

Digital Pulse Check Switzerland



The digital maturity level of European banks
January 2021

Introduction

For the second time since 2019, the Swiss Finance Institute (SFI), together with the strategy and management consultancy zeb, is recording the digitalization status of Swiss banks as part of a broad-based study and comparing the findings with the digital maturity of other European banks.

At first glance, little has changed: Innovative, small, agile fintech companies as well as large, cross-sector tech corporations are waiting in the wings and willing to provide banking services for all generations of customers with forward-looking digital solutions. Since the first edition of the Swiss Digital Pulse Check, other neobanks such as yapeal and neon, have gained a foothold in this country and are operating with focused service offerings. More so than in 2019, however, it is apparent that most established banking institutions have recognized the signs of the times. They are digitalizing their existing services step by step or rethinking them from the customer's point of view. COVID-19 has accentuated this change once again. Digitalization and virtualization represent a great opportunity for banks to deal with the challenges of the pandemic and to meet customer needs in new ways.

Nevertheless, a bottleneck can be identified: the implementation of digitalization, i.e. the path from the strategic blueprint via project and line work to market-ready offerings and processes, is (still too) slow at many institutions. Even among the top 25 percent of the most digitalized banks, increases in growth and efficiency are not (yet) reflected in the income statement. It is also apparent that the hurdles already identified in the first edition of this study still exist: in particular, the digital leadership culture and the flexibilization of bank structures by means of cross-functional teams and agile organizational forms are still not very well developed.

However, it is also true that the financial sector as a whole has undergone a significant development over the past two years and that the digital transformation as a whole is gathering pace – a development that is both necessary and indispensable for the prosperous future of the entire industry.

In addition to an analysis of the digital maturity level, two focus topics are explored in depth in this study booklet. The technical papers on “Advanced analytics for financial crime prevention” and “Asset tokenization” are exemplary for the multitude of digitalization topics in the operational and management area of banks. They show that digital transformation cannot and should not be limited to the customer interface. We hope you will enjoy the findings.

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How we measure the digital maturity level of banks

Methodology and participants

To determine the digital maturity level of banking institutions, zeb has developed the Digital Performance Indicator (DPI) model and refined it in cooperation with the Swiss Finance Institute for this Swiss study. This indicator can be used to determine and compare the status and development of digital transformation within the financial industry.

The DPI identifies the extent to which banks have advanced their digital transformation along four dimensions (see Figure 1):

- Strategy
- Business model
- Processes, data and IT
- Management and organization

The study team defined specific criteria and success factors for each analysis dimension to make the progress of digital transformation measurable. The banks were asked by means of an online questionnaire to indicate their current state of development for each criterion – the individual maturity levels were then operationalized by the study team with concrete design examples. This objectifies the bank's assessments. Responses were weighted in a scoring model and aggregated to the overall DPI. The five maturity levels are interpreted as shown in Figure 2.

As a consolidated figure, the DPI reflects the digital maturity level of each institution and allows comparisons to be made.

A total of 159 executives from European banks were surveyed, with 31 percent coming from Switzerland and Liechtenstein. 36 percent of the respondents work for a cantonal bank. 26 percent work for other regional banks. Large banks are represented by 16 percent of the respondents, private banks by 18 percent.

Liechtenstein: In the entire study, Liechtenstein institutions are included in the group of Swiss banks. This is to ensure that no inferences can be drawn as to the data of individual participants, which might otherwise have been possible due to the relatively small number of Liechtenstein banks.

European banks: When the study refers to European banks, this means participants outside Switzerland and Liechtenstein.

Figure 1: Four dimensions of digital transformation

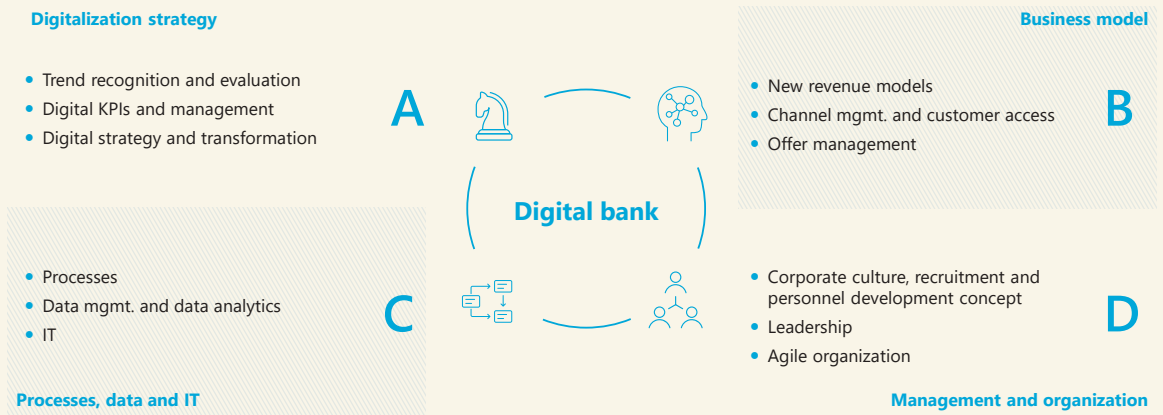


Figure 2: Digital Performance Indicator – DPI

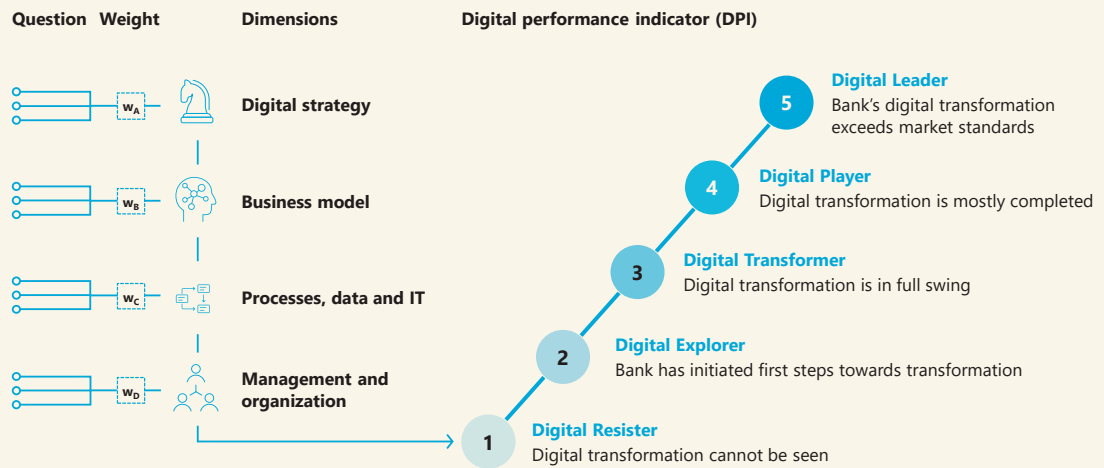


Figure 3: Participant structure by country

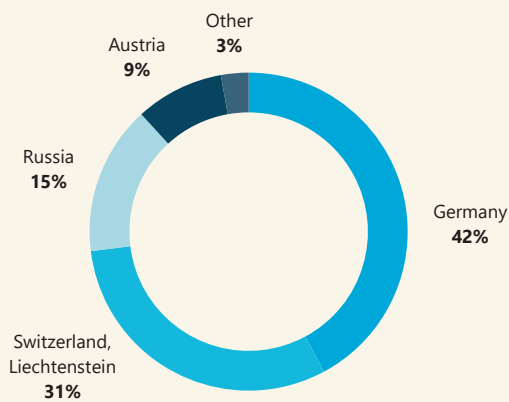
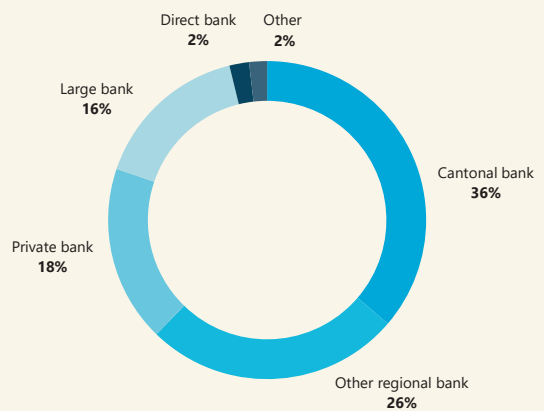


Figure 4: Participant structure in Switzerland by bank type



Online tool with the study results

You can access a detailed presentation of the survey results in our online study tool. Here you will not only find evaluations down to the level of individual criteria, but also a wide range of filter options for individual analyses.

The big picture: the digital maturity of banks is steadily increasing, but implementation is still slow

Positive development of Swiss institutions in 2021 vs. 2019

In our last digital maturity survey in 2019, three main things stood out:

- Swiss banks were very well positioned at the pure strategy level and were also able to demonstrate a high level of maturity here in a European comparison (DPI 3.2).
- In the implementation dimensions – i.e. “Business model”, “Processes, data and IT” and “Management and organization” – the level of digital maturity of the Swiss banks, on the other hand, was significantly lower. This discrepancy to the strategy dimension was also evident in the case of banks abroad.
- The lowest maturity was recorded in the “Management and organization” dimension (DPI 2.4).

| DPI Switzerland | DPC 2019 | DPC 2021 | Change |
|-----------------------------|----------|----------|--------|
| Digitalization strategy | 3,2 | 3,7 | + 0,5 |
| Business model | 2,6 | 3,2 | + 0,6 |
| Processes, data and IT | 2,7 | 2,7 | +/- 0 |
| Management and organization | 2,4 | 3,1 | +0,7 |

The Digital Pulse Check 2021 now shows that the average digital maturity level of Swiss banks has increased in three out of four dimensions. It is particularly worth noting that the greatest progress was made in the “Management and organization” category, which was still relatively underdeveloped in 2019. Here, the DPI increased by 0.7 points to a value of 3.1. As in 2019, the highest DPI is achieved in the area of digital strategy (3.7). The elements of supply and channel management grouped under “business model” follow in second place with a DPI of 3.2, which shows an increase of 0.6 points since 2019.

