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THE POTENTIAL OF ARTIFICIAL INTELLIGENCE IN FINANCE

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ABSTRACT
The world of finance is changing, with digitisation entering all areas of our lives, including finance. It is called fintech, or financial technology, which is now at the stage where we can start talking about the financial applications of artificial intelligence. Financial digitisation is wide-ranging, from core processes, through back- and front-office applications, all the way to the customer. We channel a lot of data into bigdata. The amount of data stored here on a daily basis can no longer be manually processed. This is where solutions such as automation, machine learning and ultimately artificial intelligence come in. In this paper, I will introduce the concept of fintech and its relation to the financial applications of artificial intelligence.

JEL codes: G00, O33, Q55,

Keywords: fintech, automation, digitisation, artificial intelligence, finfluencer

1 THE EVOLUTION OF THE FINTECH PHENOMENON

The development of Fintech can basically be divided into 3 stages. The beginning of Fintech 1.0 dates back to the summer of 1866, when the first telegraph cable was laid across the Atlantic Ocean - In fact, it was the start of the first era of financial globalisation, and it was an invention that enabled the transmission of information not only regionally but also intercontinentally (*Arner* et al., 2015). An important part of this era was the spread of the use of the telex machine (*Ashta–Biot-Paquerot*, 2018). In 1933, Germany introduced the use of teleprinters. By the end of the Second World War, they had grown into a network that covered most of Europe and, by 1957, was present in 39 countries. The next major event of the Fintech 1.0 era was the launch of the first general-purpose credit card in 1950,

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which was co-founded by Diners Club co-founders *Frank McNamara* and *Ralph Schneider* (Diners Club International, 2022).

A breakthrough innovation marked the beginning of the second era of Fintech Ashta–Biot-Paquerot, 2018). The idea was based on a feature of the post-war world: the widespread use of cheques. This meant greater convenience than conducting cash transactions, carrying and counting change. On the other hand, banks had to do a lot of costly accounting work, and the reason for this was economic development, as, of course, rising wages made it more expensive for them to employ more staff. Higher wages increased the demand for leisure activities at the expense of weekend work. In addition, customers continued requesting cash on Saturdays and even on Sundays. Taking these factors into account, they tried to create a system that reduced accounting costs, but, at the same time, allowed them to provide a higher level of banking services. The solution to these problems was the introduction of ATM in 1967. In the beginning, customers could withdraw money against a voucher on any day for 6 months, but this system required manual bookkeeping. The scope of banking functions was reorganised and the work of the retail branches was taken over by central offices. With this move, banks wanted to reduce costs, but the implementation was not as successful as expected.

The next initiative that defined Fintech 2.0 was the implementation of SWIFT (Society for Worldwide Interbank Financial Telecommunication) in 1973 (Ashta–Biot-Paquerot, 2018). As with most of the solutions already mentioned or to be mentioned below, its development was initiated in the hope of working more efficiently and providing a higher level of service. In the 1960s, a number of major US and European banks invested in private networks and various computer equipment to enable cross-border banking. In these international transactions, effective communication between them played an important role, but free text messages often contained minor or major errors, which unfortunately hindered the process. The solution was the standardisation of internal banking procedures. In 1973, on the initiative of the European banks, SWIFT was set up in Brussels as an international financial organisation (initially with 239 banks from 15 countries). It is now an essential part of international transactions. More than 11,000 financial institutions in 200 countries are members of this infrastructure.

Other notable examples from the Fintech 2.0 era include the first commercially available mobile phone in 1983, and the launch of so-called "program trading" in 1987, which acted as a catalyst for the algorithmic trading of securities (Arner et al., 2015; *Mitchell*, 2021). In addition, the emergence of community finance in the 2000s, as mentioned earlier, also had a significant impact on the development of financial technologies (Ashta–Biot-Paquerot, 2018). The spread of the internet played the greatest role in the financial market (*Lee–Shin*, 2018).

The beginning of the economic crisis in 2008 marked the end of the previous era and the beginning of the current one (*Bussmann*, 2017). Banks have been busy dealing with the crisis and complying with the various regulatory requirements following the recession, which has given green light to small start-ups and various innovative solutions.

The launch of Bitcoin in 2009, followed by the emergence of other cryptocurrencies, fundamentally changed people's concept of money, and has been one of the most significant milestones of Fintech 3.0 (so far). In the early 2010s, smartphones appeared the market en masse, giving virtually anyone, anywhere, anytime access to the internet. This phenomenon led almost immediately to the widespread adoption of mobile payment solutions (*Johannes*, 2022).

The start of Fintech 3.5 also goes back to 2008, with the difference that it refers to the financial technology of the developing world (Arner et al., 2015). These areas have not been able to develop a high level of banking infrastructure (e.g. Bangladesh), partly due to the fact that the money spent on IT-related improvements is significantly below European and North American levels, and most data protection rules are also less strict (Energycatalyst, 2020; Arner et al., 2015). Another obstacle is that financial awareness is below Western standards, wages are lower, and cash transactions predominate over card payments, as, unfortunately, many people do not have access to financial services (e.g. opening a bank account) which are considered to be basic in Europe (Energycatalyst, 2020). In these underdeveloped countries, the banking system is state-supervised, but trust in it is very low, partly due to its failure and partly due to numerous corruption scandals (Arner et al., 2015). Because of this, the masses are open to different Fintech solutions provided by non-banks, giving them a chance to further develop and catch up with Western financial systems.

