ARTIFICIAL INTELLIGENCE IN KAZAKHSTAN FINANCIAL MARKET

CURRENT STATE, PERSPECTIVES AND ANALYSIS OF REGULATORY APPROACHES
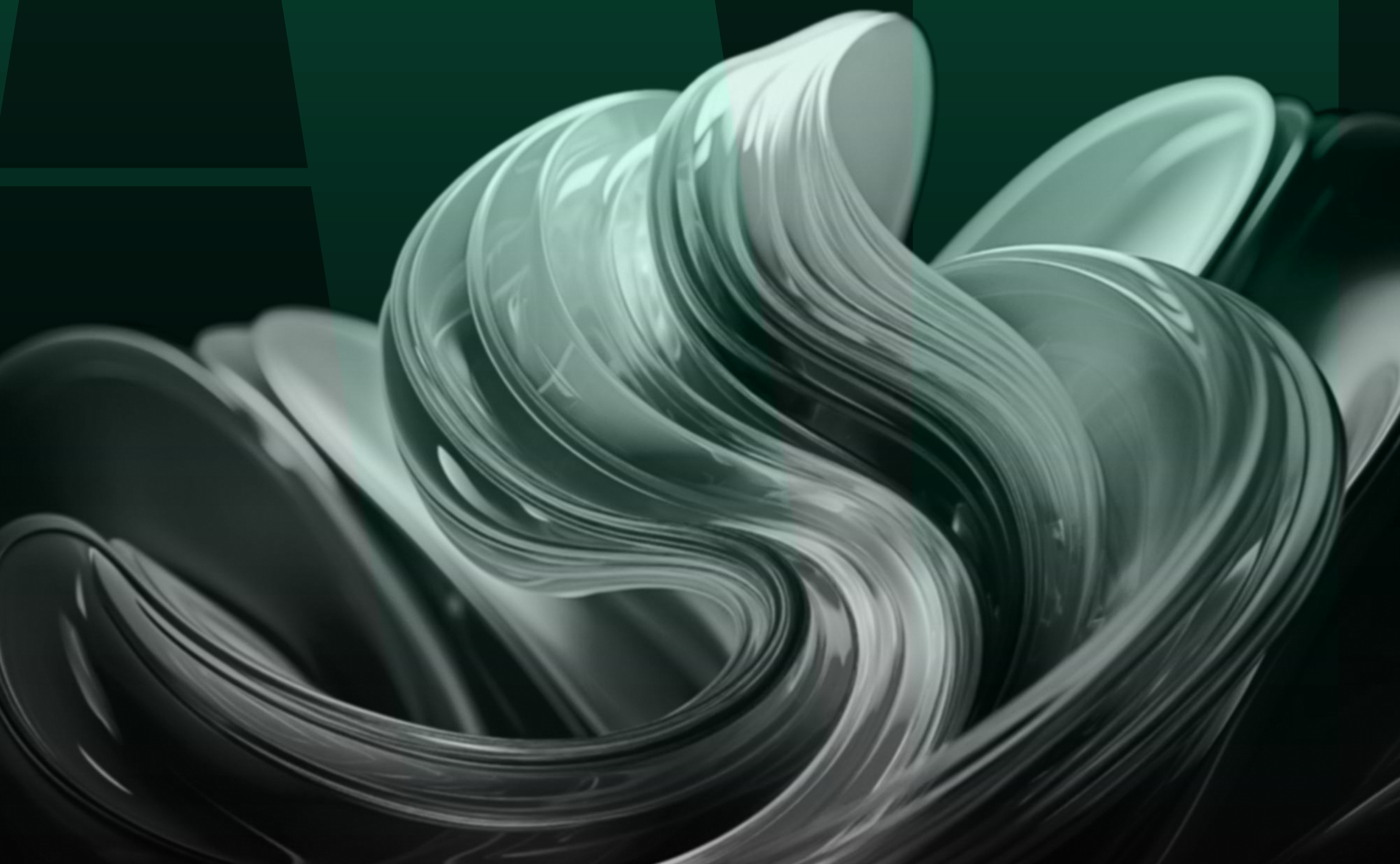
Opening remarks

Timur Suleimenov
Governor of the National Bank of the Republic of Kazakhstan

"The dynamic development of fundamental models of artificial intelligence, or AI, is now supported by expanding capacity and increasing accessibility of computing infrastructure, which forms the basis for unprecedented advancement. This is evidenced by the forecasts of the international expert community: the spread of AI could double the pace of global economic growth by 2025 and affect an average of 40% of jobs worldwide.

As artificial intelligence has become the central element of the global technology agenda, financial market in Kazakhstan has already been actively applying machine learning and advanced modeling technologies in a wide variety of application scenarios, from credit scoring to computer vision for identification.

Our common task is to leverage the accumulated technological expertise and drive it towards creation of a sustainable AI ecosystem in the financial market. This ecosystem will transform the potential of AI technologies into benefits that are clear to citizens and businesses, such as user-friendly interfaces, speed, security, and reduced cost of service.

The role of the National Bank is to create favorable conditions for integration of AI into the financial system of Kazakhstan. This includes shaping the appropriate legislative environment regarding the use and protection of data to "train AI", maintain competition incentives in AI proliferation, define regulations for cloud computing, etc. Moreover, it is essential to ensure availability and security of computing infrastructure for resource-intensive processes like fundamental model training, localization of open-source models, etc. We also see our role in supporting AI human capital initiatives in the financial market.

The focus is also on applying AI technologies in financial regulators' own projects, including fraud prevention, secure digital identification, advanced modeling and more.

It is important to realize that there are no ready-made "formulas" or algorithms for the development of the AI ecosystem, therefore, the key success factor is the joint effort of all market participants. We will work to create such platforms and support all initiatives necessary for development"

Opening remarks

Madina Abylkassymova
Chairperson of the Agency of the Republic of Kazakhstan for Regulation and Development of Financial Market

" Implementation of artificial intelligence in the financial sector opens up new horizons for innovation and improves the quality of services provided. The agency pays special attention to studying and implementing AI in the field of supervisory technologies (SupTech) and regulatory technologies (RegTech), which facilitates timely and informed decision-making and monitoring of systemic risks.

The harmonious development of AI in the financial industry and the creation of favorable regulatory environment are possible only through active interaction between the regulator and financial organizations "

Renat Bekturov
Governor of the Astana International Financial Centre

" In the rapidly transforming global economy, the integration of artificial intelligence (AI) into the operations of financial organizations becomes one of the most significant catalysts for efficiency and accessibility of financial services.
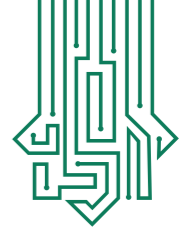
One of the priorities of AIFC is to promote innovations to attract investments and develop the financial market and financial services. Our work in this area has resulted in several initiatives and projects, including the regulatory sandbox FinTech Lab, a pilot project for testing crypto-fiat channels, full digitalization of registration services in AIFC, and many other developments.

AI is one of the effective tools for fostering innovations. It automates routine tasks, enhances data analysis and market trend forecasting, and much more.

Regulating AI in the financial industry requires a multifaceted approach, which should include fostering international cooperation, utilizing a flexible regulatory framework, adhering to ethical norms, ensuring transparency, and accountability. Such a comprehensive strategy not only contributes to the reasonable integration of AI into the financial sector but also promotes the financial industry towards sustainable growth and innovation, simultaneously protecting it from potential risks and ethical pitfalls "

INTRODUCTION

Introduction

Artificial intelligence (AI) technology is **one of the main technological trends of the decade**, exerting a transformative influence on a wide range of industries. Originating as a theoretical concept in the mid-20th century, AI has become **one of the key drivers of the global economy today**, thanks to progress in big data, reduced computational costs, and advances in machine learning algorithms. The emergence of generative AI, capable of analyzing and generating information in various formats, is estimated by McKinsey to potentially contribute up to $4.4 trillion to the economy.

AI technology is **bringing significant changes to various spheres of our lives**, ranging from media content recommendations to forecasting medical conditions and managing autonomous vehicles. At the same time, economists and sociologists are already considering the impact of AI technology on global labor markets, while professional unions, associations, and coalitions of technical and creative professions are demanding restrictions on the use of AI technologies in production. **Like any technology, AI brings new opportunities and risks, including in financial markets.**
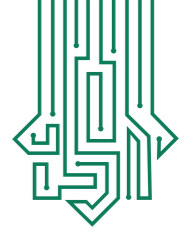
The use of AI technology and its components by participants in the financial market has been occurring since the 1980s when they began using it to detect financial malpractices through the analysis of extensive transaction data. Expanding their horizons, global financial institutions evolved from supporting scientific research to establishing their own departments specializing in the study of artificial intelligence. This has led to extensive use of predictive AI models in areas such as credit scoring, algorithmic trading, risk management, and marketing analysis. By integrating and combining the capabilities of predictive and generative AI, **financial organizations are opening up new avenues for enhancing the efficiency and innovativeness of their products**. This includes creating personalized investment offers and financial services, as well as improving customer satisfaction and experience.

Financial regulators are also taking a proactive stance embracing AI for predicting the outcomes of macroeconomic policies, enhancing the efficiency and timeliness of data-driven decisions, and directly supervising market participants. By implementing such initiatives, regulators not only improve the performance of their core tasks but also enhance the professional skills of their teams by analyzing potential risks associated with the implementation of new technologies.

At present, experts highlight the main risks for the financial market associated with the implementation of AI: model bias, privacy concerns, issues related to lack of transparency and model complexity, risks to the stability and reliability of AI results, cybersecurity issues, risks to financial stability, and ethical risks. However, many experts also speak of risks associated with the use of AI by regulators, which may lead to so-called "poly-crises" - a complex situation where various crises occur due to the neglect of unlikely scenarios not covered by AI models.

In response to the rapid spread of AI and the aforementioned risks, many countries around the world are developing legislative acts, with 31 governments already having enacted laws regulating the use of this technology. Laws on the use of AI are established both at the level of broad regulation and for specific industries, including finance. Currently, there is no single "golden standard" for such regulation, and different jurisdictions have different approaches, each of which requires detailed study.

To avoid the risk of lagging behind in the adaptation and development of AI technologies, President Kassym-Jomart Tokayev has prioritized making Kazakhstan a leader in AI. In this regard, **in February 2024, the Ministry of Digital Development, Innovation and Aerospace Industry presented draft documents on the Concept of Artificial Intelligence Development for 2024-2029** and the Action Plan for its implementation. These documents analyze in detail the current level of AI integration in Kazakhstan and outline directions for its future development at the national level.

Introduction

Recognizing the significance and specific aspects of applying artificial intelligence in the financial sector, regulatory bodies in Kazakhstan have initiated a thorough analysis of the existing situation to develop recommendations and a strategic plan for further AI technology development. As part of the preparation of this report, a survey was conducted among participants in the financial market, the results of which demonstrated the active use of AI in Kazakhstan's financial organizations. However, comparison with global players has shown that **Kazakhstan is falling behind in the application of this technology**. Despite having competence in implementing their own projects, based on global experience, regulators can significantly expand the areas of AI application. Creating a favorable environment for technology development becomes a key task requiring coordinated efforts from financial regulators.

To create a favorable environment for the development of artificial intelligence technology, financial regulators will undertake a number of key initiatives in the following areas:

Harmonizing actions with the initiatives of the Government of the Republic of Kazakhstan to ensure a unified strategic development line for AI.

Implementing a consistent stimulating regulatory strategy that promotes innovation in AI while simultaneously protecting consumer interests and minimizing potential risks.

Developing competencies and projecting them onto the financial market through training and development programs for specialists, as well as knowledge exchange and sharing of best practices.

Conducting experiments and developing proprietary projects aimed at practical application in the financial sector.
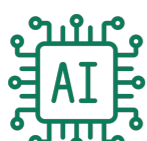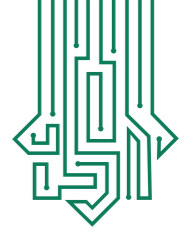
Developing infrastructure to support AI technologies, including computing resources, cloud services, and data exchange platforms.

Starting in 2024, a series of research projects related to the exploration of AI technology potential will be performed. This will be done with attention to associated risks to the financial sector's stability and public trust in the financial system. In addition to that, the process will ensure the creation of equal opportunities to utilize the benefits of this technology by all market participants.
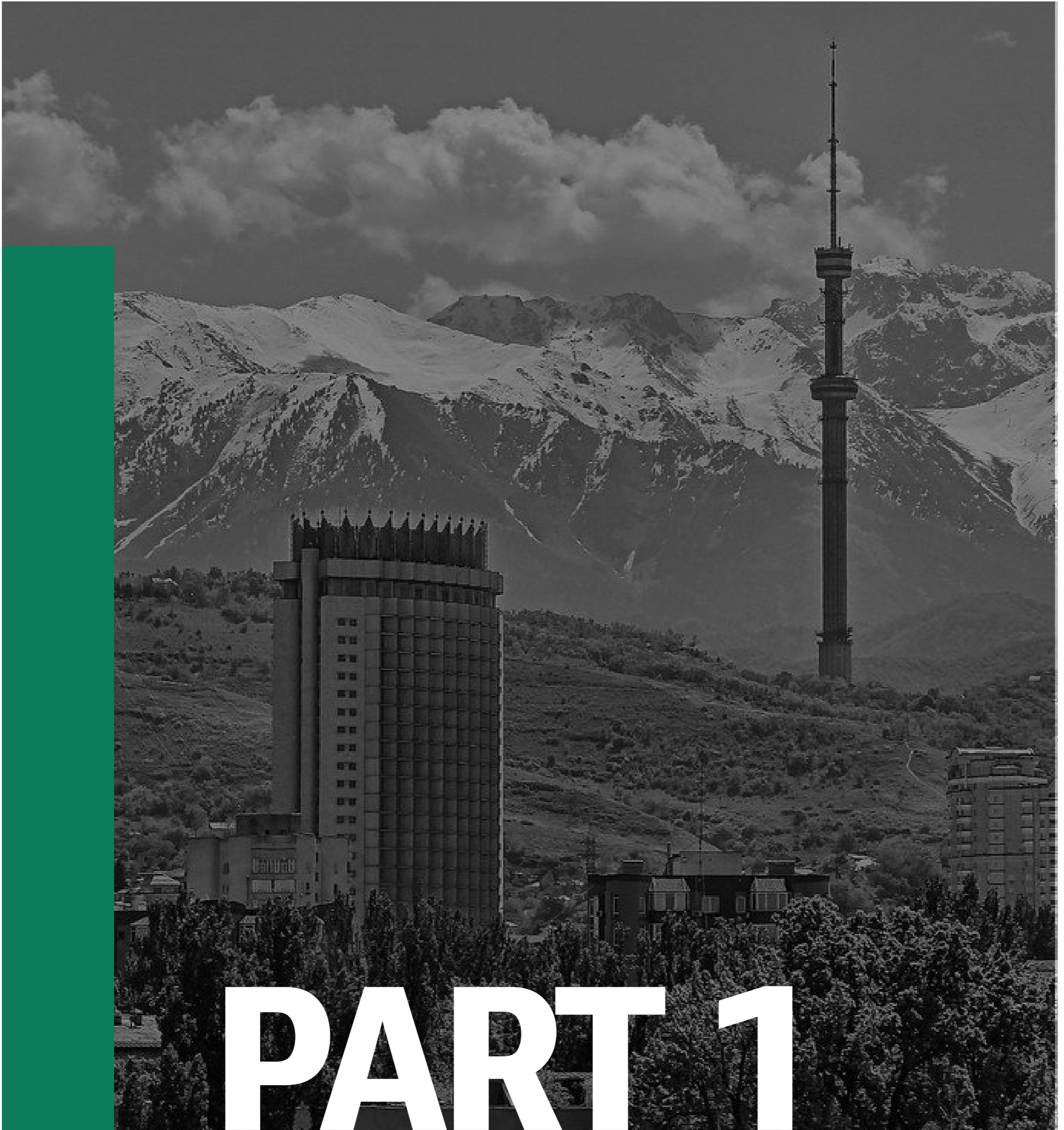
PART 1

**Artificial intelligence
in the modern world**

Artificial intelligence in the modern world

Artificial intelligence (AI) is a technology that enables computers and machines to replicate the abilities of human intelligence to solve tasks. This field of science is widely applied and encompasses various methods that help computers learn and make more accurate decisions, akin to human thinking. In simple terms, **AI allows machines to learn from experience and become smarter over time**.