However, according to our DPI measurement, there is stagnation in the “Processes, data and IT” dimension. The DPI remains unchanged at 2.7 points. This does not mean, however, that the banks are not working on these elements – it is just that some of the further developments are not (yet) sufficiently noticeable in use. In addition, our DPI model gives a comparatively high weighting to process automation and digitalization in an end-to-end perspective. As we know from practical experience, many of the established banks still decide against comprehensive end-to-end process optimizations in order to reduce complexity, investment requirements and implementation time. Instead, the optimizations focus on sub-processes and business transactions with high significance for customer quality, resource commitment or risk situation. Neobanks can take a different, digitalized approach here by adopting a “greenfield” approach from the outset.

Digital maturity profile of Swiss financial institutions and their European peers almost in harmony

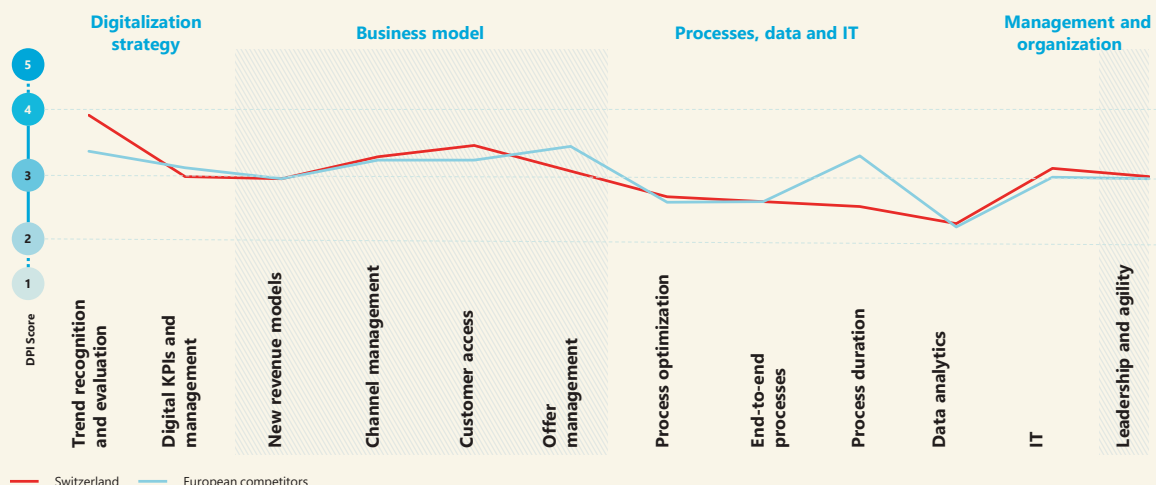
The European comparison shows that the maturity status of Swiss and foreign institutions is very similar. In addition to the already discussed lead of Swiss banks in systematic trend recognition and evaluation, three other deviations stand out:

- **Customer access:** When designing and developing the customer interface, Swiss banks use modern concepts such as customer journeys and thinking in personas somewhat more frequently than their European peers. In the case of foreign banks, traditional methods of customer segmentation are still more prevalent (e.g. according to age, income, place of residence).
- **Offer management:** At banks outside Switzerland, the online availability of simple banking products (e.g. accounts, savings) and the self-service offering are on average better than at Swiss financial institutions. The highest online capability is found in securities, where both Swiss and European banks have good offers.

- **Process time until product availability** from the perspective of a new customer: at 70 percent of European banks, private customers have access to their newly opened bank account within one day. 63 percent of the institutions also achieve this time period when opening a new securities account. On average, Swiss bank customers have to wait longer for their accounts to be made available: only 34% of banks open accounts within one day, while the figure for securities accounts is 37%.

In summary, it must be stated that on average at bank management level, there is no lack of digital strategies and understanding that corresponding transformation needs a broad foundation and that numerous facets, such as organization, processes and bank IT, must work together in order to be successful. However, many banks are not yet involving their employees strongly enough in their digital transformation, which is a profound change not only technologically but also culturally.

Figure 5: DPI comparison of Switzerland and Europe



Large banks and cantonal banks lead the digitalization field in Switzerland

The strategic work of Swiss financial institutions (DPI 3.7) is more advanced than that of their European counterparts (DPI 3.4). The local institutions did particularly well in terms of their systematic trend recognition and evaluation. This suggests that the importance of developing digital business models at management level has increased further. In a Swiss comparison, large banks and cantonal banks in particular performed best with high to very high scores in digitalization strategy. However, it is noteworthy that up to 20 percent of the regional and private banks surveyed have not yet developed a digitalization strategy or the strategies are not very advanced (DPI <2.5). This may be attributed to their size. On the other hand, the management's assessment of the benefits of (rapid) digitalization differs depending on the business activity of an institution.

A similar picture emerges in the dimension of processes, IT and data. Here, too, the large banks lead the field together with the cantonal banks. The level of digital maturity across all four bank categories is much more balanced in the area of business models. Swiss banks as a whole have recognized the need for digitalization in offer and channel management and are aligning themselves accordingly. This is confirmed by the slightly higher figures compared with the same period last year. The greatest untapped potential is still located at the organizational level. Agile working methods as a tool for customer-centric and efficient implementation of innovations have so far been used, if at all, at large financial institutions. The same is often true for engaging digital thought leaders within their own ranks.

Overview of digital maturity by bank type

Figure 6: DPI “Digitalization strategy” by bank type

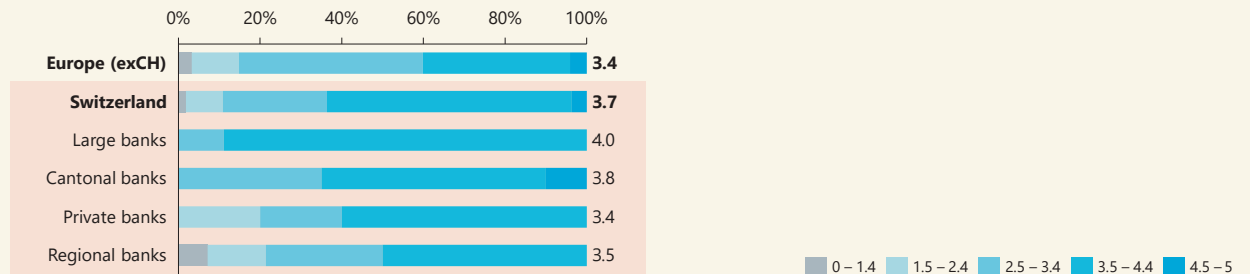


Figure 7: DPI “Business model” by bank type

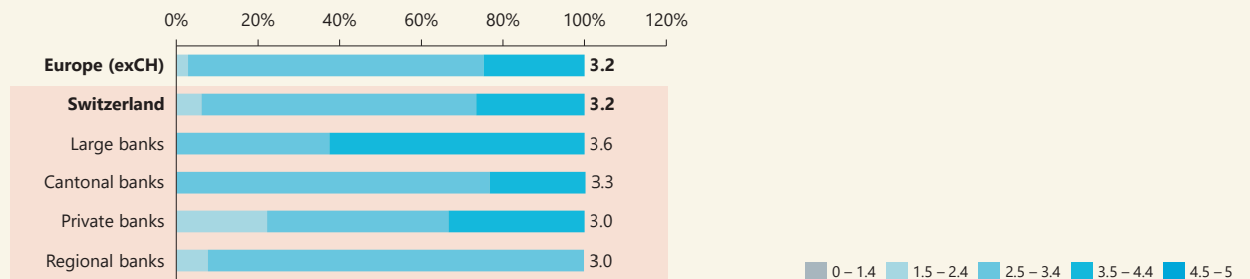


Figure 8: DPI “Processes, data and IT” by bank type

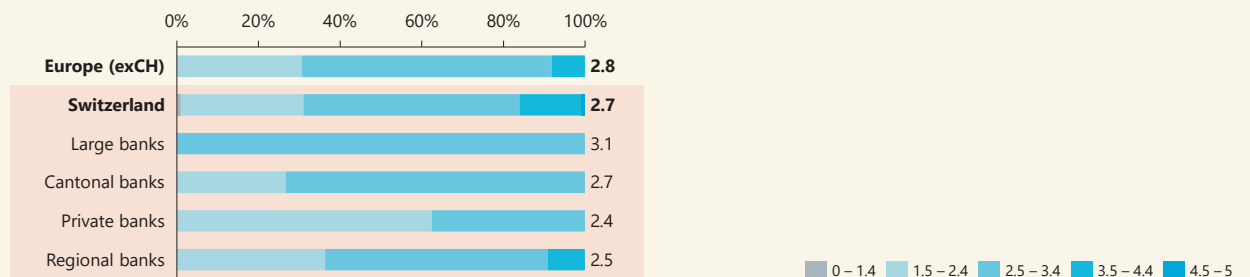
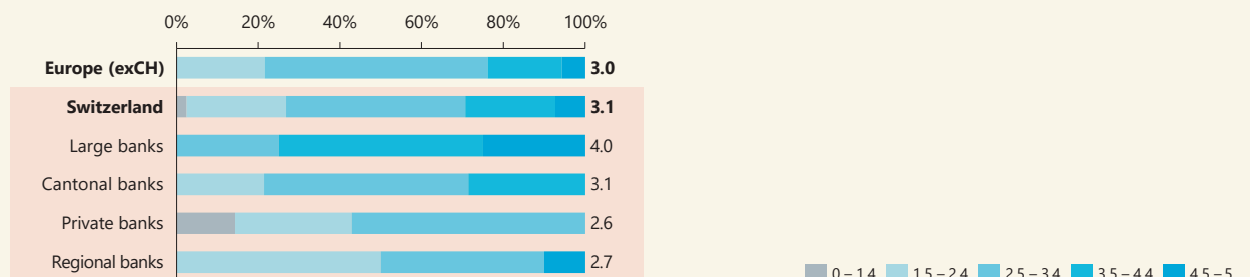


Figure 9: DPI “Management and organization” by bank type



Online study tool

You can carry out further detailed analyses of the above result overviews in our online study tool

Our 10 key findings

ONE

Banks are aiming for an ambitious digital transformation, but in some cases are standing in their own way due to insufficient implementation speed and focus.

TWO

Even among the top 25 percent of the most digitalized banks, increases in growth and efficiency are not reflected in the P&L statements.

THREE

COVID-19 has caused online availability of financial products to skyrocket, further increasing the pressure on banks to digitalize.

FOUR

Two-thirds of banks want to expand their business model via digital ecosystems by 2023, but are sticking to exclusively financial products for the time being, because clear business cases and the necessary skills to exploit beyond-banking potential are still lacking.

