Use of Innovations by Supervised Entities in the Slovak Financial Market

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Glossary

Term	Description
AI	artificial intelligence – the ability of technology to demonstrate human-like capabilities such as reasoning, learning, planning and creativity
AML	prevention of money laundering and terrorist financing
big data	data files whose size makes it impossible for them to be managed or processed using standard software in a reasonable time
Big Tech	large global tech companies
cloud (cloud computing)	servers, data storage, databases, computer networks, applications and software that are accessed via the internet
DLT	Distributed ledger technology – this supports the operation and use of data archives in which transaction records are stored across a set of network nodes which are synchronised by means of a consensus mechanism
FinTech	the field in which technological innovations are applied to the provision of various financial services to create new business models, applications, processes or products, or to improve existing products or services, to increase their accessibility or adaptability to individual needs, or to reduce their cost
IoT	Internet of Things - the connection of objects and devices equipped with sensors, software and other technologies that enable them to communicate and exchange data with other things and systems
crypto-assets	digital representation of a value or of a right that is able to be transferred and stored electronically using DLT or similar technology
online onboarding	a process by which customers can open accounts or set up financial services entirely online without the need for physical contact
RegTech	the use of technology to assist supervised entities in complying with their regulatory obligations
regulatory sandbox	a platform that permits a participant to set up a financial innovation in compliance with regulation and test it based on consultation with the supervisory authority
RPA	robotic process automation – used for processes that repeat according to a set of known rules and are

	therefore suitable to be carried out by a robot or software
smart contracts	computer code in DLT which ensures that when a set of conditions defined in advance are met, all the contractually specified performances between the parties are executed automatically

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Introduction

Technological development is causing significant changes in the way financial markets work. The application of new technologies results in financial innovations whose effects are often felt across the whole financial market, not just in one sector. At the same time, there are differences in the ways new technologies are used, not only between market sectors but also between specific financial institutions. Some changes are clearly visible (e.g. new financial products, services and solutions) while others remain largely out of the public eye. These include increases in the efficiency of internal processes and improvements in supervised entities' compliance with regulatory obligations.

Information on the use of innovations and technology in financial institutions is useful for both Národná banka Slovenska (hereinafter only "NBS") and for the public. For this reason NBS conducted a survey on the use of innovations two years ago. NBS has decided to follow up this research with a fresh overview of innovation use among the entities under its supervision.

This document summarises the information provided by 89 respondents and gives the reader a basic insight into what financial institutions operating in Slovakia think about innovations and how they are using new technologies.

1. Summary

NBS's questionnaire survey on the use of innovations by financial institutions ran from 15 November 2022 to 12 December 2022. The survey received responses from a total of 89 financial market entities. Besides domestic entities, the respondents included branches of foreign financial institutions operating in the Slovak market. For comparisons between sectors, the entities were divided into four basic categories: banking and payment services (25 entities), insurance and pension saving (16 entities), securities markets and collective investment (29 entities), and financial intermediation (19 entities).

Innovations, FinTech & Big Tech

Respondents had varying opinions on the innovations, largely dependent on whether they were part of a larger financial group. Entities that belonged to a group tended to use innovations developed by their parent company. On the other hand, there are many respondents who not only adopt innovations from their group but also develop their own local solutions.

Less than a third of respondents (27%) are currently cooperating with other financial institutions on the development and implementation of innovations. The cooperation mainly concerns payment services, distance selling of insurance, as well as web and mobile applications. A similarly sized group (30%) was cooperating with, and sometimes also investing in, FinTech enterprises. In this case, cooperation was again concentrated in the area of payment services, various IT solutions and solutions for remote customer identification. Nearly half of respondents (45%) cooperate with Big Tech companies (most often Microsoft, Google, Apple) mainly in the areas of cloud computing and mobile applications, but also a wide range of other software services.

When asked to name the most important financial innovations of the last three years, the most common responses were the optimisation of customer-facing web and mobile apps, remote customer identification for online onboarding, the use of electronic signing and digitalisation, automation and robotisation of processes . In the next three years, respondents plan to continue the optimisation of their web and mobile apps, improve online onboarding and adopt certain elements of artificial intelligence (AI).

Cloud, big data, AI, RPA & IoT

The second part of the survey looked at specific technologies and their use in financial institutions. Cloud computing is the most widespread of the studied technologies in financial institutions. A large majority of respondents (72%) already use cloud services and another 14% plan to start using them in future; only a few respondents (15%) are not yet considering using this technology. Cloud computing is used the most by financial intermediaries and the least by entities operating in securities markets and collective investment. Respondents mainly use cloud computing to share data within their organisations, to back up and archive information and to provide mobile and web apps for their customers.

Another technology that is relatively well-established in the Slovak financial market is robotic process automation (RPA), which is currently used by 29% of respondents with another 22% planning to deploy the technology in future. Nearly half the respondents (48%) said they did not use RPA and had no plans to use it in future. In sectoral terms, RPA is used the most in insurance and pension saving and the least in the securities markets and collective investment sector. Survey respondents said that they used RPA mainly for back-office automation and software testing, to process transactions and to validate customer transactions or evaluate a customer's risk profile and to conduct regular checks in sanctions lists and the relevant registers.

Every year sees an increase in the volume of data managed by financial institutions. Managing so much information requires the use of sophisticated tools for what is known as big data analysis. The majority of respondents do not currently use big data analysis but plan to implement it in future (42%). Just over a fifth of respondents (21%) already use this technology. The remainder of respondents (36%) do not plan to implement this technology even in the future. The most active users of big data analysis at present are found among banks and payment services companies while it is least used by respondents providing financial intermediation. Respondents use big data analysis mainly for risk monitoring and fraud detection, reporting and statistics, and for the analysis of customer behaviour.

In recent months, artificial intelligence (AI) has become by far the most talked-about technology. This technology is also growing in importance for financial institutions operating in the Slovak market. A fifth of respondents are already using AI technologies and more than a third (37%) plan to start using it in the future. However, the largest group (42%) still do not foresee any use for AI even in the future. The insurance and pension saving sector uses AI the most and the securities markets and collective investment sector uses it the least. The main

purposes for which AI is used are retention and the assessment of exceptions for discounts, biometrics for remote customer identification and predictive models.

The Internet of Things (IoT) has also been a widely discussed trend in recent years. The technology has found only minimal application in the Slovak financial sector so far. Just 6% of respondents currently use IoT, a fifth of respondents plan to use it in future and the remainder, nearly three quarters (74%) have no plans to use IoT even in the future. In sectoral terms, IoT has seen the most adoption in financial intermediation and the least in the securities markets and collective investment segment, where none of the respondents use this technology. At present IoT use is mainly confined to internal processes such as printing systems, camera systems and alarms, or external devices such as POS terminals and cash ATMs. Only one respondent reported using IoT to provide smart products for customers.

Online onboarding and mobile applications

The digitalisation of the financial sector has enabled customers to use a large number of financial services entirely online without the need to visit a financial institution in person. In the past it was usually necessary for a potential customer to visit a branch of a financial institution at least once to establish a contractual relationship. In contrast, more and more financial institutions now offer remote identification even for completely new customers thanks to "online onboarding" processes. Technological development has thus made it possible for customers to start using financial products and services without even once seeing the inside of a branch.

Most respondents (53%) already offer online onboarding and more than a third plan to implement it in future. Just a small proportion of respondents (13%) have no interest in offering remote identification for new customers. The main forms of remote customer identification mentioned by respondents were biometrics, video calls and the checking of submitted data in the registers of the Ministry of Interior of the Slovak Republic.

Implementation of such technologies is most advanced in the banking and payment services sector and they are least used by financial intermediaries. Although the use of online onboarding is increasing year by year, it is still not the main way most entities use to identify new customers. As many as 43% of respondents claimed that less than 20% of their new customers used online onboarding. Many financial institutions differentiate between customers whose identity has been verified in person and those who have used online onboarding. Just under half the respondents (43%) said customers who used

online onboarding were subject to certain restrictions. The most common restrictions were a more limited range of products and services or upper limits for such customers' use of individual products.

The widespread availability of smartphones has helped to make mobile applications a popular platform for the distance provision of financial services. At present, just over a third of respondents (36%) operate a mobile app for their customers and another 42% of respondents plan to launch such an app in future. Only around a fifth of respondents (22%) are uninterested in this possibility. The entities most likely to have a mobile app were in the banking and payment services sector whereas financial intermediaries were the least likely to operate an app. The mobile applications of financial institutions have become relatively popular with Slovaks. The largest group of respondents (31%) said that their mobile app was used by 40–60% of their customers.

On the other hand, the majority of respondents (69%) do not yet offer customers access to all their financial products and services through a mobile app. There are usually certain products and services that customers do not have access to in the mobile app, e.g. mortgages, certain types of insurance and certain investment services.

DLT, smart contracts and crypto-assets

Discussions about how DLT could disrupt the financial markets have been going on for years. Even so, this technology has barely taken off in the Slovak financial sector and the results of the present survey do not suggest that it will make much progress in future. Only a very small minority of respondents (2%) currently use DLT and smart contracts and another 14% plan to implement it in future. The majority (84%) have no such plans. Only one entity in the banking and payment services sector mentioned using DLT and smart contracts. They use the technology to demonstrate that nobody has tampered with an information package provided to a customer. In the field of insurance and pension savings, one entity used DLT and smart contracts to conclude insurance contracts.

The most important use of DLT is for crypto-assets. The supervised entities currently have only minimal activities in this area. Just a few respondents (4%) currently provide crypto-asset services and a similar number (4%) plan to offer such services in future. The remaining vast majority of respondents (91%) have no plans to provide services related to crypto-assets even in the future. The largest interest in crypto-asset services is in the securities markets and collective investment sector, where entities offer CFD contracts linked to crypto-assets and an investment fund specialising in crypto-assets. One of the

main barriers to providing crypto-asset services is legal uncertainty and a lack of regulation, which should change with the arrival of the planned EU Markets in Crypto-assets (MiCA) Regulation. This regulation will enable several types of financial institutions to provide crypto-asset services. It will be interesting to see if the financial institutions operating in the Slovak market will take advantage of this possibility.

RegTech and cybersecurity

Another area where financial institutions use technological innovations is compliance with their obligations as supervised entities (RegTech). Most respondents (52%) already use RegTech tools and another large group (36%) plan to start using such tools in the future, whereas only a small number of respondents (just over 12%) are not considering such a possibility. From a sectoral viewpoint, RegTech is most widely used in the banking and insurance sectors, where use of such tools was reported by over three quarters (76%) of respondents The RegTech tools are used most frequently in customer onboarding and compliance in respect of AML, fraud prevention and reporting.