In the first half of **the 20th century, science fiction introduced the concept of artificially intelligent robots to the world**. This marked the inception of the cultural assimilation of the idea of AI in the minds of future scientists and philosophers. One such individual, Alan Turing, explored the mathematical possibility of artificial intelligence, pondering why machines couldn't utilize available information and reasoning to solve problems and make decisions like humans do.
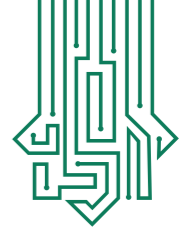
Turing faced fundamental limitations on the path to creating AI at that time – computers couldn't store commands, and **computations were quite costly**. Only large universities and technology companies could afford to engage in research in this field.

In 1956, at the conference held at **Dartmouth College** and organized by John McCarthy and Marvin Minsky, the foundation for the academic study of AI was laid. Despite disagreements and various approaches among the participants, **the conference confirmed the belief in the possibility of achieving AI**.

From 1957 to 1974, AI experienced active development due to improvements in machine learning algorithms and support from government agencies. However, high expectations collided with reality – despite successes, **computers were still too slow and lacked sufficient memory** to solve more complex tasks.

The 1980s brought new ideas and technologies, such as **"deep learning"** and expert systems, reigniting interest in AI. Japan invested significant resources in AI development, as part of the Fifth Generation Computer Systems project, although many ambitious goals were not reached.

Since the 1990s and in the new millennium, **AI has achieved many milestones**. The victory of the computer program Deep Blue over world chess champion Garry Kasparov in 1997, **the development of speech recognition programs, and successes in understanding human emotions have become vivid examples of AI capabilities**.
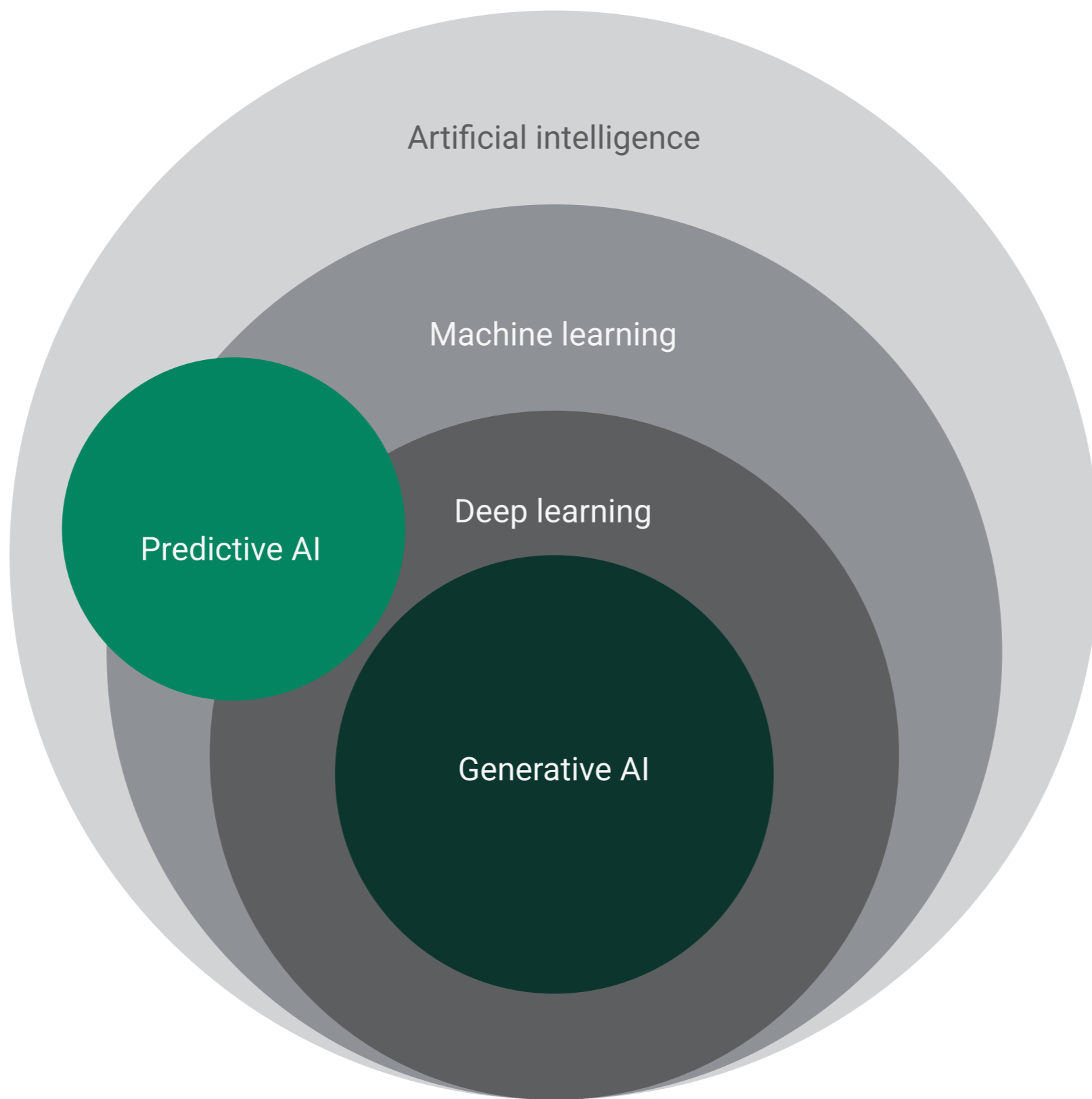
Picture 1. Comparison of artificial intelligence technologies

Artificial intelligence — a ability of artificial intelligence systems to perform "creative" functions traditionally considered the prerogative of humans. These tasks include speech recognition, learning, planning, problem-solving, natural language understanding, perception (via video, images, or sound), and the ability to manipulate objects.

Machine learning - a subfield of artificial intelligence algorithms that allows computer systems to extract knowledge from data and use it for decision-making and predictions without explicit programming, i.e., autonomously, is known as machine learning.
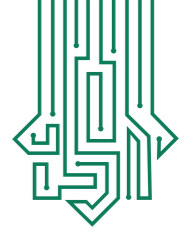
Deep learning - a subfield of machine learning that utilizes deep neural networks for processing data and training models to achieve more accurate and high-quality results is known as deep learning.

Predictive AI - is focused on predicting future events based on the analysis of historical data using machine learning or deep learning methods. It predicts trends in various domains, adapting to changing conditions.

Generative AI - a subfield of deep learning that focuses on generating new, realistic content (text, images, audio) from unstructured data. Generative AI expands the capabilities of automation, enabling machines not only to analyze data but also to creatively interact with information, creating something entirely new and valuable.

AI classification

AI, statistics, and machine learning are the three pillars of modern data science, each making a unique contribution to machines' ability to perform tasks traditionally attributable to humans. While these areas are closely intertwined, there are key differences in methodologies, objectives, and applications.

Statistics

Statistics is the science of collecting, analyzing, interpreting, and presenting data. It utilizes mathematical theories of probability to measure uncertainty and draws conclusions or forecasts based on data. Statistical methods are widely applied across various fields for data analysis and aid in making informed decisions based on empirical data.

Machine learning

Machine learning, a subset of artificial intelligence, focuses on developing algorithms that enable computers to learn from data and make predictions or decisions without explicit programming for a specific task. It includes both supervised and unsupervised learning, as well as reinforcement learning, using statistical methods to optimize the learning process.
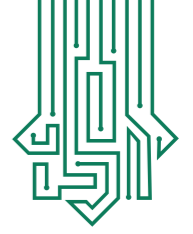
Artificial intelligence

AI encompasses a broad range of technologies that enable machines to simulate human abilities such as learning, reasoning, perception, and autonomous decision-making. AI aims to create systems capable of performing tasks that typically require human intelligence, including but not limited to speech recognition, visual perception, and strategic planning.

	DEFINITION	GOAL	TASKS
STATISTICS	The science of collecting, analyzing, interpreting, and presenting data	Data analysis	Conclusions, forecasts based on empirical data
MACHINE AND DEEP LEARNING	Development of algorithms that allow computers to learn from data	Learning from data	Forecasts, decision making
ARTIFICIAL INTELLIGENCE	Technologies that are imitating human capabilities	Imitation of intellect	Speech, vision, strategic planning

Table 1. Difference between the statistics, machine and deep learning, artificial intelligence terms

AI today encompasses various fields, from process automation to the creation of new forms of content. At the heart of this technological progress are two key directions of AI: **predictive and generative**. Predictive AI essentially implements machine and deep learning, where systems analyze historical data to forecast future events or behaviors. This AI approach has become the foundation for numerous applications, permeating every corner of modern business and science, providing machines with the ability not only to react to current data but also to anticipate future trends and outcomes.

Predictive AI

Predictive AI involves technologies and methods of machine learning used to forecast future events based on historical data. This includes risk analysis, such as predicting a customer's credit risk or forecasting consumer preferences based on past purchases. Predictive AI is actively used in financial and marketing industries to assess the likelihood of future events and make more informed decisions. This can involve both simple machine learning algorithms and more complex deep learning models.

Generative AI

Generative AI, in turn, is a subset of deep learning and focuses on creating new, realistic content from unstructured data. This can include text, images, or audio. Examples of well-known applications of generative AI include models, which can generate compelling textual responses to queries, or systems, that are capable of creating images on the fly or automatically summarizing large texts. Generative AI expands the possibilities of automation, allowing machines not only to analyze data but also to creatively interact with information, creating something entirely new and valuable.

Joint use of generative and predictive AI

Generative AI and predictive AI are important tools in the AI technology arsenal, each performing unique functions and serving different purposes. Their application does not imply choosing between one or the other, but rather emphasizes the need for their integration into the organization's AI strategy to achieve a comprehensive effect.
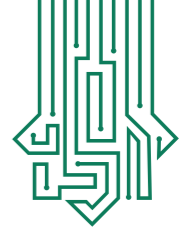
Predictive AI can be associated with the left hemisphere of the human brain, oriented towards logic, analysis, and computation. It specializes in predicting future events based on the analysis of past and current data, making it indispensable for tasks related to forecasting market trends, risk analysis, or supporting informed decision-making.

Generative AI, on the other hand, can be likened to the right hemisphere of the brain, responsible for creativity and intuition. This type of AI is capable of generating new content, mimicking human creativity. Examples of its use include creating unique textual responses in support chats, generating new ideas or product concepts, as well as developing innovative solutions for non-standard tasks.

The ideal approach involves synergistically utilizing both types of AI, allowing them to complement each other. Generative AI can offer new ideas and approaches, while predictive AI can help assess their potential effectiveness and risks. Such a combination not only improves the decision-making process but also expands the horizons of innovation, making the financial organization more flexible and adaptive to changes.

The emergence of generative AI is a true breakthrough as it expands the capabilities of AI, making its tools more accessible to a wide range of users within the organization, including those without technical backgrounds.

The ability of generative AI to process and generate information in a language understandable to humans opens up new horizons for financial institutions in creating value and innovation, turning AI into a universal resource available to every employee of the organization

The spread of AI

The latest data from McKinsey indicates rapid development of generative AI across various sectors. Within a short period since its emergence, over a third of surveyed representatives from various companies report regular utilization of generative AI in one of their business processes. AI transitioned from being primarily of interest to IT specialists to becoming a significant aspect for top management: approximately a quarter of surveyed top executives actively employ generative AI tools in their work. While in 2017 only 20 percent of respondents reported using AI in at least one business area, today this figure has risen to 50 percent.
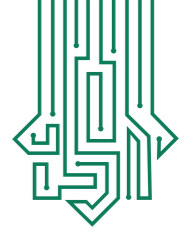

20%

2017

50%
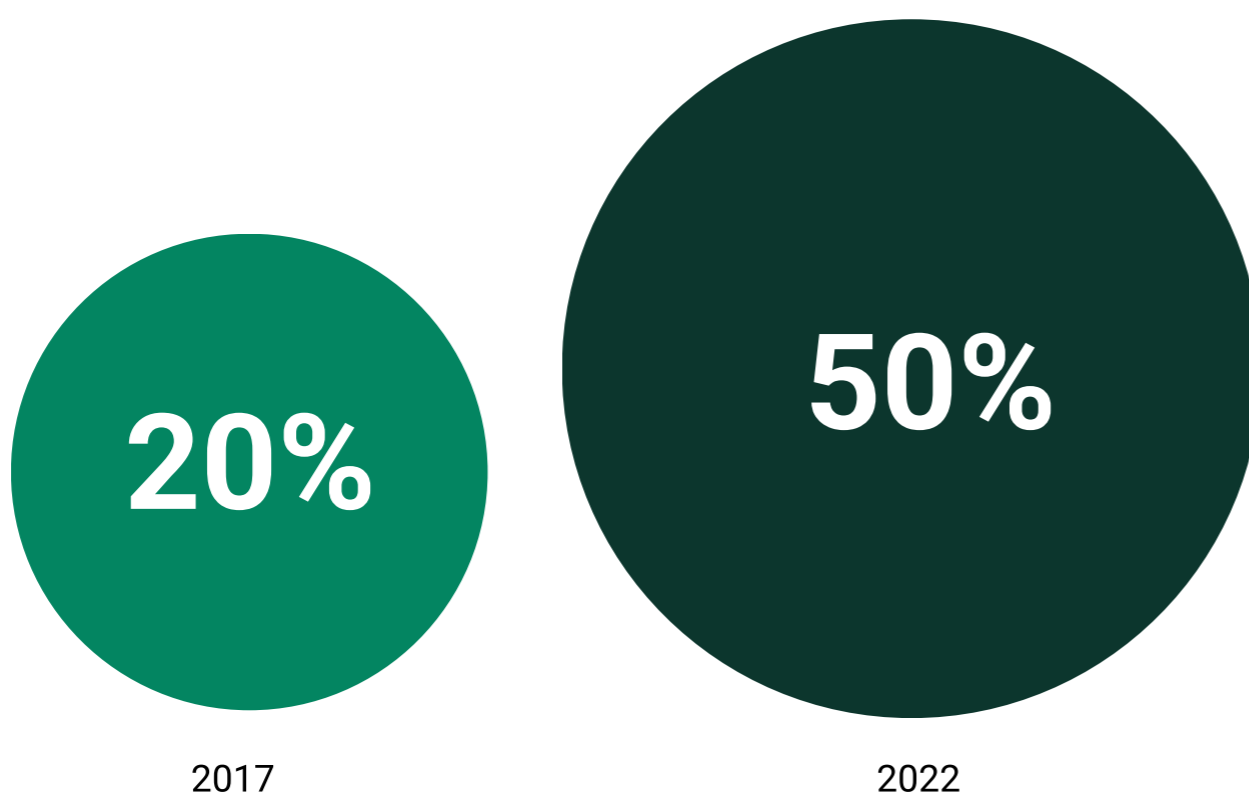
2022

In just a few years, the adoption of AI has more than doubled. In 2017, 20% of respondents from large companies reported implementing AI in at least one business area. By 2022, this figure had increased to 50%.

