozione del genere innescherebbero distorsioni di mercato.

Questi argomenti sono senz'altro validi per certi aspetti. Una ricerca «mission-oriented» mal concepita rischia di trasformarsi in breve tempo in un esercizio di pianificazione centralizzata.[36]

Tuttavia, come dimostrano gli esempi provenienti da altri Paesi, tali programmi non per forza sono mal concepiti: una ricerca «mission-oriented» frutto di un adeguato lavoro di progettazione può rivelarsi estremamente efficace al fine di promuovere determinate tecnologie e conseguire obiettivi specifici sul fronte delle innovazioni. Un esempio di programma ben funzionante è il modello ARPA (Advanced Research Project Agency).[37] Esso si contraddistingue per flessibilità organizzativa, progettazione dei programmi basata su un approccio bottom-up, discrezionalità nella scelta dei progetti e gestione dei progetti attiva. Tutte queste caratteristiche presuppongono al tempo stesso un team di collaboratori di grande talento, indipendenti e autonomi nelle decisioni. Come si può evincere dalla letteratura, il modello ARPA basato sul processo «stage gate» dimostra che

- è possibile organizzare efficacemente processi di ricerca e di innovazione che *perseguono una mission basata sulla tecnologia o obiettivi di livello superiore;*
- esso è particolarmente indicato per promuovere ambiti tecnologici in cui esiste già la tecnologia di base ma che, *per la maggior parte, risultano ancora inesplorati e presentano un enorme potenziale di miglioramento;*
- esso può rivelarsi utile anche per eliminare le *frizioni di mercato in relazione a idee e tecnologie* nei settori in cui la strada che va dall'idea all'effettiva realizzazione è estremamente complicata (ad esempio nel settore energetico in cui sono necessari ingenti capitali per la dimostrazione e la scalabilità oppure in ambiti caratterizzati da una notevole inerzia dovuta alle infrastrutture esistenti ecc.).

36 Si fa riferimento al modello principale-agente in cui il principale (in questo caso il Governo) decide secondo un approccio «top down» gli incentivi da dare agli agenti (in questo caso le aziende) per eseguire un piano. Questo determina un pessimo flusso di informazioni a partire dagli agenti.

37 Azoulay, P., Fuchs, E., Goldstein, A.P., & Kerney, M. (2019). Funding Breakthrough Research: Promises and Challenges of the 'ARPA Model'. Innovation Policy and the Economy, 19(1), 69-96.

Raccomandazioni

Sebbene il comparto dei servizi finanziari sia regolamentato prevalentemente da soggetti esterni al sistema ERI, gli operatori ERI possono contribuire in misura sostanziale a un utilizzo produttivo di FinTech potenzialmente dirompenti. Alla luce del case study qui presentato e dell'ulteriore lavoro svolto finora, il Consiglio raccomanda l'attuazione delle misure illustrate qui di seguito nei settori della formazione, della ricerca e dell'innovazione. Il case study ha permesso al CSS di farsi un quadro più generale circa le innovazioni dirompenti e le relative possibilità di gestione; esso è pertanto consapevole che gran parte delle seguenti raccomandazioni ha carattere generico. Il Consiglio, però, interpreta questo fatto come un punto di forza dell'analisi, in quanto il cambiamento legato alle innovazioni digitali riguarda allo stesso modo stakeholder su diversi livelli e in numerosi settori economici. Questa consapevolezza è inoltre in linea con le argomentazioni del CSS, secondo cui la configurazione e la gestione della digitalizzazione debbano avvenire in modo sistematico anziché attraverso misure individuali e programmi isolati.

Formazione:

- **Promozione sistematica delle competenze digitali nonché di una cultura e di «mindset» di tipo imprenditoriale:**
  Per accrescere in egual modo il tasso di adozione delle nuove tecnologie da parte degli operatori di mercato e delle aziende, il sistema della formazione svizzero deve dotare tutti gli attori coinvolti di risorse e competenze adeguate, che siano complementari alle tecnologie digitali in fase di sviluppo e ne consentano un utilizzo produttivo. A tal fine si rivela altresì indispensabile creare un legame tra le scienze sociali, la matematica e le scienze informatiche. I responsabili della politica devono essere consapevoli del fatto che una simile attività di promozione presuppone un lavoro sistematico di pianificazione, attuazione e coordinamento e che riguarda tutti i livelli della formazione, da quello di base a quello terziario, compresa la formazione continua.[38, 39]

  - *Consumatori/cittadini:* consumatori e cittadini devono ricevere le nozioni e le risorse necessarie che consentano loro di tutelare la sovranità dei dati. Inoltre, il tasso di adozione delle nuove tecnologie dipende dall'alfabetizzazione digitale («digital literacy»), da una mentalità («mindset») aperta e dalla curiosità nei confronti delle tecnologie digitali. Anche la formazione può contribuire alla promozione di tali aspetti.

  - *Forza lavoro/management:* al fine di raggiungere una maggiore produttività attraverso l'interazione uomo–macchina e al tempo stesso insegnare ad assumere un atteggiamento di resilienza verso le tecnologie potenzialmente dirompenti, il sistema della formazione deve trasmettere alla forza lavoro e al management competenze digitali complementari. Ciò va ben oltre le capacità informatiche e si estende a varie modalità di interazione – di tipo scientifico, sociale e creativo – con nuove tecnologie e grandi record di dati nonché ad aspetti legati al «computational thinking», al pensiero critico e all'empatia. Inoltre sono necessarie offerte di formazione (continua) a livello pratico che promuovano una cultura e un «mindset» di tipo imprenditoriale, comprese una maggiore propensione al rischio e una cultura degli errori costruttiva.

  - *Dirigenti:* i dirigenti devono disporre di capacità che consentano loro di integrare più efficacemente le tecnologie in fase di sviluppo nelle strategie aziendali e nei processi produttivi e di adeguare opportunamente i modelli di business. La formazione riveste un ruolo chiave nella promozione della comprensione strategica e nell'analisi delle tecnologie in fase di sviluppo e del relativo potenziale.

Ricerca:

- **Rafforzare le competenze nell'ambito delle DLT e della cybersicurezza:**
  il CSS apprezza il fatto che il Consiglio federale abbia incluso il tema «FinTech» nell'edizione aggiornata della Strategia «Svizzera digitale».[40] Con riferimento in particolare al know-how tecnologico menzionato, è di fondamentale importanza che gli istituti di ricerca svizzeri amplino le proprie competenze negli ambiti delle DLT e della cybersicurezza, definendo e sviluppando inoltre nicchie strategiche. In relazione alle infrastrutture che rivestono un ruolo chiave per la sicurezza nazionale (come i mercati finanziari), il CSS propone di introdurre un nuovo meccanismo di promozione. Esso potrebbe essere strutturato sulla base dell'attuale programma BRIDGE, che getta un ponte

38 CSSI. (2017). Notions of disruption. Studio esplorativo 3/2017. Berna: CSSI.

39 CSS. (n.d.). Raccomandazioni del Consiglio svizzero della scienza CSS relativa al messaggio ERI 2021–2024. [Non ancora pubblicato].

40 UFCOM. (2018). Strategia «Svizzera digitale». Bienne: Direzione operativa Svizzera digitale (GDS).

tra il FNS e Innosuisse. Tuttavia, BRIDGE è al momento privo dei necessari finanziamenti e andrebbe potenziato sul piano strategico per diventare uno strumento efficace della politica tecnologica di cui c'è urgente bisogno. Per affinare il proprio profilo, dovrebbe assumere le caratteristiche della ricerca mission-oriented, allineandosi al modello ARPA (si veda box sopra).[41] Un modello simile a ARPA basato sul processo «stage gate» si integrerebbe alla perfezione con i meccanismi di promozione attualmente in essere in Svizzera. A trarne vantaggio sarebbero tutti i settori economici e tutte le tipologie di scuole universitarie che fanno uso delle nuove tecnologie di base o sono coinvolte nel loro sviluppo applicativo (come ad esempio DLT, cybersicurezza, tecnologie quantistiche e intelligenza artificiale).

— **Garantire l'accesso alla promozione della ricerca a livello europeo:**
al fine di raggiungere specializzazione ed eccellenza nell'ambito delle tecnologie di base digitali, è essenziale garantire in futuro l'accesso alla promozione della ricerca a livello europeo (ad es. al programma «Digital Europe»). Il CSS propone quindi l'istituzione di un gruppo di lavoro interdipartimentale incaricato di sviluppare procedure e misure interne per l'Amministrazione federale che garantiscano in modo più trasversale la coerenza tra la politica ERI internazionale e altri settori della politica pubblica in Svizzera, tra cui in particolare la sicurezza nazionale, la politica estera, la politica di sviluppo e la politica economica (art. 41 cpv. 3 lett. b LPRI). Questo gruppo di lavoro sarebbe un possibile strumento per favorire la futura collaborazione tra la Svizzera e il 9° programma quadro dell'UE nonché lo sviluppo strategico della cooperazione con Paesi extraeuropei.[42]

— **Trattenere i talenti:**
le scuole universitarie svizzere formano eccellenti scienziati e ricercatori provenienti da tutto il mondo. Spesso, una volta conseguito il titolo di studio, questi talenti altamente qualificati lasciano il nostro Paese. È nell'interesse dell'economia nazionale impedire la fuga di questi cervelli per metterli a disposizione sia delle grandi aziende affermate che delle start-up. Il CSS apprezza quindi gli attuali sforzi del Parlamento volti a offrire a questi talenti condizioni quadro ottimali, non da ultimo affinché possano costituire le proprie imprese nel nostro Paese.