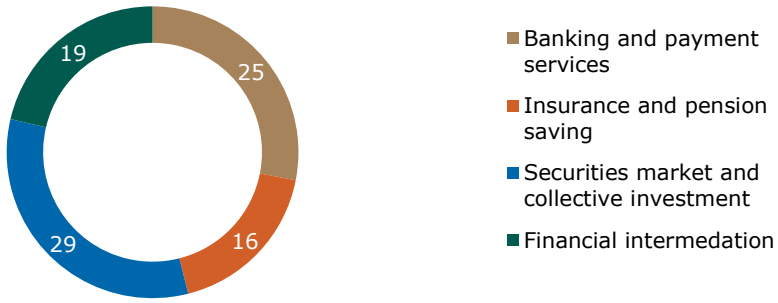
The growing importance of technology in the provision of financial services makes cybersecurity an urgent issue. For this reason, the majority of respondents (71%) plan to increase spending on cybersecurity in future while a smaller group (26%) plan to maintain it on the same level and only a very few respondents (2%) plan to reduce spending in this area, and then only moderately. The largest investments in cybersecurity are planned by entities working with securities markets and collective investment whereas there is the least interest amongst insurance and pension savings companies. Respondents plan to use increased spending mainly for penetration tests and protection against cyberattacks, increased security for data, sensitive information and systems for monitoring logs, incidents and transactions.

2. Innovations, FinTech & Big Tech

The questionnaire survey ran from 15 November 2022 to 12 December 2022. The survey received responses from a total of 89 financial market entities. Besides Slovak entities, the respondents included branches of foreign financial institutions operating in the Slovak market. The respondents were categorised into four main sectors of operation:

1. Banking, payment services, electronic money and non-bank creditors (referred to elsewhere in the text as "banking and payment services")
2. Insurance and pension saving
3. Securities markets and collective investment
4. Financial intermediation

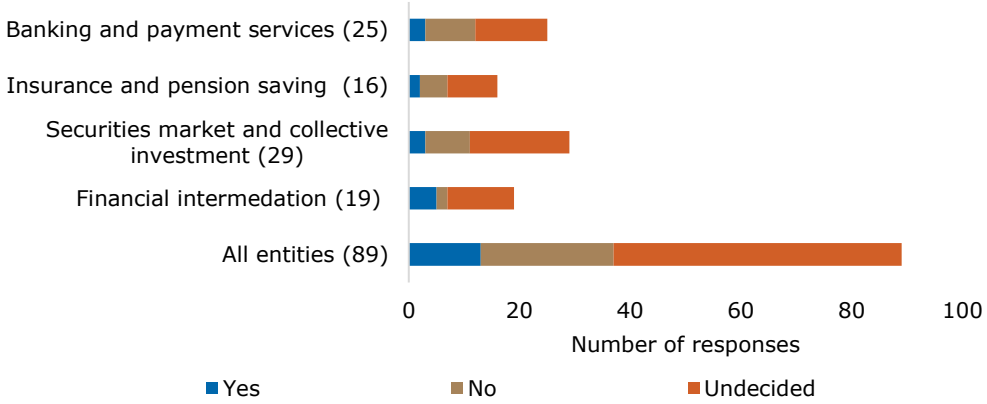
Chart 1 Sectoral classification of responses



2.1 Attitude to innovations

The first part of the survey asked about each respondent's approach to innovation and collaborative innovation, and the most significant innovations that entities have introduced or plan to introduce. NBS is an active promoter of innovation and launched a new tool to support it in 2022 – the regulatory sandbox. Respondents' interest in this tool is shown in Chart 2.

Chart 2 Planned use of the regulatory sandbox



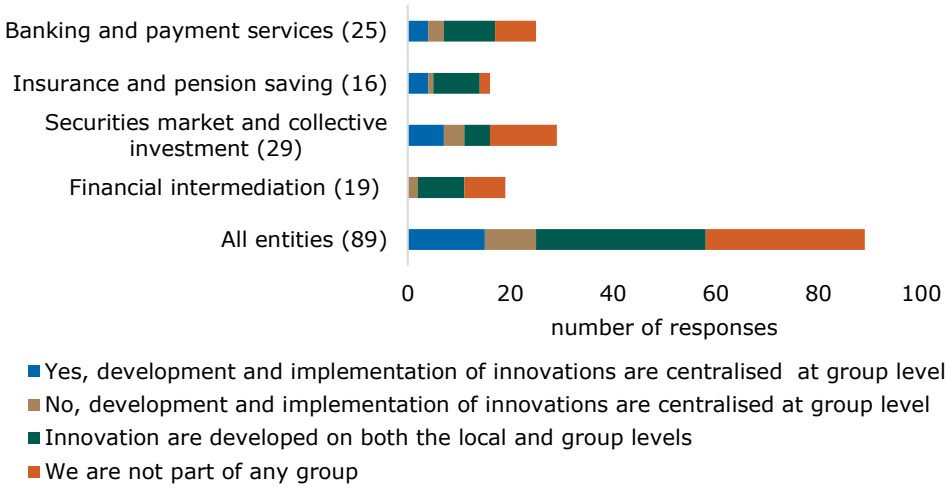
A minority of respondents (14%[1]) are planning to apply to the regulatory sandbox, slightly less than a third of respondents (27%) are undecided and the remaining majority of respondents (58%) do not plan to use this tool. The strongest interest in the regulatory sandbox is in the financial intermediation sector, where 26% of respondents plan to use it, while the lowest interest comes from the securities markets and collective investment sector, where only 10% of entities are interested.

Much can be learned about attitudes to innovation from the motivation for implementing innovations. Respondents gave similar responses about their motivations regardless of sector. The most frequently mentioned reasons include keeping up with modern trends, recruiting new customers and retaining existing customers.

Entities operating in the Slovak financial market are often part of international groups and therefore tend to adopt innovations from their parent companies, while other entities develop innovations on the local level.

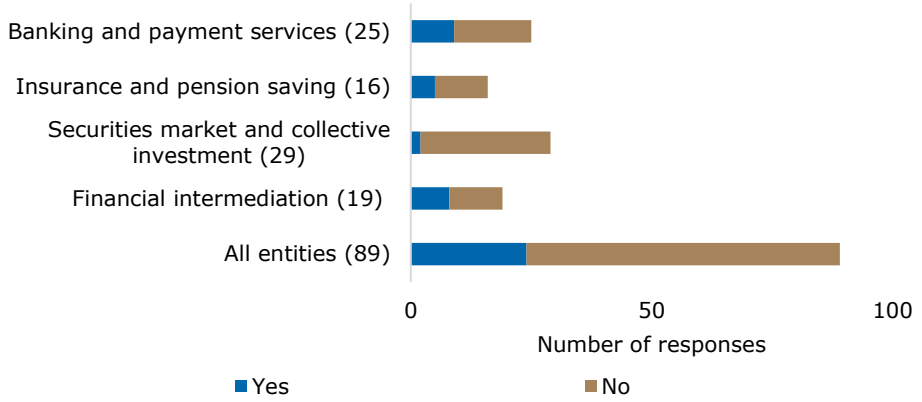
[1] *All results in this document are rounded to the nearest whole percentage*

Chart 3 Implementation of financial innovations



Respondents reported varied approaches to implementing innovations. Over a third of entities belonging to a group (37% of respondents) work on innovations on both the local and group level while a smaller percentage (17% of respondents) adopt only group innovations and the smallest percentage (11%) consists of entities that implement only locally developed innovations. There are often high costs associated with financial innovations so it is reasonable to expect that entities belonging to a group will adopt group solutions where relevant. Even so, many respondents are not content to rely just on innovations developed by their parent companies and work on their own local solutions. In this regard, it is interesting that none of the respondents from the field of financial intermediation adopted innovations from their group without also developing local solutions. Besides implementing group solutions, financial institutions can also collaborate with other financial institutions on innovations, as Chart 4 illustrates.

Chart 4 Cooperation with other supervised entities in the development and implementation of innovations



Only a minority of respondents (27%) are currently engaged in the collaborative development and implementation of innovations with other financial institutions and the remaining 73% are not cooperating with any financial institution. Nevertheless, this is a significant increase compared to the previous survey two years ago, when only a little more than a tenth of respondents (11%) were cooperating with other financial institutions. The entities most open to cooperation with other financial institutions are financial intermediaries, which is probably to be expected given the nature of their business. At the other end of the scale, the sector with the least cooperation is securities markets and collective investment. The respondents who cooperate with other supervised entities reported the following areas of cooperation:

- payment services (9 entities)
- insurance comparison and distance selling of insurance contracts (3 entities)
- web and mobile apps, and account functionality (3 entities)
- electronic signing (2 entities)
- digitalisation (2 entities) and the connection of IT systems (2 entities)
- bancassurance (2 entities)

Respondents cooperate most in the area of payment services, but distance selling of insurance contracts is also an important area where financial intermediaries need to collaborate with an insurance company. Bancassurance is another product that depends on cooperation between different financial institutions. Banks can offer insurance companies an additional distribution channel while at the same time offering their customers a useful supplementary product.

The COVID-19 pandemic had a significant impact on all aspects of life, including the implementation of innovations. According to the respondents, the most common effects of the pandemic on innovation were:

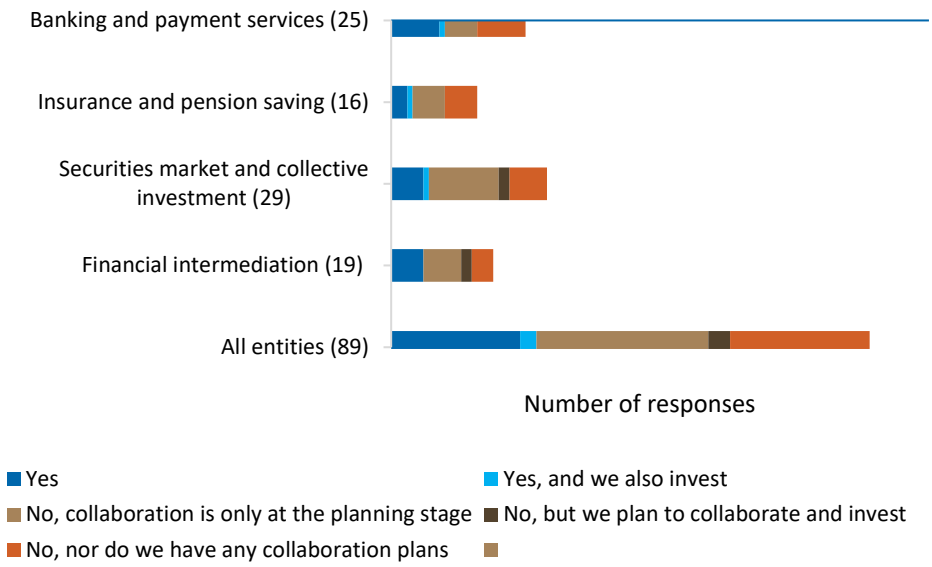
- acceleration and prioritisation of the implementation of innovations and digitalisation (42 entities)
- minimal effects (22 entities)
- changes in internal processes such as work from home and teleconferencing (13 entities)
- slower implementation of innovations (6 entities)

For most respondents, the pandemic and the measures adopted to fight it were motivation to accelerate the implementation of innovations and digitalisation in general, which was understandable since, at certain times, it was the only way to provide financial products and services. For a considerable proportion of the respondents, the pandemic did not have any significant impact on their implementation of financial innovations. These were often entities that already operated largely through digital channels and therefore did not need to make rapid changes in their established processes. Financial institutions that did not offer the possibility to work from home often had to get started quickly during the pandemic. Although the pandemic speeded up innovation for most respondents, there were also respondents for whom it had the opposite effect. Innovations could be held up if a lot of staff were off sick and there were obstacles to teamwork.