Picture 2. Comparison in AI penetration.
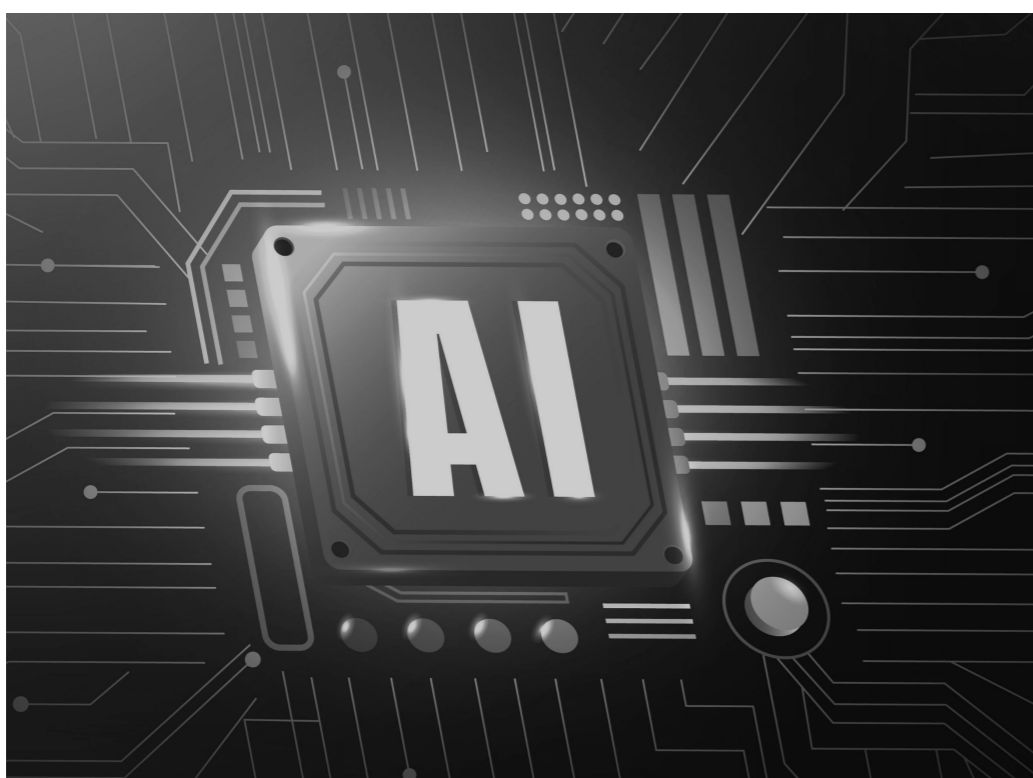
Major players from various industries are recognizing the potential benefits of integrating AI and actively increasing their funding. Reports from Crunchbase for the year 2023 reflect significant investments in the AI sector, nearing the $50 billion mark, with a substantial portion—approximately $27 billion according to PitchBook data—allocated towards the development of generative AI. Such financial momentum reflects management's confidence in the necessity of AI for future growth.
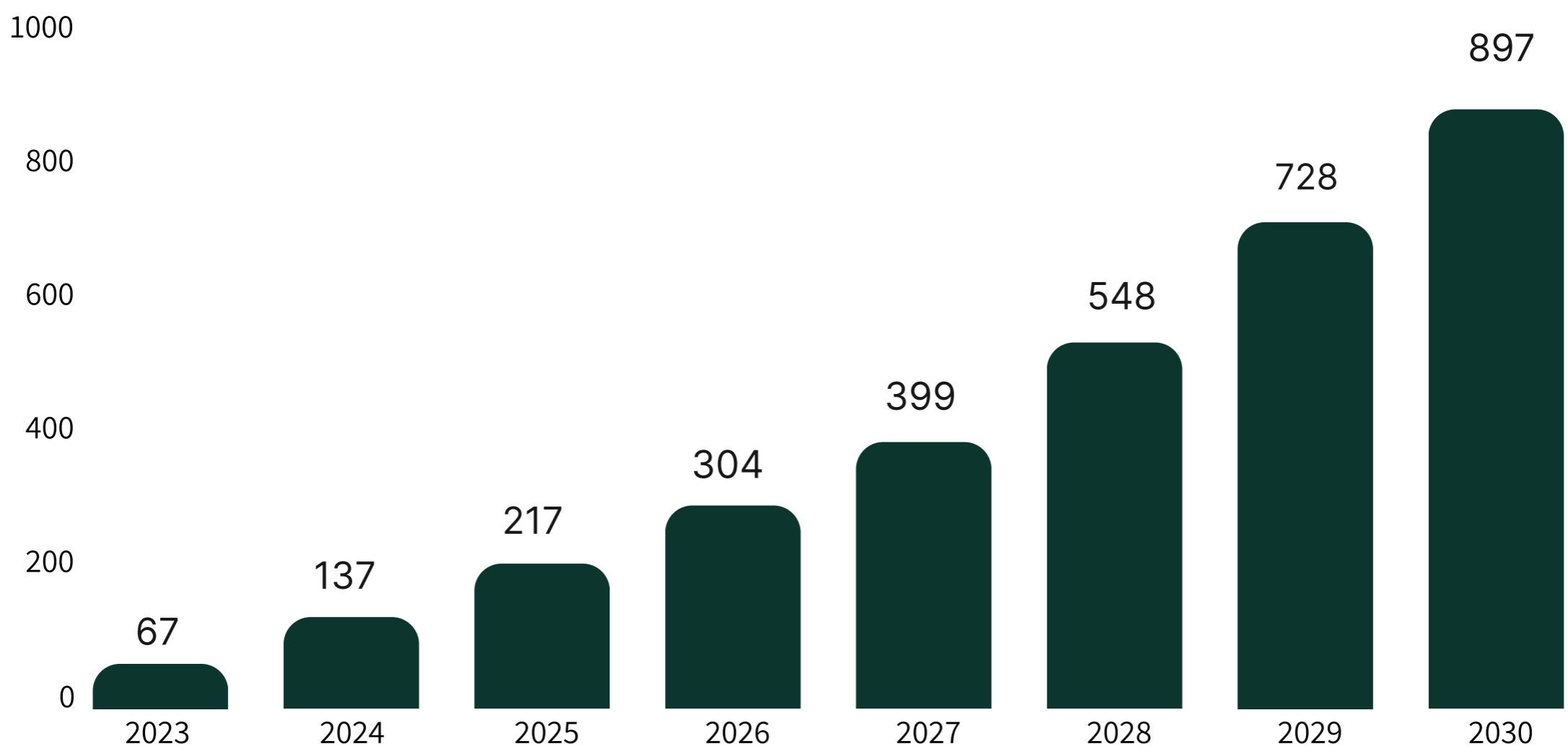
Picture 3. Valuation of the global generative AI market (in billions of dollars)
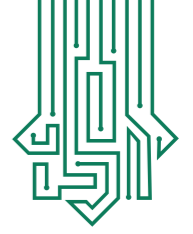
The relationship between investments and expected outcomes is reinforced by McKinsey's forecasts, according to which **generative AI has the potential to automate up to 70% of labor tasks**, promising significant changes in business processes. At the same time, PwC estimates suggest that by 2030, AI could make a substantial contribution to the global GDP, reaching $13.3 trillion. These preliminary assessments not only illustrate the significant financial potential of AI but also its role as **a catalyst for global economic growth**, supporting the strategic necessity of continuing investments to achieve operational optimization, increase efficiency, and strengthen market leadership across a wide range of industries.

Healthcare

Significant progress in healthcare is expected due to the use of AI to enhance diagnostics and drug discovery. AI-based diagnostic tools, such as **PathAI**, have significantly improved cancer detection rates. Additionally, platforms for drug discovery using AI, such as **Atomwise**, have accelerated the process of identifying potential therapeutic agent.

Finance

The financial sector has continued its transformative development under the influence of AI. Companies engaged in high-frequency trading, such as **Virtu Financial**, have implemented AI algorithms for more precise trading decisions. Meanwhile, AI-powered fraud detection solutions, like **Forter**, have strengthened financial institutions' ability to combat fraudulent activities.

Education

Coursera and **edX** platforms use AI for recommending courses and adapting content to individual learners, enhancing the online learning experience. Additionally, AI-powered assessment tools like **Proctorio**, are aimed at maintaining academic integrity during online exams.

Art and creativity

Creativity generated with the help of AI in the realms of art and music has garnered widespread attention. Artificial non-fungible tokens (NFTs), offered by companies like **Aiva** and **Artbreeder**, have disrupted the established order in the art world, prompting reflections on the nature of art and authorship. In a landmark federal court decision in the United States, it was ruled that artworks created by artificial intelligence cannot be protected by copyright.

Research and financing in the field of AI

Research institutions and organizations have made significant breakthroughs in the field of AI in recent years. DARPA's investments in AI research are aimed at making systems more understandable and transparent, increasing trust and accountability. Partnerships between OpenAI and academic institutions have facilitated collaborative research efforts in the field of AI.

Climate change

AI played a key role in addressing the climate change challenge in 2023. Climate modeling platforms such as **ClimateAI**, utilized AI to improve climate forecasts, aiding efforts to mitigate climate change. Energy management systems using AI, such as **Verdigris**, optimized energy consumption in buildings, contributing to sustainability goals.

Autonomous transport modes

Companies like Tesla and Waymo have taken center stage with cutting-edge advancements in autonomous transportation. Tesla's full self driving **(FSD)** system has received significant updates, nearing the capabilities of fully autonomous driving. Meanwhile, Waymo has expanded its autonomous taxi service to additional cities, pushing the boundaries of self-driving.

Cybersecurity

AI-based cybersecurity solutions have become more prominent as organizations strive to defend against constantly evolving threats. The AI-based platform **Darktrace** offers real-time threat detection and response solutions. According to **Qualys**, AI-powered vulnerability scanners help organizations proactively identify and mitigate security vulnerabilities.

Use of AI by financial organizations

Despite the common perception of generative AI in the financial industry as a technology underlying customer chatbots, its functional spectrum is much broader. Generative AI extends beyond standard customer service to encompass complex tasks such as automating financial analysis and supporting software solution development, significantly expanding its application in business processes. Many leading global banks and insurance companies are actively researching and implementing generative AI, developing their own models or integrating solutions offered as services. Examples of such major players, including Goldman Sachs, Deutsche Bank, American Express, and Wells Fargo, demonstrate the beginning of an era of widespread adoption of generative AI in the financial industry. These companies have already begun implementing their innovative solutions in practice, highlighting the importance of generative AI as a powerful tool for enhancing efficiency, accuracy, and innovation potential in the field of financial services.

% of respondents, using certain AI-based products

Industry	Computer vision	Deep learning	Digital twins	Face recognition	GAN	Knowledge graphs	NL generation	NL speech understanding	NL text understanding	Physical robotics	Recommender systems	Reinforcement learning	Robotized process automation (RPA)	Transfer learning	Transformers (e.g., GPT-4)	Virtual agents
All industries	34%	30%	24%	18%	11%	25%	18%	23%	33%	20%	25%	20%	39%	16%	11%	33%
Business, legal and professional services	32%	37%	31%	11%	8%	26%	12%	22%	34%	19%	23%	26%	46%	16%	11%	30%
Consumer goods/retail	33%	36%	25%	19%	13%	18%	20%	11%	22%	24%	32%	19%	25%	7%	11%	40%
Financial services	24%	22%	18%	24%	13%	29%	20%	30%	42%	14%	30%	19%	47%	17%	12%	33%
Healthcare system / pharmaceutics	32%	18%	16%	5%	5%	14%	5%	12%	29%	11%	16%	13%	16%	9%	6%	14%
High Tech/telecommunications	37%	45%	24%	16%	15%	23%	24%	29%	40%	15%	34%	23%	48%	22%	15%	43%

Table 2. Results of surveys of representatives from organizations in various sectors.
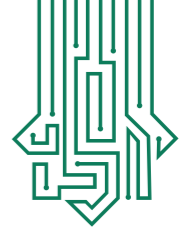
Generative AI finds broad application among major players in the financial market, **demonstrating its effectiveness in various areas**: from automating the creation of financial reports and analytical reviews at JPMorgan Chase, which helps reduce document preparation time and increase analysis accuracy, to accelerating software development processes at Goldman Sachs by automating code writing and testing. American Express uses generative AI to improve customer service, providing a more personalized approach and reommendations, while Deutsche Bank applies AI to enhance risk management efficiency, ensuring more accurate risk forecasting.