Innovazione:

— **Regolamentazione:**
al fine di promuovere l'utilizzo di tecnologie di nuova concezione e in rapido sviluppo è indispensabile creare un ecosistema dell'innovazione produttivo che incentivi la sperimentazione con queste tecnologie. Pertanto, il CSS invita a un'equilibrata regolamentazione del settore che, da un lato, preservi i diritti dei consumatori e la stabilità del sistema e, dall'altro, crei sufficiente spazio per la sperimentazione e offra condizioni eque sia ai fornitori affermati che alle start-up. Per rimanere competitivi nel panorama internazionale dei servizi finanziari, è opportuno che gli enti di regolamentazione si dimostrino dinamici e lungimiranti e che si stabiliscano standard elevati nell'ambito della protezione dei dati. La Svizzera potrebbe presentare vantaggi competitivi in tal senso, specialmente con riferimento all'affidabilità e alla sicurezza con cui vengono conservati e gestiti i dati. Ciò presuppone tuttavia un ulteriore ampliamento del know-how nell'ambito della cybersicurezza e un posizionamento forte nel contesto della regolamentazione in materia di protezione dei dati.

— **Rafforzare il settore del venture capital:**
il CSS apprezza l'istituzione della Swiss Entrepreneurs Foundation quale primo passo lungo il cammino verso il rafforzamento del settore del venture capital (VC) in Svizzera. Al fine di rafforzare ulteriormente l'ecosistema del VC, il CSS invita all'attuazione di iniziative analoghe sia a livello federale che cantonale, in particolare per attirare anche investitori stranieri e il loro know-how. Tali iniziative potrebbero prevedere (in alcuni casi) co-investimenti tra pubblico e privato, una copertura dei rischi limitata e un'attività di intermediazione.

— **Trasferimento tecnologico:**
al fine di accelerare il trasferimento di tecnologie nonché la loro adozione e commercializzazione da parte delle imprese, aziende e scuole universitarie dovrebbero collaborare per creare piattaforme che promuovano un'interazione motivata da entrambe le parti («technology push» e «demand pull»).[43] Tali piattaforme incentrate sulle tecnologie favoriscono un utilizzo produttivo del know-how esistente nonché la realizzazione di sinergie e lo scambio tecnologico. La creazione di un centro di competenza interdisciplinare e trasversale ai settori (come ad esempio «Digital Catapult» in Gran Bretagna,[44] un esempio paradigmatico di istituzione «multisfera») potrebbe avvenire

41 CSS. (11 giugno, 2018). Empfehlung des Rates zum Thema Cybersicherheit (lettera al consigliere federale J. Schneider Ammann, consigliere federale U. Maurer, consigliere federale G. Parmelin e al cancelliere della Confederazione W. Thurnherr).

42 CSS. (n.d.). Raccomandazioni del Consiglio svizzero della scienza CSS relativa al messaggio ERI 2021–2024. [Non ancora pubblicato].

43 CSS. (n.d.). Raccomandazioni del Consiglio svizzero della scienza CSS relativa al messaggio ERI 2021–2024. [Non ancora pubblicato].

44 https://www.digicatapult.org.uk/our-story/

in collaborazione con i già presenti parchi dell'innovazione e nuove reti tematiche di Innosuisse. Inoltre, il coinvolgimento in tale ambito di enti di regolamentazione potrebbe favorire la nascita di innovazioni. Questo coinvolgimento, unito a un dialogo attivo tra le parti interessate, ridurrebbe le incertezze sul piano giuridico e favorirebbe l'ulteriore sviluppo di basi normative.

— **Consumi pubblici:**
a fronte della necessità di accrescere il tasso di adozione delle tecnologie, il CSS incoraggia gli operatori federali e cantonali ad assumere il ruolo di «primi fruitori» attraverso gli acquisti pubblici. In questo modo, non solo i cittadini sarebbero stimolati a utilizzare le nuove tecnologie, ma si creerebbero anche le basi per una massa critica di consumatori e di investimenti per le aziende FinTech. Allo stesso tempo, i servizi pubblici risulterebbero più efficienti e di più semplice utilizzo.

— **Standard per la promozione della ricerca e proprietà intellettuale:**
per agevolare ulteriormente la collaborazione tra l'industria e le scuole universitarie sul fronte delle tecnologie innovative, entrambi gli attori beneficerebbero di standard e regole auto-definiti. Ad esempio, le scuole universitarie potrebbero stabilire in maniera trasparente le condizioni relative alla promozione della ricerca in ambito industriale e il modo in cui possono essere trasferiti e concessi i diritti legati alla proprietà intellettuale.

— **Accesso ai mercati europei:**
per superare i limiti legati alle dimensioni ridotte del mercato svizzero, le start-up e i fornitori principali devono avere accesso ai mercati europei. Sotto questo aspetto, la Svizzera deve definire quanto prima la propria posizione in relazione alle normative GDPR e PSD2 dell'UE e al dibattito sull'«open banking». Ciò determinerebbe peraltro una maggiore sicurezza giuridica, a tutto vantaggio dell'ecosistema dell'innovazione svizzero.

Part 2:

FinTech

Project report on a multimethod
case study conducted by the SSC

1 Introduction

The Swiss Science Council's working programme 2016–2019 entails the "disruptive change in economy and society by technology and other drivers" as one of the three overarching themes and policy topics. After an initial critical assessment of the notions of disruption in the form of an exploratory study (SSIC, 2017), the Council's working group on disruptive change has decided to investigate whether and how the financial services sector might be affected by potential disruptive innovations and what the role of education, research and innovation (ERI) actors could be. This specifically concerns emerging "FinTech" – a simple portmanteau for financial technologies.

The present case study informed the Council in the writing of its first policy analysis under the overarching theme of disruptive change. The goal of such a policy analysis is to give concrete recommendations aimed at central actors in the Swiss ERI landscape – thus pursuing the SSC's mission as a consultative body to the Federal Council, with regard to higher education, research and innovation policy matters that affect Switzerland as a location for science and innovation. Therefore, the case study on FinTech needed to provide the Council with insights into the current and potential future development in the sector, from a technological as well as framework condition's perspective. Uncovering potential gaps in the ecosystem, especially at the intersection of research/education and industry or government respectively, the Council, together with external experts, identified several action fields. These fields were ultimately refined and lead to the formulation of recommendations given by the Council in the first part of this publication.

To gain the necessary expertise in the field, the SSC has relied on different sources and methods of gathering information. First, the Council employed a Delphi survey among experts from industry, research and government bodies to uncover critical technological developments and the most influential framework conditions (Section 2). To deepen and validate the Delphi survey's findings, the SSC subsequently carried out a number of expert interviews (Section 3). Finally, the SSC hosted a workshop to discuss scenarios and potential fields of action with experts from industry and research (Section 4). The main insights from these different data sources as well as the project's general conclusions (Section 5) are presented in the subsequent sections.

History, context and definition

The development of the modern financial services sector in Switzerland is closely linked to the industrial revolution, World War I and the establishment of bank secrecy in 1934. At the beginning of the 20th century, the Swiss financial market rapidly gained international importance (Guex, 2017). Today, the financial services sector, which, among others, includes banks, (re-)insurers, and activities auxiliary to these companies,[45] accounts for a significant portion of the Swiss economy. In terms of occupation (5.2% of FTE in second and third sector)[46], added value (9.3% of GDP)[47], and exports (35.5% of Swiss current account surplus)[48], the sector is vital for the Swiss economy. Additionally, financial institutions play a systemically important role as intermediaries by pooling resources, by providing safekeeping, accounting and payment services, by supplying liquidity, by diversifying risk and by collecting and processing information, thus reducing information cost. Switzerland is also home to two global systemically important banks (Credit Suisse and UBS, see Financial Stability Board, 2017).

While the sector still achieves above-average productivity in comparison to the business sector (measured in CHF/FTE)[49], the banking sector has seen significant below-average growth in the two recent decades. According to Eberli, Emmenegger, Grass, Held, and Rufer (2015), this has been mainly due to the lifting of bank secrecy as well as the low and slow adoption of new technologies. At the same time, it may be exactly these new technologies that will be driving the future development in the financial services sector. While (re-)insurers have seen steady growth, with the establishment of a reinsurance cluster in Zurich, the number of banks has continually been decreasing. Schmuki (2017) names FinTech companies as the drivers of the structural change in the sector. Despite the lack of growth in the banking industry, Switzerland is still home to some of the largest financial service providers in the world, especially in the areas of wealth management and (re-)insurers (e.g UBS, Credit Suisse Group, Swiss Re, Zurich Insurance Group, etc.). Kobler, Bucherer, Schlotmann, and Brandes (2018) estimate that with 1.84 trillion USD or about 21% of the international market volume Switzerland is the largest wealth management centre in the world, closely followed by the UK. Thus, financial services is a significant sector in the national economy and home to big incumbents, which now may face the emergence of potentially disruptive technologies and structural changes.

To understand why and how FinTech might disrupt the Swiss financial services sector (and the financial system worldwide), it is important to understand what is understood by the term and which technologies drive current and future developments. Puschmann (2017, p. 70) refers to FinTech as "innovative financial solutions enabled by IT". He continues by highlighting that these are "often used for start-up companies who deliver those solutions, although it also includes the incumbent financial service providers like banks and insurers". The Institute of Financial Services Zug (IFZ) introduces a similar definition in its annual FinTech Study by referring to FinTech as "software solutions for innovative products, services, and processes in the financial industry, improving, complementing, and/or disrupting existing offerings" (Ankenbrand & Bieri, 2018a, p. 3). Finally, in a semantic analysis, Schueffel (2016, p. 45) concludes that FinTech is "a new financial industry that applies technology to improve financial activities". In their taxonomy, Ankenbrand and Bieri (2018a, p. 3) distinguish six product areas of FinTech, which, however, exclude the field of insurance. Each of them can be backed by different technologies and innovations, labelled as "sub-areas" (see Table 1 below).