FIVE

Retail customers already benefit from the possibility to purchase many standard products online – only mortgage applications usually have to be discussed in person.

SIX

Corporate banking is still lagging far behind the retail banking segment in terms of digitalization, as there is still a lack of digital product offering; moreover, there is still untapped potential in the area of process automation.

SEVEN

Banks could benefit much more from data analytics if they not only analyzed customer data, but also focused on optimizing operational processes.

EIGHT

Digital transformation places high demands on banks' IT departments, which often cannot implement their ambitious strategies and services as quickly as required.

NINE

Banks do not yet sufficiently involve their managers and employees in the digital transformation process, thus neglecting a key success factor.

TEN

Banks that have successfully introduced agile working methods have better processes.

“Digitalization strategy” dimension

Key finding 1 – Banks are aiming for an ambitious digital transformation, but in some cases are standing in their own way due to insufficient implementation speed and focus.

81 percent of the banks (in Switzerland: 92 percent) look at customer behavior, innovations and new technologies – it is noteworthy that, in doing so, only about one third (in Switzerland: 54 percent) seek to exchange experiences outside of the financial industry. The lack of focus and prioritization acts as a stumbling block for those banks that have identified their need for action for the next three to five years with concrete goals, measures and responsibilities – at least 38 percent of the Swiss banks surveyed admit this. In a cross-European comparison, only 26 percent of the financial institutions surveyed see it that way. In other words: simply putting together a long list of digital projects and starting them all will get you nowhere.

Incidentally, a surprising finding in this context is the fact that digitalization apparently does not fail due to a lack of budget resources, as transformation costs are considered a problem by only 17 percent (Switzerland: 18 percent). The speed of implementation, on the other hand, is a far greater hurdle, with European banks having considerably more trouble here, at 52 percent, compared with their Swiss counterparts at 34 percent.

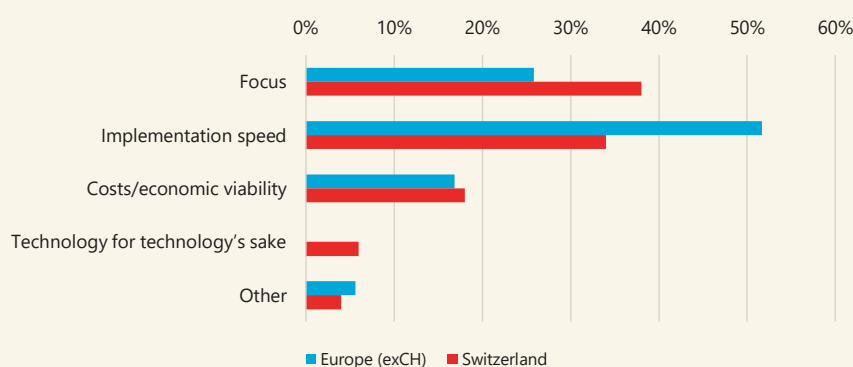
Key finding 2 – Even among the top 25 percent of the most digitalized banks, increases in growth and efficiency are not reflected in the net income figures.

In our view, digitalization has an impact in five thematic areas: customer loyalty, products and sales, empowerment of the organization, optimization of operations, processes and IT, management of finance, compliance and risk.

Digitalization secures existing revenues, generates revenue growth in both core and new customer business and generates growth in new business areas: therefore, it can make an essential contribution in each of these areas. The recipe for success behind this is lean, digital processes that have a positive impact on operating costs in the medium term. However, European financial institutions and Swiss banks have not yet reached this point, because even the pioneers in this study do not yet see any measurable effects.

Moreover, many banks have yet to establish a dedicated performance or profit measurement as is common in other areas. Only 24 percent of European banks – in Switzerland even only 10 percent – have defined explicit targets for digital sales channels. As many as 41 percent (Switzerland)

Figure 10: Greatest challenges in the course of digital transformation



and 39 percent (Europe) take the digital channels into account as part of the goal-setting process, but without controlling them independently or measuring their performance. There is clearly a need for action here.

The measurement of individual channel activities for the best possible customer experience is the key lever for sustainable monetization as well as customer-centric further development of digital sales activities. The metrics of a target system for digital sales thus include both aspects. Firstly, they include both quantitative targets (income, costs, profits, volume) – derived from the sales strategy and the overall sales targets – and secondly, they include clear KPIs for the customer experience.

The systematic collection of feedback for selected customer journeys (e.g. account/card, loan, mortgage) and the ongoing measurement of these customer experiences at regular intervals and based on clear KPIs are necessary. Developing a common understanding of key drivers of customer satisfaction relating to both the range of products and services and the operational business of the channels forms the basis for this. A channel cooperation logic is also required to prevent conflicts between channels.

Key finding 3 – COVID-19 has caused online availability of financial products to skyrocket, further increasing the pressure on banks to digitalize.

As in many other industries, COVID-19 was a resounding wake-up call for the financial industry in terms of digitalization, too. Banks found out that customers do not immediately jump ship when they cannot access their branch as they were accustomed to. The shift to online banking has also taken hold of new customer groups. 79 percent of the European banks and 68 percent of the Swiss financial institutions regard this push as a lasting effect. We assume that the decision-makers in the financial institutions will derive further impulses for action from this. They will continue to systematically exploit the opportunities in digital banking that have arisen as a result of the coronavirus crisis. The pandemic has clearly shown that bank customers are adopting digital services and using branch services to a lesser extent than before.

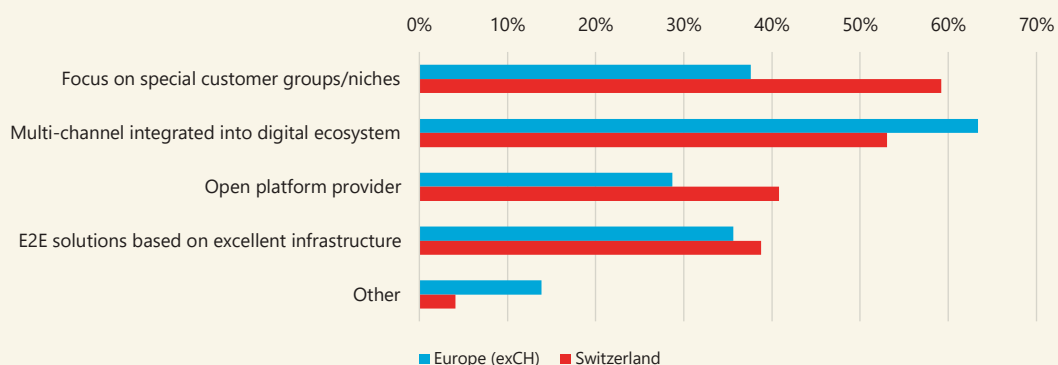
“Business model” dimension

Key finding 4 – Two-thirds of banks want to expand their business model via digital ecosystems by 2023, but are sticking to exclusively financial products for the time being, because clear business cases and the necessary skills to exploit beyond-banking potential are still lacking.

Almost all banks want to offer products and services beyond their core competencies in the future. Against this backdrop, it is not surprising that two-thirds of all banks want to expand their business model via ecosystems. Most

players plan to progressively offer new digital services as early as the next three years, with 63 percent of European banks and 53 percent of Swiss banks relying on a multi-channel financial platform. These are therefore still primarily banking-related additional services. When Swiss banks aim to develop sources of income in the non-banking area, they predominantly (77 percent) rely on the integration of additional services. While at least 20 percent of European banks are thinking about establishing ecosystem services in the area of nursing care and health, this is only conceivable for less than 5 percent of Swiss banks. Swiss banks are also somewhat less committed to integrating educational services into their own non/near-banking offerings than banks abroad (see Figure 12).

Figure 11: New digital business models planned for 2023



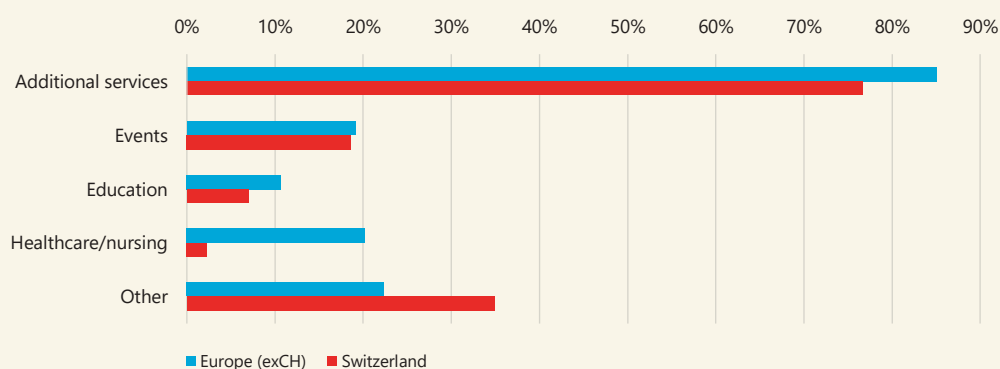
Even if such plans are new territory for the majority of financial institutions, many banks feel compelled to exploit new sources of income due to the current framework conditions. Given the still very vague ideas about how such business models could be designed, it remains to be seen, however, whether financial institutions will succeed in realizing the potential this area is expected to hold.

Digital ecosystems harbor numerous stumbling blocks

The banks believe that the greatest challenge in opening up new business areas lie in unclear business cases and a lack of experience and skills. Ultimately, entering the platform business should not be done just for the sake of digitalization, but rather in conjunction with a clear business case from which a unique selling proposition can be derived. In this respect, Swiss banks appear to be much more ambitious than their European counterparts, with 59 percent considering customer focus to be essential (Europe: 38 percent). Overall, there is still some uncertainty among banks about the importance of ecosystems: 47 percent of banks (Switzerland: 40 percent) are concerned about unrealistic expectations of potential.

However, the banking industry is not the only industry that has the ambition to build ecosystems or platforms that go beyond its own core activities to meet specific customer needs. In Switzerland, for example, many insurers have drawn attention to themselves with initial steps to develop offers relating to real estate and housing. In this respect, it is important for the banks not only to deal with the development of their own ecosystems in the role of conductor, but also to review the participation and involvement as, for example, product providers in ecosystems of third parties.