It should be noted that **AI has become an integral part of the financial market,** bringing about significant improvements in service delivery methods and information management. Thanks to its capabilities, financial institutions are finding ways to increase productivity, reduce costs, and open up new avenues for innovative growth. According to IBM, **approximately half of all major financial companies have implemented AI,** indicating its significance and necessity for strengthening their market positions: over 95% of executives believe that using AI is key to maintaining competitive advantages.
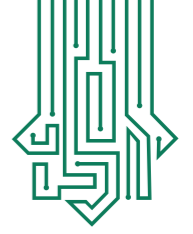
The economic impact of introducing generative AI into the global economy is estimated at 2.6–4.4 trillion US dollars per year. Considering forecasts that by 2024, the financial sector will become a leader in AI investment volumes, the implementation of generative AI is expected to increase global bank revenues by 200–340 billion US dollars annually, and insurance companies by 50–70 billion US dollars annually. Such an assessment confirms not only the economic benefits of AI implementation but also its **fundamental role in further development and success of the financial sector.** Recognizing this, 75% of banks with assets exceeding 100 billion US dollars have already integrated AI technologies into their operations. AI technology represents not just a technological innovation for the financial sector but also serves as a catalyst for numerous significant improvements and innovations:

1. **Optimization of operational processes:** AI is capable of automating everyday tasks, such as data processing and transactions, which reduces the time spent on performing tasks and decreases the likelihood of errors.
2. **Big data analysis:** thanks to AI, financial institutions can extract valuable insights from large volumes of data, which helps in making informed investment decisions and improving risk management strategies.
3. **Personalization of services:** AI enables financial organizations to provide more personalized services to clients by analyzing their behavior and preferences to offer the best financial products.
4. **Increase of risk management effectiveness:** AI can forecast and identify potential risks, allowing financial organizations to take timely actions to minimize them.
5. **Compliance and meeting of regulatory requirements: wi**th the help of AI, financial institutions can automate regulatory compliance, streamlining the process of data collection and analysis for regulatory reporting.
6. **Fraud prevention:** Using AI to monitor transactions helps detect suspicious activity and prevent financial fraud in real time.
7. **Innovational product development:** AI stimulates the development of new financial products and services, opening up new market niches and meeting evolving customer needs.
8. **Development and testing of new strategies:** AI allows modeling and testing various market behavior scenarios and investment strategies, providing a safe environment to evaluate their potential effectiveness.
9. **Strengthening of cybersecurity:** AI is actively used to enhance cybersecurity systems, providing protection against external threats and internal vulnerabilities.

PART 2

Influence of AI technology on global financial markets

Influence of AI technology on global financial markets

The Financial industry is one of the **most dynamic sectors of the economy in terms of adapting to and implementing AI.** Financial institutions stand to gain significant advantages from the implementation of AI. Currently, major players in the financial market are actively harnessing the potential of AI in various areas of their operations: enhancing customer experience, offering personalized products, improving security, and boosting operational efficiency.

Improvement of client experience

The use of AI helps financial organizations deliver higher-quality services and improve the user experience of financial services. Integrating AI into bank branches and ATMs allows for the creation of a more intuitive and efficient interface for customers. Online banking is becoming increasingly popular among clients, and the application of AI in this area enables the creation of more convenient and user-friendly interfaces, as well as providing faster and more accurate responses to customer inquiries. Effective use of AI in call centers helps reduce wait times and improve the quality of customer service. Automating request processing through chatbots and analyzing customer data allows agents to respond more quickly and accurately to customer inquiries.

Provision of personalized services

Currently, personalizing product offerings is becoming increasingly important for expanding the customer base and increasing the profitability of financial organizations. The use of **AI algorithms can adapt offerings and advertisements to individual preferences** and consumer needs. AI models can analyze data on demand, the competitive environment, seasonal factors, while taking into account individual goals, risks, and financial positions of customers to determine the optimal cost of services for both customers and financial institutions.

Increase in security

The use of AI significantly improves fraud detection and credit risk assessment processes. AI algorithms are used to create models capable of identifying anomalies and unusual patterns in financial transactions, helping to detect suspicious transactions and prevent fraudulent activities. **The use of AI** in the financial sector **not only enhances the security of financial operations but also contributes to more efficient financial transactions and reduction of losses from fraud**.
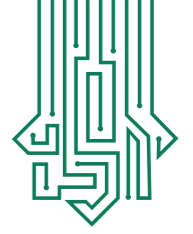
Payment systems, such as Mastercard, Visa, are actively implementing AI capable of analyzing vast amounts of transactional data in real-time to detect suspicious operations. This is done based on developed criteria and patterns of similar operations in order to prevent high risk transactions.

Increase in productivity

The use of AI allows for the automation of many processes, including optimizing resource allocation and ensuring compliance with legislative requirements. Data analytics and **AI enable** the detection of various patterns and **real-time process optimization**. This allows for prompt response to potential issues and minimizes potential risks.

The use of intelligent document processing systems, as in the case of Citi, significantly speeds up the processing of large volumes of documents by classifying information, reducing the likelihood of errors, and increasing employee efficiency.

Insider Intelligence data indicates that already three-quarters of banks with assets exceeding $100 billion have integrated AI technologies into their operations, and according to the IDC analytical center, it is forecasted that by 2024, the **financial sector will lead in terms of the size of investments in AI.**

History of AI use in financial industry

Meanwhile, it is important to note that the financial industry has long been successfully applying AI in its operations, **accumulating significant experience and developing new approaches to improve its services**.

Starting from 1987, when American Express began using systems for fraud detection, which was one of the first steps in integrating AI into the financial sector. This demonstrates that as early as the late 20th century, financial companies were striving to use various technologies to ensure the security of their clients.

In 1998, Renaissance Technologies began using **algorithmic trading**, demonstrating how AI could be used to optimize investment strategies and asset management, providing opportunities to increase returns while reducing risks.

At the beginning of the 21st century, Charles Schwab implemented AI-based **Customer Relationship Management** (CRM) systems, which improved service quality and increased customer satisfaction through personalized communication and services.

Chronology of AI implementation in the financial sector

1987 - 2001	2011 - 2012	2016	2020	2021	2022	2023
Fraud detection systems	Credit scoring	Risk management system	Financial forecasting	Capital management platforms based on AI	Risk accessment with help of AI	Client support using AI
AMERICAN EXPRESS	ZEST	JPMorgan Chase & Co.	Goldman Sachs	Morgan Stanley	citibank	HSBC
Algorithmic trading	Chat-bots and virtual assistants	Compliance with regulatory requirements		Improved fraud detection systems	AI for compliance with regulatory requirements and reporting	AI in credit underwriting
Renaissance	Bank of America	HSBC		PayPal	BNP PARIBAS	LendingClub
Client support management	Robot consultants 2.0	Personalized banking services				
charles SCHWAB	Betterment	CapitalOne				

Picture 4. Development of AI technology use by market participants
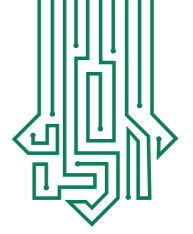
Since 2011, there has been active use of AI for **credit scoring**. ZestFinance has offered solutions that make the credit scoring process more accurate and accessible, thereby expanding opportunities for clients to access financial services.

Bank of America, JPMorgan Chase, HSBC, and other major banking institutions have actively integrated AI for risk management, regulatory compliance, personalization of banking services, as well as the creation of **chat-bots and virtual assistants, starting from 2016**. This underscores the commitment of financial organizations to leverage AI to enhance operational efficiency and improve the customer experience.

The emergence of new developments such as **enhanced fraud detection systems** by PayPal in 2021, AI-based **asset management platforms** by Morgan Stanley, as well as the application of AI for risk analysis and regulatory compliance, demonstrates that the financial industry continues to seek new ways to leverage AI to enhance its processes.

In 2022, Citibank actively worked on implementing AI in **risk assessment**, allowing the bank to more accurately analyze potential threats and manage them based on real-time data. This direction is crucial for the financial industry as it contributes to increasing resilience to financial crises and ensures more stable bank operations.

In 2022, BNP Paribas focused on using AI for regulatory compliance and reporting. With AI, the bank was able to **automate the collection and analysis of large volumes of data**, significantly streamlining the reporting process and ensuring high accuracy in compliance with regulatory standards.

In 2023, HSBC introduced enhanced AI-based customer service solutions, including chat-bots and **virtual assistants with expanded functionalities**. These technologies enabled the bank to provide personalized support to customers 24/7, significantly increasing satisfaction and loyalty levels.

LendingClub in 2023 utilized AI to optimize lending processes, particularly for **assessing borrowers' creditworthiness**. The application of artificial intelligence in this area allowed the company to make the loan approval process more efficient and accessible to a wide range of customers, reducing the risks of loan defaults.

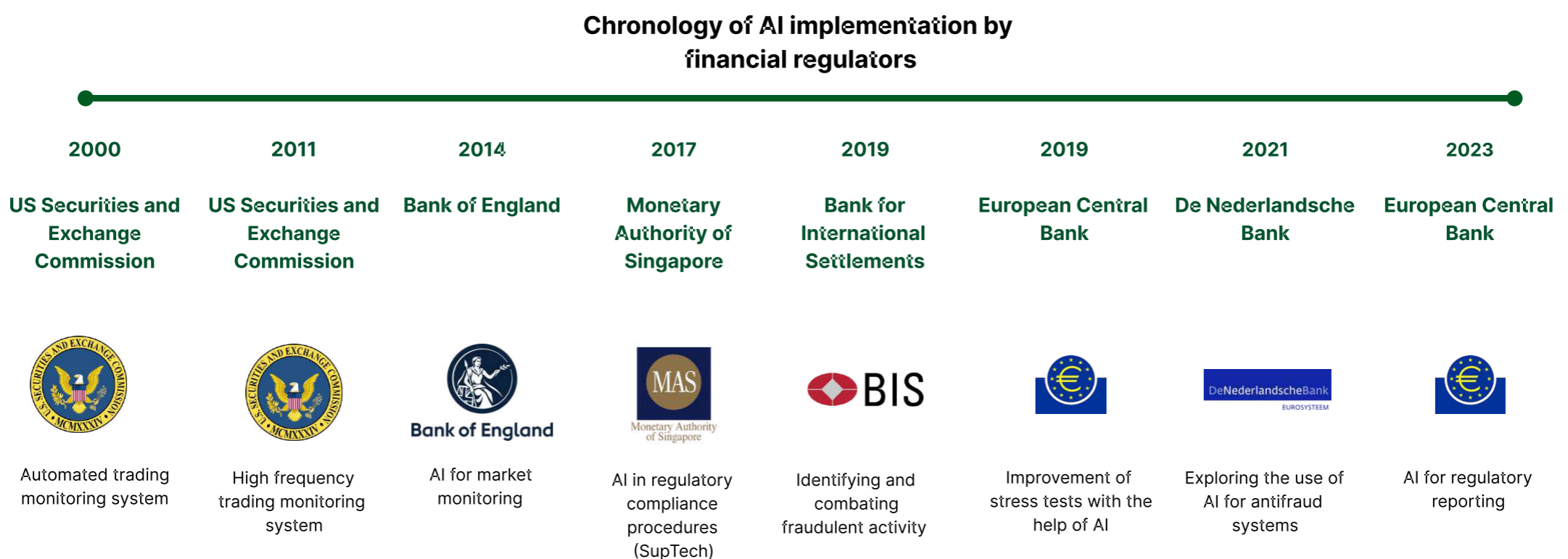These examples demonstrate that the financial industry continues to actively explore and implement innovative technologies based on artificial intelligence to enhance operational efficiency, improve customer service quality, and ensure a high level of security and reliability in their services.

History of AI use by financial regulators

As financial market participants increasingly began to apply AI in their operations, financial regulators worldwide also did not lag behind in exploring and utilizing this technology. Already **in the late 1990s**, regulators began to explore the theoretical possibilities of neural networks, which laid the foundation for the subsequent integration of AI into regulatory processes.

Starting in the early 2000s, for instance, the U.S. Securities and Exchange Commission (SEC) began utilizing automated systems for **monitoring and analyzing trading activities to detect potential violations**, including insider trading. This significantly increased the efficiency and speed of responding to suspicious transactions.

Chronology of AI implementation by financial regulators

2000	2011	2014	2017	2019	2019	2021	2023
US Securities and Exchange Commission	US Securities and Exchange Commission	Bank of England	Monetary Authority of Singapore	Bank for International Settlements	European Central Bank	De Nederlandsche Bank	European Central Bank
Automated trading monitoring system	High frequency trading monitoring system	AI for market monitoring	AI in regulatory compliance procedures (SupTech)	Identifying and combating fraudulent activity	Improvement of stress tests with the help of AI	Exploring the use of AI for antifraud systems	AI for regulatory reporting

Picture 5. Development of AI technology use by financial regulators

By 2011, the SEC was already employing more sophisticated AI tools **to monitor** high-frequency trading, adapting to the rise of algorithmic trading and enhancing its ability to monitor risks associated with this type of trading.

In 2014, the Bank of England initiated research into the use of machine learning and AI to **enhance understanding of market dynamics**, demonstrating regulators' commitment to gaining deep insights into the impact of technology on financial markets.

In 2017, the Monetary Authority of Singapore (MAS) launched initiatives to promote the use of AI in **regulatory compliance procedures** (SupTech), emphasizing the importance of technology in enhancing efficiency in the financial sector.

In 2019, the Bank for International Settlements (BIS) began discussing the potential of AI and machine learning to **improve the stability of financial markets**, underscoring the increasing importance of these technologies for the global financial system.

Since 2019, the European Central Bank (ECB) has started integrating AI into **stress testing guidelines**, using machine learning models for more accurate analysis of the banking sector under various economic scenarios.

In 2021, De Nederlandsche Bank (DNB) began researching the use of AI to **detect and combat fraudulent activities**, particularly in payments and financial transactions, indicating a growing focus on the security of financial operations.

Finally, **in 2023,** the European Central Bank implemented AI systems to optimize the submission of regulatory reports, significantly increasing the efficiency of data collection and analysis.

Thus, **not only financial institutions but also regulators have accumulated significant experience in AI**, allowing them to effectively adapt to new challenges, enhancing transparency, security, and stability in financial markets. This collaboration between market participants and regulators contributes to the creation of an innovative and reliable financial infrastructure, ready to meet the challenges of the modern economy.

Detailed examples of AI use by financial regulators

Financial regulators worldwide are actively striving to integrate AI, not only to enhance their effectiveness but also to adapt to the constant changes in the economic environment and financial markets. In rapidly evolving market conditions, **the application of AI becomes a key factor for promptly responding to new challenges and ensuring macroeconomic stability.** The use of AI in the activities of financial regulators encompasses a wide range of tasks and directions, contributing to the modern strategy of financial system development and the economy as a whole.

European Central Bank has applied machine learning methods to automate the classification of data from more than ten million legal entities in Europe, improving the efficiency of information processing.

The Bank of Spain has developed a tool based on machine learning algorithms to correct low-quality data and fill gaps in the accounting reports of firms, significantly improving the quality of reporting.

The Bank of Israel has implemented information dashboards for statistical calculations and derivative market analysis, providing users with flexible tools for selecting variables, adding filters, and applying detection algorithms.

Data processing

AI enables timely and high-quality data processing by automating data collection, analysis, and classification. The ability of algorithms to operate in real-time ensures **prompt data retrieval, reducing time delays**. Additionally, AI enhances data quality by **identifying and correcting errors**. The application of AI in data management strengthens the analytical capabilities of financial regulators, allowing for in-depth data analysis, trend identification, and risk forecasting.

Building real-time indicators based on unstructured data

Financial regulators are actively integrating AI for processing information required for **analyzing economic indicators**, including inflation. The use of AI in the classification process contributes to more precise and consistent distribution, thereby enhancing the quality of assessments.

The European Central Bank has launched the PRISMA system for collecting and analyzing microdata, including statistics and data from fiscal receipts and online stores, enhancing the accuracy of monetary policy.