2.2 Relationship to FinTech

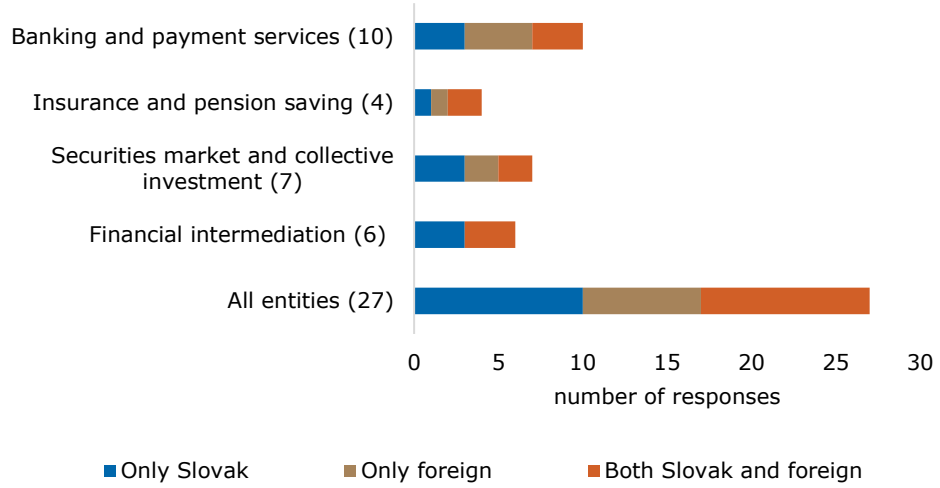
In recent years, new companies have begun to enter the Slovak market focusing on financial innovations known collectively as “FinTech”. The supervised entities have a relatively complex relationship to FinTechs. Some of the entities are collaborating with FinTech companies while others see them as competition; some of the respondents even defined their own business as “FinTech”.

Chart 5 Cooperation with FinTech companies



The question of cooperation with FinTech companies divided the respondents into three equal-sized groups. The first group, consisting of just under a third of the respondents (30%), already cooperates with FinTech companies, including a few who not only cooperate, but also invest in such companies (3 entities). The second group, with just over a third of respondents (34%), does not cooperate with FinTech companies or invest in them, but plans to change this in future. The third group, comprising the remaining 36% of respondents, has no current plans for cooperation with FinTech companies and does not expect to cooperate with them in future. The results are similar to the previous questionnaire two years ago, in which 32% of respondents said that they were cooperating with FinTech companies. The responses to this year's questionnaire suggest that cooperation with FinTech companies will increase in the near future. The entities that are most open to cooperation with FinTech companies are in banking and payment services whereas the least keen are entities operating in securities markets and collective investment. Approaches to collaboration with FinTech companies vary even amongst the entities currently cooperating with them or investing in them, as Chart 6 shows.

Chart 6 Cooperation with foreign FinTech companies



Cooperation with exclusively Slovak FinTech companies is reported by 37% of respondents and an equal proportion (37%) cooperate with both Slovak and foreign FinTech companies. A smaller percentage of respondents (26%) cooperate only with foreign FinTech enterprises. Since many FinTech companies operate internationally, it is interesting to observe that a relatively large number of respondents prefer working with local firms. The respondents to the questionnaire mentioned the following areas of FinTech cooperation:

- various IT solutions (9 entities)
- solutions for payment services (6 entities)
- remote customer identification (4 entities) and electronic signing (1 entity)
- AML (4 entities)
- working with data (3 entities)
- automation (2 entities) and digitalisation (1 entity)
- reporting (1 entity)

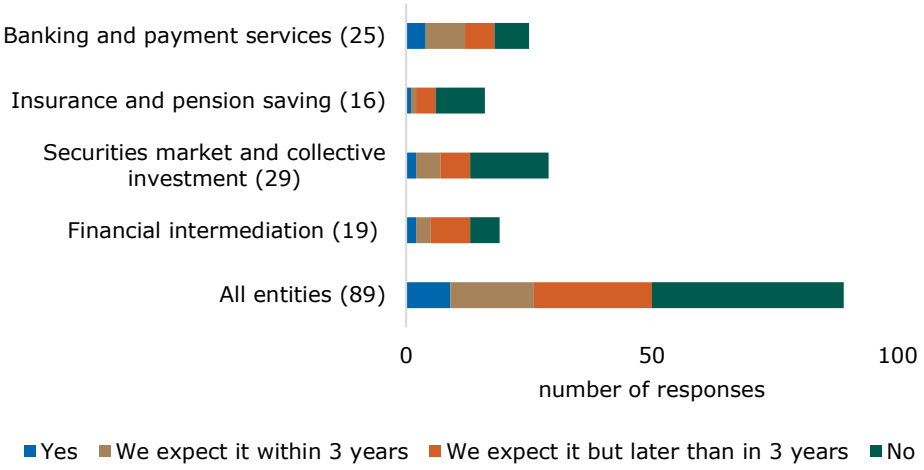
Most FinTech collaboration is broadly related to IT solutions. Several entities cooperate on solutions in the field of payment services, which only confirms the importance of this area within FinTech. The remaining areas of cooperation concern remote client identification, electronic signing and compliance with AML requirements. An interesting finding is the relatively small number of FinTech collaborations in the fields of automation, digitalisation and reporting. It suggests that supervised entities prefer to keep these activities in-house. FinTech collaborations can have risks as well as benefits. The main risks mentioned by respondents were:

- operational risk related to unreliability and outages (13 entities)

- weaker security and the possibility of data leaks (6 entities)
- "vendor lock-in" and over-reliance on external solutions (3 entities)
- compliance risk (2 entities)
- leaks of know-how (1 entity)

Financial institutions recognise the problems that could be caused by an unreliable FinTech partner, such as service outages or leaks of sensitive data. There are also risks even in working with a sufficiently reliable FinTech partner. Over-reliance on external solutions and "vendor lock-in" can become a problem when a financial institution later decides to change an existing solution. A FinTech company with a technically sound solution can also cause problems for a financial institution if the solution does not comply with the requirements of Slovak legislation. Another risk for financial institutions is the potential for leaks of know-how that collaborating FinTech companies could pass to competitors or use to boost their own competitiveness. The perception of FinTech companies as competitors is shown in the following chart.

Chart 7 Perception of FinTech companies as competition



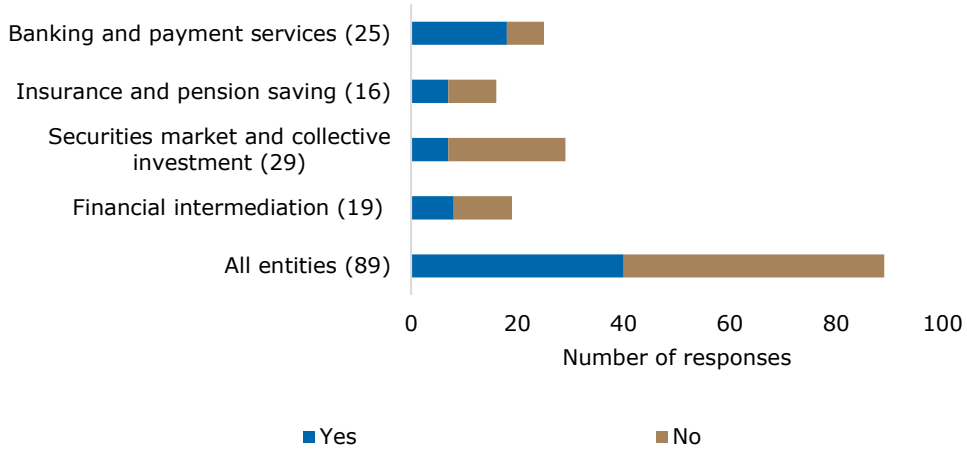
A tenth of respondents currently see FinTech companies as competitors for the business, just under a fifth (19%) of respondents expect that FinTech companies will become competitors within the next three years and just over a quarter (27%) of respondents think that FinTech companies could become their competitors in more than three years. The remaining respondents (44%) not only see no threat of competition from FinTech companies in the present, but also expect no such competition in future. The results are very similar to the findings of the questionnaire two years ago, when 13% of respondents saw FinTech companies as competitors. The areas where respondents see FinTech companies as competitors are payment solutions for merchants (1 entity), payment services in general (1 entity), provision of consumer credit (1 entity),

distribution of investment products (1 entity), insurance intermediation (2 entities) and the direct selling of insurance products (1 entity).

2.2 Relationship to Big Tech

Innovation is driven not just by supervised entities and FinTech, but also by "Big Tech" companies. These are large technology companies from outside the financial sector which provide services to financial institutions as can be seen in the following chart:

Chart 8 Cooperation with Big Tech companies



Almost half of respondents (45%) currently work with Big Tech companies, which is an increase compared to two years ago, when less than a third of respondents (32%) reported working with these large corporations. The highest level of cooperation (70%) is in banking and payment services. The sector least likely to cooperate with Big Tech was securities markets and collective investment, where just under a quarter (24% of respondents) reported such cooperation. A better understanding of such cooperation requires knowing the specific forms involved. The respondents to the questionnaire mentioned the following areas of cooperation with Big Tech:

- various software services (15 entities)
- cloud (13 entities)
- mobile applications (6 entities)
- payments (6 entities)
- advertising (3 entities)
- automation (1 entity)

Cooperation can cover quite broad areas, which explains why the most answers used the general category – various software services. As regards specific areas,

cloud computing clearly stands out, followed at a distance by mobile applications and payments. A few entities also mentioned cooperation on advertising and automation. It is likely that many of the entities that did not mention any area of cooperation use some Big Tech products, but do not consider this to be cooperation.