Figure 12: Addressed sources of income in near- and non-banking for enhancing the business model



Key finding 5 – Retail customers already benefit from the possibility to purchase many standard products online – only mortgage applications usually have to be discussed in person.

Half of the job is finished, but there is still work to be done. The banks have now managed to make more than three quarters of their products available online. Compared to the last study from 2019, there is an increase in most segments. Currently, 32 percent of Swiss banks (Europe: 57 percent) allow you to open an account online. For savings accounts, the figure is 26 percent (Switzerland) vs. 37 percent (Europe). Accounts and securities accounts can be opened within one day at about half of the European banks. Switzerland is still clearly behind here with 33 percent.

While it is important to look at what has been achieved, critically examining what needs to come next is just as crucial. The below-average online rate for mortgage financing shows that banks are still leaving potential untapped. Establishing digital solutions for more complex customer needs still seems too demanding for many European and especially Swiss banks at the moment – both in terms of the implementation challenges and the necessity from the customer's point of view. Initially taking out mortgages in particular is associated with a high need for advice, for which hardly any digital solutions are provided at the moment.

Key finding 6 – Corporate banking is still lagging far behind the retail banking segment in terms of digitalization, as there is still a lack of a digital product offering. In addition, there is still untapped potential in the area of process automation.

Initially, everything revolves around making access to banking products as easy and convenient as possible for customers and striving for a maximum degree of automation. Uncomplicated digital onboarding and basic products and services that can be purchased directly would be the minimum. Corporate banking customers are clearly at a disadvantage here. For example, a business account can be opened completely online at 18 percent of European banks – in contrast, Swiss banks do not offer their corporate customers any digital solutions. This is where the otherwise innovative Swiss should step up their game.

The ability to hold several accounts simultaneously (multi-account capability) or to credit payments in real time at any time of day is increasingly regarded as a key requirement by corporate customers. Online platforms in conjunction with a contact center are becoming increasingly important, especially for small and medium-sized business customers.

Many banks do not yet seem to feel a great deal of pressure to innovate in the corporate banking sector with regard to the customer interface and the range of services offered. Digital add-on services, which should enhance the still important relationship manager's advisory services, are currently still in short supply. Accordingly, many financial institutions are still stuck in the first phase of digital transformation and have just begun to digitalize their bank-internal processes. New competitors such as Amazon, Google, specialized fintech companies, but also established providers of accounting software are closing this gap by offering new digital solutions.

“Processes, data and IT” dimension

Key finding 7 – Banks could benefit much more from data analytics if they not only analyzed customer data, but also focused on optimizing operational processes.

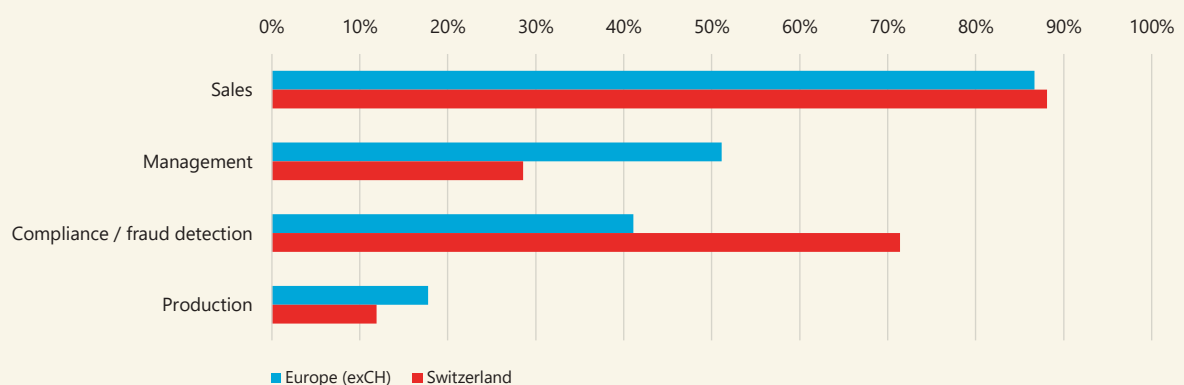
Internal bank processes also continue to show room for improvement. Only about a third of the banks surveyed use modern methods such as early scanning and character recognition using OCR and AI, with Switzerland still slightly behind the European banks (35 percent) with a usage share of 30 percent. Process automation with the aid of robotics (RPA) is used by 34 percent of Swiss banks – in the European sample, the figure is 42 percent. However, use of these methods is expected to double over the next two years.

It is widely accepted that data generation and use are important to businesses today. Banks use the intelligent analysis of data primarily for sales purposes. Only 12 percent (Switzerland) and 18 percent (Europe) of banks see any use cases at all for data analytics to optimize back-office operations. However, zeb’s experience shows that about 60 to 80 percent of the potential with a direct impact on results is to be found in a bank’s operations and in its financial and risk management. So it is precisely here that

further noticeable efficiency potentials could be leveraged. The fact that 93 percent of European financial institutions do not use any overarching, systematic cost-benefit analyses – the Swiss are significantly better positioned here at 76 percent – can certainly explain the lack of consideration of data analytics use cases outside the sales area to some extent.

On the other hand, more than one third of the banks complain about the lack of know-how: 35 percent of Swiss banks and 43 percent of European financial institutions do not have the technical infrastructure to use data analytics. And 53 percent (Switzerland) and 64 percent (Europe) see the current data protection regulations as the biggest hurdle.

Figure 13: Planned areas of application for data analytics

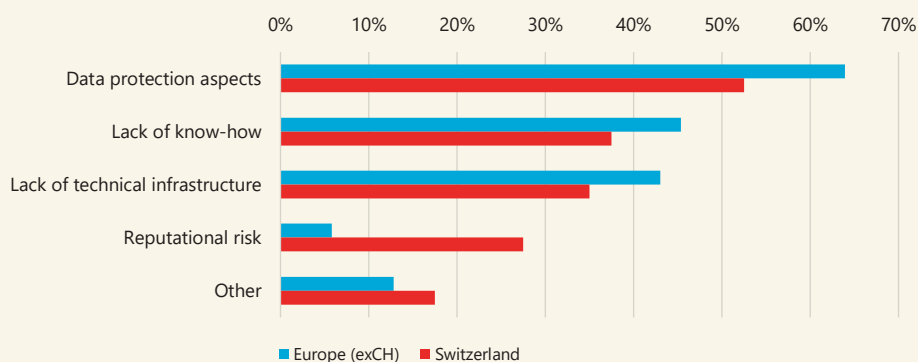


Key finding 8 – Digital transformation places high demands on banks’ IT departments, which often cannot implement ambitious strategies and services as quickly as required.

Digitalization is – of course – largely IT-driven. Many banks are currently feeling the effects of this, as they realize that there is often a bottleneck here. Just under half of the banks surveyed in both Europe and Switzerland are

satisfied with the performance of their own IT. At around one third of respondents’ banks, release cycles take between four and six months. The acceleration of these release cycles often requires costly modernization of existing IT legacy, a modification of development methods and complex organizational transformation. Without these investments, the goal of multiple releases per day will be difficult to achieve. In addition, at overall bank level, banks must learn to sensibly prioritize their requirements from different areas. This way, a focus can be achieved that allows a few, promising use cases to be implemented quickly.

Figure 14: Challenges in the use of data analytics (multiple answers)



“Management and organization” dimension

Key finding 9 – Banks do not yet sufficiently involve their managers and employees in the digital transformation process, thus neglecting a key success factor.

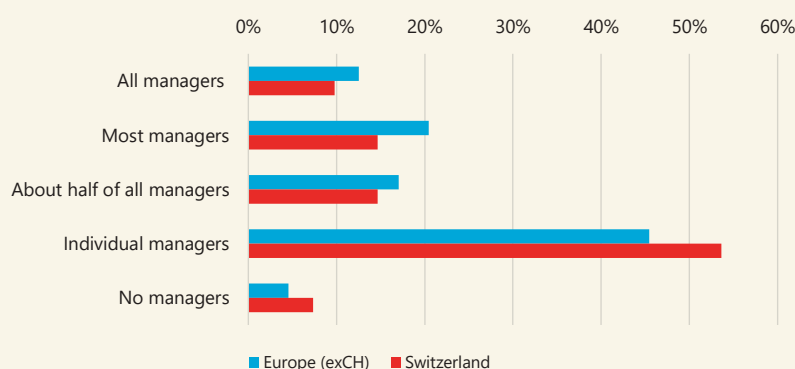
In an adaptable company, people should voluntarily take on new roles and functions, show initiative and act responsibly. This only works if they have role models who act accordingly, if they are trusted and if there is a positive feedback culture that encourages change.

This currently seems far from the truth. Only 15 percent of Swiss banks and 20 percent of European banks are convinced that their managers can establish themselves as digital leaders. Only 10 percent (Switzerland) or 13 percent (Europe) say all managers are working together to drive digital transformation forward and act as role models. Conversely, this means that there is significant room for improvement in terms of digital role models.

Digitalization requires a different way of thinking and a different responsibility that goes beyond traditional structures. Instead of clinging to old structures for fear of making the wrong decisions, the focus should be on the spirit of innovation and the courage to embrace the new. Skills such as openness, innovative spirit and flexibility are

important characteristics in this regard. Digital leaders promote concepts that are geared towards innovation. Changes can be taken up and implemented faster. Digital leadership relies more on working in a network than on strict hierarchies. Appreciation for the employees and the freedom that digital leaders allow are important for this. They promote lateral thinking and the personal development of each individual. A positive error culture and trust in the team encourage innovation and new ways of thinking. Dealing with the team and also the position of the digital leader as a role model are important aspects to ensure that a bank does not lose employees even if old jobs are replaced due to digital transformation. Motivated employees do not see this kind of change as a loss, but rather as an opportunity to contribute other strengths. What is needed is a new concept for personnel development that systematically targets digital (leadership) skills. 39 percent of Swiss and 45 percent of European banks have at least added digital skills to their job profiles.