The National Bank of Kazakhstan has developed and implemented the NBK Price Tracker information system, which analyzes price dynamics in online stores to construct a proxy indicator of inflation

Forecasting and alternative assessment of macroeconomic variables

Financial regulators are increasingly using AI for **forecasting and effectively managing macroeconomic policies**. The use of neural networks, deep learning methods, and big data analysis allows financial regulators to more accurately identify trends, account for complex interrelationships, and improve forecast accuracy. AI also contributes to adaptability in rapidly changing economic environments, which is critically important for obtaining accurate forecasts.

The Bank of France utilizes natural language processing methods to analyze news articles, creating an inflation perception indicator that serves as an indirect measure of household inflation expectations.

The Bank of Japan utilizes internet trend analysis in forecasting macroeconomic indicators such as consumer demand, real estate market trends, and unemployment.

In addition to forecasting processes, the use of AI for **assessing public and business expectations** is becoming more widespread. AI enables the automation of data analysis from various sources, including social media, economic reports, and public surveys. Natural language processing algorithms can analyze texts and identify sentiments and expectations, complementing traditional assessment methods.

Use of artificial intelligence in communications

Financial regulators are integrating AI into their operations to enhance **communication** efficiency. One prominent example is the use of AI to create chatbots that provide information regarding and ongoing projects. These virtual assistants can respond to inquiries and provide statistics.

Additionally, AI is improving the **process of writing texts for financial regulators**. Natural language processing (NLP) algorithms enable the automatic generation of reports, analytical materials, and even conclusions based on data and statistics.

The Central Bank of the Philippines has created a chatbot for efficient complaint processing. This bot filters messages, determines the competence for resolving complaints, and contributes to trend analysis to identify market violations.

Prudential regulation

The **integration of AI into the prudential regulation** of individual financial institutions represents a modern and efficient method of ensuring financial stability. This approach aims at deeper and more accurate monitoring of financial organizations, thereby facilitating more effective risk management.

One of the key elements of employing AI in prudential regulation is the ability to **analyze and forecast credit risk**. Additionally, the use of AI in prudential regulation includes assessing liquidity risk.

The European Central Bank has developed the Athena system for natural language processing, analyzing over 5 million documents and assisting supervisory authorities in identifying market trends and risks through a unified web platform.

Banco de Portugal use machine learning to look for anomalies in the country's central credit register. The main goal of this project is to support credit organizations in evaluating risks related to their counteragents.

Evaluation of market participants' impact

Financial regulators actively employ AI to **assess the influence of market participants' behavior on various macroeconomic variables**. The complexity of financial markets demands more precise and timely analysis tools from financial regulators. AI enables the **automation of processing large volumes of data**, identifying hidden patterns, and predicting potential trends. Assessing market participants' behavior using AI allows regulators to react more accurately to the dynamics of economic variables and make well-founded decisions.

The Bank of Indonesia employed machine learning algorithms to analyze the impact of foreign investors on exchange rates and monetary policy, analyzing around 2000 variables and identifying bond yields as a key predictor of foreign investment flows.

Combating financial crimes

Financial regulators are deploying AI to effectively combat **money laundering, terrorist financing, and detect financial crimes** even with minimal data. One of the key technologies utilized is machine learning, capable of identifying anomalies in financial transactions, raising red flags on potential fraud cases.

Additionally, financial regulators integrate AI into **monitoring systems** that automatically analyze transactions and **identify potential non-compliance with financial standards**. Natural language processing (NLP) technologies are also applied to analyze textual data related to financial operations, uncovering suspicious schemes.

Money laundering poses a serious threat to the global financial system, undermining its integrity and security. Expert assessments indicate that the volume of laundered funds ranges from 2% to 5% of the world's GDP, which, given the current global GDP, equates to a sum of 2 to 5 trillion US dollars. Less than 1% of these estimates is seized annually; however, compliance costs for anti-money laundering requirements and ensuring institution security significantly increase.

The traditional approach to combating money laundering, which involves monitoring transactions for suspicious activity, proves to be fragmented and ineffective.

The BIS Innovation Hub, in collaboration with the Bank of England, developed the Hertha system to detect financial crimes through network analytics and real-time analysis of fraudulent transaction patterns, using synthetic datasets to minimize false positives.

The Monetary Authority of Singapore and six major commercial banks are developing the COSMIC platform for secure information exchange regarding potential financial crimes among financial institutions, with the goal of simplifying detection and prevention of criminal activities

Revealing illegal activities with DeepFake

The DeepFake technology, used for fraudulent operations, involves the manipulation of images, videos, or audio files using artificial intelligence and deep learning. This technology can mimic voices, facial expressions, and movements, creating realistic yet false content.

The use of DeepFake technology for fraud poses a significant threat, and some laboratories and institutes are already actively engaged in researching and developing methods to detect such fraudulent activities.

*One such example is the process of **testing biometric solutions providers as part of their integration into the National Payment Corporation's Identitification Data Processing Center.** Part of this process involves evaluating the biometric solutions of various providers for their ability to detect the use of DeepFake technologies to falsify identity when accessing financial services. As DeepFake technologies continue to advance, developing effective and timely measures to counter their use for fraudulent purposes in the financial industry and enhancing overall security becomes particularly relevant.*

Use of synthetic data

Central banks, with access to confidential information, can play a key role in **creating synthetic datasets, opening up broad prospects** for innovation and development for various companies. Projects such as Aurora and Hertha represent important initiatives aimed at creating synthetic data using artificial intelligence technologies.

Synthetic data can include information about financial transactions, payments, and other aspects of the economy. Due to the confidential nature of the data, **synthetic datasets provide a high level of protection for personal information**, which is particularly important in the context of privacy compliance and regulatory requirements. Companies accessing such synthetic data can use it to train their models and develop innovative products. **Synthetic datasets serve as a powerful catalyst for the development** of the financial industry and related sectors.

Role of Open Banking for development strategy of artificial intelligence

The global development of the Open Banking concept is a significant driver for the use of AI in the financial market. This direction, associated with the real-time collection and subsequent processing of data using AI, provides more open and standardized access to financial data.

In combination with RegTech, the development of Open Banking systems provides more efficient mechanisms for regulation and supervision in the financial sector. In the context of RegTech, this means that regulators can receive real-time, accurate information from financial institutions. This enhances the regulators' efficiency in microprudential regulation, detecting financial crimes, preventing fraud, and ensuring compliance with regulations. Overall, the development of Open Banking within RegTech supports a more integrated, transparent, and efficient approach to regulating the financial sector, contributing to improved security, risk reduction, and higher regulatory compliance levels.

At the same time, the development of Open Banking is essential for advancing technologies and approaches to generating synthetic data, which can only be formed based on real data, and their secure collection is impossible without a well-developed Open Banking system. The observed development of companies in the financial technology industry in the European Union, the United Kingdom, and Australia is associated with ongoing and consistent efforts to develop Open Banking for the free and secure exchange of customers' banking data. However, there are several limitations to connecting to these systems and using them. Synthetic data, on the other hand, can become the next driver of growth in financial technologies related to AI development. In the case of synthetic data, the barrier to entry is lowered, and the data is available for use by a wider range of companies, including startups that often cannot meet technological and financial performance requirements.

Matrix of AI use

Use of AI by financial organizations

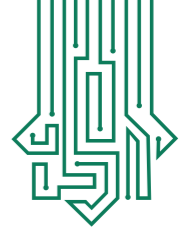| Marketing and sales	Prospecting and onboarding	Product development	Operations process	Financial advice	Customer support	Risk and compliance	Support of corporate functions

Predictive AI

Customer retention	Customer LTV modeling	Analytical banking offerings	Intelligent payment routing		Call transcript analysis and insights mining	Early warning credit risk monitoring	Optimization of risk-weighted assets
Cross-selling and acquisition	Personalized onboarding		Smart payment repairs			Collateral risk assessment	HR: AI-powered talent acquisition
Pricing and fee optimization			Differentiated collections			Automated credit decision making	Optimal allocation of resources
Omnichannel engagement			Branch network optimization				

Both

	Intelligent document processing and digitization			Support and proactive needs identification for RM/client interactions		Transaction monitoring	HR: Talent retention and employee sentiment analysis

Generative AI

Hyperpersonalization of text content (e.g., email)	Streamlined onboarding (including KYC)	Identification of emerging product trends to support product teams	Document prepopulation		Policy/contract monitoring and synthesis	Knowledge database for legal teams	Knowledge management and analysis
Hyperpersonalization of image content	Initial fact finding for a new client	Helping users discover products tailored to needs		Investment reports and research synthesis	Automated document classifiation	Suspicious activity report prepopulation	Code generation and review
Client acquisition chatbots for engagement				Syntesized, tailored reports for customer distribution based on individual interests	Customer service/contract center support interface and chatbots	Ongoing customer due diligence	Memo writing
Sales training for simulating client conversations					Agent coaching and performance	Compliance monitoring and documentation creation	IT: Synthetic data generation and use for test cases
						Document synthesis for lending reviews	Finance: Drafting reports and planning
						Enhanced underwriting	

Legend:
- Engancing customer intimacy
- Controlling credit risks
- Providing analytics-based products and services
- Improving operational excellence
- Containing compliance and operational risks
- Steering and controlling
- Building workforce and culture

Source: BCG

Picture 6. Use of AI technology in financial organizations framework in financial organizations according to BCG

In the modern financial sector, AI plays a crucial role by providing a **variety of innovative solutions** aimed at enhancing efficiency, accuracy, and personalization of services. The use of predictive AI, which analyzes historical data to forecast future events, is already widely adopted in financial institutions. Applying this approach allows, for example, **optimization of credit scoring processes, automation of risk management, and increased accuracy in financial forecasting**.

Generative AI offers additional opportunities. This type of AI is capable of **generating new data, texts, and images**, paving the way for the creation of synthetic financial reports, simulation of economic scenarios, and employee training using simulated data, thus minimizing risks and enhancing confidentiality.

The infographic illustrates the areas where AI creates value: from marketing and sales, where AI assists in personalizing offerings and engaging customers, to operations and risk management, where AI technologies provide deeper and more precise data analysis. Additionally, AI plays a significant role in **enhancing financial advising** by offering individualized solutions based on comprehensive analysis of client financial behavior.

However, alongside its enormous potential, **AI also carries a range of risks, including issues of data privacy and security, ethical dilemmas, potential discrimination, and threats to employment**. These risks require careful consideration and management, which can only be achieved through the development and implementation of adequate regulation. Proper regulation should ensure a balanced approach that allows for the realization of AI's full potential while minimizing its negative consequences.

Main risks for financial market participants

Currently, experts highlight a number of risks associated with the full-scale integration of AI into various sectors, particularly the financial one:

1. Risks of model bias

Bias inherited by AI from training data poses a serious problem that can lead to **incorrect decisions**. Bias may arise from **incomplete or inadequate data** used to train the system or from the influence of human biases on AI algorithms. Reliable human intervention and adherence to appropriate security standards will be critical factors in preventing inaccurate or biased assessments.
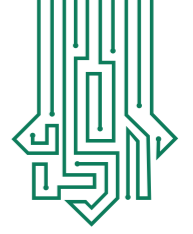
2. Risks of confidentiality

Processing **large volumes of sensitive financial information requires high standards of confidentiality**. This data may be part of training datasets for AI models, and its leakage can lead to serious consequences, including breaches of user confidentiality and security. Such risks underscore the importance of taking **measures to ensure data protection** and developing stringent security policies when using AI.

3. Risks, associated with opacity and complexity of models

Some AI models, especially deep neural networks, can be complex and opaque to humans. Organizations need to be able to explain their decisions and actions both internally and to external stakeholders. However, ensuring explainability of decisions and actions based on AI algorithms is a complex and multifaceted problem. AI algorithms have dense structures dependent on numerous parameters and often represent an ensemble of interacting models, essentially functioning as "black boxes." In this case, the issue of explainability is related to the challenge of tracing relationships between outputs and input data.

4. Risks of stability and reliability of AI results

The stability of AI performance becomes a key issue in ensuring financial resilience and integrity. Robustness encompasses issues related to the accuracy of AI model outputs, especially in a changing environment. One of the key challenges is the **ability of AI algorithms to minimize false results** during periods of structural changes. The ability of AI to generate new content based on training data creates the risk that AI may produce erroneous results based on a training sample that is unrelated to new realities. This phenomenon is known as **"AI hallucinations".** The reasons for this phenomenon are not fully understood, but it is noted that the presence of significant gaps or ambiguous terms in the training dataset for the model may be associated with the occurrence of such errors.

5. Cybersecurity risks

The implementation of AI introduces new challenges for cybersecurity. AI can be used to create sophisticated phishing messages and emails. The proliferation of deepfakes, leading to the creation of more realistic videos, audio, or images, can cause serious harm to both organizations and individuals. Moreover, **AI models themselves can be vulnerable to various attacks**; for example, during training, malicious actors may manipulate the data in the training set ("data poisoning") to undermine the training process and reduce the model's accuracy. Given that AI technology is a relatively new phenomenon, the full extent of its vulnerability to cyberattacks has yet to be fully understood. However, early indications point to potentially serious issues that require careful consideration, especially when considering widespread adoption of the technology.
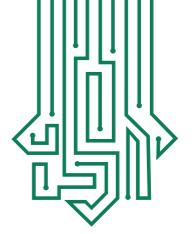
6. Financial stability risks

The expanded use of AI in the financial sector brings new threats to financial stability. AI, acting as an algorithm, performs tasks typically carried out by humans, providing not only quantitative analysis but also recommendations and decision-making. **Erroneous and excessive use of AI** can lead to the accumulation of risks and instability in the financial market.

- Incorrect usage and excessive reliance on artificial intelligence.
- High concentration of companies developing and managing AI models can lead to many companies using similar algorithms. Harmonization of actions by market players ("herd behavior") in the financial market can amplify cycles and lead to more frequent booms and crashes.
- AI may create additional risks if risk management models are inadequately trained, resulting in AI taking increased credit or market risks to maximize profit.