1.1 Impact of Fintech innovations on traditional finance

Payments are one of the most commonly used and least regulated financial services (Lee–Shin, 2018). There is a strong focus on this topic, it is developing very dynamically and there is a lot of room for innovation in the sector. It concentrates on two main areas, one for retail payments and the other for retail and corporate payments. I intend to highlight several solutions in the area of retail payments. One of them is the mobile wallet. A great example is Barion, a Hungarian company, but of course we could mention Google Wallet or Apple Pay when it comes to Fintech services from the Big4 companies. P2P mobile payments, represented by PayPal, (bypassing the big credit card issuers) also play a prominent role in the field. It is also important to mention the QR code-based mobile payment system,

real-time payment solutions and international transfers in various foreign currencies, for the latter of which Wise offers favourable options. Mobile payments offer significant benefits for both the provider and the user (Lee–Shin, 2018). Fintech companies in this field offer customers a modern, fast and convenient payment experience, while mobile payments allow companies to collect more and more useful data about users, which can later be used as a basis for innovation (Bussmann, 2017; *Pintér*, 2022).

The next important area to mention is crowdfunding. As its name implies, it focuses on making people helping start-ups, providing financial support for a potential breakthrough or revolutionary idea (Lee–Shin, 2018). The system consists of three participants: the entrepreneur, who initiates the fundraising; the contributors; and the so-called moderating organisation, which acts as an intermediary between the funder and the funded, and whose websites provide information on the different projects that can be funded and the type of support available. There are 3 main types of community funding, the first of which is the reward-based method. This type of support can be a good choice for start-ups and start-up entrepreneurs aiming to develop an innovative product or service. The idea is to deliver the result expected by the „investors" within a predetermined timeframe, however, the contributors are not refunded the money they offered, but rather the promised product instead (European Commission, 2022a). Popular companies in the field include Kickstarter and Crowdfunder. Donation-based funding has the same basis as the previous form of crowdfunding, except that those who help the entrepreneur do not receive a monetary reward for their support (Lee–Shin, 2018). One of the best-known organisations in this area is considered to be GoFundMe. The main idea of equity-based financing is that firms sell a share to an external party in exchange for investment, which may be a popular choice in the SME sector (Lee & Shin, 2018). This form of aid usually involves a significantly larger contribution than the previous two, and therefore the risk is naturally higher. Therefore, it is essential that a convincing business plan is in place, that the conditions for return are made clear in advance, and that the entrepreneur is aware of the rights of shareholders and other aspects (European Commission, 2022b). Several companies, such as Crowdcube or AngelList, are involved in equity-based financing. The role of Fintech in the capital market does not end with crowdfunding. A number of companies (e.g. Robinhood) offer investors the opportunity to trade different stocks and commodities and monitor potential risks in real time (Lee–Shin, 2018).

P2P lending is also an important, core area of the Fintech sector. Organisations in this sector, such as Funding Circle, allow individuals and companies to lend and borrow money to each other easily and efficiently at low interest rates (Lee–Shin, 2018). However, unlike banks, these companies are not involved in the process,

but help the lender and the borrower to find each other and charge them a fee for using the service. Credit risk assessment is not based on the usual process applied by banks either (e.g. they also use the data accumulated on social media for this purpose) (Bussmann, 2017; Deutsch–Pintér, 2018). These Fintech companies represent strong competition for banks and credit institutions, as they are not yet subject to capital requirements regulations, and thus the total amount of lending is not limited, which gives them a significant competitive advantage in this area (Lee–Shin, 2018).

One of the most frequently mentioned areas in the world of Fintech, the concept of blockchain was coined by *Satoshi Nakamoto* in 2008 (Bussmann, 2017). Initially this technology was used as the public ledger for the first cryptocurrency, Bitcoin, but nowadays it is applied in many areas (e.g. smart contracts). The original aim of the project was to create a P2P system that would allow transactions to take place between two parties, bypassing traditional banking institutions. The aforementioned parties do not know each other, they do not have the trust to trade, therefore one of the most important goals when creating the blockchain database was to eliminate this problem. In order to do this, they have developed a technology that allows all parties to see the accounting lines on the blockchain, so that if there is a change, everyone is informed, thus preventing fraud.

One of the most popular Fintech sectors is robo-advice (Lee–Shin, 2018). Robo-advice covers computer algorithms that can provide investors and traders with instant information about news affecting the capital markets, including social media trends, to help them make decisions (Bussmann, 2017). On the FutureAdvisor platform, for example, due to this technology, the desired asset allocation can be developed (e.g. taking into account risk appetite), which the robot keeps in balance in spite of constant market changes (Bussmann, 2017).

The insurance sector has also been influenced by Fintech, as in many of the areas already mentioned, the business model of this industry is based on direct contact between the parties, in this case the insurer and the customer, and flexible, modern service delivery (Lee–Shin, 2018; Pintér, 2008) Personalised premiums for health, accident or even life insurance. In the case of vehicles, a great example is pay-as-you-drive insurance, which requires the usage data of the vehicle and analyses them to calculate the premium to be paid (*Puschmann*, 2017). Major participants in this area include e.g. Clearcover and Next Insurance.