Product area	Sub area
Analytics	Big Data, Machine Learning, Artificial Intelligence
Banking infrastructure	Open Bank (API), Identity & Security Management, Information & Transaction, Platforms, Personal & Business Finance Management, Financial Compliance Solutions
Distribute Ledger Technology	Cryptocurrency, Blockchain
Deposit & Lending	Crowdinvesting, Crowdlending, Invoice Trading
Investment Management	RoboAdvisor, Social Trading, Hybrid Models, Advice-supported Digital Investing
Payments	Mobile Payment, Online Payment, Money Transfer

Table 1. Taxonomy of FinTech business models
Source: Ankenbrand and Bieri (2018a)

45 Based on the NOGA 2008 General Classification of Economic Activities, this refers to section K, "financial and insurance activities" (divisions 64–66), see Federal Statistical Office FSO (2008).

46 Data for second quarter 2018, Source: Federal Statistical Office FSO (2018a).

47 Data for 2016 (prognosis), Source: Federal Statistical Office FSO (2018b).

48 Data for 2017, Source: Swiss National Bank SNB (2018).

49 Data for 2016 (prognosis), Source: Federal Statistical Office FSO (2018c).

While important parts of the spectrum of FinTech, technologies such as machine learning (ML), artificial intelligence, platforms and the distributed leger technology (DLT) are not exclusive to the field of financial services. For incumbent financial service providers such technologies pose challenges as they enable the disintermediation of services and the automation of processes and provide the basis for new business models which change established architectural logics of production. However, this also offers opportunities to incumbents to save costs and thus increase labour productivity. At the same time, these technologies enable start-ups to disrupt incumbents with easier-to-use services and products and to offer customers disintermediated and personalised services with lower margins (i.e. lower prices) and new markets which allow for an easier and more effective resource allocation.

The issue of FinTech is of great importance to Switzerland and the Swiss financial services sector. Facing a potential transformation of the sector, incumbent companies need to overcome organisational inertia to integrate the new logics of production and to avoid external disruption. At the same time, FinTech might enable Swiss start-ups to exploit Switzerland's central role in international financial markets and to establish themselves internationally, to challenge incumbents and to shape the transformation of the sector.

The Swiss start-up community is continually growing in the area of FinTech, with over 220 start-ups active in 2017, 36% more than only two years before. In the last five years, especially the business areas of investments management (+40 start-ups), DLT (+31 start-ups) and deposit and lending (+29 start-ups) have seen strong growth (Ankenbrand & Bieri, 2018c). Especially around the city of Zug, the so-called "Crypto Valley" has formed, an ecosystem revolving around distribute ledger technologies and Blockchain (but not exclusive to financial services). According to the IFZ Global FinTech ranking, two Swiss cities (Zurich and Geneva) rank among the top three most robust FinTech ecosystems worldwide (Ankenbrand & Bieri, 2018b). Additionally, among the few "unicorns" in Switzerland (privately held start-ups valued at or above one billion USD), is Avaloq Group – a FinTech company.[50]

Relevance of FinTech for ERI policy

In Switzerland, on a policy and regulatory level, FinTech is an important issue for the Swiss Financial Market Supervisory Authority (FINMA), the State Secretariat for International Finance (SIF), the Swiss National Bank (SNB) and the Federal Office of Justice (FOJ). For instance, there exists a round table of representatives of industry and government officials, which regularly discusses current issues revolving around FinTech. In January 2018 the SIF established a working group, which will review the legal framework and identify any need for action with regard to Blockchain and initial coin offerings (ICO).[51] In February 2018 FINMA published guidelines with regard to the ICO[52], and in August 2018 FINMA opened the consultation on the Anti-Money Laundering Ordinance (AMLO-FINMA), which was necessary after the Swiss parliament launched a new licencing category under the Banking Act (BA), the so-called "FinTech" licence.[53]

However, as the development, establishment and productive exploitation of new and emerging technologies is also a question of successful and effective knowledge and technology transfer, FinTech should also be of concern for ERI actors. Additionally, most of these technologies are based on results from basic research at higher education institutions – and their development is still heavily influenced by new research (for instance in the area of artificial intelligence, machine learning and cybersecurity). While some issues might be generally observed in other emerging technologies and industrial sectors as well, the financial services sector also displays some unique characteristics, which make the productive exploitation of FinTech a special challenge for ERI actors. The high degree of national and international regulation in the financial services sector is of special consideration in shaping a productive innovation ecosystem. Not only should small and young companies be able to access the market and collaborate with incumbents, but also should established companies be able to expand abroad and attract foreign talents and investments. At the same time, to allow for a fast but smooth transition and adaption of emerging technologies, suppliers of education and research play a key role in equipping employees and managers with the necessary skill-set, thus fostering the resilience of the workforce.

50 http://fintechnews.ch/fintech/fintech-insurtech-unicorns/18441/

51 https://www.admin.ch/gov/en/start/documentation/media-releases.msg-id-69539.html

52 https://www.finma.ch/en/news/2018/02/20180216-mm-ico-wegleitung/

53 https://www.finma.ch/en/news/2018/08/20180828-mm-gwv-finma/

Whether incumbents in the financial services sector will be disrupted or not, whether by start-ups or foreign companies is not of direct relevance for the Swiss ERI system. However, it is of importance to exploit the potential of FinTech wherever Switzerland might establish new strategic niches, based on its good starting position, potential and competitive advantages. Here, the ERI system plays a key role as it educates talents, delivers the necessary research and technologies and shapes the relevant framework conditions for a thriving and productive ecosystem.

The SSC's central questions

In preparing this case study on FinTech, the SSC's working group on disruptive change formulated several key questions, which the Delphi survey, expert interviews and concluding workshop should answer:

1. What technological changes do experts foresee changing the business (hard-/soft-/wetware)?

2. Which technologies threaten incumbents ("what keeps CEOs up at night")? Which technologies empower start-ups?

3. What are the biggest threats/opportunities for the Swiss financial sector (linked to technology, regulation, business models, etc.)?

4. How do incumbents deal with possible disruption ("what makes a smart incumbent")? How are start-ups being disruptive?

5. How do current framework conditions affect the establishment of these potentially disruptive technologies and their effects on incumbents and start-ups?

6. What does the Swiss education/research system provide to address the mentioned threats/opportunities?

2 Delphi survey[54]

2.1 Project

The Delphi survey is a method for collecting expert opinions in an interactive process that limits sources of bias, which tend to exist in personal interactions.[55] In several rounds, experts are confronted with a list of items on which they offer feedback while reviewing the overall results from the previous round. By anonymising the expert contributions, influences such as reputation, personality traits (persuasiveness, etc.), and rhetoric skills are excluded. With several rounds of assessments, the results can be refined through reflecting on previous expert assessments, which typically (though not necessarily) enables convergence of ideas. The Delphi method is thus situated between pre-formulated surveys with questionnaires and flexible methods such as workshops or interviews. It is therefore a suitable method to investigate a wide or complex field, as it provides an overview, structuring, and beginning hypothesis propositions. This survey style also offers the possibility to reduce bias sources through the organisers' conceptual framework: The experts are not provided with specific factors for evaluation, but instead explore the field themselves, anonymously, with minimal guidance from the organisers.

In exploring which FinTech might become critical for future survival and how framework conditions affect these developments, the SSC has decided to carry out such a Delphi survey with an expert panel of 12 people, three each from research, start-ups, industry incumbents and governmental bodies. The survey focused on technological aspects (future development of FinTech) and the influence of framework conditions. These were divided into three spheres (economy, government/administration, research/education), based on the Triple Helix Model, as presented by Ranga and Etzkowitz (2013). The Triple Helix Model is an analytical framework for innovation policy in a knowledge society and also served the SSC later in identifying potential thematic overlaps and gaps leading to the formulation of fields of action. In their framework, research and education (originally referred to as "university") plays an enhanced role in knowledge societies, based on three factors:

1. Involvement in socio-economic development ("third mission")
2. Capacity to provide students with new ideas, skills and entrepreneurial talent
3. Capacity to generate technology.

A schematic depiction of the four areas surveyed by the experts can be found in Figure 1 below.

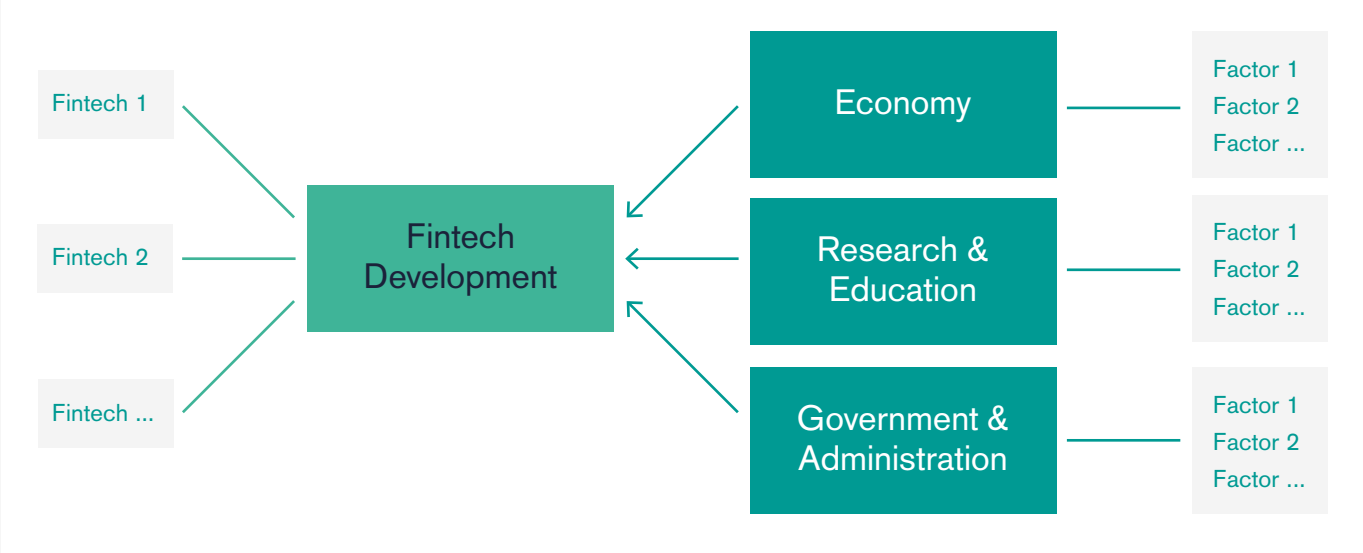


Figure 1. Surveyed areas and factors
Source: Project report TU Berlin

54 Excerpts in this section are based on the final project report delivered to the SSC by TU Berlin. It is available from the SSC' webpage under the following link: https://wissenschaftsrat.ch/images/stories/pdf/en/2019_05_SSC_TU_Berlin_Delphi_survey_FinTech.pdf

55 The method has initially been developed by RAND Corporation in the 1960s, see Dalkey and Helmer (1962).

The experts were selected by the SSC working group according to their association to create an as wide and diverse an expert field as possible. The Delphi study was carried out in a classic three-round approach, which was adapted to a more open brainstorming session in the first round (see Figure 2). Unfortunately, over the three rounds the number of experts actively participating in the survey decreased. Ten of the original 12 confirmed experts contributed to the first round, while eight experts contributed to the second and third rounds.