7. Risks, related to ethics

- **Using AI to attract customers** to the company's new products based on customer data stored within the organization. This creates a risk that the bank may violate privacy laws when using data for AI purposes.
- Limited ability to address complex inquiries is **a limitation of chatbots**. If the algorithm cannot recognize a request or the client's goal, it usually provides basic information or directs the client to the frequently asked questions section. Additionally, some algorithms are unable to accommodate individual speech characteristics or work with foreign languages, which **can lead to discrimination against certain population groups**. Such solutions may reduce the company's labor costs, but client dissatisfaction and alienation can lead to long-term reputational consequences.
- AI algorithms in decision-making can rely on discriminatory factors (such as religion, ethnicity, gender, etc.). The European Banking Federation recommends minimizing the use of such data and also suggests sourcing data from a wide range of diverse sources to reduce the likelihood of bias. At the same time, AI algorithm developers should also have diverse and rich experiences. After all, the algorithms and decisions made based on them ultimately reflect the shortcomings of their creators.
- An important issue is the **question of accountability in the event of negative consequences**. The problem is that the initiators of systemic risks not only do not know whether they are actually contributing to the escalation of future catastrophic events, but also do not know who will suffer as a result of such events and when.
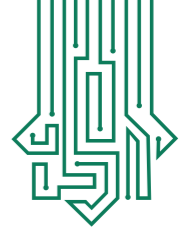
Risks for financial regulators

In addition to the risks arising in the private sector, attention should also be paid to potential risks associated with the use of AI for regulatory purposes. In a study conducted by John Danielson and Andreas Utermann (On the use of artificial intelligence in financial regulations and the impact on financial, 2023), an analytical review was conducted, addressing the following aspects:

1. **Data.** Does the AI model's ability to effectively learn depend on the availability of sufficient data? Is there a risk of missing certain factors in the training data that could significantly influence the AI's recommendations or decisions?
2. **Variability.** Are there immutable rules that the AI model must follow, and how effectively can regulators update these rules in response to external changes?
3. **Goal alignment.** Can AI models be given clear goals? Can the actions of the AI model be monitored in the context of these goals, or will they remain unclear?
4. **Decision-making authority.** Will an employee have decision-making authority, will approval from a specific committee be required, or will a fully distributed decision-making approach be implemented to address this issue?
5. **Accountability.** Does the use of AI models by the private sector exacerbate the regulator's task of monitoring violations and identifying responsible parties in case of abuses? Is there difficulty in clearly defining responsibility for losses and attributing them to specific individuals?
6. **Consequences.** What are the potential consequences of using artificial intelligence—are they limited to minimal impacts, are they significant but manageable, or could they lead to catastrophic outcomes?

Based on this analysis, the authors compiled a summary table for the most discussed areas of application:

Task	Data	Mutability	Objectives	Authority	Responsibility	Consequences
Fraud/Compliance Consumer protection	Ample	Very low	Clear	Single	Mostly clear	Small
Micro risk management Routine forecasting	Ample	Very low	Mostly clear	Single	Clear	Moderate
Criminality Terrorism	Limited	Very low	Mostly clear	Multiple	Moderate	Moderate
Nation state attacks	Limited	Full	Complex	Multiple	Moderate	Very severe
Resolution of small bank failure	Limited	Partial	Clear	Mostly single	Mostly clear	Moderate
Resolution of large bank failure Severe market turmoil	Rare	Full	Complex	Multiple	Often unnclear	Severe
Management of global systemic crises	Very rare or not available	Full	Complex & connflicting	Multiple & international	Unclear even ex-post	Very severe

Table 3. Assessment of risks associated with the use of AI technology for financial regulators by application areas

Based on the analysis, the authors conclude that despite the significant advantages of using AI in various sectors, **regulators must exercise special caution in identifying systemic risks in the banking sector and assessing the risks of global crises**. Anselm Küsters, Head of the Digitalization and New Technologies Department at the European Policy Center in Berlin, highlights one of the risks of using AI tools as their potential to exacerbate crises, based on the fact that algorithms are trained on past data that may not be applicable in unique situations. This underscores the concept of a "poly-crisis" proposed by economist-historian Adam Tooze, describing how the accumulation of various crisis shocks can lead to more serious consequences than each individually.

Küsters also points out the risks associated with the expansion of **the use of opaque AI methods, which may contribute to the amplification of negative feedback loops**. He calls on the European Parliament to pay additional attention to the risks associated with algorithmic forecasting, especially during crisis periods, emphasizing the need for a comprehensive approach to regulation and risk management related to the use of AI.

Thus, it is important for the use of AI to **comply with regulatory requirements**, ensure transparency and protection of customer data, and prevent potential systemic risks. The growing diversity of AI types and solutions highlights **the need for the development of appropriate regulatory frameworks that will facilitate the safe, ethical, and effective implementation of these technologies in the financial sector**. This becomes a relevant direction for further consideration, which should take into account both the potential and limitations of AI, ensuring the sustainable development of financial markets.

Overview of modern approaches to regulation of AI in the world

The **regulation of artificial intelligence technology**, its application, and the use of data for model training occupies **the key position on the agenda of many governments**. According to assessments by the Center for Strategic and International Studies as of October 2023, approximately 31 countries have enacted legislative acts related to AI regulation, explicitly mentioning the term, while discussions on similar draft laws are ongoing in 13 countries.
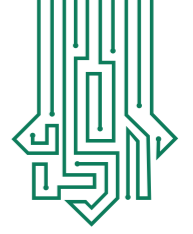
Regulatory strategies cover a wide range of approaches, and despite attempts by many researchers to systematize them, a detailed analysis reveals significant differences in regulatory approaches. **Rarely is there a universal approach** covering the use of AI both at the level of general regulation and in the context of specific sectors or particular application scenarios. Thus, it is important to distinguish between different aspects and levels of regulation.

- **General AI Regulation:** This encompasses a set of legislative acts, regulatory documents, including foundational principles and guidelines for the application of legislation, established within a specific jurisdiction to regulate the use of AI technology across a wide range of domains.

- **Financial AI Regulation:** This involves a complex of legislative and regulatory acts, framework agreements, and methodological guidelines specifically related to the financial sector, regulating the activities of financial market participants and providing the regulatory framework for the functioning of the financial market in the context of AI application.

Table 4 provides an overview of regulatory strategies among leading jurisdictions at the forefront of AI and financial technology development. The table outlines both general approaches to regulating the use of AI across various domains and specific strategies directly applicable in the financial sector.

Based on the analysis of various approaches to regulating artificial intelligence, the following conclusions can be drawn:
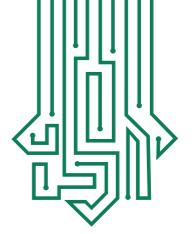
1. **Regulation of AI varies significantly from one country to another,** making it difficult to identify a global trend.

2. **Most countries have adopted fundamental principles for AI use,** either based on international agreements or by developing their own local frameworks. In the absence of specialized legislation, these principles form a "soft" basis for AI regulation.

3. **Among the most stringent general approaches to regulation is the EU AI Act**, which serves as a benchmark for other countries considering similar legislative acts. However, such initiatives require prolonged discussions and adjustments, and to date, no such law has been enacted.

4. **AI regulation is closely related to regulations on the use of personal and confidential data**, and is being developed in parallel with changes to existing data laws.

5. Despite limitations in **general regulation, the regulatory framework in the financial market, except in the EU and China, proves to be more flexible** and geared towards stimulating development.

6. Many **financial regulators focus on regulating common AI applications,** such as algorithmic trading and credit scoring, preferring to issue clarifications to existing legislation rather than creating new laws.

7. A common practice is the formation of **specialized associations and working groups** involving market representatives (e.g., in the UK, Singapore, Canada), which facilitates the development of balanced regulatory approaches through active engagement with stakeholders.

	EU	UK	USA	Singapore
General regulation approach	Classification of models by risk level and differentiation of regulation by class, from soft regulation to complete ban.	Fragmented regulation in various industries. Creation of a specialized institute for studying the safety of using AI technology – AI Safety Institute.	Decentralized regulation based on common principles and industry standards.	Decentralized regulation based on general principles and frameworks (regulatory frameworks).
Regulatory document	• EU Artificial Intelligence Regulation (2024) • General Data Protection Regulation (GDPR) • Digital Services Act (DSA) • Fundamentals of AI Cybersecurity (FAISP)	• Implementation of AI regulatory principles in the UK. An Initial Guide for Regulators (2024) • AI Safety Institute approach to evaluations (2024) • White Paper on AI (2023) • Equality Act(2010)	• AI Bill of Rights (2023) • Presidential Decree (14110) - Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence (2023) • AI Risk Management Framework (AI RMF, 2023)	• Model AI Governance Framework (2020) • AI Verify, an AI governance testing framework and a software toolkit by PDPC and Infocomm Media Development Authority (IMDA)
Financial regulation approach	Initiatives can come from both the European Central Bank and country institutions. A neutral approach to AI regulation.	A flexible and proactive approach consisting of careful regulation, active collaboration with market participants, openness to changes in regulatory approaches, and the use of regulatory sandboxes.	Fragmented between financial regulators. Prohibition on the use of unreasonable decisions and causing harm.	Acceptance of basic principles. Active interaction with market participants. Combining regulatory support, open standards and regulatory sandboxes. Publish joint reports to promote best practice.

	India	Australia	Japan	China
General regulation approach	Establishment of general principles, establishment of "soft" restrictions to stimulate the industry.	Establishing voluntary ethical principles, limiting the use of data within the framework of current laws. Classification of models by risk level and differentiation of regulation by class, from soft regulation to complete ban.	Establishing general principles, regulating AI by developing requirements for individual use cases, including online recommendation systems, autonomous transport control, etc.	Regulation of certain areas of AI application: DeepFake, development of recommendations, GenAI. Limiting unjustified differentiation of recommendations and labeling requirements for works created with the help of AI. Establishing data standards requirements for training AI models.
Regulatory document	• National AI Strategy (2018) • Principles for the Responsible Use of AI (2021) • Implementing principles for the responsible use of AI (2021) • Digital Privacy Protection Act (2023)	• Privacy Act (1988) • Competition and Consumer Protection Act (2010) • Legislation against discrimination • A number of legislative acts aimed at protecting copyrights	• Social Principles of Human-Centered AI (2019) • AI Governance in Japan Ver. 1.1 (2021) • Guide to Managing the Implementation of AI Principles (2022) • Digital Platform Transparency Act (2020) • Personal Data Protection Law (2022)	• Administrative Regulations on Recommendation Algorithms for Internet Information Services (2022) • Regulations on the Administration of the Service for Deep Synthesis of Information on the Internet (2023) • Interim Regulations for the Management of Generative AI Services (2023)
Financial regulation approach	Actively explores the risks and necessary regulations to regulate the development of AI. Careful in approach to preserving the development potential of fintech.	Exploring risks and opportunities.	point-by-point regulation of individual cases of application.	Setting standards for organizing the use of AI systems in financial sector companies.

Table 4. Overview of regulatory approaches by different jurisdictions

Analysis of the historical development of approaches to regulating AI in the reviewed countries allows identifying the following key stages:

1. **Formulation of regulatory goals:** at this stage, regulatory bodies need to define specific goals for the development of regulation. The main question here is what the primary priority is: protecting public interests from potential negative consequences of AI usage, stimulating technology development, adapting existing legislation to AI-related challenges, or other aspects.

2. **Definition of expected regulatory outcomes:** at this stage, specific expectations from the implementation of regulatory mechanisms are formulated based on the established goals. Metrics are developed to assess the effectiveness of regulation and its alignment with the stated objectives.

3. **Establishment of regulatory principles:** Taking into account international experience and existing framework agreements, regulators develop fundamental principles that underlie AI regulation. Additional guidelines may be attached to these principles, detailing their practical application.

4. **Analysis of specific use cases and assessment of the need for specific laws:** at this stage, situations posing the greatest risk to specific market participants or to the market as a whole are identified, and corresponding rules are developed. This process may run parallel to the previous stages and sometimes even precede them.

5. **Legislative process:** once the preceding stages have been successfully completed, the process of creating legislation begins, involving all stakeholders to ensure the maximum balance and acceptability of the new regulations.

Integration of market segment representatives and interested groups into the AI regulation process can occur at any of the stages described above. Although such involvement may lead to temporary delays in the development and implementation of regulatory mechanisms, it simultaneously contributes to forming a deeper and more comprehensive understanding of the needs and expectations of all participants in the process.
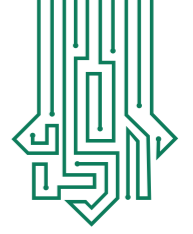
Analysis of AI regulation, based on studying global experience, underscores **the importance of a comprehensive and multi-level approach to this process**. The importance of clearly defining the regulatory goals, expected outcomes, and key principles is a key task to ensure that the implementation of AI will contribute to the public good, **stimulate innovation, and mitigate potential risks**.

Active engagement of stakeholders at all stages of regulation not only enriches the discussion and facilitates the creation of more balanced regulatory acts but also enables regulators to adapt to rapidly changing technological landscapes. At the same time, recognizing and effectively managing AI-related risks requires regulators to be **flexible in applying regulatory instruments**. Finally, achieving a balance between stimulating innovation and protecting public interests remains a key challenge that will shape the future of AI in the financial sector and beyond.

PART 3

Perspectives on AI development and its use in the financial market

Overview of the AI technological sector in Kazakhstan and development perspectives

As of today, various **countries are striving to become global leaders in the field of artificial intelligence**. They are attracted by **the growing prospects and opportunities** offered by AI technologies, as well as advanced analytics for addressing significant issues. According to McKinsey & Company, Kazakhstan has high potential in this industry.

Research shows that **Kazakhstan is among the top three countries in the region** in the global innovation index and ranks 81st out of 132 countries, leading in indicators such as "Infrastructure" (59th position) thanks to high results in areas such as "Government Online Services" (8th position) and "Internet Participation" (15th position) (WIPO, 2023). In the IMD World Digital Competitiveness Ranking (2023), which measures the ability and readiness to implement and use digital technologies, Kazakhstan ranked 34th out of 64 countries worldwide.

Priority directions for AI development in Kazakhstan were outlined by President Kassym-Jomart Tokayev during his address at the annual Digital Bridge forum in Astana. It is worth noting that more than 20,000 people from over 30 countries participated in the forum to discuss the future of the IT industry, strengthening Kazakhstan's position as a leading center for digital and fintech technologies in the Eurasian space. Tim Draper, an American venture capitalist, was also present at the forum and **highly praised the development of information technologies in Kazakhstan**. Draper praised the country's digital solutions, stating that they surpass even those of the most developed economies, including the USA.
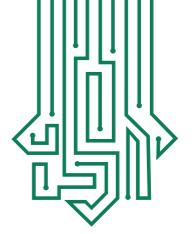
During his speech, the President discussed the **possibility of transforming Kazakhstan into a leader in the field of AI**. He emphasized the need for in-depth analysis and reform of the legislative framework to integrate AI into daily life while safeguarding personal data and civil rights. **The President also highlighted key areas for applying machine learning, including the oil and gas sector, agriculture, logistics, and energy**. In his opinion, successful implementation of these technologies could act as a catalyst for the country's long-term development.

On February 20, 2024, as part of the digital transformation of public administration and the development of digital technologies, the **Ministry of Digital Development, Innovation and Aerospace Industry** published draft documents: the **Conception for the Development of Artificial Intelligence for 2024-2029 and its Action Plan for implementation**. These documents provide a detailed analysis of the current level of AI adaptation in Kazakhstan. Nevertheless, it should be noted, that this document doesn't include a separate section related to financial market of Kazakhstan.