The AFR, Instant Payment System, was implemented in Hungary based on TIPS (TARGET Instant Payment Settlement), and launched on 2 March 2020 with the participation of GIRO Zrt., the National Bank of Hungary and 35 commercial banks (all domestic banks were required to participate in the AFR (the National Bank of Hungary, 2022c; Takarékbank, 2022). The in course of the establishment of the AFR, SEPA was considered to be an example, precisely to ensure that the

changeover would not cause major problems if the euro were to be introduced in Hungary, as well (EPC, 2020). The TARGET Instant Payment Settlement, also known as TIPS, is also an important part of the Fintech world (the National Bank of Hungary, 2022a). Its basis, TARGET2, was created to support the European Central Bank's monetary policy and unity. TARGET2 is a decentralised payment system that allows central and commercial banks to conduct euro-based payment transactions. The TIPS was launched on 30 November 2018, courtesy of the Eurosystem, taking into account the ISO 20022 standards and the common set of rules of the SCT Inst (SEPA Instant Credit Transfer - a pan-European instant payment system) (Bayle, 2018). This is a market infrastructure service, established as an extension of TARGET2, which allows PSP customers to make transfers 24/7 and have the money in the receiving party's account within seconds, in order to preserve the unity of the European payments market. TIPS aims, among other things, to process transactions within a maximum of 10 seconds and to ensure security and continuity (ECB, 2022). Payment service providers can make these instant payments through an account opened for this purpose at their central bank. One can join TIPS as a participant, as a reachable party or as an instructing party (*Bayle*, 2018). Participants have x number of accounts in TIPS, and reachable parties are eligible for settlement with these x number of participant accounts, however, they do not have such accounts themselves. Through the so-called instructing parties (e.g. clearing houses) transfers between credit institutions can be carried out. In Hungary, the Interbank Clearing System operated by GIRO Zrt. can be considered the instructing party (National Bank of Hungary, 2022b). At present, the system supports only domestic transfers, such as regular or value date transfers, and it is also possible to send and receive payment applications in several financial institutions, also domestically (*Vrazsovits*, 2022a; 2022b). The relevant requirements are that no date of settlement shall be specified and that the amount of the payment shall not exceed the ceiling of HUF 10 million (EPC, 2020). Under the rules, the amount transferred is irrevocably credited to the beneficiary's account within 5 seconds, and the payer receives a message if the transaction is rejected. If the money does not arrive in the desired account within 5 seconds, 20 minutes are available to carry out a successful transaction (Vrazsovits, 2022a). In addition to their account number, account holders can also assign a secondary identifier to their account, such as their phone number or email address (EPC, 2020). The National Bank of Hungary has recently published the planned elements of the AFR development concept, as reported by *Lajos Bartha*, the National Bank of Hungary's Managing Director for Financial Infrastructures and Banking Operations, and I would like to highlight some of them (Turzó, 2022). All banks will be obliged to accept payment applications, as well as to read QR codes. The codes will be based on a centrally authenticated standard, which will be a major

step forward in security. Following the standardisation of the QR code, the focus will be on NFC (Near Field Communication standard collection) as well as on AFR via deeplink. The upper limit for transactions will be set at HUF 30 million instead of HUF 10 million, and a message will be required after each transfer to confirm its success.

2 ARTIFICIAL INTELLIGENCE IN FINANCE

Before discussing Artificial Intelligence (AI) in finances, it is very important to deal with the idea that financial systems need to be prepared for the high number of financial transactions in today's world. It's worth looking at the figures in the National Bank of Hungary payment statistics:

Table 1
Transactions conducted with payment cards issued in Hungary

Reference period	Number of purchases (pieces)
2021 4th quarter	328,411,165
2022 1st quarter	315,618,368
2022 2nd quarter	363,781,784
2022 3rd quarter	382,500,784
In total:	**1,390,312,101**

Source: National Bank of Hungary, 2023

Based on the table above, if we examine 1 year, there were 1.4 billion purchases in Hungary in the aforementioned period, which is 44 transactions per second. It is impossible to process this amount of data manually, and it is important that information processing, and ultimately IT, has developed to such extent in recent decades that it is no longer solely processing, but it also means a high level of automation. However, we must go a step further and start thinking about how machines can learn and develop basic structures of thought.