While there was a relatively large amount of variation regarding areas of cooperation, there was more agreement on the specific Big Tech companies that respondents worked with. The following Big Tech firms were mentioned:

- Microsoft (24 entities)
- Google (23 entities)
- Apple (17 entities)
- Amazon (12 entities)
- other Big Tech companies: Facebook, IBM, Adobe, PayPal, Xiaomi (6 entities)

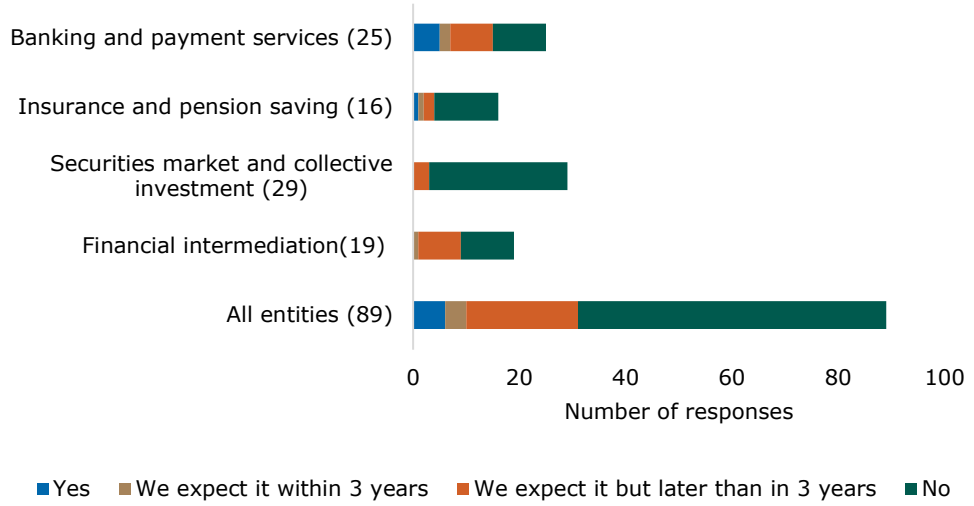
As with the previous question, it is reasonable to expect that the entities that did not mention any of the Big Tech firms actually use some of their services. Cooperation with Big Tech companies also comes with risks as well benefits. The most frequently mentioned risks of cooperation with Big Tech are:

- data security (10 entities)
- over-reliance (6 entities)
- disadvantageous conditions due to a weaker bargaining position (5 entities)
- operational reliability (5 entities)
- high costs (3 entities)
- other – non-approval of newer versions of mobile applications and compliance risk (2 entities)

Respondents' greatest concerns relate to data security. The leakage of sensitive data or direct misuse by a Big Tech firm could have disastrous consequences for a financial institution. Another significant risk is over-reliance on Big Tech solutions. After the internal systems of a financial institution have used the services of a specific Big Tech firm for several years, they typically become tightly integrated with such services and it would therefore be very expensive to change the service provider. Over-reliance can also be a problem on the operations side. Any Big Tech service outage could completely cripple the operations of a financial institution. Big Tech firms dominate the market and therefore do not, as a rule, negotiate on conditions of cooperation and prefer to lay down their own terms, which can result in a financial institution accepting unfavourable conditions. Some Big Tech firms are starting to offer services in

financial markets directly, which financial institutions could see as potential competition. The respondents' views on this question are illustrated in Chart 9:

Chart 9 Big Tech companies as competition



Only a tiny minority of the respondents (3%) currently see Big Tech firms as competition (3 entities), which makes sense because the financial services that Big Tech companies currently provide in the Slovak market are relatively limited. A similarly small proportion of respondents (4%) expect Big Tech firms to become their competitors within the next three years. Nearly a quarter of respondents (24%) expect the Big Tech companies to be their competitors in a period over three years. A large majority of respondents (65%) do not foresee any competition from Big Tech. The situation has not changed much in the last two years since the previous survey when just 2% of respondents saw Big Tech as a competitor. Only the future will tell whether the Big Tech companies will begin providing financial services on a large scale in the Slovak market and what market share they will acquire.

2.4 Specific innovations

In addition to the more general questions on attitudes to innovations, the questionnaire also asked about the specific financial innovations that respondents had implemented. Amongst the most important innovations introduced in the last three years, respondents mentioned:

- optimisation of web and mobile apps for customers (24 entities)
- remote customer identification for online onboarding (11 entities) and the introduction of electronic signing (9 entities)
- digitalisation (4 entities), automation (6 entities) and robotisation of processes(4 entities)

- use of cloud computing (4 entities) and RegTech solutions (2 entities)
- use of elements of artificial intelligence (2 entities)
- telemetry (1 entity)
- opening of a branch in the metaverse (1 entity)

Most respondents mentioned work on web and mobile apps for customers. This was an expected result because financial institutions continuously improve the functionality and expand the potential of their web and mobile apps. It is to be expected that most financial institutions made changes in their web and mobile apps in a greater or lesser extent. The second most frequently mentioned type of innovations was remote customer identification, mainly by means of biometrics or electronic signing. The growth of remote communication with financial institutions that eliminates the need to visit a place of business in person has been going on for several years with the COVID-19 pandemic being a major driving force. Another trend that the pandemic accelerated was digitalisation, automation and the use of robotisation for internal processes. The purpose of such innovations is to increase their efficiency and reduce costs. Financial institutions increased their use of cloud computing and various RegTech solutions for the same reasons. A few respondents mentioned rarer innovations such as the use of elements of artificial intelligence, the introduction of a new type of insurance or the opening of a branch in the metaverse.

The survey did not restrict itself to current innovations but also inquired about future innovations that financial institutions are still working on. The most important innovations that respondents plan to implement in the next three years include:

- improvements in web and mobile apps (19 entities)
- remote customer identification for onboarding (15 entities) and the introduction of electronic signing (9 entities)
- use of elements of AI (9 entities)
- automation (8 entities), digitalisation (9 entities) and robotisation (2 entities) of processes
- use of cloud computing (3 entities)
- instant payments (3 entities)
- telemetry (2 entities)
- new products such as fractional shares (1 entity), Pre-IPO access (1 entity), digital assets (1 entity)

The results suggest that current trends still have some way to run. Financial institutions will continue to focus mainly on improvements to their web and mobile applications. Entities that do not yet offer online onboarding or

electronic signing will develop such solutions. An area where increased interest can be observed is the use of AI. While only two entities included AI in their most important current innovations, AI was ranked among the most important innovations of the next few years by nine respondents.

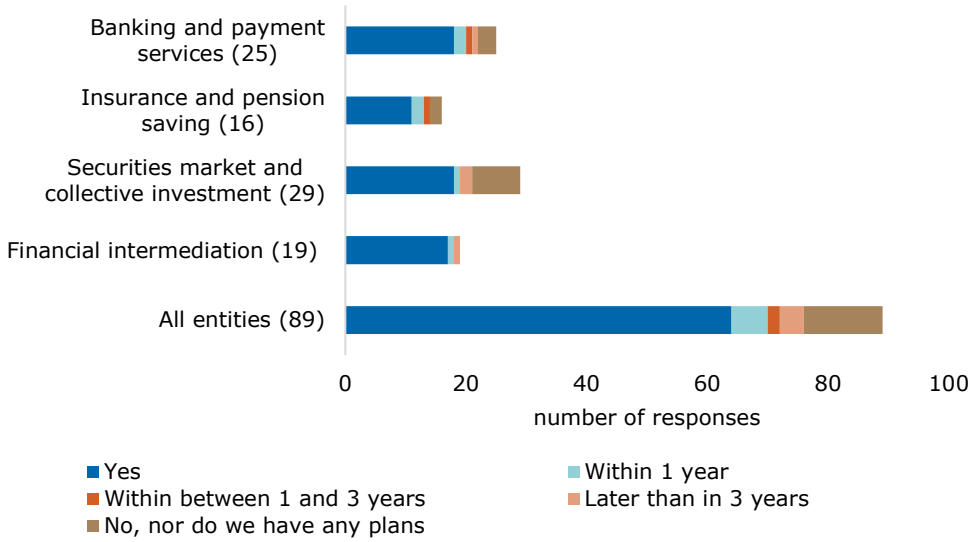
3. Cloud, big data, AI, RPA & IoT

New technologies are gradually transforming the Slovak financial market. There are, however, significant differences in approach between sectors and between individual financial institutions. The differences are not just in the technologies that are deployed but also in the purposes and method of their use by financial institutions. The same technologies can be used in very different ways. NBS's survey therefore asked the respondents about the ways that they used or did not use specific technologies.

3.1 Cloud computing

As has already been made clear, cloud computing is one of the most popular technologies adopted by financial institutions in the Slovak market. The respondents' views on this technology are set out in Chart 10.