Figure 15: Perception of managerial staff as digital leaders

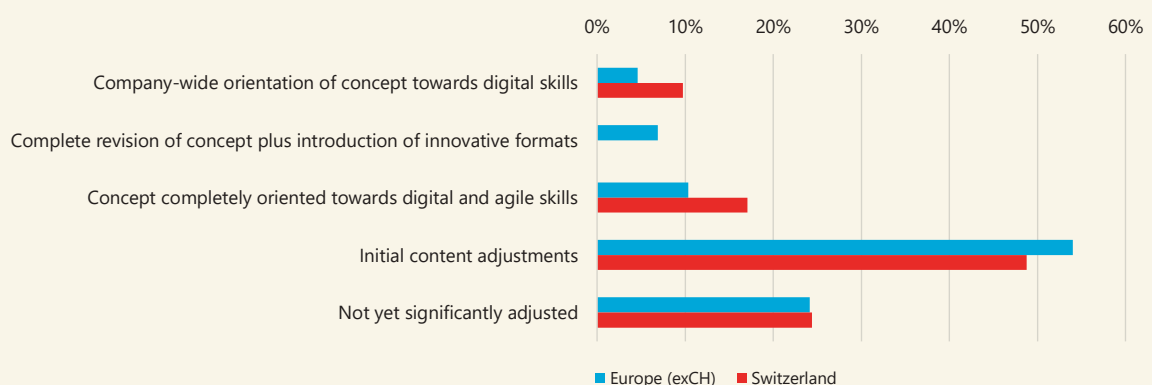


Key finding 10 – Banks that have successfully introduced agile working methods are better positioned in terms of process automation and digitalization.

Dynamic market developments and shorter go-to-market cycles require an increased adaptability of the organization. Traditional silo structures with a predominantly hierarchical orientation are no longer an option in these times. Key success factor: establishing cross-functional teams with clear governance and expanding interdisciplinary networks linked by a common vision (purpose). Agile working methods can be successfully implemented in these areas.

Looking at agile working methods, these appear to have arrived in the banks in one form or another. They are mainly used in the areas of change (Switzerland: 87 percent and Europe: 74 percent) and innovation as well as the customer interface (Switzerland: 84 percent and Europe: 71 percent). In addition, cross-functional collaboration is practiced by an above-average 73 percent of Swiss banks and only 45 percent of European banks. Our study also shows that banks that use agile working methods are significantly better positioned in terms of process automation and digitalization.

Figure 16: Promoting digital skills and speed of change



Conclusion

Swiss banks maintain their lead in the area of strategy – however, client and profit-effective implementation does not keep up the (strategy) pace.

Swiss banks are the frontrunners in digital strategy development in a European comparison. In the last two years, they have increased their digital maturity – but the same is true of banking players in Europe, who have been able to do so to the same extent. It may be noted that the digitalization of the banking sector is well advanced, at least in terms of their plans. So far, and this is the less pleasant realization, implementation has yet to keep pace with digital strategies. At the same time, it should be noted that the established financial institutions have made up a lot of ground on the neo-banks. The idea of supposedly sluggish banking giants who can't keep up with the new kids on the block in digitalization issues has definitely run its course. Nevertheless, a bottleneck can be identified: the implementation of the envisaged digitalization steps from the strategic blueprint into concrete digital projects and processes does not yet correspond to the theoretical ambition level of the banks. The oft-cited image of the tanker making a major course adjustment and needing the appropriate amount of time to do so, seems to fit. In contrast to the small, agile neo-banks, which are setting up their IT on a greenfield site, traditional financial institutions, for example, are forced to deal with IT structures that have decades of legacy. This costs time and/or money. However, it would be wrong to infer from this that size is a disadvantage, because digitalization of the financial industry is an ongoing process. Large tankers may not be as agile as fintech speedboats. On the other hand, they are much calmer and more stable in the water when the waves are high, especially since the banks' business models will only reflect the technological complexity of digitalization in the coming years.

Digital thought leaders remain sought-after – credible and experienced digital experts in banks are to be established further.

Bank employees have become less fearful of digitalization – this is shown by an annual survey conducted by the SFI. This makes the role of digital figureheads, who identify and exemplify the enormous potential of digitalization – and thus also fuel and accelerate the transition, all the more important. These role models do not necessarily need to have a banking career of their own. Many examples, also in Switzerland, show that role models from other sectors can provide very welcome impulses for rethinking previous solutions and for breaking up existing structures. They are an important support for the digital future of an industry that may have been skeptical of unconventional ideas in the past. The challenge is to place digitalization experts within their own organization where they can generate the greatest impact: in cross-functional leadership positions, where they can ensure that digitalization projects are closely coordinated and thus rolled out efficiently.

Increasingly agile forms of work recognizable – network organizations digitalize better.

Agility is a key success factor (not only) for banks when it comes to meeting the challenges of an increasingly volatile environment as well as the growing demands of digitalization. However, the path to an agile organization poses the greatest challenges to most companies in the form of far-reaching change. Agility is multidimensional. For this reason, several facets must be considered on the path to an agile organization – from innovation and delivery methods to organizational and governance tools and the work environment. And as always, at the heart of it all are the sense-making and guiding principles of the organization. More and more Swiss banks have recognized the benefits of agility – from the introduction of agile project methods to the establishment of network organizations. They are also well ahead of their European peers in this area. Nevertheless, there is still evidence of fears of contact and concerns about tearing down supposedly proven structures. This is where a rethink is needed, because digitalization is not the

sum of various IT projects. Viable and value-added digital processes and offerings can only be developed through the interaction of a wide variety of teams from all relevant areas of a bank. The paradigm shift this entails, e.g. due to the elimination of functions and ranks, is an enormous feat. This is one of the reasons why innovative working methods have not yet become more of a standard, even though they promise to improve problem areas that have been keeping the management teams of financial institutions busy for many years: long decision-making processes accompanied by corresponding decision-making time, rigid structures and an error culture characterized by fear embedded in hierarchical thinking result in weak customer orientation and poor time-to-market. Agility counters these pain points with a new scope. With a clear customer focus, agility promises improvement by changing the way employees think and act. As a result, this behavior leads to better products and, in this context, also to digitalization, which delivers faster and more sustainable results. It also makes companies attractive as employers for digital talents who place less emphasis on hierarchies and more on personal responsibility.

Asset tokenization – deep dive

SFI Professor Rüdiger Fahlenbrach (EPFL), Matthias Lehneis (zeb)

1) Introduction

Tokenization of assets involves the digital representation of real assets on distributed ledgers, or the issuance of traditional asset classes in tokenized form.

Asset tokens need to be distinguished from utility tokens and payment tokens. Utility tokens represent a right to use a predefined good or service.¹ Payment tokens are primarily a means of payment, similar to established fiat currencies.

We will focus on asset tokens, as many consider them to be the digital assets with the largest economic potential. An asset token represents a claim to benefit from the asset, e.g. future cashflows like interest or dividends or as a collateral. Tokenizable assets include not only securities such as shares of equity (similar to stocks) and debt (similar to bonds), ownership in investment funds, and commodities but also other non-financial assets such as art or real estate.

Since the main purpose of the token is most often to generate value for investors, regulators will generally classify asset tokens as securities and will subject them to securities regulation. Some tokenization-specific regulation has already been implemented to create an adjusted legal framework and to ensure legal clarity – such as legislation on crypto custodians (e.g. in Germany 2020) as well as on electronic securities (e.g. German “eWpG” for debt-base tokens expected in 2021, Swiss “DLT law” expected in 2021, Liechtenstein “Blockchain Act” in 2020). The market for asset tokenization evolves rapidly and in addition to hundreds of fintech startups, several established exchanges are developing infrastructure solutions for digital assets themselves (e.g., SIX which is developing the Six Digital Exchange SDX and Börse Stuttgart which is developing a digital trading and custody solution) or fund startups that do (e.g., Euronext is an early stage investor in Tokeny Solutions).

The purpose of this article is to explain the asset tokenization ecosystem, and to highlight the potential benefits and key challenges in asset tokenization. We will then use the simple examples of a fictional security token offering for a Swiss small and medium sized enterprise as well as the fictional asset tokenization of an artwork by Ferdinand Hodler to show some of the concrete challenges.

¹ Initial Coin Offerings (ICO) were a popular fundraising method for blockchain startups between 2016 and 2018. A majority of those ICOs were utility tokens. The market declined after cases of fraud and concerns about viable business models.

2) Security token ecosystem

For asset tokens to really take off, a trusted, comprehensive and regulatory sound ecosystem is required. The ecosystem consists of the roles as laid out in Figure 1.

The security token ecosystem, once fully developed, has the following main characteristics:

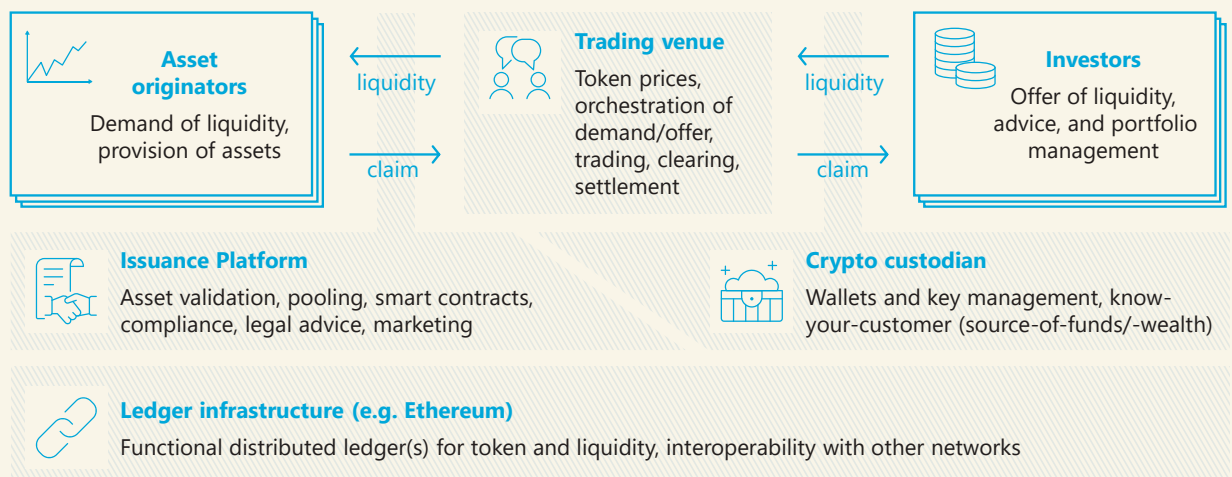
- Digital certificates (represented by the tokens) represent all assets, claims and entitlements. They replace for example security certificates printed on paper.
- Smart contracts fully automate all procedures – they implement the rules of the market as well as of a specific token. One can think of a smart contract as a programmed prospectus.
- Cryptographic algorithms secure all data storage and communication and encrypt them through public/private keys. They prohibit tampering and ensure a secure and verifiable origin of transactions.