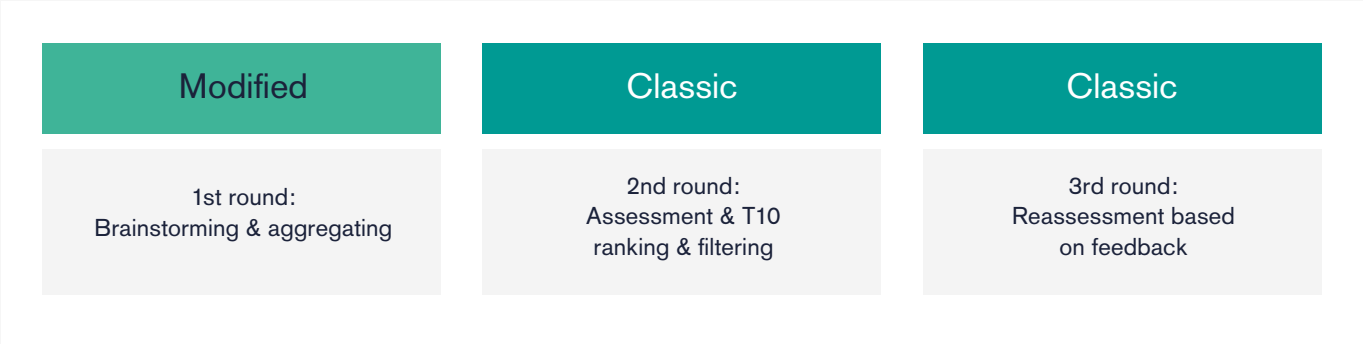


Figure 2. Three steps of the Delphi survey
Source: Project report TU Berlin

In the first round, the blog-like brainstorming allowed the experts to review the pre-existing content and contribute their ideas in real time. The second round was a classic Delphi evaluation with two estimations per item under expected and optimal conditions. The third round was a review of the experts' estimations of the top 10 listed items based on the feedback from the second round.

The SSC mandated an external partner from TU Berlin (Chair of Innovation Management) to implement and carry out the Delphi survey using an online platform and to produce a project report, including a discussion of results. The survey itself and evaluation of the collected data were carried out between September 2017 and February 2018. Participants were granted an anonymous evaluation of their data, but also had the chance to signal if their names and affiliation should be listed in the SSC's final report (see Annex).

2.2
Insights: Technologies

In the first round, the brainstorming phase, experts were asked to enter any FinTech they know and were also invited to add further entries based on the other experts' anonymous inputs. A total of 74 items were entered in this round, which were then aggregated by a researcher from TU Berlin to a list of 29 unique items.

In the second round, the experts were then asked to rank these technologies based on their expected (under current framework conditions) and potential (under optimal framework conditions) importance with regard to business survival in five years. The scale ranged from 1 ("small") to 5 ("critical").[56] Larger differences between expected and potential importance hint at technologies where an improvement of framework conditions could lead to a growing future importance and thus areas for policy action.

In the third and final round, the experts were asked to re-evaluate their previous ranking based on the other experts' ranking, but were only presented the top 10 ranking technologies. This re-evaluation is an important step, as it allows for a convergence of opinion or gives signs for issues on which experts explicitly don't agree on or have polarising opinions.

The final ratings and top 10 ranked technologies are presented below in Table 2. While "cybersecurity technologies" rank first with regard to their expected as well as potential importance (ranging between high and critical), the technology with the highest unexploited potential is clearly DLT. The unexploited potential is the difference between the experts' assessment of the expected and the potential importance. Although DLT ranks second with regard to its potential importance, its average ranking dropped in the final ranking round by the expert panel to sixth place from a previous second place. Similarly, cryptocurrencies dropped three ranks. At the same time, e-identity has seen a sharp increase in the relative ranking, climbing up from a previous seventh to a tied second rank. However, this technology has also seen a substantial decrease in unexploited potential (-0.50) between the two ranking rounds. These significant changes in ranking hint at very dynamic developments in the field. Among others, technologies which did not find an entry in the final top 10 list include "quantum computing", "financial news & opinion analysis" and "platforms".

Rank	Technology	Expected	Potential	Difference	Average
1	Cybersecurity technologies	4.00	4.50	0.50	4.25
2	Digitization & automation of customer services	3.63	4.13	0.50	3.88
2	E-identity & authentication technologies	3.75	4.00	0.25	3.88
4	Smart data technologies/algorithms	3.63	4.00	0.38	3.81
5	Algorithms for autonomous learning & analysis	3.38	4.14	0.77	3.76
6	Blockchain, distributed ledger & cryptoledger technologies	3.25	4.25	1.00	3.75
7	Smart contracts	3.25	3.88	0.63	3.56
8	API	3.13	3.88	0.75	3.50
9	Crypto- & cybercurrencies	3.13	3.75	0.63	3.44
10	Plug & play technologies	2.88	3.13	0.25	3.00

Table 2. Final ranking of important technologies, sorted by average importance
Source: Project report TU Berlin

56 "Small" was defined as "The technology may be already in use in the next five years, but is of low importance for the average company, e.g. some new start-ups etc." "Critical" was defined as "The technology will be necessary for the average company to survive in the market in the next five years."

2.3
Insights: Framework conditions

With regard to relevant framework conditions, the experts were asked to name any influences which might be important in affecting the current or future development of FinTech. However, based on the Triple Helix Model, the possible sources of such influences were divided into three spheres: Economy, government/administration and research/education. For each of these three, the experts were invited in the first round to enter any item that seemed relevant to them, again combined with the possibility to enter additional items, based on the other experts' anonymised entries. A total of 108 items were entered (39 economy; 43 government/administration; 26 research/education).

In the second evaluation round, experts were asked to rate the aggregated unique item entries from the three spheres (24 economy, 19 government/administration, 12 research/education) according to their expected and potential level of influence on the development of FinTech in the Swiss financial sector. The scale ranged from 1 ("small") to 5 ("critical").[57]

The third round then again presented the experts with the top 10 ranked items as a basis for a final re-evaluation of their own rankings. Larger differences between expected and potential influence hint at framework conditions which have either room for manoeuvre or optimisation potential – thus again indicating areas for policy action.

Economy

In the economic sphere, as presented in Table 3, the item which scored highest on average was the general regulatory environment (ranging between "significant" and "high"). This may come as a surprise, as one would assume this item to be better situated in the government and administration sphere. This item also has the highest potential influence in the economic sphere (ranging between "high" and "critical"). However, the highest unexploited potential lies in the area of start-up funding as well as the closely related topic of financing and investment of new market entrants by incumbents.

Between the two rating rounds two significant shifts could be observed. Placed in the final 10th rank, digitised shares and asset financing (such as initial coin offerings) were previously ranked second by the experts. Especially their potential influence decreased by a whole category (-1.0). At the same time the relative influence of an international contact network increased, moving upwards four ranks – while its absolute expected and potential influence did not change much between the two evaluation rounds.

Rank	Economic sphere	Expected	Potential	Difference	Average
1	General regulatory environment	3.38	4.25	0.88	3.81
2	General policy & administrative conditions for start-ups	3.38	4.00	0.63	3.69
2	International contact network	3.38	4.00	0.63	3.69
4	Start-up funding	3.13	4.13	1.00	3.63
5	Adaption of FinTech in day-to-day business	3.38	3.63	0.25	3.50
6	General legal framework for data protection & privacy	3.00	3.75	0.75	3.38
7	IT/FinTech knowledge & skills of employees	3.00	3.63	0.63	3.31
8	Investment into & financing of new entrants by incumbent firms	2.75	3.63	0.88	3.19
9	Cost pressure on incumbent firms (regulation, low interest rates, international competition, …)	3.13	3.13	0.00	3.13
10	Digitised share & asset financing (ICO, assets on Blockchain & cryptoledgers)	2.75	3.38	0.63	3.06

Table 3. Final ranking of economic factors, sorted by average influence
Source: Project report TU Berlin

57 "Small" was defined as "The impact factor will have little to no influence on the development of FinTech in the Swiss financial sector in the next five years." "Critical" was defined as "The impact factor will be absolutely necessary respectively decisive for the development of FinTech in the Swiss financial sector in the next five years."

Government and administration

The final top 10 list of factors in the government and administration sphere, as presented in Table 4, sees e-identity and authentication policies and promotion at the top, with an average influence of 3.79 (between "significant" and "high"). It is also the factor with the highest potential influence. The highest unexploited potential, however, lies in coin, token & digital assets transfer, international networking support and regulated access to customer data. The latter specifically refers to the revised payment service directive (PSD2[58]) applicable to the Single Euro Payments Area and intended to increase competition and innovation among banks and non-banks in the payment industry. Such a regulation does not exist in Switzerland to date. The items listed in this sphere give a deeper understanding of the most pressing and important regulatory issues in the context of emerging FinTech as well as the international collaboration and cross-border business in the financial services sector.