Chart 10 Use of cloud computing



A large majority of respondents (72%) already use cloud computing. Another 7% of respondents plan to start using it in the next year. The same proportion (7%) plan to implement cloud computing at a later date and just 15% of respondents have no plans to use such technology at present. Compared to two years ago, there has been a noticeable increase in cloud use. In the last survey, 57% of respondents worked with the cloud. In terms of sectors, cloud computing is most used by financial intermediaries. It is least used in the securities markets and collective investment sector, but even here most

respondents are already using the cloud (60%). Respondents report using the cloud for the following purposes:

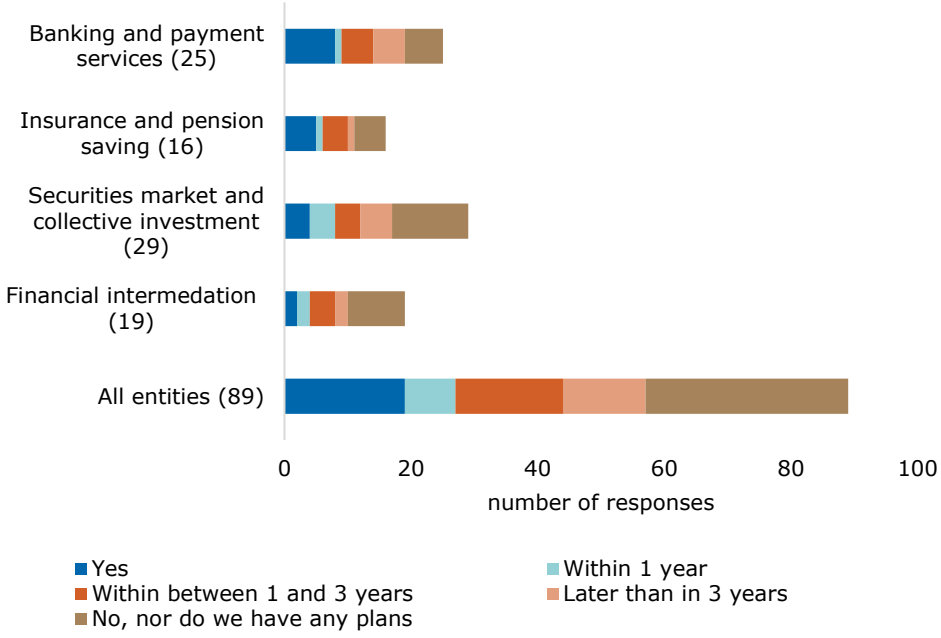
- data sharing within the organisation (27 entities)
- data backup and archiving (21 entities)
- mobile and web applications for customers (10 entities)
- e-mail (9 entities)
- operation of whole infrastructure (8 entities)
- authentication, digital onboarding (3 entities) and video calls (1 entity)

The most commonly reported uses of the cloud are for internal purposes such as sharing or backing up data and e-mail. A smaller proportion of the respondents use cloud computing not only for internal systems, but also for their customer-facing mobile and web apps. Some entities have even moved their entire IT infrastructure into the cloud.

3.2 Big data

Recent years have seen exponential growth in the volume of data available to financial institutions. It is not always possible for individual entities to make efficient use of such data. Well-used data can help a financial institution to improve the quality and efficiency of many processes. Many financial institutions have therefore invested in the complex analysis and use of large data sets, "big data", as illustrated in Chart 11.

Chart 11 Use of big data



Just over a fifth of respondents (21%) have already implemented big data analysis, just under a tenth (9%) plan to start in the next year and more than a third (33%) in the more distant future. The largest group of respondents (36%) do not plan to work with big data even in the future. This represents a slight increase compared to the survey two years ago, when 17% of respondents reported using big data analysis. The most active users of big data analysis at present are found among banks and payment services companies while it is least used by respondents providing financial intermediation. Respondents use big data analysis mainly for the following purposes:

- risk monitoring and identification of potential problems and fraud (4 entities)
- reporting and statistics (4 entities)
- customer behaviour analysis (3 entities)
- testing algorithms on historical data and predictions (3 entities)
- other purposes, e.g. personalised marketing (1 entity), segmentation (1 entity) or improvement of processes (1 entity)

Big data analysis can be helpful in detecting phenomena that people cannot see or overlook at first glance. Such data can help entities to detect problems such as fraud or to predict future events. As reporting duties involve increasing volumes of data, it is another area where interest in big data analysis is growing. It can also help financial institutions to develop a better understanding of their customers' needs and behaviour.

3.3 AI

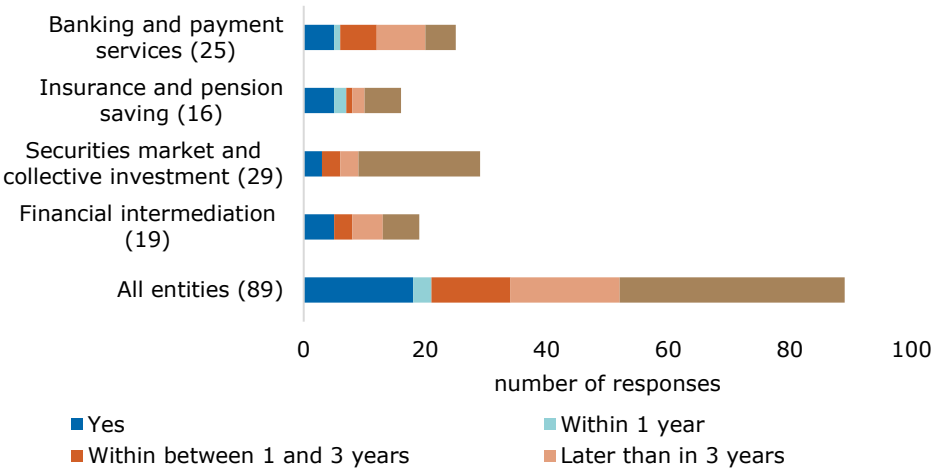
The use of AI by mainstream consumers is one of the most prominent trends of recent months. Anyone can give any question to an AI and will generally receive a relevant answer. NBS decided to ask the AI itself about AI use. On the question: *"How is AI currently being used in the Slovak financial market and what potential can AI offer the Slovak financial market in the future?"* the AI responded as follows:

> *"Current uses of AI in the Slovak financial market include, for example, its use by banks and insurance companies to automate and streamline processes such as credit scores, insurance claim processing and the calculation of insurance plans. AI's potential future uses in the Slovak financial market include the use of artificial neural networks to increase the efficiency and precision of risk management, to personalise customer*

services and to improve the customer experience. AI can also be used to develop new financial products and services. [2]

The survey gave similar questions to the financial institutions operating in the Slovak market. Respondents' attitudes to AI are illustrated in Chart 12.

Chart 12 Use of AI



Only a fifth of respondents are using AI at present. Only a few respondents (3%) plan to start using it in the next year, but more than a third (34%) have AI in their longer-term horizon. The largest group of respondents (42%) are not using AI and have no plans to change that in future. If some of the optimistic predictions about the future of AI come true, however, all financial institutions will be forced to reconsider their positions on this technology. In a competitive environment, supervised entities that are not using AI may gradually fall behind the financial institutions that integrate this technology into their solutions. AI is an area with some of the strongest growth since the last survey two years ago, when just 6% of respondents were using the technology. The insurance and pension saving sector uses AI the most and the securities markets and collective investment sector uses it the least. The survey respondents mentioned the following uses of AI:

- retention and exceptions for discounts (4 entities)
- biometrics for remote customer identification (3 entities)
- robotisation for cancellation of insurance benefit assignments (2 entities)
- prediction models (2 entities)
- monitoring of calls and IT applications (2 entities)
- recognition and evaluation of objects (1 entity)
- price elasticity calculations (1 entity)
- chat with customers (1 entity)

[2] *ChatGPT. OpenAI. Accessed at: https://openai.com/blog/chatgpt/*

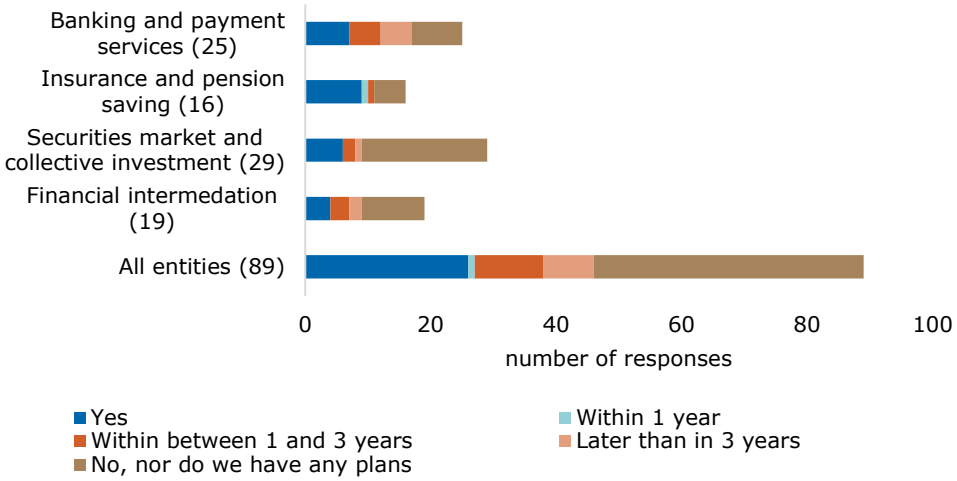
- customer behaviour analysis (1 entity)
- monitoring of calls and IT applications (2 entities)
- image, sound and text analysis (1 entity)

Compared to other technologies, such as cloud computing, AI has a much more diverse range of uses. Individual financial institutions use AI for completely different tasks. The most frequently mentioned included customer retention, biometrics and prediction models. It is interesting to note that only one respondent uses AI for chatting with customers. Considering the significant progress that has recently been made in this area, it would be fair to expect much more frequent use in the future, which could lead to the gradual replacement of customer support by AI chatbots.

3.4 RPA

Robotic process automation (RPA) is utilised for processes that repeat according to a set of known rules and are therefore suitable to be carried out by a robot or software. Typical use cases are data processing or communication with other digital systems. As its name suggests, RPA is used mainly to automate processes in ways that reduce costs and increase efficiency. Respondents' use of RPA is described in the following chart:

Chart 13 Use of RPA



Less than a third of respondents (29%) currently use RPA, just over a fifth (22%) plan to start using it in future, but almost half of respondents (48%) do not use or plan to use RPA. Of the studied sectors, it is most used by insurance and pension savings companies, where more than half the respondents (56%) are already using this technology. Conversely, the sector with the least interest is securities markets and collective investment. The main purposes for which respondents use RPA are:

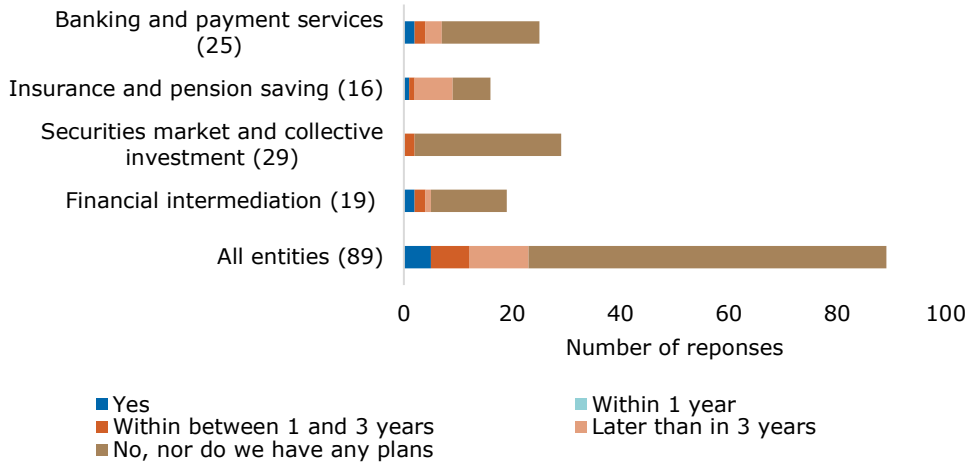
- back office automation and software testing (9 entities)
- transaction processing and validation of customer transactions (4 entities)
- evaluation of customer risk profile and regular checks in sanctions lists and registers (3 entities)
- communication between insurance companies and subordinate financial agents (3 entities)
- other purposes, e.g. processing e-mail correspondence (1 entity), downloading files from external sources (1 entity) or registration of smaller insurance limits (1 entity)

The most frequent RPA applications mentioned by respondents were back office processes and the testing of internal systems, which are closely related to the processing of customer transactions, e-mail correspondence and downloading data from lists and databases. However, RPA can also be used for external processes such as communication with collaborating financial institutions.