- Issuers and investors can access the platform and the tokens on it directly without intermediaries – the software is the intermediary.

These characteristics would ensure several advantages compared to today’s financial market infrastructure:

- Issuers and investors can trade and settle their deals instantaneously without any human intervention, and thus more efficiently and faster than today.
- Issuers and investors face lower barriers for market access – issuance costs are expected to be lower, and markets as well as specific instruments are expected to be more standardized thus leading to less cost of information acquisition on the investor’s side.
- Trading venues will bring together liquidity supply and demand more effectively (once interoperability of DLT networks is established).
- The overall architecture of the ecosystem ensures transparency for regulators.

Figure 1: Roles forming the ecosystem for asset tokenization



- Assets that were so far inaccessible for securitization can be tokenized (like artwork, luxury goods or single real estate objects). However, it remains to be seen whether there is sizeable demand.

Note that given these broad advantages, such a security token ecosystem could also become the foundation for a future mainstream financial market architecture digitally serving securities and derivatives, and not only for novel token-based instruments in more niche markets.

3) Roles and players in the ecosystem

Initially, the concept of blockchains (and particularly Bitcoin as its first incarnation) promised the ultimate decentralization of financial services where counterparties (e.g. issuers and investors) interact directly with one another, and without any necessity to rely on intermediaries that grant fee-based access to financial markets via entry points they protect. However, with rising complexity of the asset tokenization business (through increasing number of participants, advancing regulation, a growing universe of assets, etc.) some players specialize in and professionalize parts of the value chain. So instead of a utopian peer-to-peer model, a structured ecosystem with certain roles is emerging.

a) Assets originators/issuers

Asset originators acquire liquidity by tokenizing their assets either in exchange for future cash flows only (like interest) or as shares (cash flow and voting rights). Assets originator and issuer will, in most cases, be the same entity, but especially when assets are bundled in baskets, the issuer could be a separate entity. Smaller companies may get access to funding via financial markets, as the costs and complexity to issue a new asset token are expected to be lower than those to issue current classic securities.

b) Issuance platforms and related services

Issuance platforms enable issuers to tokenize their assets – or more specifically, claims to the assets – making them available for sale and for trading. Many platforms offer tokenization solutions for a wide range of assets including debt or equity, but also physical assets such as real estate and art.

Issuance platforms range from basic open-source protocols for the technical implementation of token issuance (merely software-as-a-service) to more comprehensive platforms that offer technical, legal, compliance and transaction solutions. Security token issuers need legal advice to stay compliant with relevant securities laws. Compliance solutions offer services for security token issuers to stay

consistent with current regulations such as investor verification or anti-money laundering and know-your-customer rules. Several platforms also offer solutions to facilitate the interactions with investors, by maintaining a shareholders' registry, collecting investors' initial payments, managing the actual token allocation, and handling distributions such as dividends or coupon payments. Tokens could also handle voting rights for annual general meetings. Market participants believe that these transaction solutions could lead to sizeable efficiency gains and cost savings for small and medium-sized firms.

As many issuers, especially those in the blockchain domain, do not choose a one-stop-platform offering all services but only a technical solution platform, a veritable industry of advisory service companies has sprung up to help issuers with legal advice, marketing, investor acquisition, or technical advice.

The list of issuance platform startups is ever expanding; it is difficult though to obtain viable information on how much real business these platforms have actually already done. To give some examples of working platforms, Tokeny Solutions, based in Luxembourg, and Exporo, based in Hamburg, have already helped tokenize real estate projects. Daura, a joint venture of SIX, Swisscom, Sygnum, MME and Wenger & Vieli is a digital share platform for financing and investing in Swiss SMEs that has successfully completed feasibility studies and attracted first clients. Cashlink and Centrifuge are two other well-known examples.

Our assessment is that – after an initial flood of new startups – there will be a significant consolidation of the platform provider industry. Issuers from traditional, non-blockchain industries will want to work with providers that cover the entire spectrum of services. Platforms that have the backing of large and reputable sponsors will have an edge, as issuers will be concerned about failures of platforms and resulting problems for their on-chain issued securities.

c) Investors

Early investors will be those that are familiar with tokens, i.e. those who already have wallets and invest in cryptocurrencies. Traditional investors will become interested in the market once easy-to-use custody solutions are developed. Ideally, retail investors will eventually be able to hold tokens in their bank's security account without having to deal with wallets and private keys at all.

d) Crypto custodian

Each counterparty will need wallets to manage their identity, perform operations and store tokens. Investors need wallets to receive tokens and to purchase the security tokens with crypto assets. Issuers need wallets to deploy the smart contracts underlying the token and to receive funds paid in cryptocurrencies. Cryptographic private keys represent those wallets. These keys play a crucial role and they need to be handled with utmost care and be managed very professionally to prevent tampering, theft and loss.

Thus, custody solutions are a key development step: the Capital Markets Technology Association (CMTA), an independent association formed by players from Switzerland's financial, technological and legal sectors, defines a digital assets custody solution as a system that securely manages access to the tokens and prevents their theft and unrecoverable loss. Custodigit AG, a Swiss-based joint venture between Swisscom and Sygnum, developed a digital asset platform which originated from the need for institutional grade custody services. Upvest and Finoa are further examples of companies that provide custody solutions.

e) Trading venues

One of the main purported benefits of security token offerings is the creation of trading venues for assets that cannot be easily traded within the current infrastructure. If the asset token ecosystem could create a liquid market for private or non-standard securities, investor interest in these assets could significantly increase. Many startups seek to create token exchanges, and many established exchanges are also developing or at least conceptualizing such digital trading platforms. Upcoming regulation like the Swiss “DLT law” will require specific licenses for trading venues. Many observers consider the establishment of an open, regulatory compliant marketplace sponsored by a reputable and established player as a critical element for building a scalable digital assets ecosystem. A large fragmentation of the market, with many competing exchanges and different standards has potentially hampering effects on the liquidity of the tokens.

An additional benefit of the technology behind security tokens is that trading on exchanges can take place with almost instantaneous clearing, reducing counterparty risk and freeing up collateral. For settlement to be achieved at near real-time and for delivery to be certain in securities transactions (Delivery versus Payment or DvP), the securities transacted and the corresponding payments need to switch ownership simultaneously. A tokenized form of currency on the blockchain will be necessary for the payment leg of the transaction. For example, SIX and the Swiss National Bank have started to explore technological options to make digital central bank money available for the trading and settlement of tokenized assets between financial market participants. When the Capital Market Technology Association organized a dry run to subscribe and trade tokenized shares, they used a CHF-pegged settlement token provided by Sygnum Bank. In a different proof-of-concept study by Deutsche Börse, Swisscom, Vontobel and Zürcher Kantonalbank on settling securities transactions with tokenized shares via distributed ledger technology (DLT), Deutsche Börse provided the cash

tokens in Swiss francs through its subsidiary Eurex Clearing, against a collateral deposit in the central bank account of Eurex Clearing at the Swiss National Bank. These examples show that the establishment of an on-chain settlement currency is extremely important for the ecosystem to work.

Finally, exchanges will need to develop minimum listing standards. The history of the BondM segment of the Börse Stuttgart can serve as a warning example. In 2010, Börse Stuttgart wanted to give small and medium-sized enterprises access to the capital market. The BondM segment allowed the issuance and trading of bonds in much smaller denominations than what was possible before. However, the exchange and investors soon faced massive adverse selection problems; many of the issuers defaulted, and the high-quality issuers returned to traditional forms of financing such as bank loans. As early as December 2014, stock exchange officials declared the SME bond market a failure. Another more recent example is of course the market for ICOs, in which a series of fraudulent offerings led to a total loss of capital for investors, dramatically reducing investor appetite for future ICOs.

f) Ledger infrastructure

All of the aforementioned roles and functions require a shared technical platform that implements an indisputable ledger of transactions as well as tamper-proof tokens by means of strong cryptography. Recent solutions are predominantly based on blockchains and distributed ledgers (DLT) with Ethereum being the defacto standard (by usage, not by norm). However, other approaches are also conceivable – current and expected regulation is agnostic with regard to specific technologies.

As the concepts and the technology are still evolving, accepted technical standards for tokens, protocols and interfaces are missing. Investors, assets originators and parties implementing the above roles need to be concerned about a potential lock-in to platforms and technologies

that may become outmoded, which could limit their chances in a still maturing ecosystem.

Interoperability between different platforms and blockchain solutions will need to be developed and enhanced. In Switzerland, the Capital Markets Technology Association (CMTA) has set out to create such common standards around issuing, distributing and trading securities in the form of tokens using the distributed ledger technology¹. Swisscom, MME and other partners have launched the 4T-DLT initiative. They create an open repository for the technical and legal information, definition and standards for a secure, interoperable and reliable Swiss Distributed Ledger Technology infrastructure².

4) Challenges to the tokenization of assets: two fictional use cases

a) Fictional tokenization of the shares of a small and medium sized Swiss company

Examples of traditional securities issued first in a conventional way and then transferred on the blockchain to be tokenized already exist, for both large and small companies. For example, Daimler issued a *Schuldschein* bond in conventional form and with the use of blockchain technology in parallel. In Switzerland, Mt. Pelerin, a financial service provider developing solutions for asset tokenization and token trading, tokenized its own shares in compliance with the Swiss regulatory framework and assisted by the Capital Market Technology Association.

Market participants already undertook several feasibility studies in Switzerland. In August 2020, the Capital Market Technology Association, supported by Swissquote Bank, Taurus Group and Lenz & Staehelin, organized a dry run to subscribe and trade tokenized shares. Participating banks included a number of traditional banks as well as two digital asset banks with a Swiss banking licence, SEBA Bank and Sygnum Bank. Participating banks acquired tokenized shares issued by a Geneva-based corporation (*société anonyme* / *Aktiengesellschaft*) and traded these securities both over-the-counter (OTC) and on Swissquote Bank's digital asset trading platform. Swisscom, Deutsche Börse, and three partner banks successfully carried out a feasibility study at the end of 2019. They settled securities transactions with tokenized shares via distributed ledger technology (DLT). With this proof of concept, the share registry of a real Swiss company was digitalized using the *daura* platform.