Before detailing the train of thought above, it is important to understand the term BigData, which includes all the systems that manage, store, create or categorise a huge amount of everyday data in a structured or unstructured form. Regarding data, we can talk strictly about data generated electronically, however, in connection with the topic, we must consider all things which have informational value. In view of the above, we also have to take information exchange between people into account, which is not too efficient unless we do this activity in a written and/

or digitalised form. According to the principles described by *Belényesi*: "Big Data is a large amount of unstructured data, the appearance of which is result of accelerated technical development of recent years" (Belényesi, 2016). Consequently, when we talk about Big Data, we refer to a set of data that is a raw source of information and almost impossible to grasp and analyse with the naked eye and hand, or to extract from it any information that could support really important decisions. At the same time, we have to admit that, when discussing the potential of this tool, we should also take into account systems and technological innovations which can appropriately organise and sort such data, and finally present them in a clear, structured and visualised form (Belényesi, 2016). A prerequisite for the use of Big Data is that raw data are already stored in an organised form, with appropriate metadata tags and features. In the case of most complex systems, preliminary work is done by pre-written mathematical algorithms. In terms of program design and solution implementation, it is important to note that, in the initial phase, software based on possibilities provided by smart algorithm and artificial intelligence may be very similar, however, these types of software cannot be compared. An algorithm that does not use artificial intelligence is written and developed by specialists by means of standardised and proven methods. At the same time, when writing artificial intelligence, the software is created with the so-called deep learning method through simulations and experiments. Later, this software can perform its task on its own, with a minimum error rate. In general, people cannot comprehend the structure and content of such codes (*Hsinchun* et al., 2012). When creating the algorithm, it is possible to use ready-made artificial intelligence (e.g. tests, simulations), but the final product will not reflect the complexity of a software based on serious artificial intelligence. Despite all this, AI and smart algorithms are often given similar recognition and rank in common language, therefore it is difficult to separate the two when discussing these tools. By processing and organising unstructured data, the use of data will be significantly easier. Such Big Data algorithms can organise data and store them in various data warehouses in a uniform format, from where different users can process them with further programmes according to their needs. The information content and readability of the data extracted from data warehouses have not yet reached their full potential, but with the help of experts, software, algorithms and AI, such data can be easily and quickly assembled into a visualised whole that anyone can interpret. These data are presented to decision-makers in the form of various diagrams and tables. After processing the information, they are able to make decisions (*Yoshua–Yann*, 2007). The structured data available may play a significant role in the operation of companies, such as in optimising corporate operations, developing different stages of the process of sales or taking decisions on planning corporate strategy. Nowadays, the most important thing for organi-

sations dealing with products and services is to retain their customers and consumers. In order to achieve this goal, they need accurate data about users and customers. There are already a lot of methods implemented in everyday products for measuring consumer behaviour related to the products. A significant part of the amount of data generated in countless daily transactions consists of protection protocols and translation packages built around transaction data. In spite of the fact that the issues of data security and personal data are discussed in several places, I will not detail them in this publication, however, I cannot ignore them, either in connection with Big Data, or AI (*Halaska*, 2016). Based on the above, it is clear that structured data provide great help to the professional users of a well-built system.

In order to understand the advantages of artificial intelligence, it is important to describe the features and potentials which distinguish artificial intelligence from the operation of an algorithm rich in possibilities. We should map out when a program can be called artificial intelligence, and what the differences are between the scientific statement and the meaning of the term in common parlance, which can lead to misunderstandings. In order to qualify as AI from a professional point of view, such type of software should be examined in several aspects.

To sum up, artificial intelligence is modernising the whole financial industry by rationalising traditional manual banking processes and providing deeper insight based on generated data, which helps to determine the manner and place of investments. Artificial intelligence also changes customer experience by creating faster contactless interactions, which include real-time credit approval, as well as better fraud protection and cyber security. Regarding cyber security, it is worth studying the details of Act LIII of 2017 on the Prevention and Combating Money-Laundering and Terrorist Financing, the short summary of which is as follows:

- detecting money laundering anomalies,
- stored historical data,
- searching anomalies based on pre-determined parameters,
- filtering out and checking suspicious transactions, taking actions,
- subsequently, not in real time.

Artificial intelligence has a major influence on the way financial organisations manage risk, which includes security, regulatory compliance, anti-fraud, anti-money laundering (AML) and know-your-customer (KYC) policies. Due to the fact that artificial intelligence is part of their infrastructure, banks, investment companies and insurance companies can carry out real-time calculations to predict performance, detect anomalies in spending behaviour or maintain compliance. In addition, they can use artificial intelligence in several other ways.

AI allows financial institutions to accelerate and automate historically manual and time-consuming tasks, such as market research. Artificial intelligence is able to analyse a large amount of data fast in order to identify trends and help the prediction of future performance, enabling for the banks, inter alia, the exploration of lending growth potential and the assessment of risks. The assessment can also be applied to insurance, where personal data can be collected and used to determine insurance coverage and premiums. Artificial intelligence can also be used for cyber security purposes, especially for the identification of fraudulent transactions. By closely observing purchase behaviour and comparing it with past data, AI can indicate abnormal activity, automatically alert both the institution and the client to check the purchase or transfer in real time and take action to resolve the problem if necessary.

For bank customers, AI and ML (Machine Learning) can improve the overall customer experience. The rise of online banking (i.e. contactless banking) minimises the need for face-to-face interactions, but the transition to the virtual can result in vulnerability at several endpoints (e.g. smartphones, desktops and mobile devices). Artificial intelligence can automate many basic banking activities, e.g. payments, deposits, transfers and customer service requests. Artificial intelligence can also handle the application process for credit cards and loans, including approval and rejection, providing almost instant replies.