3.5 IoT

The Internet of Things (IoT) is one of the major technological trends of recent years. In very simple terms it can be described as a set of methods for connecting things via the internet. These connections create new opportunities for interaction within systems as well as new way to remotely control and track things, including access to more advanced services which would be inconceivable without an internet connection. Use of IoT in the Slovak financial market is relatively limited at present, as can be seen from Chart 14.

Chart 14 Use of IoT



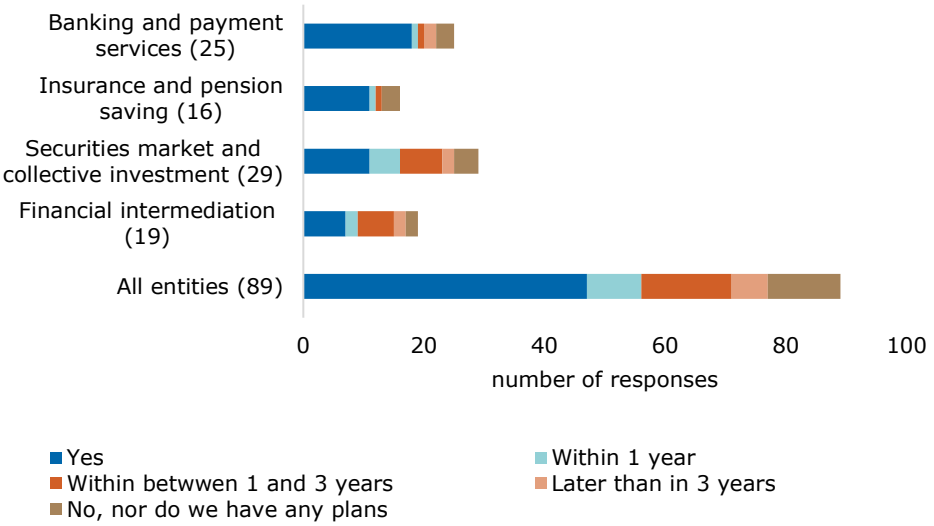
Just 6% of respondents currently use IoT, a fifth of respondents plan to use it in future and the remainder, nearly three quarters (74%), do not use it and have no plans to do so even in the future. The sector that uses IoT the most is financial intermediation, and it is used the least in the securities markets and collective investment segment, where none of the respondents use this technology. Respondents use IoT in internal processes such as printing systems (3 entities), camera systems and alarms, or external processes such as POS terminals and cash ATMs (2 entities). Only one respondent reported using IoT to provide smart products for customers.

4. Online onboarding and mobile applications

4.1 Online onboarding

Amongst the hottest trends of the last few years has been digitalisation in the provision of financial services. Clients are making fewer visits to the brick-and-mortar branches of financial institutions and increasingly using online services. At the same time, a growing proportion of financial institutions are enabling customers to start using their services without setting foot in a place of business, as shown in Chart 15.

Chart 15 Online onboarding of new customers



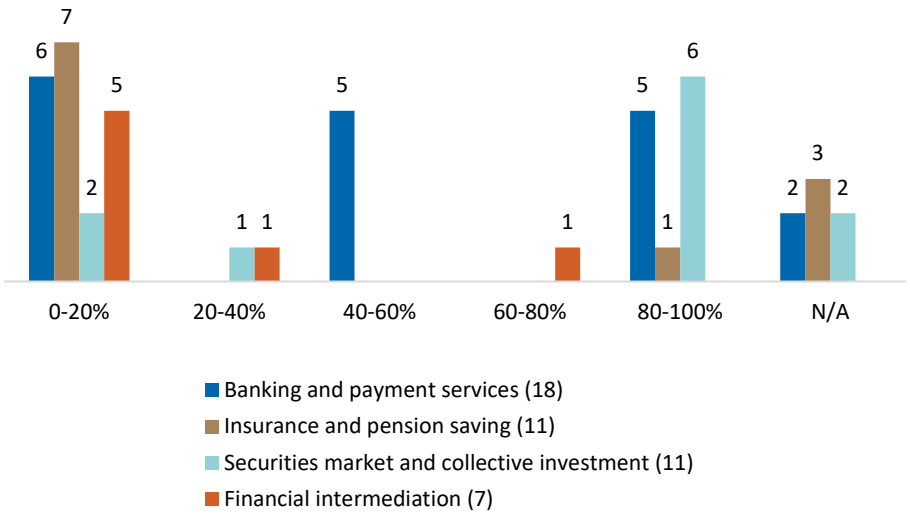
Most respondents (53%) already offer online onboarding, which is a way for customers to start using the financial institution's services without having to visit it in person. Over a third of respondents plan to implement this option in future. Just a fraction of respondents (13%) are not interested in offering online onboarding for new customers. Use of online onboarding is growing year by year, as can be seen from a comparison with the situation two years ago, when only 40% of respondents provided this service. Implementation is most advanced in the banking and payment services sector and it is rarest in the financial intermediation sector. Competition has driven banks to allow customers to open accounts and access other services online whereas financial intermediaries continue to prefer in-person meetings with customers. There are differences in the way individual financial institutions implement online onboarding. In addition to presenting identification documents, which are a

matter of course, respondents report using the following means of identification in the remote customer identification process:

- biometric verification (14 entities)
- video call (7 entities)
- verification of data in the registers of the Ministry of the Interior of the Slovak Republic (6 entities)
- account statement (6 entities)
- notarial certification of signature or an advanced electronic signature (5 entities)

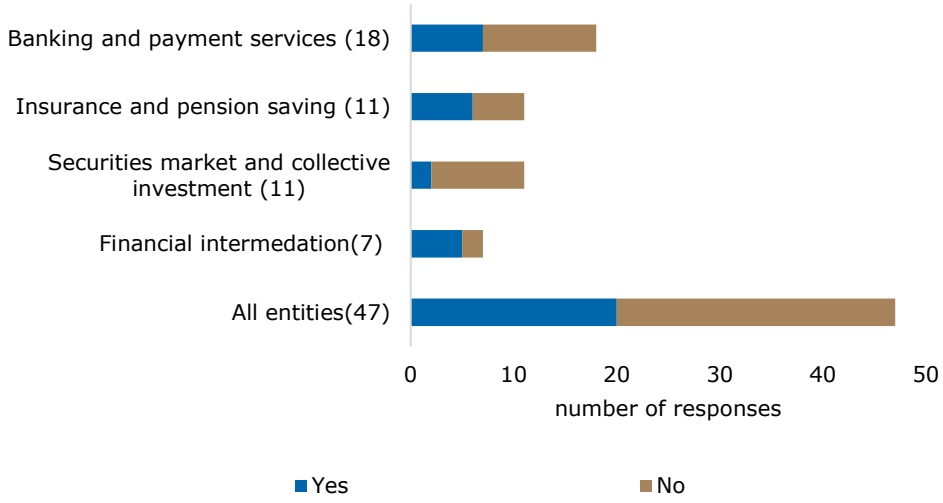
Respondents mostly used biometric identification, often supplemented by checks in the registers of the Ministry of Interior of the Slovak Republic. Video calls for identification are now relatively simple from a technical point of view but place high demands on personnel. Other items that financial institutions use for identity checks include a statement from an existing bank account, an advanced electronic signature and even older means of identification like notarial certification of a signature. In remote customer identification, a financial institution must balance two competing interests. On the one hand, they need to obtain sufficient data to identify the customer unambiguously but on the other, the entire process needs to be quick and simple so as not to put off the customer. A negative example is the respondent who wrote that their remote customer identification process is so complicated that none of the customers have ever managed to complete it and that everyone who tried it ultimately decided to go to the respondent in person. At the same time there are other financial institutions where most new customers are recruited through online onboarding, as Chart 16 shows.

Chart 16 Percentage of new clients using online onboarding



Respondents most often (43%) reported that only 0-20% of new clients used online onboarding, another 17% of respondents claimed 20-80% of new clients used it, and just over a quarter of respondents (26%) said that more than 80% of new clients used this option; the remaining respondents who offered online onboarding did not have the data to answer. There were also significant differences between sectors. While over half the respondents operating in securities markets and collective investment claimed that over 80% of their new customers used online onboarding, the number of respondents in financial intermediation claiming such a high rate of online onboarding was zero. In some financial institutions, customers who use online onboarding do not have the same status as customers who have visited a place of business in person and they are subject to certain restrictions, as illustrated by Chart 17.