Hence, it is technologically feasible for a Swiss SME to issue tokenized shares. We believe, however, that an important consideration that deserves more discussion is the economic feasibility.

¹ More info at: <https://www.cmta.ch>

² More info at: <https://www.4t-dlt.ch>

Politicians, chambers of commerce, and other industry groups have sought capital market access for SMEs for decades, and various solutions have been proposed and rejected. The fundamental problem is one of asymmetric information and the cost of due diligence.

Small and medium-sized companies typically receive money from their house bank that has a long-standing relation with the SME. The bank bases its lending decisions on both hard information (e.g., profitability, investments, order book) and soft information acquired throughout the years of the relationship (quality of the management team, management team's vision of the future, spending habits). The SME could theoretically share hard information with external financiers, but soft information by definition cannot be shared. If a company is not profitable or has a weak balance sheet, a potential financier needs to thoroughly understand the business model and turnaround plan. The financier would also be concerned and would want to understand why the house bank does not continue to finance the SME. The problems are compounded for startups because they have only an idea, and neither customers nor profits to show. It is for these asymmetric information reasons that highly specialized venture capitalists typically finance startups and highly specialized private equity firms typically finance larger SMEs. SMEs need to have a minimum size so that the extensive due diligence pays off and that private equity firms can deploy enough capital.

For that reason, when proponents of asset tokenization claim that middlemen can be entirely cut out from the investment process, it appears naïve to us. For example, the lack of expertise of investors at least partially explains the failure of the ICO market. The creation of a long-term viable market for the tokenization of shares for SMEs requires a solution to the problem of asymmetric information. Stock exchanges should introduce minimum listing standards but those will be, by definition, coarse. The new tokenization ecosystem, to develop fully, will most likely also require a new sort of financial intermediary between issuers and investors that can do the required due diligence at scale.

b) Tokenization of an artwork by Hodler

An important additional issue in the tokenization of real assets is that they continue to exist in the “off-chain” world. An artwork, for example, needs not only to be placed in custody to ensure that the tokens are backed, but also needs to be taken care of. The process requires a highly specialized entity that provides these storage and maintenance services, and many of the emerging companies that want to tokenize real assets work under the assumption that new entities will emerge that can provide such services more efficiently. A second concern with art or other real assets such as collectible cars is that many people would also like to derive consumption benefits from owning them – they want to look at the artwork or drive the car. Tokens that give an individual fractional ownership rights to 1/10,000th of an artwork by Hodler are then appropriate only for financial investors. Prudent financial investors will demand a well-diversified portfolio of artwork to minimize idiosyncratic risks, most likely requiring an intermediary that constructs the well-diversified portfolio. In addition, several academic studies have cautioned that the returns to art ownership net of all fees are actually disappointing, and fees would need to decrease dramatically through the tokenization process to make investing in art profitable. Our assessment is therefore that the tokenization of artwork or collectibles will remain a niche market.

5) Conclusion and recommended action

The market for asset tokens is still young and evolving. Many start-ups and some incumbent banks and exchanges compete for the best ideas – many of which are new interpretations of traditional, long-known financial instruments such as asset-backed securities (ABS). Regulators and legislators have caught up and are on their way to establishing legal clarity during 2020 and 2021 (and, realistically, also beyond).

Conventional financial markets and the emerging asset token market are not comparable in size and are still rather disconnected – liquidity is usually bound within the respective market. At this stage, we do not expect new disruptive financial instruments based on asset tokens to have a large impact on financial markets, but we rather believe that the impact will come through solutions that boost the speed and efficiency of incumbent financial markets. For example, the replacement of paper-based stock certificates with cryptographic tokens and the replacement of manual processing with automated smart contracts could lead to large efficiency gains.

We believe that incumbent financial intermediaries should prepare themselves for major changes to the architecture of future financial markets and to how securities are issued, traded and settled. We offer the following recommendations:

1. Familiarize the company and its employees with the technology and the critical new concepts. At least a basic understanding is important to grasp and follow the fundamental changes to come.
2. Refine the positioning of the company whether it plans to seek business by taking over one or several of the aforementioned roles in the new ecosystem – either as an enhancement or an addition to the current business model.
3. Once positioned, start to actively follow the path as the market share will be split within the next two or three years. Start to build a network of complementary partners, as collaboration is key in this evolving ecosystem.

Advanced analytics for financial crime prevention

SFI Professor Dr. Damir Filipović (EPFL), Dr. Dirk Holländer (zeb), Fredrik Wilhelmsson (zeb)¹

This article specifies some challenges and presents learnings from deploying advanced analytics² in the field of anti-money laundering to improve compliance and reduce the operational burden. The target audience includes compliance officers, financial crime prevention experts and advanced analytics gurus.

Why the need for a change?

The application of a risk-based transaction monitoring system to fight money laundering (ML) and terrorist financing (TF) is an obligation by law, enforced by local legislations (Anti-Money Laundering Act and Ordinance). Systems and controls applied by financial institutions to comply with local laws and detect illicit behaviors are predominately based on rules that monitor financial transactions and behaviors of customers or other financial intermediaries based on single or aggregated events typically over a shorter timeframe. The rules for when to

alert an event were developed with respect to typical red flags known to be associated with ML and TF.

Rule-based systems have the advantage of being simple to interpret, i.e. an alert (breach of a threshold) can be directly linked to the specific event/rule that triggered the alert. These systems however come with a series of limitations:

- high false positives rates (= low productivity³) of low single % figures (European benchmark),
- commonly operated using a third party provider with noticeable licensing costs and limited in its configurability,
- limited with respect to the number of data attributes that can be considered in the rule (rule complexity increases exponentially with every data attribute included and the number of potentially overlapping rules),
- reactive to detect evolving trends in ML and TF due to the manual interventions required

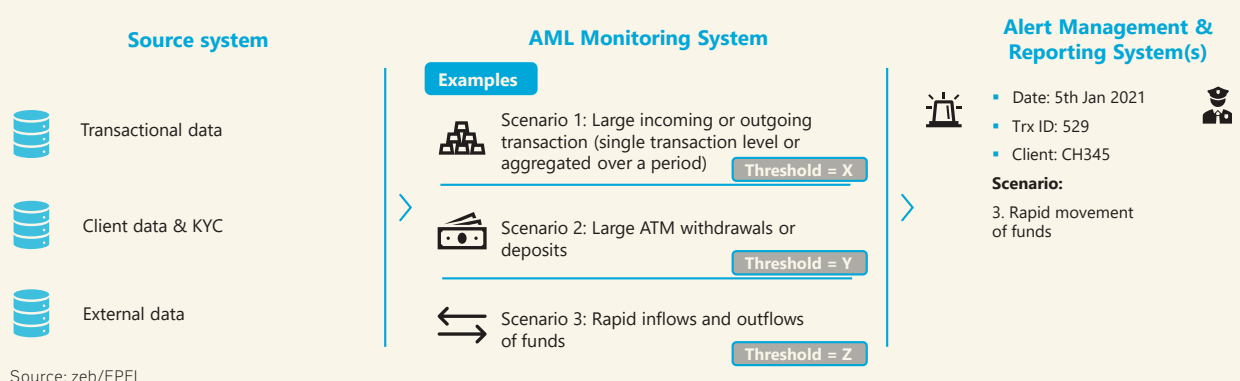
While these systems are still considered industry standard, there is some agreement across the banking sector that the standard rule-based systems are no longer fit-for-purpose due to their cost intensive operation and low productivity.

¹ The authors like to thank Mr. Dominik Wyss for his valuable contribution to a prior version of this article.

² Advanced analytics is the umbrella term for supervised and unsupervised machine learning, predictive and prescriptive analytics, artificial intelligence and innovative visualization tool kits.

³ Productivity refers to the quality of an alert, i.e. how many of the alerts created are actually indicative of money laundering or terrorist financing activities, and as such is a key performance indicator for the effectiveness of a transaction monitoring system.

Figure 1: Rule-based systems



Across the banking sector and primarily within the large banking area significant investments have been made to manage the operation and the output. For example, Nordea, the Nordic region’s biggest bank, increased the number of compliance officers dealing with Financial Crime Compliance from 160 during 2013 to more than 1500 during 2019. Similar scenarios are witnessed across other major European banks with HSBC going from a few hundred in 2012 to several thousand during 2017.

As the abundance of data to be processed for potential illicit behavior increases, the use of more advanced analytical capabilities is appropriate in order to consider increasing efficiency and effectivity in the ML and TF monitoring practice.

Advanced analytics revealing high potentials

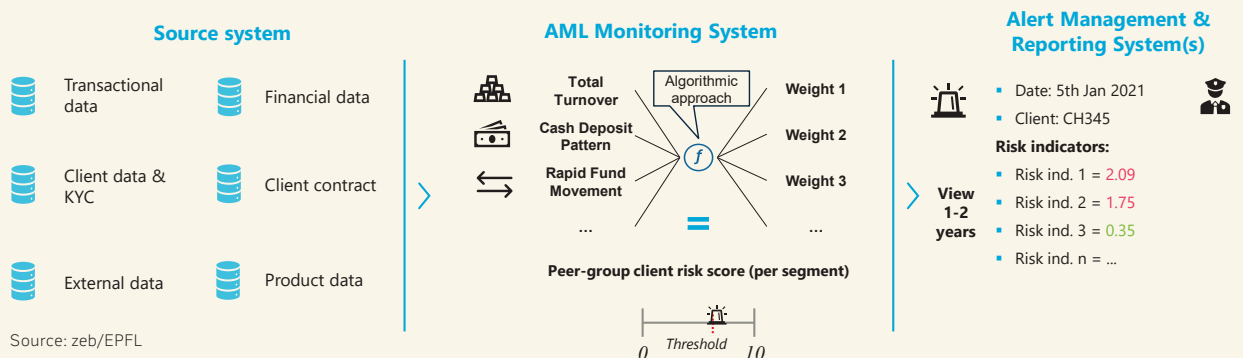
The application of advanced analytics has already proven valuable in a wide array of areas across financial services. Examples include

- predicting the risk of a loan default reducing the volume of impaired loans,
- predicting a client churning and thereby limiting the cost of client management,
- the next best product to offer a client (and when), increasing sales for specific product segments,

to name a few standard ones.⁴ Financial institutions of various sizes are implementing new advanced ML and TF monitoring solutions to strengthen compliance or reduce operational burden. These new solutions are either deployed on top of already established rule-based solutions with an advanced analytical layer to filter out false-positives, or as new “greenfield” analytics solutions including more advanced features. The new solutions are still being calibrated and tuned. However, they have improved operational performance and productivity compared to rule-based solutions.