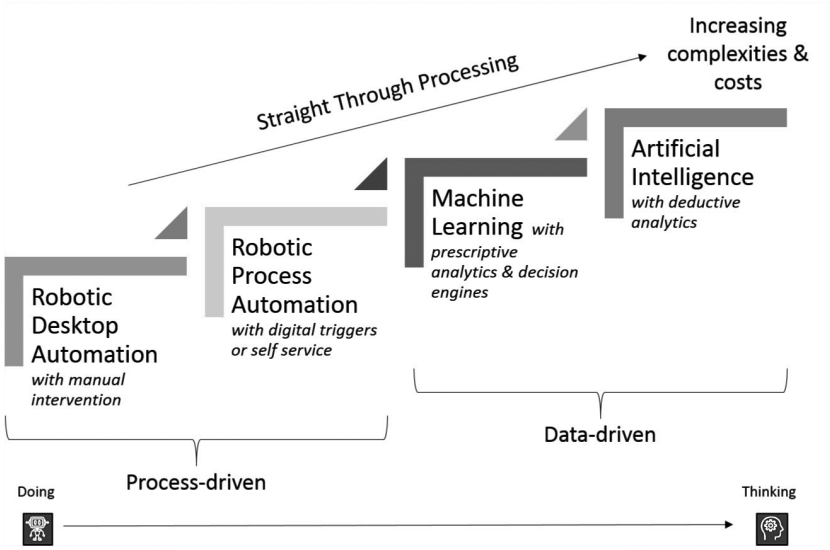
However, most institutions believe that AI and ML can improve the course of business and give them a competitive edge. According to a survey by Forrester, 98% of AI projects - 80%-85% of ML projects do not start due to various logistical and management problems or „last mile" problems, which suggests that institutions should involve IT and AI network professionals to complete AI projects. In addition to logistics, financial organizations also face a high number of security and compliance regulations as they use sensitive and personal data every day. Any AI solution should be able to protect such data and comply with the industry- and region-specific guidelines - as finances are of global significance and cover the majority of companies. The sheer volume of data itself represents a complex challenge. In order to enable any AI solution to work effectively, institutions need to keep all data in arranged pipelines and silos, allowing ML to accurately predict and forecast markets according to specific business objectives.

The following question must be raised: Is machine learning the key to efficient financial operations? Machine learning applications can be used for everything from risk assessment to asset management. By using data, they can gain critical insight and streamline various processes while optimizing results. Applying machine learning in financial applications is a developing practice which is being used in a variety of ways across the industry. The diverse applications of machine learning in finance have also opened up a lot of new finance jobs related to ma-

chine learning. However, this practice helps to understand machine learning in finance and how it can be used in career building. Machine learning belongs to the concept of artificial intelligence. It designs and develops algorithms which can learn from data and make predictions based on such data. Machine learning models provide the technology for the automation of cognitive tasks. Machine learning technology is used in various financial tasks, including credit scoring, tracking and recommendation of investments, fraud detection and algorithmic trading. Machine learning can help financial companies make better decisions on pricing, risk and customer behaviour. Technology can build models which improve the understanding of large data sets and reveal patterns that facilitate the design of new business systems and processes. When working in the financial field, rationalization and automation of various processes with machine learning has several advantages. Financial companies can use these technologies to automate tasks such as paperwork, calculations, data monitoring, and claims processing. As a result, employees can focus on more value-creating activities (Pintér, 2004).

Customer engagement is another critical area where machine learning and AI can be used. IoT (Internet of Things) devices can generate a significant amount of data which can be useful for understanding customer behaviour and preferences. Later, such data can be used to create personalised marketing campaigns or improve customer service. On the whole, better customer service and a better customer experience typically result in more sales and higher customer satisfaction rates. Consequently, it is definitely not worth mixing the concepts artificial intelligence (AI), machine learning (ML) and automation.

Figure 1
From process control to data control



Source: Forbes, 2022

RPA (robotic process automation) refers to the use of preconfigured software that uses business rules and predefined activity choreography to autonomously execute a combination of processes, activities, transactions, and tasks in one or more independent software systems in order to achieve results or provide services with human exception handling.

AI[2] is a combination of cognitive automation, machine learning (ML)[3], reasoning, hypothesis generation and analysis, natural language processing and deliberate algorithm mutation that provides insights and analysis at the level of or above human capabilities.

To put it simply, RPA can be considered as a software robot that imitates human activities, while AI deals with the simulation of human intelligence by machines.

2 An example for AI applications: https://builtin.com/artificial-intelligence/ai-finance-banking-applications-companies.

3 An example for ML applications: https://www.projectpro.io/article/projects-on-machine-learning-applications-in-finance/510.

At the most basic level, RPA is about „doing", while AI and ML are about „thinking" and „learning", or, if you like the simile: muscle versus brain.

For example, suppliers send electronic invoices by email, they are downloaded into a folder, the relevant information is sorted out, and, finally, the invoices are created in the accounting software. In this scenario, RPA is suitable for automating the querying of emails (for the sake of simplicity, the query is based on the subject of the email), for downloading of attachments (i.e. invoices) to a specific folder and the creation of invoices in the accounting software (mainly copy and paste operations). On the other hand, artificial intelligence is required to intelligently „read" invoices and gain relevant information such as invoice number, supplier's name, the due date of the invoice, product description, amounts due and more. Invoices consist of essentially unstructured or, at best, semi-structured data. For example, different suppliers have different invoice templates and formats. Different invoices may contain items with different serial numbers. As every activity in RPA has to be specifically programmed or scripted, it is virtually impossible to teach the robot exactly from where to extract the relevant information for each received invoice. This is why there is a need for AI to intelligently decipher the invoice as a human being would. It is certain that invoice processing can be managed exclusively by means of RPA. In this case, we will deploy what we generally call present automation.