In contrast to the previous sphere, where only two items have seen significant changes between the two evaluation rounds, almost every item in this list has seen changes of between two and seven ranks. However, this was not caused by significant changes in the experts' absolute rating but rather the relatively close average ranking of several items.

Rank	Government and administration sphere	Expected	Potential	Difference	Average
1	E-identity & authentication policies & promotion	3.43	4.14	0.71	3.79
2	Adapted regulation of incumbent firms such as insurance firms and pension funds to allow for FinTech investments	2.86	3.57	0.71	3.21
3	Adaptation of data protection & privacy policies (to international standards/EU GDPR)	2.75	3.63	0.88	3.19
3	Coin, token & digital asset transfer as regulated financial/investment transaction	2.63	3.75	1.13	3.19
3	Start-up development programmes	2.88	3.50	0.63	3.19
6	Anti money laundering regulation for cryptocurrencies & digital assets	2.63	3.50	0.88	3.06
7	International FinTech networking support	2.50	3.50	1.00	3.00
8	Regulated access to customer data (PSD2/owned by customers)	2.50	3.43	0.93	2.96
9	Alignment of policy & regulation stakeholder efforts	2.38	3.25	0.88	2.81
10	Cryptocurrency as regulated payment method	2.38	3.13	0.75	2.75

Table 4. Final ranking of government and administration factors, sorted by average influence
Source: Project report TU Berlin

58 See press release of the European Commission (2015).

Research and education

For the influence of the research and education sphere, which is of central interest to the SSC, Table 5 gives an overview of the final top 10 list. On average, the factor of FinTech and IT knowledge and skills education of students was ranked highest by the experts. None of the factors reached a critical potential influence in the final ranking, compared to the previous two spheres. Most of the items that concern aspects of knowledge and technology transfer relate to the education of students and professionals. Only a single item refers to the aspect of spin-offs.

Although only ranking in 9th place, the standardisation and definition of digital assets shows the highest unexploited potential. The training of professionals has seen a sharp decrease in the relative ranking (-7), while the continuing EU programme participation has climbed five ranks. However, the final top 10 list puts four items tied in the fifth rank, which caused much of the relative changes in ranking.

Rank	Research and education sphere	Expected	Potential	Difference	Average
1	FinTech & IT knowledge & skills education for students	3.13	3.88	0.75	3.50
2	Entrepreneurial training & education for students & pupils	3.00	3.75	0.75	3.38
3	IT knowledge & skills education for pupils	2.88	3.63	0.75	3.25
4	Research specialisation: centre of competence/ hubs/champions	2.88	3.50	0.63	3.19
5	Fintech promotion & active usage (government, regulation, public institutions, ...)	2.75	3.50	0.75	3.13
5	FinTech research & education funding	2.75	3.50	0.75	3.13
5	Support for top start-ups from universities	2.88	3.38	0.50	3.13
5	Continuing EU programme participation (mobility, funds, …)	2.88	3.38	0.50	3.13
9	Standardisation & definition of digital assets	2.50	3.71	1.21	3.11
10	FinTech knowledge & skills training for professionals	2.75	3.25	0.50	3.00

Table 5. Final ranking of research and education factors, sorted by average influence
Source: Project report TU Berlin

2.4
Analysis and outlook: Overlaps and gaps

The analysis of the results and insights of the Delphi survey focused on establishing the necessary knowledge to identify which technologies are most prominently driving potential structural changes in the sector and which framework conditions are most influential in driving this development. Based on the experts' ratings, the following four technology fields can be considered the most important, either because of their high expected influence or unexploited potential:

1. Cybersecurity technologies and e-identity
2. Distributed ledger technology (DLT)
3. Algorithms & Artificial intelligence (AI), automation
4. Cryptocurrencies.

At the same time, the final project report by TU Berlin differentiates between technologies which might be of a more disruptive nature and thus empowering start-ups, and others, which are more equally accessible to both, start-ups and incumbents. Referring to algorithms for autonomous learning and analysis, DLT, cryptocurrencies and smart contract, the TU Berlin researchers state that "[t]heir potential may be expected to be exploited by start-ups rather than by established enterprises, which are built on their own historically developed tangible and intangible assets and solution approaches and may find it highly challenging to cope with drastic changes."

Additionally, by analysing thematic overlaps of the three spheres as well as gaps in the experts' assessment, the SSC has identified issues that needed clarification or further investigation. These thematic issues, which are presented in detail below, were the basis for the subsequent expert interviews. According to the idea of a "balanced" Triple Helix Model, the best environments for innovation are created at the intersection of the three institutional spheres (Ranga & Etzkowitz, 2013). Hence, identifying thematic issues with great overlap between these spheres points at areas which may create synergies and enhance innovation. Simultaneously, the identified gaps, however, point at issues which slow down or prevent such innovative collaboration between the actors of the three spheres.

Overlaps

- *Regulation:* Although primarily situated in the government and administration sphere, the issue of regulation was also named by the experts in the other two spheres. The potentially most influential of all items was the aspect of regulation – mentioned under the economic sphere. This exemplifies how strongly this business sector is shaped by regulation, in Switzerland and abroad. Given the important influence of regulation in all three spheres and ultimately on the realisation of potentials that lie in emerging FinTech, this will be a decisive factor when looking at optimising the innovation ecosystem in Switzerland. However, as the Council's interest in disruptive innovations also includes their effects on society, regulatory aspects should not only be evaluated from a business but also from a societal perspective.

- *DLT:* Next to being one of the key technologies driving FinTech development, as rated by the experts, diverse aspects relating to the distributed ledger technology are also mentioned in the three spheres shaping the framework conditions. One of them is the item with the highest unexploited potential: The regulation of coin, token & digital asset transfer as financial/investment transaction. But also the economic and research/education spheres touch on DLT – either as new business models, which allow new forms of asset transfers, smart contracts and general disintermediation or as focus of further necessary research efforts and content for teaching.

- *Data:* Financial institutions store and process large amounts of data, documenting client preferences, transactions and possessions as well as information about their background, health and even geographical mobility. It therefore does not come as a surprise that in the most important FinTech and all three spheres the aspect of data is mentioned several times. This concerns aspects of data privacy and protection (economy & government/administration), data as basis for automated analysis and learning algorithms (technology), educating students in the handling of large data sets (research/education) and access to customer data (government/administration). Several of these issues in data privacy and protection touch on European regulations, such as PSD2 and the EU General Data Protection Regulation (GDPR), both having no counterpart in Swiss regulation, at the moment. Additionally, data has also been named as "new currency" by the experts.

Gaps

- *Role and standing of research and education:* Out of the three spheres shaping the framework conditions, research and education received the fewest entries in the initial brainstorming phase and was on average ranked the least influential. Additionally, one expert even stated "is there any?" when asked about influences from research and education. This may either indicate that research and education have an actual low influence on the developments in the sector or that they have been underrated by the experts, as they are not visible enough or not well connected and directly relevant for businesses.

- *KTT*: Although four items listed in the research and education sphere concern the education of students and professionals, there is only one item that addresses the actual technology transfer by mentioning the creation of spin-offs. In other spheres, the collaboration with higher education institutions and the transfer of technology is not mentioned at all. Either FinTech are developed independent of research institutions ("in-house") or the main transfer of technology happens via the mobility of people. In contrast to other business sectors (such as industry or pharmaceutical companies), KTT may be less important for the financial services sector or it might be a neglected puzzle piece in the current state of the ecosystem.

- "*Acquisition and development*": The question whether the technologies compiled by the experts are truly enabling start-ups to become disruptors remains open given the insights from the Delphi survey. At the same time, even if these technologies might enable such a disruption, several publications propose that start-ups in the financial services sector are looking more for collaboration with incumbents than trying to take over business shares (see for instance Ankenbrand & Bieri, 2018c). Simultaneously, Ferrary (2017) proposes what he calls "acquisition and development" instead of traditional research and development, meaning that incumbents buy research services by acquiring start-ups and then integrating the acquired technologies. This is also supported by an item with a high unexploited potential in the economic sphere, namely the "investment into & financing of new entrants by incumbent firms". These are important aspects in understanding the ecosystem and determining where disruption could happen, and thus a gap the survey's results are not able to explain.

Outlook

The Delphi survey was foremost able to answer the Council's questions with regard to which technologies experts foresee changing businesses and to some extent which of them would rather threaten incumbents or empower start-ups. With regard to framework conditions, the study was also able to give valuable insights where the biggest (unexploited) potential lies in positively affecting the establishment of the aforementioned potentially disruptive technologies. However, with regard to the more dynamic questions relating to the incumbents' reaction, the strategy of start-ups and where the biggest threats and opportunities lie for Switzerland, the survey did not inform the Council sufficiently to come to preliminary conclusions. Thus, in addition to the gaps and overlaps identified in the aforementioned analysis, the questions regarding dynamic responses and strategies had to be discussed in the expert interviews and the concluding workshop.

3 Expert interviews

With the aim of clarifying and reflecting certain insights from the Delphi survey, the SSC carried out a number of expert interviews. These address the identified potential gaps as well as contextual information which was not easily retrievable in the Delphi survey itself. A total of five interviews were conducted by the SSC; four interview partners were also experts on the Delphi panel, the fifth interview partner did not take part in the Delphi survey. The interview partners were selected based on their different backgrounds (covering all three spheres from the Triple Helix Model) and commitment in the Delphi survey (for the list of experts, see Annex).

3.1 Questions

To allow for enough flexibility in the interviews, the conversations were based on a short questionnaire, but additional questions were asked depending on the direction the conversation took (semi-structured interviews). The four central questions were sent to the experts by e-mail in advance and are listed below. As most questions were based on the results which emerged from the Delphi study, the interview partners were also supplied with a short summary of the Delphi survey, including the four most important technology groups (1. Cybersecurity technologies and e-identity; 2. Distributed Ledger Technology [DLT]; 3. Algorithms & AI, automation; 4. Cryptocurrencies), the identified thematic overlaps as well as potential gaps.