⁴ zeb research

Figure 2: Advanced analytics solution



As for the rule-based systems, the new and advanced models are based on common compliance red flags while also considering additional analytical input to further scrutinize a customer's activity to a deeper extent. The set of input variables are expanded to include broad referential/client, contract, transaction, product, digital and alternative data to provide a complete relationship, view as opposed to a transaction-only view (as in the rule-based world). This allows the whole relationship i.e. additional information of e.g. client KYC profile, peer-segment behavior, previous significant events, historic transactional behavior, etc., to be taken into account.

Advanced analytics solutions extract valuable information from this context in order to make better informed decisions about whether a series of transactions are illicit or not. As training data, the advanced analytics-based systems are leveraging the historic alerts (from rule-based engines) that have been reviewed by the bank's investigators as key input / labels for the supervised machine learning model. Individual clients are scored with an alerting threshold determined.

It's not without its challenges!

Applying advanced analytical capabilities in the compliance and ML and TF monitoring realm is however not without its challenges, which must be tackled to deploy such a system in production, and eventually replace an existing rule-based system.

Training data: supervised machine learning algorithms make use of labelled input data, however, in transaction monitoring, such training data is typically not available at the quantity and type optimally required. Specific challenges include:

1. Only a very small population of a bank's clients actually conduct risky behavior with respect to ML and TF, of which only a small percentage is actually caught with the current systems. Accordingly, there is a problem that training data is highly imbalanced. This can partially be remediated with smart approaches to under/oversampling.
2. Since the labels are based on alerts from the previous rule-based system, they may be biased towards specific predetermined sets of rules and as such may not be representative of the actual (unknown) positive training population. This bias can hardly be avoided, however it is expected to be reduced over time once the machine learning-based model creates new alerts based on what it learns from the data, which can then be fed back into it after review.

Figure 3: Implementing a new advanced analytics solution is not without its challenges



Training data



Data quality management



Alert review



Risk appetite

3. Labels are never clearly positive (i.e. “money laundering = yes”) or negative (i.e. “money laundering = no”), as opposed to many other areas and use-cases applying advanced analytics (client left the bank = yes/no, loan defaulted = yes/no). In compliance, an alert is subject to multiple escalation steps before it is handed over to the national Financial Intelligence Unit (FIU) – in Switzerland, this is the Money Laundering Reporting Office (MROS) – and Financial Investigative Units/Authorities. As such, it needs to be clearly defined at which escalation stage an alert is considered positive. Additionally once the alert is handed over, its value for the FIU is not fed back into the system. Depending on the number of labels, an alert is typically categorized as positive rather early in the processing order so as to ensure sufficient risk coverage in a low risk appetite setting.

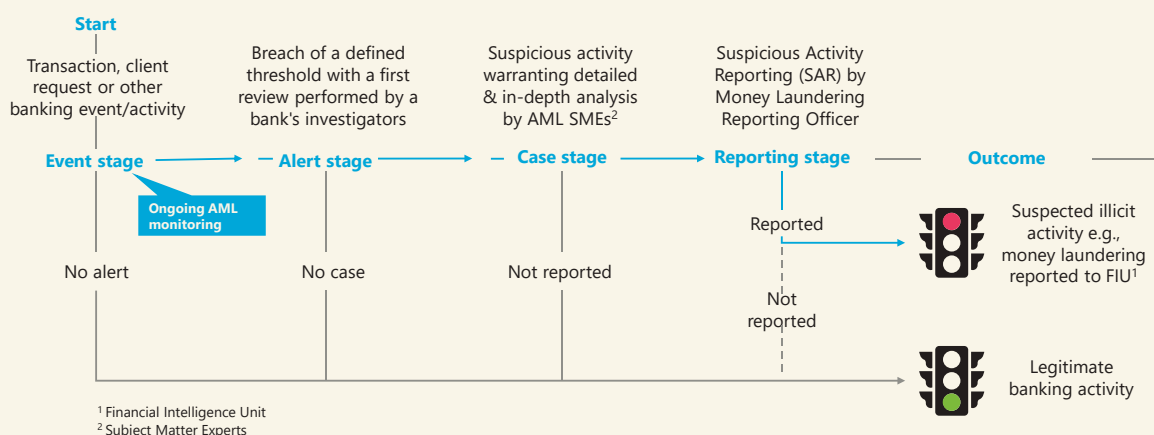
This kind of label scarcity can be addressed by interactive machine learning methods. An example is Active Learning, which is an incremental learning approach that interactively queries instances for labeling, e.g., by human analysts. It has recently been successfully applied to detect illicit transactions on the Bitcoin blockchain.⁵

⁵ Lorenz, Joana, et al. "Machine learning methods to detect money laundering in the Bitcoin blockchain in the presence of label scarcity." arXiv preprint arXiv:2005.14635 (2020).

Data quality management: The monitoring obligation is bank-wide and financial crime compliance systems are commonly deployed and operated with such mandates. Sourcing data from a vast number of systems and business areas creates two challenges:

1. Definition and data taxonomy of the types of products, transactions, clients, industry types and account across the bank requires granular analysis work. This is often a complex undertaking requiring in-depth banking knowledge to understand the transactional flows linked to the services offered. The mapping of individual types is a lengthy process, however key for the model to understand and an important enabler to generate valuable results.
2. Data qualities for certain data attributes are often not comprehensively available as they haven't been collected consistently across time or with various priorities (e.g. best effort) due to the different regulatory requirements. The advanced model needs to be tailored for such events, however not without acknowledging that there is an impact on the performance.

Figure 4: Compliance process



Source: zeb/EPFL

Alert review: for financial institutions, the alert review is today a manual procedure requiring an assessment and documented justification of why a certain client activity was or was not a risky behavior, worthy of further escalations. With a rule-based system, the investigator can narrow the investigatory search to a specific event and seek potential justifications (e.g. inheritance, sale of a car). In the new system, the assessment is a statistical output with an indication of what is considered risky and will look at six months to two years' worth of history. That is, a review across the full relationship is required with indications of what to look for. Additional tools facilitating drilling down and building connections between clients is therefore key. Investigators must train to understand the inner workings of the model and adapt new review processes and tools to efficiently review the output. This makes the application of advanced machine-learning algorithms difficult, since with increasing complexity of the algorithm, the outputs may be less interpretable. This is typically a leading argument to why certain banks have selected a rather simplistic linear model approach to prevent a "black box". Machine learning research, on the other hand, has recently made progress in developing methods for interpreting "black-box models", which should also be applicable for ML and TF monitoring.⁶

Risk appetite: Compliance Officers need to make a decision on the bank's risk appetite on how to deal with compliance red flags and transactional flows as well as how the model is configured. If all possible scenarios are to be managed and considered by a single model or control, the performance of the model decreases at the expense of the ambition to cover "everything". Prioritizing according to risk appetite is difficult in a world where one client's systematic illicit behavior going undetected could have a severe impact. Managing your risk appetite is however key to ensuring a productive system, significantly outperforming the old system. On the methodological side, this necessitates an elaborate misclassification cost analysis that strikes a balance between the cost of false positives and false negatives (undetected illicit behavior). The same consideration and methodology must also be applied across the data quality space where the acceptance of certain data attributes being insufficient is inevitable.

⁶ See, e.g., Molnar, Christoph. "Interpretable machine learning. A Guide for Making Black Box Models Explainable", 2019. <https://christophm.github.io/interpretable-ml-book>.

Continuous long-term investment as the way forward

As in many other applications of machine learning based systems, business stakeholders have a natural skepticism towards a new advanced analytical model (especially one that applies a “greenfield” approach), until proven productive. This is justifiable, since currently the rule-based models have been thoroughly tested and validated by compliance, regulators, vendors and competitors. A new model must go through the same scrutiny and testing before it can become the sole monitoring model for financial crime.

This requires substantial management buy-in and attention to break any potential change resistance and actively shift the review culture from the old rule-based world to the new advanced analytical world. Acknowledging that the journey requires investment and the application will improve over time is a pre-requisite for success.

The alternative is much worse

Over recent years we have seen the impact for European banks of systems and controls not being up to standards or diligent enough in detecting illicit behavior. A recent example is Swedbank, which as the worst-performing European bank stock in 2019 saw its market value shrink by \$8 billion for failing to properly perform its AML controls. Another example is ING, with \$1 519 million in fines since 2012 for money laundering prevention shortcomings after it was revealed that its clients were able to use their bank accounts for money laundering practices for years. The list of examples is unfortunately very long. With an eye to heavy fines and tougher scrutiny from various watchdogs, financial institutions are investing to avoid ending up as one of the aforementioned examples. In conclusion, although the advanced analytics journey comes with its challenges and might be longer than the CEO or CFO would like it to be, the end result is predicted to be paid back via a reduced operational burden as well as a higher confidence in the compliance operations, avoiding such negative scenarios.

Recommendations to make it work

Applying advanced analytics is a learning process that an organization must go through. There is experience from successful implementation processes on which can be built:

- Prototype quickly, ideally using up-to-date and non-obfuscated data, e.g. starting with areas with the highest number of labels. Once model components are fit for compliance purposes, subsequently ramp up for quick and broad deployment across other regions and relevant areas (i.e. note that one model does not fit all client segments and products and therefore must be tailored to the individual business area and its inherent money laundering risk)
- Tailor operational impact to a degree where the feedback is substantial enough to calibrate and adjust for improvements, however not to an extent where it creates business resistance i.e. over-burden as the first in a series of actions
- Define measurements and KPIs on the performance of your analytics to compare the impact between legacy and your new solution, e.g. “false positive” ratio
- Build supporting analytical and insights tools for reducing the process time that can be achieved by new and automated tools to document and prove the investigatory procedures
- Define further input values and insights using existing data to support the scoring model and performance

The introduction of advanced analytics for financial crime prevention is more than just the installation of new software. Ultimately, it represents nothing less than a fundamental paradigm shift and must accordingly be accompanied by a structured transformation process.

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