Oxford Insights Government AI Readiness Index 2023

Country	Position in the rating	Number of points
USA	1	84,8
Singapore	2	81,9
Great Britain	3	78,5
Canada	5	77
UAE	18	70,4
Russia	38	62,9
Turkey	47	60,5
Kazakhstan	72	48,5
Uzbekistan	87	43,7
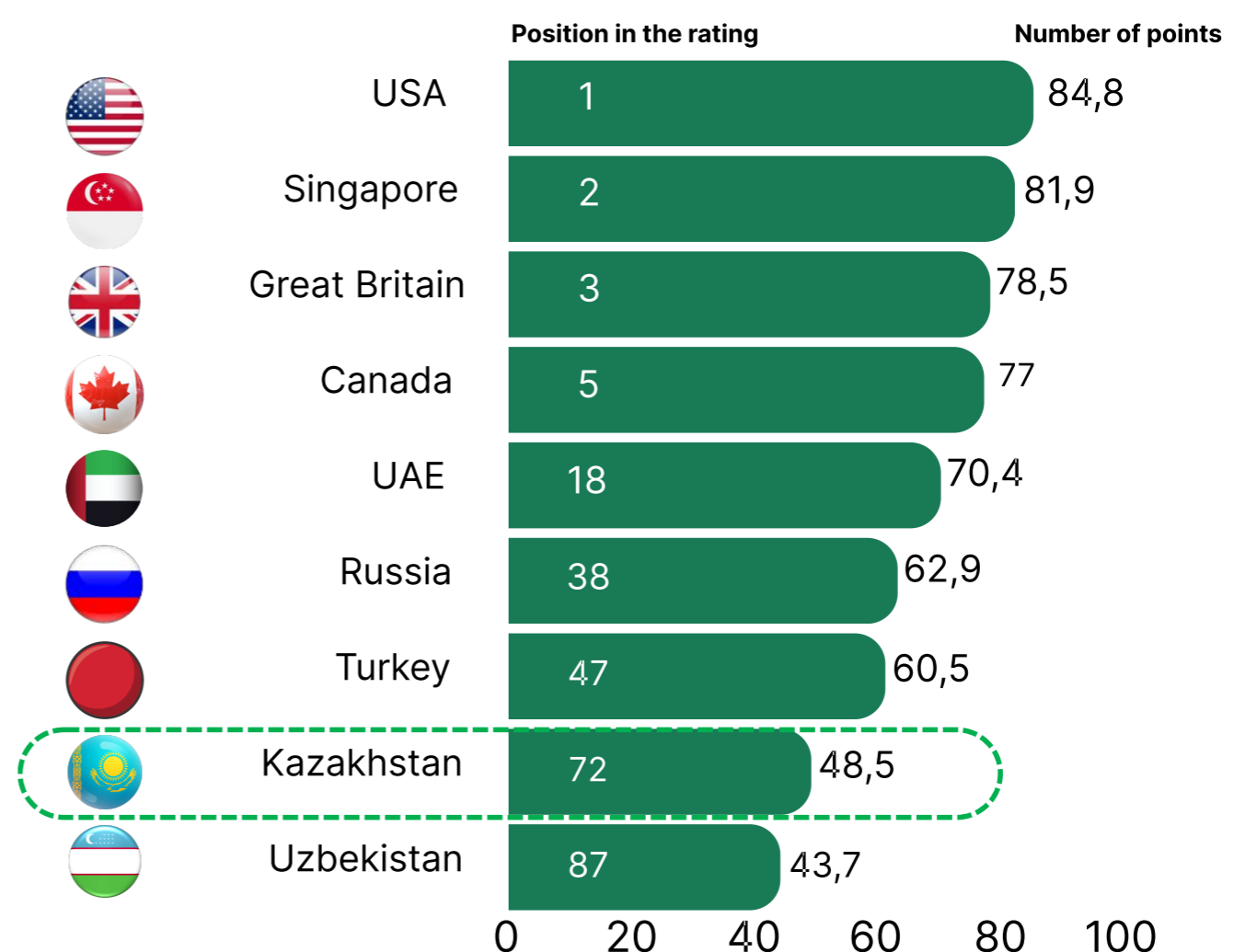
Picture 7. Government readiness index for AI Implementation according to the 2023 Oxford Insights ranking

According to the Oxford Insights Government AI Readiness Index for 2023, Kazakhstan ranks 72 out of 193 countries. Among the main factors that **may hinder the development of technology** are the **lack of strategic documents for AI development**, established ethical principles, and the low level of Kazakhstan's technology sector. Despite the overall positive trend in readiness indicators and infrastructure, the absence of cloud providers indicates possible challenges in technology adaptation.

Among the **main factors** for the successful development of AI technology in Kazakhstan are a **high level of digitization and widespread internet penetration**.

The main potential barriers to development include:

- Lack of modern infrastructure and sufficient computing power for artificial intelligence.
- Lack of technical security standards for AI products, creating difficulties for evaluation.
- Restricted access to data.
- Low quality of internet.
- Absence of an active national institute for the development of scientific research projects and development.
- Low demand for AI products among potential clients and a cautious attitude towards the technology.

Furthermore, the report highlights the issue of excessive expectations from the technology, which could potentially lead to reduced funding and investment outflow.

Principles of AI technology development according to the Conception:

- **Technology Leads, Regulation Follows.** In terms of artificial intelligence, a low level of regulation provides a technological advantage. The level of regulation should be increased gradually as artificial intelligence develops.
- **Artificial intelligence does not replace, but complements humans.**
- **Cooperative data usage.** Data should mutually enrich each other and be accessible to all participants in the artificial intelligence ecosystem.
- **Legacy of Kazakhstan's social values.** The development direction of artificial intelligence should correspond to the values of Kazakhstan's society.
- **Pragmatism.** The technical viability of implementing any artificial intelligence technology should be conditioned by economic feasibility.
- **Confidentiality.** The development of artificial intelligence technology should not infringe upon the privacy, personal, and family secrets.
- **Justice.** Artificial intelligence technologies should not subject anyone to discrimination based on their origin, social, official, or property status, gender, race, nationality, language, religion, beliefs, place of residence, or any other circumstances.
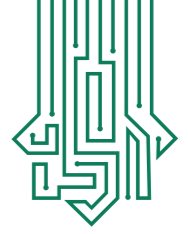
Approaches to development according to the Conception:

- **Infrastructure.** Artificial intelligence must be provided with computational power, for which international cooperation with global sector leaders is required. This includes building a new supercomputer and strengthening communication infrastructure to ensure high-quality internet.

- **Data.** Establishing a national artificial intelligence platform based on "Smart Data Ukimet" will enable secure data exchange among various government systems and provide developers with ready-made solutions to facilitate data handling.

- **Human capital.** Developing human capital should involve broad sections of the population by creating open-access courses, enhancing opportunities for workers' skills development, and providing avenues for AI specialists' career advancement through specialized events and institutions (hackathons, incubators, IT schools), as well as through educational programs of higher education institutions.

- **R&D.** Strengthening Kazakhstan's positions requires the development and implementation of a national language model, stimulating developments and research in this field, especially in less competitive niches for subsequent export of these solutions, and supporting and financing startups.

- **AI economy.** Building a quality institutional base will involve the adoption of a legal regulatory framework conducive to the development of AI technology, the adoption of ethical principles in this field, and, in the future, the establishment of a national system for standardization and conformity assessment, an AI regulation commission, and the systematic determination of additional regulatory approaches.

- **Target indicators and expected results.** The Conception provides transparent indicators for evaluating activities related to AI technology development.

Picture 8. General description of significant parts of the AI ecosystem in Kazakhstan

Research on use of AI technology in Kazakhstan's financial market

To assess the maturity of Kazakhstan's financial market in terms of research and utilization of AI technology, a specialized survey was conducted. **The survey involved 94 participants from the financial market, including 15 second-tier banks, 20 microfinance organizations, 20 insurance companies, 21 professional securities market participants, and 18 residents of the Astana International Financial Centre (AIFC).**

Currently, 31% of financial market participants are using AI to some extent in their activities. The highest level of AI usage is noted among second-tier banks – 60% (Picture 9). However, according to a survey by NVIDIA, the global average for AI usage among financial organizations is 43%. This is higher than the overall rate among participants in the Kazakhstani financial market, indicating **a slower adaptation and implementation of AI in the financial sector of Kazakhstan.**

The difference in the level of AI usage among different types of financial institutions emphasizes that **some market segments may be more prepared for innovation than others**. This difference could be related to variations in available resources, innovation culture, and customer needs.
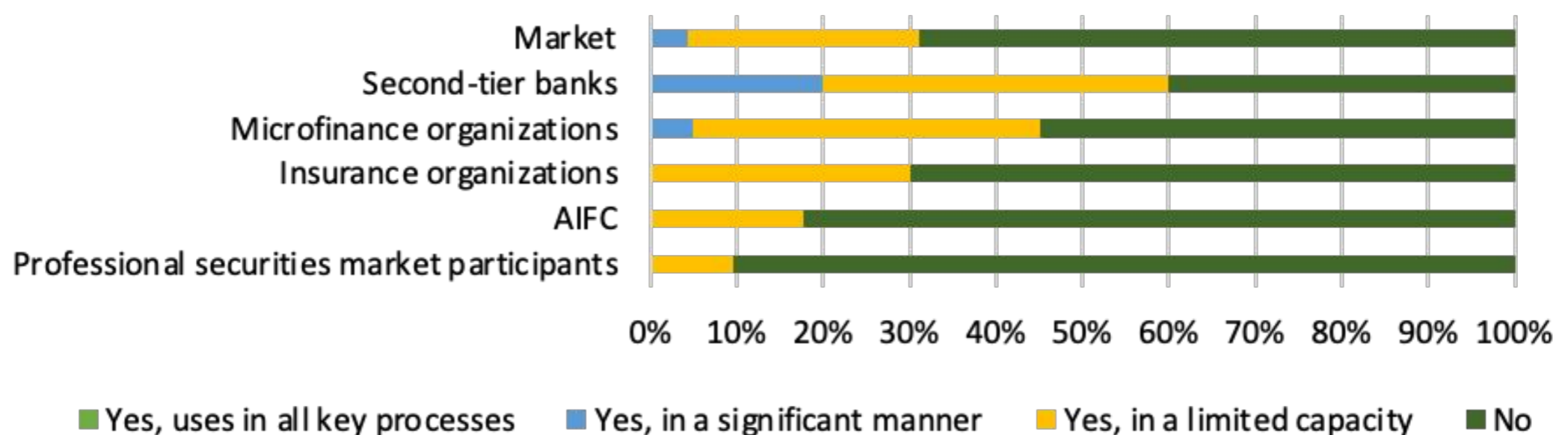

Picture 9. Use of AI in operations of financial organizations.