- How do you see the aforementioned technologies affecting the financial services sector? How are they enabling/challenging start-ups and incumbents?
- Where do you see room for improvement with regard to framework conditions in Switzerland to fully take advantage of the potential inherent in the aforementioned technologies?
- How do you perceive the role and interaction/relation between FinTech start-ups and incumbents in the financial services sector? How do these perceive each other? Are there different stances with regard to the aforementioned technologies?
- How do you perceive the interaction between research/education and businesses with regard to FinTech?

3.2 Insights

After the interviews, the written notes were compared, analysed and grouped into four different thematic areas. This grouping laid the basis for the subsequent formulation of scenarios, which were the core of the concluding workshop hosted by the SSC.

Influence of technology on incumbents and start-ups

Technologies requiring large sets of data or number of customers to become efficient in improving processes and accuracy, promote collaboration between start-ups and incumbents (AI, DLT). However, technologies that lead to fundamental changes in the logic of how a service is delivered to the client (usually through the elimination of intermediaries) threaten incumbents and thus have big disruptive potential (DLT, cryptocurrencies, automation). This is also reflected in the incumbents' attitude towards certain technologies: Incumbents are very hesitant about adopting and incorporating these new technologies, as this would ultimately lead to a "self-cannibalisation".

Cybersecurity is crucial for future survival and may even form Switzerland's future unique selling proposition (USP) in securely storing data (instead of assets or money). However, some experts don't assign this technology a very innovative or disruptive character; cybersecurity is just rather seen as a plain necessity. This different assessment might simply be a question of perspective: Either cybersecurity is seen as a necessity for protecting its own company from external cyber-attacks or it might be used as a technology underlying a new business model where it is offered as a service to clients. Especially the second case could be interesting for start-ups in establishing new business ventures, while the first one is rather a main concern of incumbents.

While cryptocurrencies could revolutionise the way money is created, managed and exchanged, most of the experts are critical of said technology: An adoption of cryptocurrencies may threaten Switzerland's reputation of trustworthiness – a view that is also dominant among incumbent companies who are very hesitant about adopting these technologies. Still, one expert said that the emergence of Blockchain and cryptocurrencies is a historically unique chance to change financial markets worldwide – and Switzerland should be part of this development.

Strengths and weaknesses of Switzerland

Given the country's small size, Switzerland has the advantage of short routes and close contacts between higher education institutions (HEI), businesses, and regulatory bodies. The country has a positive image based on its political stability, trustworthiness, excellent research facilities and outputs as well as a high level of (numerical) education. Switzerland is home to several MNEs and thus has a very competitive financial services sector internationally. Also, the establishment and development of the "Crypto Valley" are praised by several experts.

At the same time, the big incumbents are also perceived as a problem, as they dominate the national sector. This may especially be a disadvantage for small companies or start-ups, as they tend to be neglected by policy makers. Experts see weaknesses in the mindset towards entrepreneurship, risk-taking, and a culture of learning from failure. In contrast, one expert said Swiss entrepreneurs are actually willing to take more risks, as the Swiss start-up ecosystem is not as good as elsewhere and thus starting a company is riskier.

Although Swiss HEI produce innovative technologies and are at the forefront of ground-breaking research, translating those technologies to business applications seems to fail often – especially in the area of software and IT (as compared to complex technical innovations that grow slowly). Also, successful Swiss start-ups very often don't aim high but pursue more sustainable paths or simply exit early. This may be reasonable, but also explains why much of the big "disruptors" come from abroad.

Opportunities and room for improvement

The experts generally agree that the Swiss regulatory environment is very good. Should the carefully balanced regulation continue and keep up with ongoing changes, this might even attract new foreign businesses in the future, some experts argue. However, such a continuous optimisation of the regulatory environment should include improvements with regard to balancing start-ups' and incumbents' interests in regulatory policy making. Other experts call for simpler processes in establishing companies and allowing more room for experimentation. Certain technologies would require national standards to harness their full potential (e.g. e-identity). Here, the government could boost innovation also as early adopter of certain technologies. While better connecting HEI with businesses might enable a better commercialisation of promising technological innovations, the absorption of such technologies also heavily depends on business cultures and functioning process for the integration of innovation. If mindsets don't change here, Switzerland may jeopardise its good starting position with regard to the successful exploitation of FinTech.

Given Switzerland's small size, experts call for a joining of forces and more interdisciplinary research approaches. Some call for improving collaboration between HEI and businesses through self-defined standards in research funding, more favourable intellectual property rights regulations, and the establishment of interdisciplinary competence centres. Especially with regard to commercialisation and knowledge and technology transfer, experts mentioned that negotiations with HEI are sometimes tiresome. Switzerland possesses great strength and expertise in technical areas, which might also be beneficial for FinTech (Big Data analysis in Bioinformatics, for instance). National funding agencies could play a crucial role in connecting interdisciplinary research expertise with innovative businesses.

Given Switzerland's image of trustworthiness, data storage based on world-leading cybersecurity may be Switzerland's future USP, shifting business models from safe-guarding monetary to non-monetary assets.

Open/unresolved questions

Some experts question the limits of technology with respect to possible areas of application. These do not specifically concern issues the Council has formulated for this case study, they touch, however, on the general question of the overarching theme of disruptive innovation. For example, experts touched on topics with regard to human-machine interaction and the question whether the full exploitation of available technologies is desirable – either socially or even from a business perspective (e.g. perfect discrimination and information about customers in the area of insurance). Should things simply be done because they are technically possible? What is reasonable, (socially) desirable, and contributing to sustainable value creation?

4 Workshop

The workshop, which concluded the Council's case study, was organised with the intention of developing scenarios and discussing recommended courses of action. These scenarios and fields of action did then serve the Council as a basis for the formulation of its specific recommendations aimed at the central actors in the Swiss ERI system.

The SSC invited all experts from the existing Delphi panel as well as additional experts from business, research, and government to participate. Including members of the SSC's working group, a total of 12 participants took part in the workshop in Bern at the end of September 2018.

4.1 Scenarios

After a brief thematic introduction, reviewing the results from the Delphi survey and the expert interviews, the participants of the workshop were assigned to two different groups. Together with members of the Council, a positive and a negative scenario for the future state of the Swiss financial services sector were discussed. The scenarios were used to gain insights into how current framework conditions, emerging technologies, changing customer needs and potential changes in policy might affect innovative developments in the sector. This was achieved by presenting the participants with a description of how the sector might look in a future year 2030. Using the scenario or planning technique of "backcasting", as introduced by Robinson (1990), participants were asked to identify factors which could connect such a future scenario to the current situation.

The two subsequent subsections are short summaries of the scenarios the two groups have worked with. They were pre-formulated by the SSC based on the previous insights from the case study and were expressly formulated in an extreme way to trigger as much response as possible.

Scenario 1: *"Business model transition and repositioning"*

- *General introduction:* Switzerland has achieved a slow transition of its "traditional" financial services sector (with dominant intermediaries) to become a leading country for digital and secure financial and data services. The country is still profiting from its image as a trustworthy and innovative partner with a stable political system and excellent education system.

- *Consumers/society*: Consumers profit from disintermediated, transparent and cheaper services and have obtained data sovereignty through digital IDs and secure ways to manage, exchange and sell personal data, assets and currencies. New technologies are perceived as means to enhance individual capabilities and sovereignty instead of threatening either their jobs or privacy.

- *Incumbents*: Traditional banking and insurance companies have shifted their business models and successfully adapted and reshaped their unique selling propositions. Although they still offer services revolving around privacy, security and safeguarding assets, their business has gradually shifted, as many processes have been automated and disintermediated. They managed to escape the trap of holding on to previous high-margin services

and adapted the new logic and architecture of how funds are exchanged and that data became a new asset to be exchanged and safeguarded (and thus overcame their "organisational inertia").

— *Start-ups:* Swiss FinTech start-ups have managed to expand beyond the Swiss market and have established themselves among global players. The Swiss start-up ecosystem attracts foreign investors and talents and works closely together with HEI. Start-ups successfully collaborate with incumbents and have found productive overlaps and synergies in simplifying services, data analysis and cybersecurity, based on AI, ML, DLT and quantum encryption.

— *Talents:* Swiss HEI, MNEs and start-ups still manage to attract top local and foreign talents. Swiss financial and data service providers are perceived as attractive employers.

In discussing the positive scenario, the workshop's participants pointed out the current competitive advantages Swiss incumbents have. Still, in order to achieve such a positive scenario, incumbents need to make better use of their data to offer better and more personalised services to customers. The participants see cybersecurity as a necessity in holding up Switzerland's good image of trustworthiness. This would require good education as well as research in the area. While they don't attribute cryptocurrency the necessary features for a future USP for Swiss companies, they see large potential in a hybrid form of human-machine interaction in supplying services to customers. To accomplish a positive transition Switzerland must also rely on foreign talents which are able to think outside of the box. Attracting and retaining such talents requires better immigration policies.

Scenario 2: *"External disruption and organisational inertia"*

— *General introduction:* Switzerland has lost its position among the world's most important markets for financial services. Employment and productivity in the banking sector have declined and the majority of small banks have gone out of business. Foreign FinTech and IT firms have entered the Swiss market and gained sustainable market shares from previous incumbents. Insurance companies suffered the same fate and were not able to make use of the good starting position.

— *Consumers/society:* The new dominant service providers of financial and data services offer cheaper, easier and disintermediated services. However, as data is often stored abroad under uncertain regulatory frameworks, consumers have lost their data sovereignty. The sharp decline in employment in the sector led to a drop of employment rate in Switzerland.

— *Incumbents:* Holding on to high-margin products and services and failing at overcoming organisational inertia, previous incumbents in the financial services sector have been marginalised by foreign companies, some of them originating from the IT sector. Instead of transitioning towards new business models, the collaboration with start-ups was driven by safeguarding its existing business and buying up competition.

— *Start-ups:* Promising FinTech start-ups have moved abroad, as the Swiss ecosystem has proven to be unable to allow for international expansion. Collaboration with HEI and the commercialisation of their knowledge and technology was too costly and complicated.