Chart 17 Restrictions for clients using online onboarding

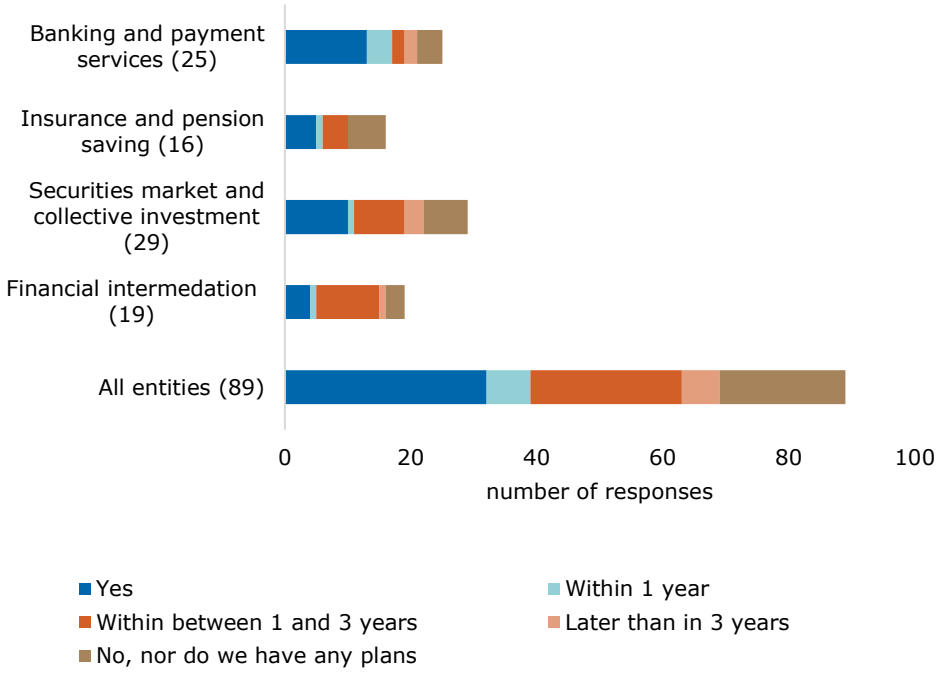


A majority of respondents (57%) said that they had no restrictions for customers who used online onboarding. Restrictions were least likely to be applied by entities operating in securities markets and collective investment and most likely to be applied by financial intermediaries. The most common restrictions were reductions in the range of products and services available (10 entities) and maximum limits on customers' use of individual products (2 entities), with some entities using a combination of both restrictions (3 entities). Less common restrictions included the blocking of active operations (1 entity) and restrictions on the purposes for which funds could be used (1 entity). Additionally, in some cases, respondents allowed online onboarding only for certain types of customers – e.g. natural persons – consumers who were citizens of the Slovak Republic and therefore had the lowest level of risk (2 entities).

4.2 Mobile applications

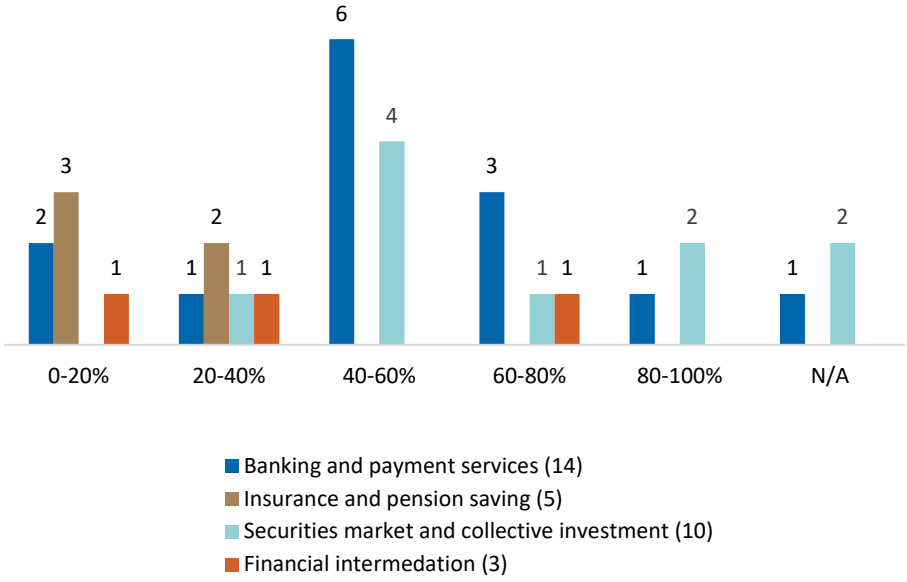
Another effect of the digitalisation trend is that more and more customers are using distance financial services. The rapid development of smartphones has helped mobile applications become a popular way to access financial services remotely. As a result, the number of financial institutions offering their customers a mobile app is increasing every year:

Chart 18 Provision of services through mobile apps



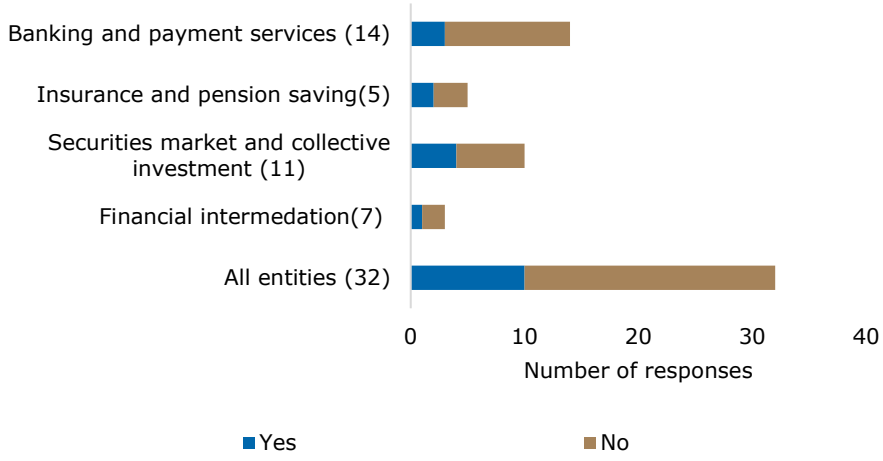
At present, over a third of respondents (36%) operate a mobile app for their customers and another 42% of respondents plan to launch such an app in future. Only just over a fifth (22%) are uninterested in this possibility. This represents a small increase compared to the situation two years ago when mobile apps were offered by 32% of respondents. The sector where entities are most likely to have a mobile app is banking and payment services sector whereas financial intermediaries are the least likely to provide an app. While mobile apps have become a matter of course for banks, financial intermediaries still have no strong motivation to offer them to their clients because the clients often use the mobile apps of each financial institution directly and do not need another app from their financial intermediary. Many customers use banking apps every day but would probably use a financial intermediary's app only briefly when interested in purchasing a new financial product or service. Customers have become used to the mobile apps of financial institutions and use them extensively, as Chart 19 shows.

Chart 19 Percentages of customers using mobile apps



The respondents' responses are distributed relatively evenly. The largest group of respondents (31%) said that 40-60% of their customers used their mobile app, while the smallest group (9%) was respondents claiming that over 80% of customers used it. The sector with the most widespread mobile app use is securities markets and collective investment, where a fifth of the respondents said that over 80% of their customers used their mobile app. The lowest customer use levels were reported in insurance and pension savings, where most respondents said that less than 20% of customers used their mobile app. There are large differences between mobile apps both between the sectors and between specific financial institutions, not only in terms of design, but also in terms of functionality, as can be seen in Chart 20.

Chart 20 Access to all products/services through mobile apps



Most respondents (69%) do not offer customers access to all their financial products and services through their mobile app. The insurance and pension savings sector is most likely to provide full access and the financial intermediation sector is the least likely to do so. This is not so surprising given that financial intermediaries are highly dependent on their cooperation with other financial institutions, whose products they distribute, and therefore they cannot guarantee the availability of all their offerings through an app. The services that were least likely to be available to customers through mobile apps, according to the respondents, were:

- some investment services, trading on the stock exchange, one-time investments and some investment platform features (5 entities)
- some reports and statements (4 entities)
- some types of insurance and amendments to them (3 entities)
- some credit products such as mortgages, refinancing loans and motor vehicle financing loans (3 entities)
- requests to change data or signature samples (2 entities)
- all services except for selected services with their own application e.g. remote customer identification and payment card services (2 entities)

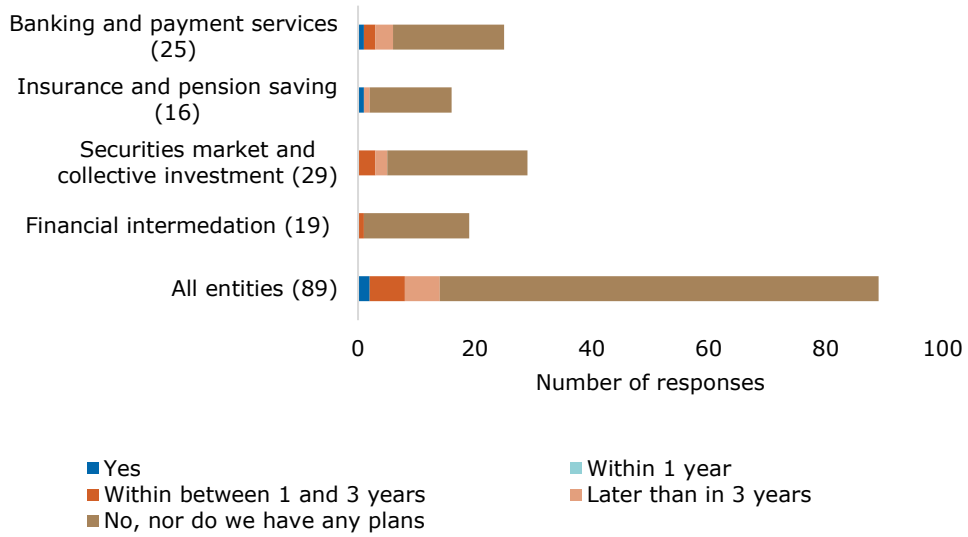
Restrictions usually involve offering a narrower range of products and services, but also withholding changes in data or signature samples. One of the interesting findings of the survey is that some financial institutions have dedicated mobile apps for specific services such as remote customer identification.

5. DLT, smart contracts and crypto-assets

5.1 Use of DLT and smart contracts

A few years ago there was intensive discussion about how DLT would bring about a fundamental change in the operation of the financial sector. In the Slovak financial sector, the technology remains the exception rather than the rule, as Chart 21 shows.

Chart 21 Use of smart contracts and DLT

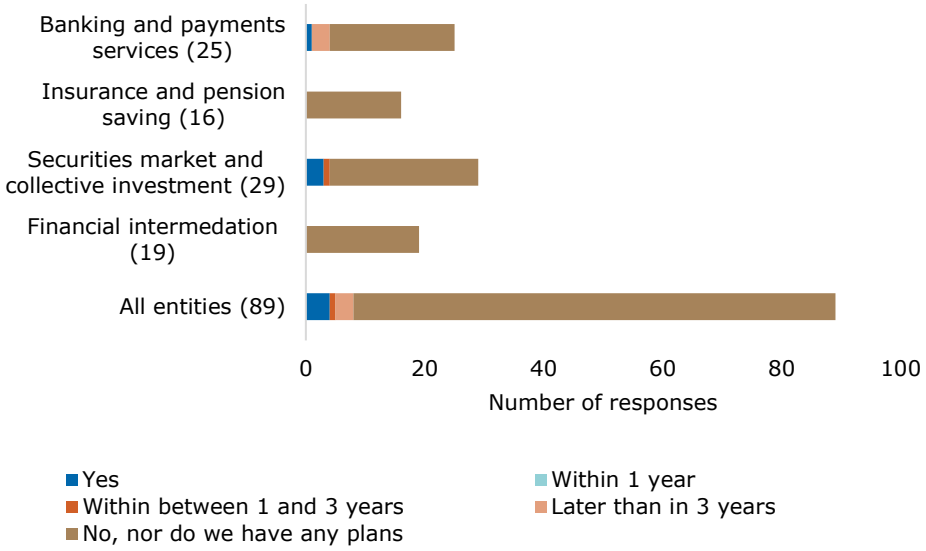


Only a miniscule proportion of respondents (2%) currently use DLT and smart contracts, a few more (7% of respondents) plan to start using this technology in the next 1-3 years and a similar proportion in 3 or more years. The vast majority of respondents (84%) have no plans to use this technology even in the future. At the time of the previous survey two years ago, no respondents were using this technology. One entity in the banking and payment services sector mentioned using DLT and smart contracts. They use the technology to demonstrate that nobody has tampered with an information package provided to a customer. Another entity has applied this technology in the insurance and pension savings sector and uses DLT and smart contracts when concluding insurance contracts. Use of DLT could increase in future thanks to the new European regulation on a pilot regime for market infrastructures based on DLT, which establishes a clear legal framework for the use of the technology.