Robotic Desktop Automation (RDA) is like a virtual assistant that works hand-in-hand with human employees. Returning to our example, after the invoices are downloaded, they are passed through a kind of optical character recognition (OCR) software that tries to extract the required information. Later, a human employee validates this information before returning the job to the RPA robot so that it can create the invoices in the system. Based on the above, the main advantage of using an RPA and an AI solution is that direct processing (with minimal human intervention) can be achieved. The disadvantages are the increased costs and the complexity of the project.

RPA is strongly process-oriented - it is about the automation of repetitive, rule-based processes, which typically require cooperation with several different IT systems. Process discovery workshops are usually a prerequisite for the introduction of RPA, the purpose of which is to map and document the existing „current" processes in the process definition document (PDD). In the case of our invoice processing example, we intend to find enough sample invoices to train the ML algorithms, ensure that our samples are of good quality (especially if the invoices are scanned), and that the invoices are representative of the dataset. After that, the task is to select the right ML algorithm and then train it properly so that it can recognize other new accounts faster and more accurately than a human. Ultimately, RPA and AI are nothing but valuable tools to help the digital transforma-

tion of your organization. Whether you introduce RPA or AI (or both) depends on the specific purpose for which you wish to use it, and ensuring "fitness for the purpose" is paramount. In the case of RPA, many organizations mention reasons such as grabbing the „low-hanging fruit", rapid implementation and time-to-market (typically within weeks or months), low cost and complexity, and other reasons. Many smartly opt for RPA and use it as the first rung on the digital ladder to intelligent automation.

3 SUMMARY

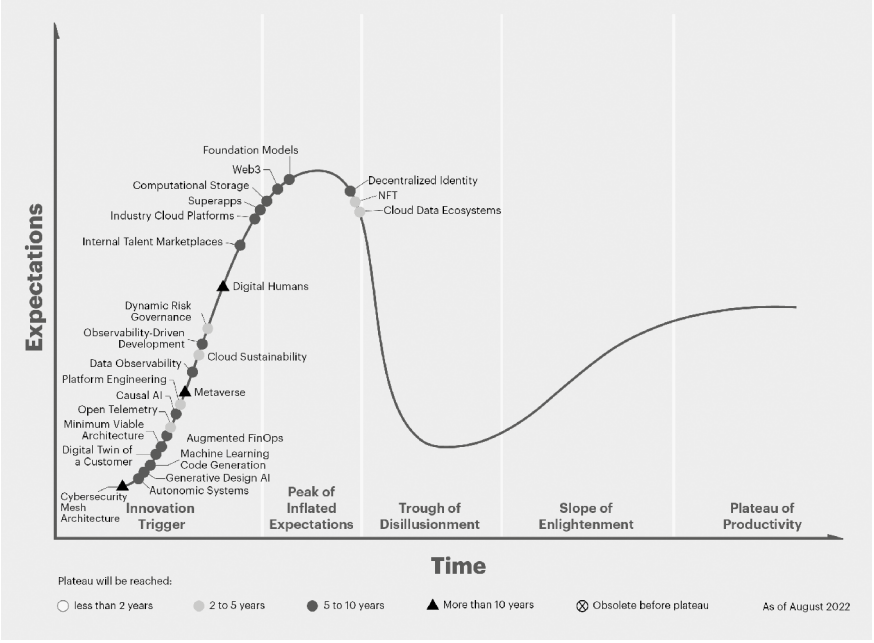
Financial technologies, fintech, financial technology define our current financial world. Fintech advanced through three periods which brought us the era of artificial intelligence, where computers trade with each other and customer interactions are not carried out manually either. The development of fintech was simultaneous with the development of IT. The fintech 1.0 era was brought about by the telegraph, while the start current 3.5 era was marked by technologies such as mobile telephony, big data, internet. Even the increase in computing performance contributed to this development. Therefore, we can safely say that the development of fintech is moving hand in hand with the development of IT. It could also be called evolutionary IT, because we can trace the steps back to the first computer. At the same time, the „mutations" have consciously pushed the development forward and added something to the financial world almost every day. . Here let us think about the development from the first internet bank to the appearance of the of the mobile bank and the related technologies. The digitization of financial solutions is due to evolutionary information technology, and it can be deduced with simple logic that as soon as mobile phones became suitable for mobile banking, mobile banks appeared immediately. But the same can be claimed about internet banking. Internet protocols themselves or their encryption occurred when the technology became capable of carrying out such activities. It would be worth writing a separate study on how old the Internet with IPV4 technology is and how the current applications were built on this old technology, and what security problems this entails to this day.