— *Talents:* Promising local and foreign talents preferred to work in other sectors and FinTech firms abroad, as working for Swiss incumbents in the financial services sector seemed unattractive and not promising with regard to future market prospects.

In discussing the negative scenario, the workshop's participants first evaluated how realistic the assumptions were and where the weaknesses of the Swiss market and ecosystem lie. Participants see especially the small market size and low adoption rate of new technologies by customers as one of the weaknesses. Also, incumbents seem hesitant about adopting new technologies and business models and primarily acquire start-ups to defend existing business models instead of establishing new business cases. At the same time, start-ups strive at collaborating with incumbents rather than disrupting them. Swiss companies will not be able to sufficiently grow if they cannot be part of the European market and attract and retain foreign talents. At the same time, Switzerland has a very good image, which should be used by companies to offer new services, based on the image of trustworthiness, privacy and excellence. Secure data storage and trade could be such a future niche where Switzerland might have competitive advantages.

4.2 Fields of action

The final discussion of the workshop was focussed on collecting the insights from the previous discussions of the two scenarios and reformulate them into possible fields of action. Some of these inputs may be of general validity in discussing the start-up ecosystem in Switzerland and how digitalisation affects the national economy. Others are specifically geared towards the unique features and characteristics of the financial services sector. In analysing the workshop's outcomes, the SSC has sorted the participants' inputs into three categories: education, research and innovation.

Education

The participants did agree that the federal strategy for digital Switzerland points into the right direction, fear, however, that governmental bodies will not follow through. This also includes the fostering of the digital literacy of consumers, working and managerial personnel. In order to exploit the potentials embedded in FinTech, a major focus should lie on educating talents, in- and outside of companies (i.e. basic and executive education) and follow through with the national strategy. Switzerland's very good education system could be a general "lever" in the training of talents and establishment and absorption of new technologies – although Swiss consumers are very hesitant at the moment.

Research

As cybersecurity is of special concern to financial service providers – an industry which heavily revolves about the safeguarding and secure transfer of valuable assets – the fostering of research competences in this area is necessary. Expanding research efforts with regard to cybersecurity is addressed in the national strategy for Switzerland's protection against cyber risks (NCS) 2018–2022 (Federal Council, 2018). Additionally, cybersecurity and FinTech are both part of the national strategy "Digital Switzerland" and the respective action plan (Federal Office of Communications OFCOM, 2018). The participants value the consideration of these issues, but also call to effectively follow through with the strategic goals.

Additionally, as the development of new technologies and their transfer from research to businesses also depend on foreign talents, the visa requirements for people studying and researching in Switzerland should allow for them to stay in Switzerland after the completion of the PhDs and Postdocs in order to start their own businesses.

As service innovations differ from technological innovations, this should also be a field for research and include how to offer the appropriate mechanisms to incentivise and protect such innovations.

Innovation

Most of the issues raised in the final discussion did concern the Swiss business and innovation ecosystem, primarily aspects of funding, competition, regulation, culture and mobility.

Although Switzerland does not lack the necessary funds for investing in start-ups, the venture capital ecosystem needs improvement.[59] This concerns the culture, know-how and diversity of actors. The establishment of the Swiss Entrepreneurs Foundation is regarded as a good initial step, however, initiatives such as the one launched in the 1990s in Israel could be a role model for Switzerland.

Further, the participants call for a more open attitude towards failure in entrepreneurship. Similarly, Switzerland could follow the model of the Singapore regulatory bodies in creating space for experimentation and collaboration with higher education institutions.

In commercialising Swiss innovations, it is indispensable to guarantee access to European markets. Being a highly regulated sector, this might benefit major national companies. However, to enable long-term competitiveness and growth of start-ups, regulation should be carefully balanced between safeguarding local business and guaranteeing the necessary level of international competition. Innovations in the area of RegTech might give Swiss companies a competitive advantage in dealing and complying with national and international regulation.

Switzerland has to build on its existing excellent image as a stable and trustworthy location for businesses and services. While the small and diverse national market might safeguard local companies from competition at the time, companies need to be aware of the ongoing transformation in the sector. This specifically concerns the productive usage of their data and adopting their business models. The acquisition of start-ups should not simply serve the purpose of defending their existing business model, but allow for the creation of new business cases.

As technologies driving FinTech are not exclusive to the financial services sector, platforms and networks should enable productive exploitation of existing knowledge and expertise in the areas of Big Data analysis, artificial intelligence and machine learning, for instance from the pharma industry.

---

59 A participant of the workshop specifically referred to the Israeli programme "Yozma", which is described in an OECD report as the most successful and original programme "which virtually established the thriving Israeli venture capital industry" (OECD, 2010, p. 120).

5 Summary and conclusions

In conducting a case study on the subject of FinTech and potentially disruptive innovations in the Swiss financial services sector, the SSC did not only intend to gather the necessary insights to formulate recommendations to allow the Swiss economy to foster and exploit emerging technologies. The study also served as an opportunity to explore new methods in assessing emerging technologies with a diverse set of experts and sources of information. While the Delphi survey has been proven very useful in gathering expertise about the state of the art and possible future developments, the expert interviews and workshop were necessary to validate and gain more insights about dynamic factors and the interactive discussion of open issues and potential fields of action.

Disruptive innovations, as per definition, can only be observed post hoc. However, given the findings and insights from the SSC case study, several factors indicate that certain FinTech might cause such a disruptive transformation of the financial services industry. Offering the possibility of disintermediating and automating services at much lower costs, incumbents are not interested in cannibalising their existing high-margin services. At the same time, many of the newly offered services either work more slowly than the existing services or are only used by a small fraction of consumers yet, especially in Switzerland, where customers seem hesitant about adopting new technologies. Such characteristics are typical for areas where disruptive innovations emerge. Still, the establishment of such disruptive characteristics heavily depend on the reaction of incumbents, the strategy of start-ups and the regulatory environment. Especially the financial services sector is heavily regulated, which might disable such disruptive forces. However, changes in the regulatory framework conditions are known to cause disruption of industry incumbents. The lifting of the Swiss bank secrecy might have been such a case.

Answering the SSC's working group's first and second central questions, the Delphi panel's experts identified the following technologies as the (potentially) most important for future business survival:

1. Cybersecurity technologies and e-identity
2. Distributed ledger technology (DLT)
3. Algorithms & Artificial intelligence (AI), automation
4. Cryptocurrencies.

Among these, technologies which require large sets of data or number of customers to become efficient favour incumbents or foster collaboration between start-ups and incumbents (AI, DLT). However, technologies that lead to fundamental changes in the logic of how a service is delivered to the customers (usually through the elimination of intermediaries) threaten incumbents and thus have big disruptive potential (DLT, cryptocurrencies, automation). Although critical for future business survival, the experts in the interviews did not agree on the disruptive potential of cybersecurity. While some see such technologies as a simple necessity, others see potential in them for the creation of new business models in safeguarding and securely trading data as a new form of valuable assets.

With regard to the working group's third question, the experts in the interviews and workshop have identified threats and opportunities for the Swiss market and ecosystem – with some diverging opinions, specifically with regard to cryptocurrencies. While some experts see Switzerland's excellent image of trustworthiness and reliability in jeopardy in the case of a wide-spread adoption of cryptocurrencies, others see great opportunities in establishing competitive advantages in this area and name the Crypto Valley in Zug a prime example. Although the sector is heavily regulated, most experts agree that the general regulatory framework in Switzerland is very good and does not threaten the development of FinTech. Some even name the regulatory environment as an opportunity for attracting foreign companies and investors, if it keeps up with current developments and carefully balances the interests of start-ups and incumbents. Given Switzerland's small market size, it might not be the primary market for foreign competitors to attack. Still, future competition and threats might origin from IT firms such as GAFA companies, as they are proficient in data analysis – an issue, in which especially banks still have large unexploited potential. At the same time, this is an area of great business opportunities for Swiss companies. Shifting their business models from safe-guarding monetary to non-monetary assets such as data, Swiss companies might profit from the country's good reputation as being safe, politically stable and trustworthy. This would require cutting-edge cybersecurity and encryption technology.

Although some of the presented and discussed technologies have the potential to disrupt incumbents by disintermediating, decentralising and automating existing services, a lot of findings, including other written sources, indicate that Swiss start-ups rather offer services complementary to incumbents and thus strive for collaboration rather than disruption – or simply

exit early and don't attempt to grow big like other start-ups do abroad. Some experts do not see a problem in this behaviour and it might be deeply rooted in Swiss culture. However, it might also be an explanation why Switzerland has not seen many true "unicorns" emerging from their start-ups. Incumbents seem to be well aware of the emerging technologies – but experts also indicate that most of them are very hesitant about adopting them or radically changing their businesses, as it often would lead to self-cannibalisation. The collaboration with or acquisition of start-ups by incumbents is often used to defend existing business models, while some experiment with new technologies and independent but firm-owned spin-offs, as suggested by Christensen (2000).

Among the different framework conditions affecting the establishment of potentially disruptive technologies, experts have often named cultural reasons and the regulatory issues. As for start-ups, licenses are costly or difficult to acquire and room for experimentation is limited. Therefore, these companies are often looking for collaboration with incumbents. Some experts rather see foreign IT companies as potential sources of disruption. While these may not have the image of trustworthiness in data handling, they might have the expertise in data analysis financial service providers currently still lack. However, being a heavily regulated market, the entrance of such competitors might not be seen in the near future. Although Switzerland does not lack the necessary capital for funding innovative start-up companies (irrespective of business sectors), the venture capital ecosystem in Switzerland could be improved according to several experts. Following the Israeli model, experts call for more favourable framework conditions to attract foreign VC companies and investors, which in the end would also profit Swiss FinTech start-ups in productively exploiting potentially disruptive technologies.