5.2 Activities related to crypto-assets

Crypto-assets remain the most significant application of DLT. They represent a new type of asset that is used for investment purposes and to a lesser extent for payments. Slovak financial institutions currently engage only minimally with crypto-assets, as Chart 22 shows.

Chart 22 Provision of crypto-asset related services



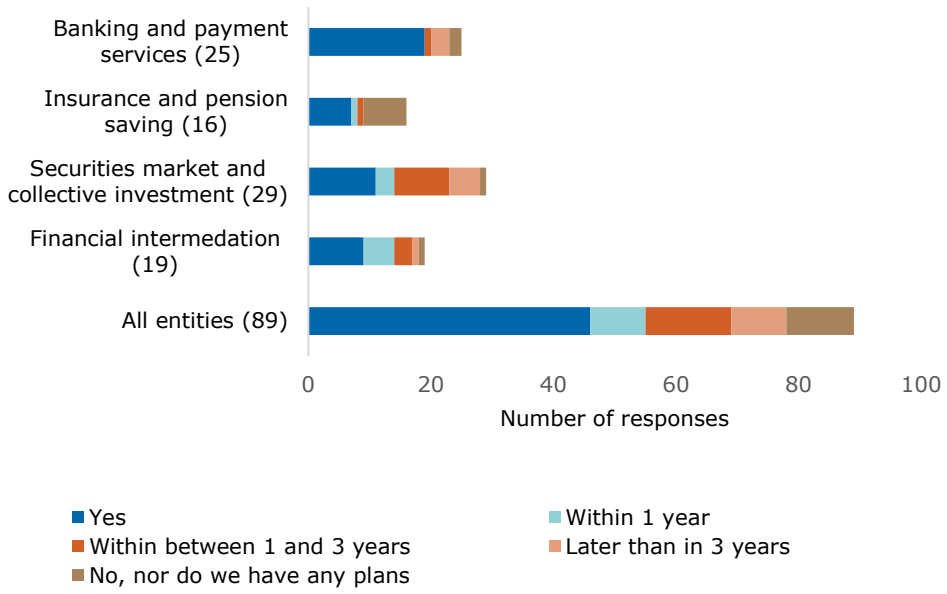
A few respondents (4%) currently provide crypto-asset related services and a similar number (4% respondents) plan to offer such services in future. The remaining vast majority (91% of respondents) have no plans to provide services related to crypto-assets even in the future. In the last two years, the proportion of respondents providing crypto-asset related services has not changed. In the previous survey, it was also 4% of respondents. As regards sectors, the strongest interest is in the securities markets and collective investment sector, where three entities provide crypto-asset related services. The specific services are CFD contracts linked to crypto-assets (2 entities) and an investment fund specialising in crypto-assets. It will be interesting to see whether this situation will change after the implementation of the planned EU Markets in Crypto-assets (MiCA) Regulation, which will enable several types of financial institutions to provide crypto-asset services without requiring additional permits. According to the survey, this could motivate even some large financial institutions to provide such services. Furthermore, at present many financial institutions still do not know what MiCA will enable them to do and therefore there is reason to believe that even though they are not considering such activities at the moment, competitive pressure could force them to review their position.

6. RegTech and cybersecurity

6.1 RegTech

Financial institutions use technological innovations not just to create new products and services for their clients but also to improve their internal processes and especially to improve compliance with their duties as supervised entities. The tools that they use for this purpose are known as "RegTech". Financial institutions operating in the Slovak market already make significant use of RegTech tools, as Chart 23 demonstrates.

Chart 23 Use of RegTech tools



Most respondents (52%) already use RegTech tools and over a third (36% of respondents) plan to start using such tools in the future, whereas only a small number of respondents (over 12%) are not considering such a possibility. RegTech is the area that has changed most in the last two years. In the last survey, only 9% of respondents used Regtech tools. From a sectoral viewpoint, RegTech is most widely used in the banking and insurance sectors, where use of such tools was reported by over three quarters (76%) of respondents At the other end of the scale, the lowest use is in the securities markets and collective investment sector, where RegTech tools are used by less than half of respondents (44%). The most frequent uses of RegTech mentioned by respondents were:

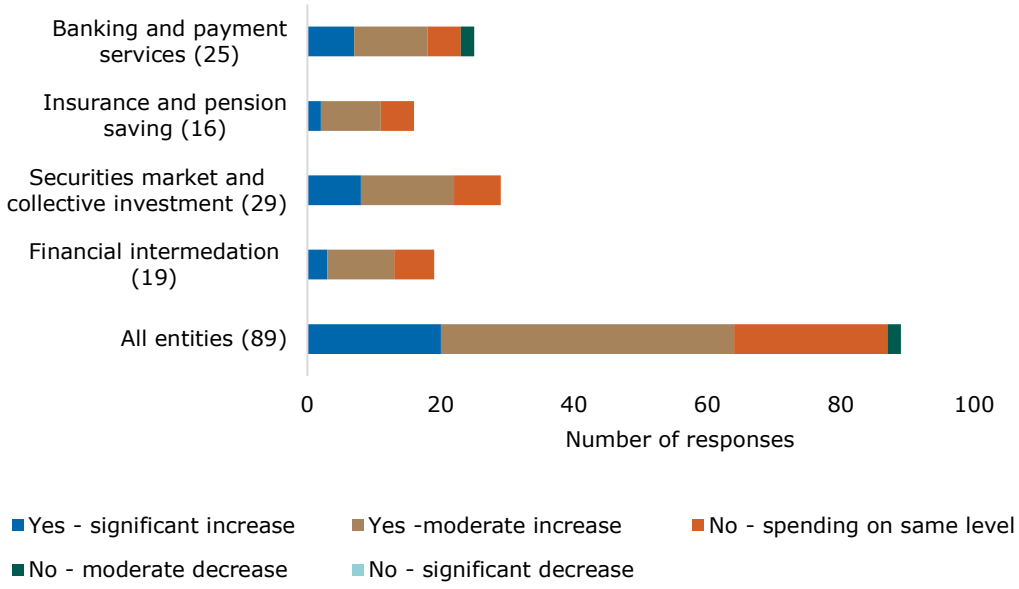
- customer onboarding and AML compliance (KYC) (34 entities)
- fraud prevention (4 entities)
- reporting (2 entities)
- cybersecurity tools (2 entities)
- analytical system APIs (2 entities)

The results make clear that respondents use RegTech solutions primarily for AML compliance both during onboarding and later in the customer relationship. Financial institutions need to keep up with constantly changing sanctions lists and lists of politically exposed persons and it is usually most convenient to use commercial solutions specialising in this area. In addition to checking customers against these lists, financial institutions use RegTech solutions to monitor transactions both to flag suspicious transactions for AML purposes and for the protection of customers against fraud. Other, less frequently mentioned uses of RegTech solutions include reporting to supervisory authorities and connections to various analytical systems.

6.2 Cybersecurity

As the complexity of the technologies used by financial institutions continuously increases, their exposure to operational risk also grows. An outage or other problems in any technological solution can cause significant damage to financial institutions and even prevent them from operating for a time. This increases the importance of cybersecurity, as Chart 24 illustrates.

Chart 24 Increasing expenditure on cybersecurity



Nearly half the respondents (49%) plan a moderate increase in spending on cybersecurity in the next three years, just over a quarter (26%) plan to keep spending at around the same level as at present and a similar proportion (22%) plan a significant increase. A few respondents (2%) plan a moderate reduction in spending in this area but no respondents expect to make significant cuts. The largest increase in spending on cybersecurity are planned by entities working with securities markets and collective investment and smallest increase are planned by insurance and pension savings companies. The purposes of increased cybersecurity spending that respondents mentioned most frequently were:

- penetration tests and protection against cyberattacks (23 entities)
- increased security for data, sensitive information and systems (17 entities)
- monitoring of logs, incidents and transactions (11 entities)
- human resources and training for staff (8 entities)
- compliance with existing and new regulations, e.g. NIS, DORA (4 entities)

Financial institutions recognise their potential vulnerability and therefore plan to invest resources mainly in protection against cyberattacks. A closely related aim is monitoring their IT infrastructure and any relevant incidents. Many financial institutions are making deliberate efforts to harden the security of their key data and systems. It does not matter how good a technical solution is if there are not enough qualified personnel to operate it, so it is natural that some respondents plan to increase spending on human resources. It should also be remembered that there are regulations governing cybersecurity. The implementation of the EU's Digital Operational Resilience Act (DORA), which lays down uniform rules for financial institutions across the EU, will lead to significant changes in this area. It will take some time to adapt to the amended legislation. Some respondents have therefore begun preparations for the new rules already.

Conclusion

Active support for financial innovations is a priority for NBS. To provide it, it needs to know what financial innovations and technologies are really being used in the Slovak market. NBS therefore carried out a survey of financial institutions to map their use of innovations.

The results of this survey show variations in approaches to innovations and technologies, not only between specific financial institutions but also between sectors. The results make clear that certain technologies are already well established in the Slovak financial market, while the implementation of others can be expected in the near future; on the other hand, there are some that must wait until the more distant future and some that financial institutions have no plans for at all. Of course, only the future knows which other innovations will become a normal part of the Slovak financial market.

In conclusion, NBS would like to thank all the respondents who took part in the survey and thereby helped to create a more complete map of innovation use in the Slovak financial market. NBS plans to conduct further surveys at regular intervals to track and compare the development of financial innovations.