Financial technologies have measured up to the current level of IT. The first step was digitisation, then RDA, which is robotic desktop automation. Actually, this was when they realized after digitisation that not everything could be manually processed. Then came RPA, robotic process automation, which refers to the use of pre-configured software that applies business rules and predefined activity choreography to autonomously execute a combination of processes, activities, transac-

tions and tasks in one or more independent software systems to deliver a result or service through human exception handling.

It is worth looking at Gartner's hype cycle diagram to see what new technologies will define our future. This is also important because technologies such as NFT (non-fungible token) or the cloud-data ecosystem are already in decline. Of course, one can disagree with this view, but Gartner has been dealing with the „hype cycle" methodology for a fairly long time, therefore we believe that artificial intelligence technologies in the diagram below are really on the rise:

Figure 2
Gartner hype-cycle, 2022



Source: Gartner, 2022

Future trends include terms such as casual AI, which is a branch of artificial intelligence that most closely resembles human choices and decisions. However, terms like sustainable cloud or open telemetry can also be mentioned. Decentralised identity sounds a bit different in Hungarian. At this point, we can rather talk about the usability of separate data, i.e. healthcare, taxation, education and transportation data are all listed separately, but are accessible from a central system. This decentralised identity is really about bigdata, which mostly contains an individual's personal data. It is declining because it is merely a simple data connec-

tion, while AI can do much more than that. Artificial intelligence does not only look for patterns, it can do much more than that. AI reveals connections that we are no longer able to detect manually. The most important aim is that the background data, databases and structured resources are all available and operate stably and reliably. In the case of financial data, it is impossible not to store the data correctly. There is no way to tell the customer that their payment or investment is roughly available. If the basic infrastructure works reliably, then machine learning or artificial intelligence can follow. In the case of financial products, I would definitely emphasize legal regulations, so that they provide adequate information to the operators of the financial sector. This question is also about trust, because around the 2008 crisis, trust in classic financial institutions wavered, which was where fintech solutions started. They were based on fundamental trust, which was required for continued building. After 14 years, complete solutions have already been created. It is worth mentioning Revolut or Wise. Digitisation, evolutionary informatics are what brought about this era, but the way forward is questionable, especially its direction. One of the possible scenarios for development involves artificial intelligence, machine learning and the highest level of automation of those tasks which cannot be done manually anymore.

REFERENCES

Arner, D. W. – Barberis, J. N. – Buckley, R. P. (2015): The Evolution of Fintech: A New Post-Crisis Paradigm? https://doi.org/10.2139/ssrn.2676553.

Ashta, A. – Biot-Paquerot, G. (2018): FinTech evolution: Strategic value management issues in a fast changing industry. *Strategic Change*, 27(4), 301–311, https://doi.org/10.1002/jsc.2203.

Belényesi P. (2016): Verseny és Szabályozás 2016 – Digitális Platformok és a Big Data [Competition and Regulation 2016 - Digital Platforms and Big Data]. Budapest: Institute of Economics of The Hungarian Academy of Sciences, 127–163.

Bussmann, O. (2017): The Future of Finance: FinTech, Tech Disruption, and Orchestrating Innovation. In Francioni, R. – Schwartz, R. [eds.] (2017): *Equity Markets in Transition* (473–486). Springer International Publishing. https://doi.org/10.1007/978-3-319-45848-9_19.

Computerworld (2019): Miért van szükség API-biztonságra? [Why is API security required?], https://computerworld.hu/biztonsag/miert-van-szukseg-api-biztonsagra-268739.html

Deutsch, N. – Pintér, É. (2018): A társadalmi felelősségvállalás és a pénzügyi teljesítmény közötti kapcsolat a magyar bankszektorban a globális válságot követő években [The Link between Corporate Social Responsibility and Financial Performance in the Hungarian Banking Sector in the Years Following the Global Crisis]. *Financial and Economic Review*, 17(2), 124–145, http://epa.oszk.hu/02700/02758/00016/pdf/EPA02758_financial_economic_review_2018_2_124-145.pdf.

Diners Club Internation (2022): The Story Behind The Card, Diners Club International, https://www.dinersclubus.com/home/about/dinersclub/story.

ECB (2022): What is TARGET Instant Payment Settlement (TIPS)? https://www.ecb.europa.eu/paym/target/tips/html/index.en.html.

Energycatalyst (2020): Market Guide: Fintech, https://energycatalyst.community/developer/wp-content/uploads/2020/12/Market-Guide-fintech.pdf.

ENISA (2022): ENISA Threat Landscape 2022, https://www.enisa.europa.eu/publications/enisa-threat-landscape-2022.

EPC (2020): AFR – the Hungarian Retail Instant Payment System, https://www.europeanpayments-council.eu/news-insights/insight/afr-hungarian-retail-instant-payment-system.

European Comission (2022b): Equity crowdfunding, https://ec.europa.eu/growth/access-finance-smes/guide-crowdfunding/different-types-crowdfunding/equity-crowdfunding_en.

European Comission (2022c): Rewards-based crowdfunding, https://ec.europa.eu/growth/access-finance-smes/guide-crowdfunding/different-types-crowdfunding/equity-crowdfunding_en.

Forbes (2022): Should You Be Using RDA For More Efficient Service? https://www.forbes.com/sites/bradbirnbaum/2018/09/07/rda-rpa-service/?sh=a42c955b8e2b.