Generally, the experts highlight the Swiss ERI system's excellence in achieving a high level of general education and the production of research outputs. Also, the short routes between HEI and businesses are praised, although some experts suggest an improved joining of forces and easier way of negotiating commercialising research outputs. Most FinTech are based on technologies also used in other sectors. The respective expertise and in-depth knowledge in these technologies already exist in Switzerland, but might currently be mainly used in other areas and industries. Closer collaboration between different HEI and businesses, across economic sectors, could create big opportunities for Swiss FinTech companies in commercialising these technologies. Some experts therefore call for the creation of competence centres in the area of distributed ledger technology and cybersecurity. One expert argues that while Switzerland is very proficient in exploiting slowly growing complex technical innovations, it lacks the entrepreneurial culture and necessary framework conditions for doing so in the area of software. This lack of mindset and culture is also addressed by others in the interviews and discussion and may also be reflected in the low adoption rate of new technologies by Swiss consumers. To foster innovative and entrepreneurial mindsets, hands-on further education and courses should equip business people with the necessary skill-sets. This would also foster better and faster adoption and integration of innovations in incumbents.

Appendix

A.1
List of experts

The SSC expresses its gratitude to the following experts for contributing to the SSC's survey, interviews and workshop.

Delphi survey

- Lutz-Peter Berg, Head of Science & Innovation, Embassy of Switzerland in the United Kingdom
- Noël Bieri, Swiss Financial Market Supervisory Authority, FINMA
- Lamine Brahimi, Co-Founder, Taurus Group
- Expert 4
- Expert 5
- Christina Kehl, Co-Founder & Managing Director, Swiss Finance Startups
- Christoph M. Mueller, Founder and Chairman, CreditGate24 (Schweiz) AG
- Michael Müller, CEO Schweiz, Baloise Group
- Dr. Thomas Puschmann, Director Swiss FinTech Innovation Lab, University of Zurich
- Dr. Samuel Schenker, Economist, State Secretariat for International Finance SIF
- Dr. Patrick Schüffel, Adj. Professor, Institute of Finance, HEG Fribourg
- Expert 12

Interviews

- Lutz-Peter Berg, Head of Science & Innovation, Embassy of Switzerland in the United Kingdom
- Christina Kehl, Co-Founder & Managing Director, Swiss Finance Startups
- Michael Müller, CEO Schweiz, Baloise Group
- Dr. Thomas Puschmann, Director Swiss FinTech Innovation Lab, University of Zurich
- Dr. Jim Pulcrano, Adjunct Professor, IMD

Workshop

- Denis Bieri, Institute of Financial Services Zug IFZ, HSLU
- Prof. Dr. François Degeorge, Managing Director and Senior Chair, Swiss Finance Institute
- Dr. Philip Hanke, Lecturer on Legal Tech, University of Bern and ZHAW
- Prof. em. Dr. Beat Hotz-Hart, University of Zurich
- Michael Müller, CEO Schweiz, Baloise Group
- Dr. Thomas Puschmann, Director Swiss FinTech Innovation Lab, University of Zurich
- The SSC has been represented in the workshop by:
  – Gerd Folkers, president
  – Gabriel Aeppli, member
  – Jane Royston, member

References

Ankenbrand, T., & Bieri, D. (2018a). Definition & Framework of the FinTech Ecosystem. In T. Ankenbrand, A. Dietrich & D. Bieri (Eds.), *IFZ FinTech Study 2018* (pp. 3–6). Zug: Institute of Financial Services Zug IFZ.

Ankenbrand, T., & Bieri, D. (2018b). Hub Comparison. In T. Ankenbrand, A. Dietrich & D. Bieri (Eds.), *IFZ FinTech Study 2018* (pp. 30–34). Zug: Institute of Financial Services IFZ.

Ankenbrand, T., & Bieri, D. (2018c). Overview of Swiss FinTech Companies. In T. Ankenbrand, A. Dietrich & D. Bieri (Eds.), *IFZ FinTech Study 2018* (pp. 35–41). Zug: Institute of Financial Services Zug IFZ.

Christensen, C. M. (2000). *The Innovator's Dilemma*. New York: HarperBusiness.

Dalkey, N., & Helmer, O. (1962). *An Experimental Application of the Delphi Method to the Use of Experts.* Santa Monica, CA: The RAND Corporation.

Eberli, A., Emmenegger, M., Grass, M., Held, N., & Rufer, R. (2015). Beitrag branchenspezifischer Effekte zum Wachstum der Schweizer Arbeitsproduktivität *Strukturberichterstattung* (Vol. 54/1). Bern: Staatssekretariat für Wirtschaft SECO.

European Commission. (2015, October 8). European Parliament adopts European Commission proposal to create safer and more innovative European payments [Press release]. Retrieved from: http://europa.eu/rapid/press-release_IP-15-5792_en.htm?locale=en

Federal Council. (2018). *National strategy for the protection of Switzerland against cyber risks* (NCS) 2018–2022. Bern: Federal IT Steering Unit FITSU.

Federal Office of Communications OFCOM. (2018). *Strategie "Digitale Schweiz".* Bern: Federal Office of Communications OFCOM.

Federal Statistical Office FSO. (2008). NOGA 2008: *General Classification of Economic Activities.* Neuchâtel: Federal Statistical Office FSO.

Federal Statistical Office FSO. (2018a). *Full-time job equivalent per sector* [Data set]. Retrieved from: https://www.bfs.admin.ch/bfs/en/home/statistics/industry-services/business-es-employment.assetdetail.5827414.html

Federal Statistical Office FSO. (2018b). *Industries production account* (*50 industries*) [Data set]. Retrieved from: https://www.bfs.admin.ch/bfs/en/home/statistics/national-economy/national-accounts/production.assetdetail.5966206.html

Federal Statistical Office FSO. (2018c). *Labour productivity by economic activity at current prices* (*50 activities*) [Data set]. Retrieved from: https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases/tables.assetdetail.6126874.html

Ferrary, M. (2017, September 21). Silicon Valley: a cluster of venture capitalists? *Paris Innovation Review.*

Financial Stability Board. (2017, November 21). 2017 list of global systemically important banks (G-SIB). Retrieved October 24, 2018, from: http://www.fsb.org/wp-content/uploads/P211117-1.pdf

Guex, S. (2017, September 27). Finanzplatz. Retrieved October 22, 2018, from: http://www.hls-dhs-dss.ch/textes/d/D45549.php

Kobler, D., Bucherer, S., Schlotmann, J., & Brandes, D. (2018). *The Deloitte International Wealth Management Centre Ranking 2018.* Zurich: Deloitte Consulting AG.

OECD. (2010). *SMEs, Entrepreneurship and Innovation.* Paris: OECD Publishing.

Puschmann, T. (2017). Fintech. *Business & Information Systems Engineering, 59*(1), 69–76. doi: 10.1007/s12599-017-0464-6

Ranga, M., & Etzkowitz, H. (2013). Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society. *Industry and Higher Education, 27*(4), 237–262. doi: 10.5367/ihe.2013.0165

Robinson, J. B. (1990). Futures under glass: A recipe for people who hate to predict. *Futures, 22*(8), 820–842.

Schmuki, D. (2017). Fintech-Unternehmen treiben den Wandel im Bankenwesen voran. *Die Volkswirtschaft, 90*(4), 50–52.

Schueffel, P. (2016). Taming the Beast: A Scientific Definition of FinTech. *Journal of Innovation Management, 4*(4), 32–54.

SSIC. (2017). Notions of disruption *Exploratory study* (Vol. 3/2017). Bern: Swiss Science and Innovation Council SSIC.

Swiss National Bank SNB. (2018). *Swiss balance of payments – Current account – Year* [Data set]. Retrieved from: https://data.snb.ch/en/topics/aube#!/cube/bopcurra?fromDate=2008&toDate=2017&dimSel=D0(L0,T0,T4,V1,F,T7,T9),D1(E,A,S)

Abbreviations

AI	Artificial intelligence
AMLO	Anti-Money Laundering Ordinance
API	Application programming interface
ARPA	Advaced Research Projects Agency
BA	Banking Act
CHF	Swiss franc
CEO	Chief executive officer
DLT	Distributed ledger technology
doi	Digital Object Identifier
ERI	Education, research and innovation
EU	European Union
FINMA	Swiss Financial Market Supervisory Authority
FinTech	Financial technologies
FOJ	Federal Office of Justice
FSO	Federal Statistical Office
FTE	Full-time equivalent
GAFA	Google, Apple, Facebook and Amazon
GDP	Gross domestic product
GDPR	General Data Protection Regulation
HEI	Higher education institutions
HSLU	Lucerne University of Applied Sciences and Arts
ICO	Initial coin offering
IFZ	The Institute of Financial Services Zug
IMD	International Institute for Management Development
IP	Intellectual property
IT	Information technology
KTT	Knowledge and technology transfer
ML	Machine learning
MNE	Multi-national enterprise
NCS	National strategy for the protection of Switzerland against cyber risks
NOGA	General Classification of Economic Activities
OECD	Organization for Economic Co-operation and Development
PSD2	Revised Payment Service Directive
RegTech	Regulatory technology
RIPA	Federal Act on the Promotion of Research and Innovation
SIF	State Secretariat for International Finance
SNB	Swiss National Bank
SSIC	Swiss Science and Innovation Council
SSC	Swiss Science Council
USD	United States Dollar
USP	Unique selling proposition
VC	Venture capital

Imprint

Swiss Science Council SSC
Einsteinstrasse 2
CH-3003 Bern
T +41 (0)58 463 00 48
F +41 (0)58 463 95 47
swr@swr.admin.ch
www.wissenschaftsrat.ch

ISBN 978-3-906113-60-9
Bern 2019

Copy-editing: Doris Tranter, Stéphane Gillioz
Concept and design: Modulator, Branding + Design
Photography: Thomas Baumann

Swiss Science Council SSC
Einsteinstrasse 2
CH-3003 Bern

T +41 (0)58 463 00 48
F +41 (0)58 463 95 47
swr@swr.admin.ch
www.wissenschaftsrat.ch