Gartner (2022): What's New in the 2022 Gartner Hype Cycle for Emerging Technologies, https://www.gartner.com/en/articles/what-s-new-in-the-2022-gartner-hype-cycle-for-emerging-technologies.

Halaska, G. (2016): Mire jó a Big Data? – Interjú Huszics Györggyel [What is Big Data good for? – Interview with György Huszics.] *DigitalHungary*, 29 July 2016, https://www.digitalhungary.hu/marketing/Mire-jo-a-Big-Data-interju-Huszics-Gyorggyel/2586/?fbclid=IwAR27CEpQm3FW5XJrtUDx1NgHQjSSGz7GXP2MLxEhtiiVm9wzMYo6bQxMo20.

Hsinchun, C. – Roger, H. L. – Chiang, C. – Veda, C. S. (2012): Business Intelligence and Analytics: From Big Data to Big Impact. *MIS Quarterly*, University of Minnesota, Management Information Systems Research Center, Dec. 2012, 36(4), 1165–1188, https://www.researchgate.net/publication/284679162_Business_Intelligence_and_Analytics_From_Big_Data_to_Big_Impact.

Jessé, Marc Bayle De (2018): TARGET Instant Payment Settlement: The Eurosystem's response to an evolving payments landscape. *Journal of Payments Strategy & Systems*, 12(4), 322–327, https://discovery.ebsco.com/c/n3fo33/viewer/pdf/h4exqdmysf.

Johannes, M. (2022): Evolution of Fintech. Zigurat, https://www.e-zigurat.com/innovation-school/blog/evolution-of-fintech/.

Lee, I. – Shin, Y. J. (2018): fintech: Ecosystem, business models, investment decisions, and challenges. *Business Horizons*, 61(1), 35–46. https://doi.org/10.1016/j.bushor.2017.09.003

Mitchell, C. (2021): Program Trading. *Investopedia*, https://www.investopedia.com/terms/p/programtrading.asp.

Mitnicksecurity (2022): The History of Social Engineering, https://www.mitnicksecurity.com/the-history-of-social-engineering.

MNB (2022a): Pán-európai elszámolásforgalmi rendszerek [Pan-European clearing systems], https://www.mnb.hu/penzforgalom/az-euro/pan-europai-elszamolasforgalmi-rendszerek.

MNB (2022b): Giro, https://www.mnb.hu/penzforgalom/a-hazai-penzforgalmi-infrastruktura/giro.

MNB (2022c): Elérhetővé vált az azonnali fizetés! [Instant payment is now available!], https://www.mnb.hu/azonnalifizetes.

MNB (2023): Pénzforgalmi táblanézet [Payment statistics spreadsheet], https://statisztika.mnb.hu/publikacios-temak/penzforgalmi-adatok/penzforgalmi-adatkozlesek/tajekoztato---penzforgalom.

Pintér, É. (2004): Értékteremtés a banki szolgáltatásban [Value creation in banking]. *Vezetéstudomány*, 35(2), 18–23.

Pintér, É. (2008): *A pénzügyi szolgáltatások reintegrációja – a bankbiztosítási tevékenységet befolyásoló tendenciák* [Reintegration of financial services – trends affecting bancassurance ac-

tivities]. Thesis, University of Pécs, Faculty of Business and Economics, https://pea.lib.pte.hu/handle/pea/15208.

Pintér, É. (2022): Az innováció természetrajza [The natural history of innovation]. In Stukovszky, Tamás – Illyés, Péter [szerk.] (2022): *A kis- és középvállalkozások innovációja: Elmélet és gyakorlat* [Innovation of small and medium-sized enterprises: Theory and practice]. Budapest, Magyarország: Akadémiai Kiadó Zrt. 81–96.

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

Takarékbank (2022): Az Azonnali Fizetési Rendszer (AFR) [Instant Payment System (AFR)], https://www.takarekbank.hu/azonnali-fizetesi-rendszer#.

Turzó, Á. P. (2022): Készül az AFR 2.0 – Elmondta az MNB, mit terveznek az azonnali fizetéseknél [AFR 2.0 is being created – The National Bank of Hungary has announced what they are planning in connection with instant payments]. *Portfolio*, https://www.portfolio.hu/bank/20220912/keszul-az-afr-20-elmondta-az-mnb-mit-terveznek-az-azonnali-fizeteseknel-564845.

Vrazsovits, R. (2022a): Március 2-án indul az azonnali fizetési rendszer Magyarországon! [The instant payment system is to be started in Hungary on March 2!]. *Bank360.hu*, https://bank360.hu/blog/azonnali-fizetesi-rendszer.

Vrazsovits, R. (2022b): Fizetési kérelem: már kérni is lehet az utalást, nemcsak kapni [Payment request: the transfer can already be requested, not just received]. *Bank360.hu*, https://bank360.hu/fizetesi-kerelem

Yoshua, B. – Yann, LC. (2007): Scaling Learning Algorithms towards AI. In Bottou, L. – Chapelle, O. –DeCoste, D. – Weston, J. [eds.] (2007): *Large Scale Kernel Machines*. MIT Press, 34(5), 1–41.