45% of the respondents noted that they plan to use AI in 2024. Overall, it can be observed that the AI development plans in 2024 are directly related to the current level of AI usage. This may indicate that **initial investments and experience in AI implementation strengthen organizations' intentions** to continue investing in this technology (picture 10). At the same time, while insurance organizations are currently inferior to microfinance organizations in terms of AI use, the percentage of insurance organizations that expressed their intention to use AI in 2024 is higher than the level of MFOs.
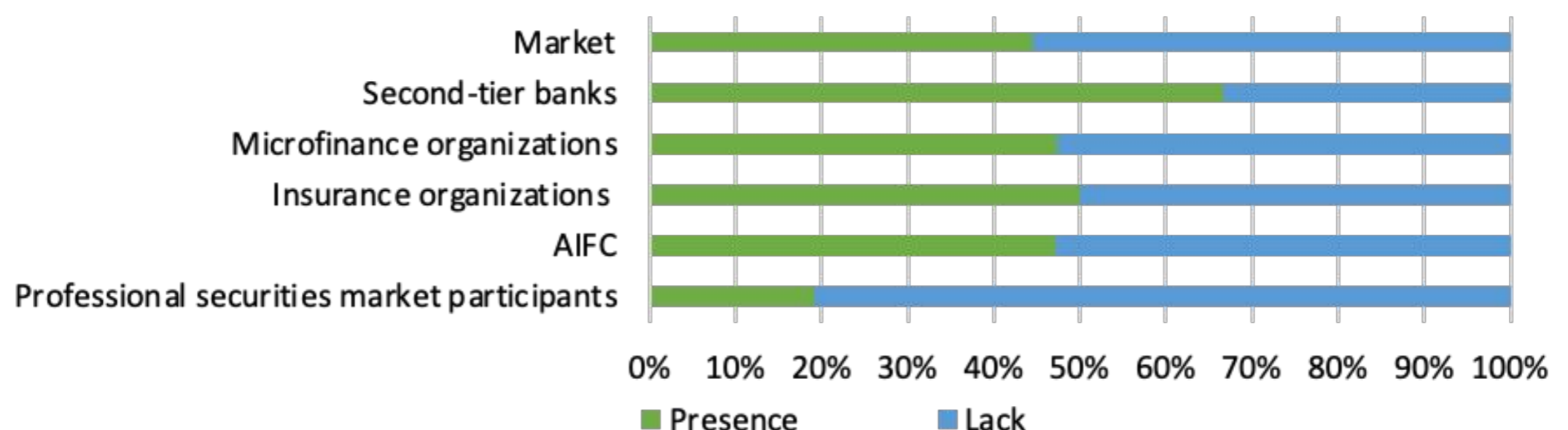
Picture 10. Presence or lack of plans to integrate AI in 2024.
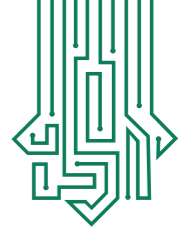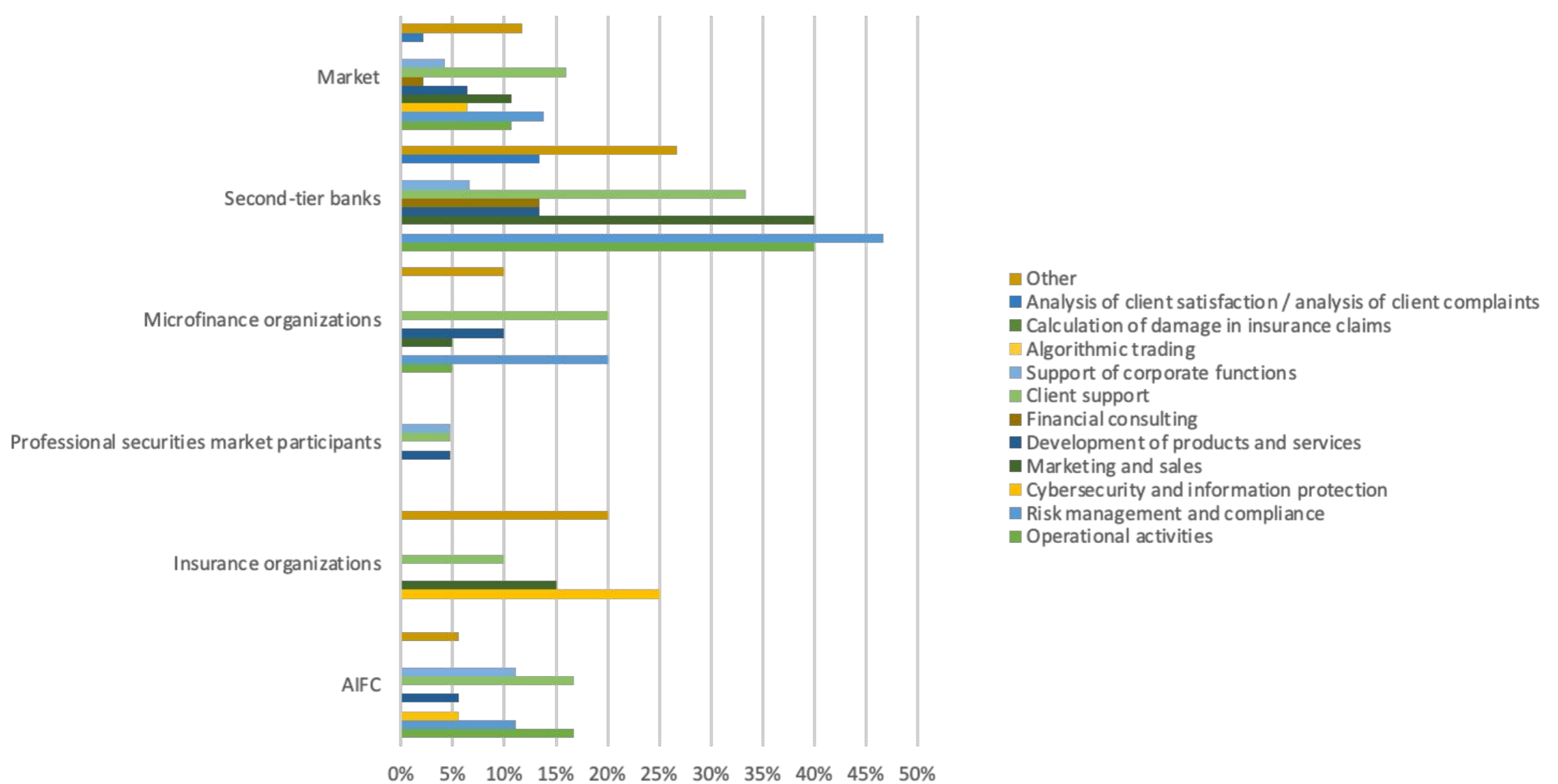
37% of the respondents noted that AI implementation is at an early stage, 4% are at the pilot project stage, 11% are at the stage of partial implementation, and 4% have fully implemented AI, including 3 Tier 2 banks and 1 microfinance organization (Picture 11). The presence of full AI implementation among Tier 2 banks and microfinance organizations may reflect a larger resource base and potentially stronger pressure for process automation and efficiency improvement.
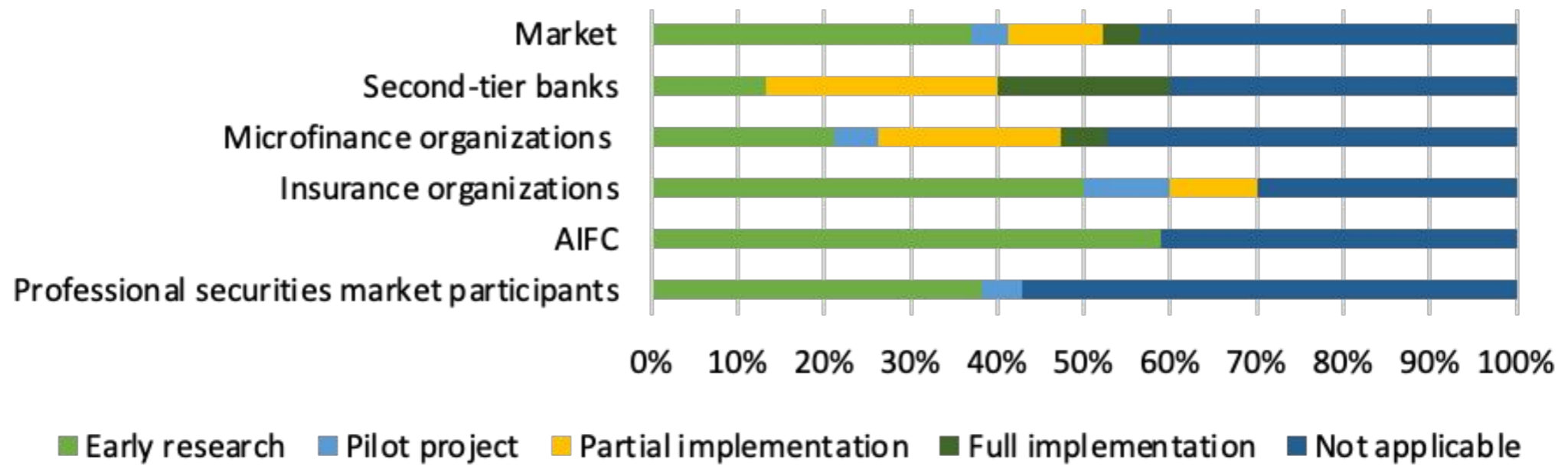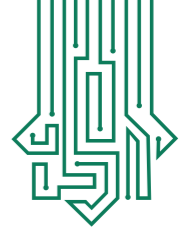

Picture 11. AI integration stages.

16% of respondents use AI for customer support, 14% for risk management and compliance, 13% for marketing and sales, 11% in operational activities and 6% for cybersecurity and product and service development (Picture 12). At the same time, according to the NVIDIA survey, global players use AI for operational activities - 48%, risk management and compliance - 45%, marketing - 34%, and sales - 27%. Significant differences between Kazakhstani companies and international players in the use of AI may indicate potential areas for further growth and implementation of AI, as well as **opportunities** for improving and automating processes among Kazakhstani organizations in **operational activities, risk management and compliance, as well as in cybersecurity.**


Picture 12. AI utilization spheres.

17% of respondents noted that the implementation of AI increased the level of automation of internal processes, 15% - increased the level of customer service and improved risk management, 9% - improved data processing accuracy, 7% - optimization of decision-making and increased efficiency of marketing strategies (Picture 13). At the same time, according to the NVIDIA survey, global players report that the use of AI has increased operational efficiency - 43%, created advantages - 42%, improved user experience - 27%, created new business opportunities - 23%. Obviously, **Kazakhstani players highly appreciate the potential of this technology.**
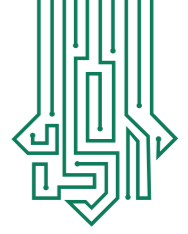
Operational efficiency and competitive advantage are key areas where AI has the greatest impact at the global level, which is significantly different from the results of Kazakhstani companies. The survey results of Kazakhstani companies show a more even distribution of benefits from the use of AI, with lower percentages in each category.
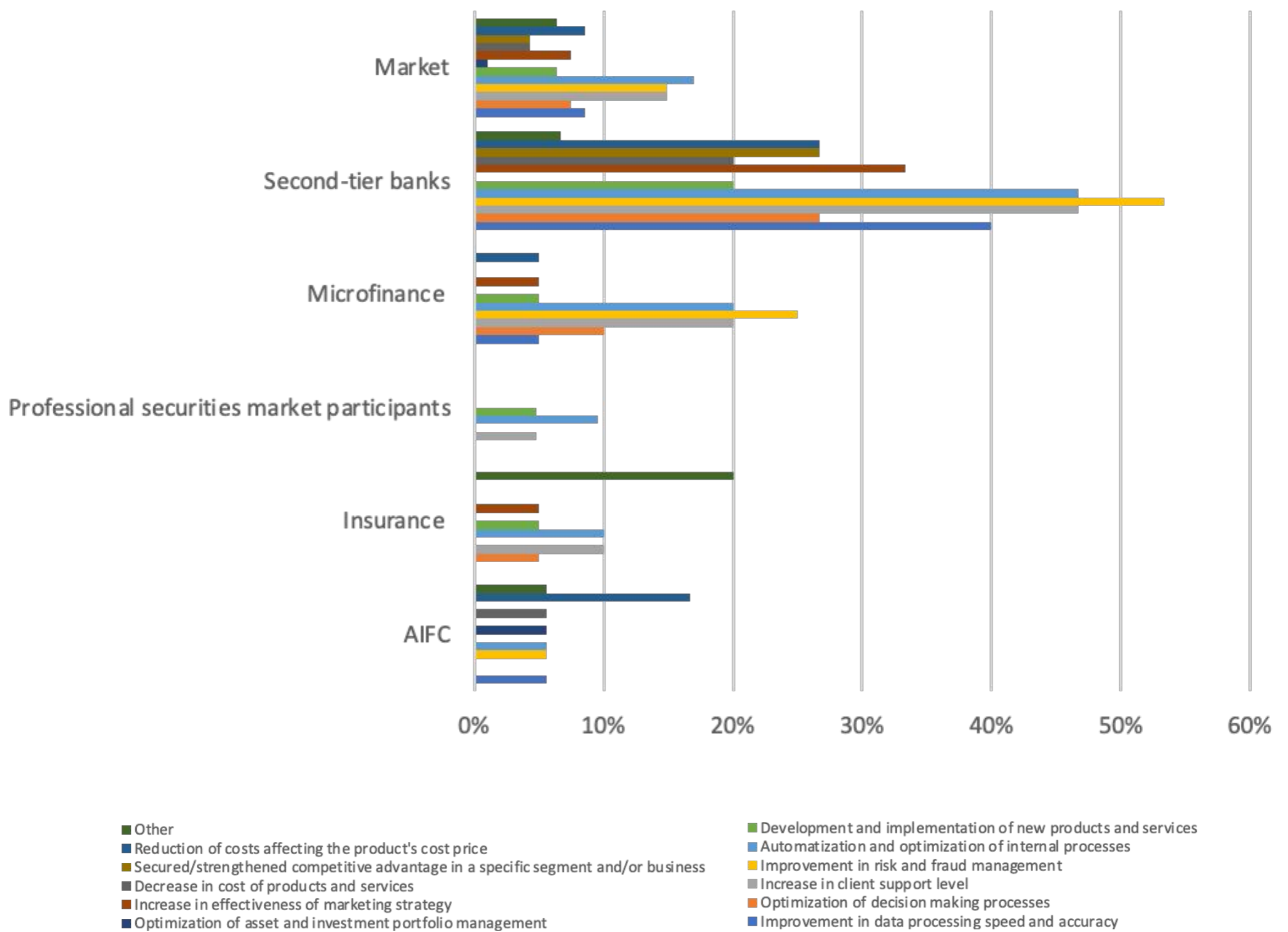
Picture 13. How AI improved operations of financial organizations.

The most popular AI technology in the Kazakhstani financial market is machine learning - 17% and computer vision - 12%. large language models - 11%, natural language processing, business process automation and speech transcription and synthesis- 10% (Picture 14). Global players use data analytics - 69%, data processing - 57%, natural language processing - 47%, large language models - 47%, and generative AI - 43%. Overall, it can be argued that the **distribution of AI technologies in Kazakhstan and worldwide is similar**, although it is less pronounced in Kazakhstan, which may be due to different stages of technology adoption.

Machine learning is the most popular AI technology both in Kazakhstan and globally, although its usage share in Kazakhstan is significantly lower. Technologies related to language processing, such as NLP and LLMs, are used approximately equally in Kazakhstan and globally, indicating attention to automation opportunities and improving customer interactions. **Robotic process automation** received an equal share in Kazakhstan compared to other AI technologies, indicating **a desire to improve operational process efficiency**.
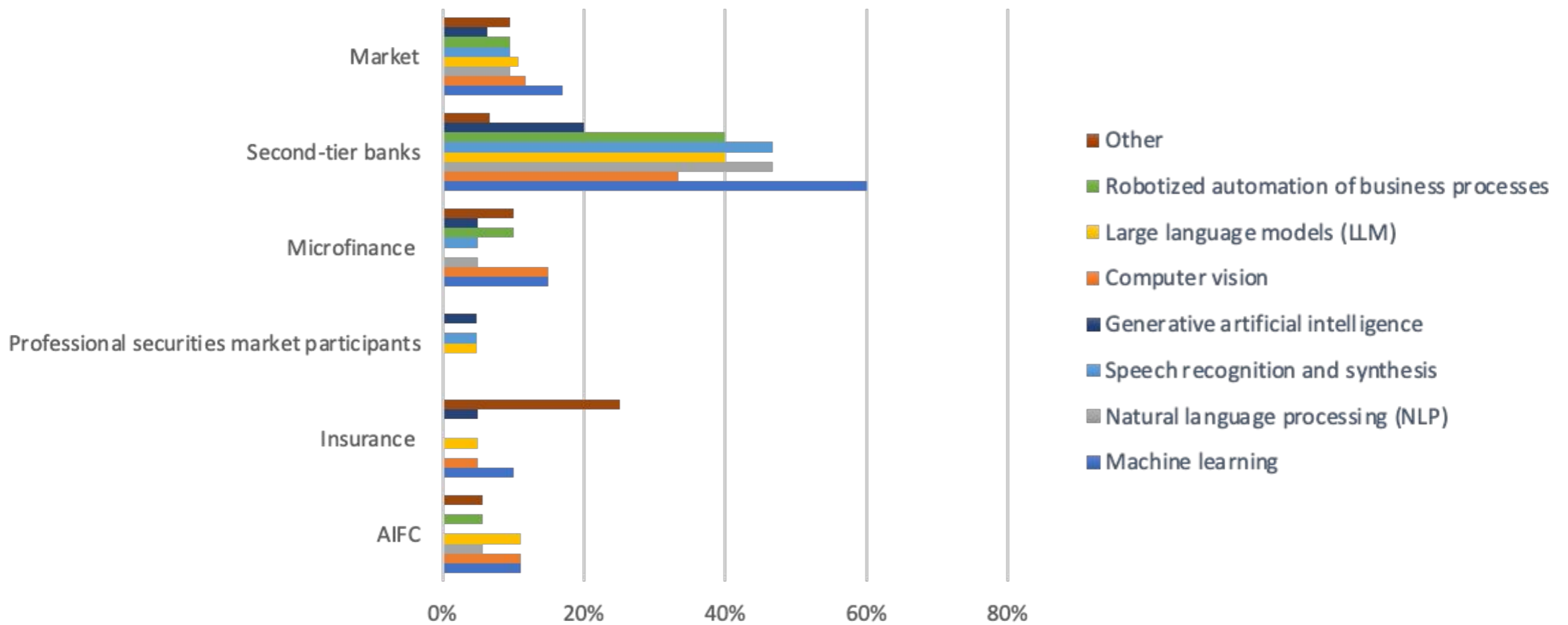
Picture 14. What AI technologies do financial organizations use

The majority of respondents use generative AI and large language models to enhance customer interaction experience - 27% (34%, NVIDIA data), marketing - 14% (32%), report generation - 11% (37%), and synthetic data - 11% (33%) (Picture 15).

Improving customer interaction is the most commonly mentioned application of generative AI and LLMs both in Kazakhstan and globally, emphasizing the importance of enhancing service quality and customer satisfaction. At the same time, **Kazakhstani organizations should focus on developing other aspects of generative AI** that are already showing success in improving their competitive position in the market.
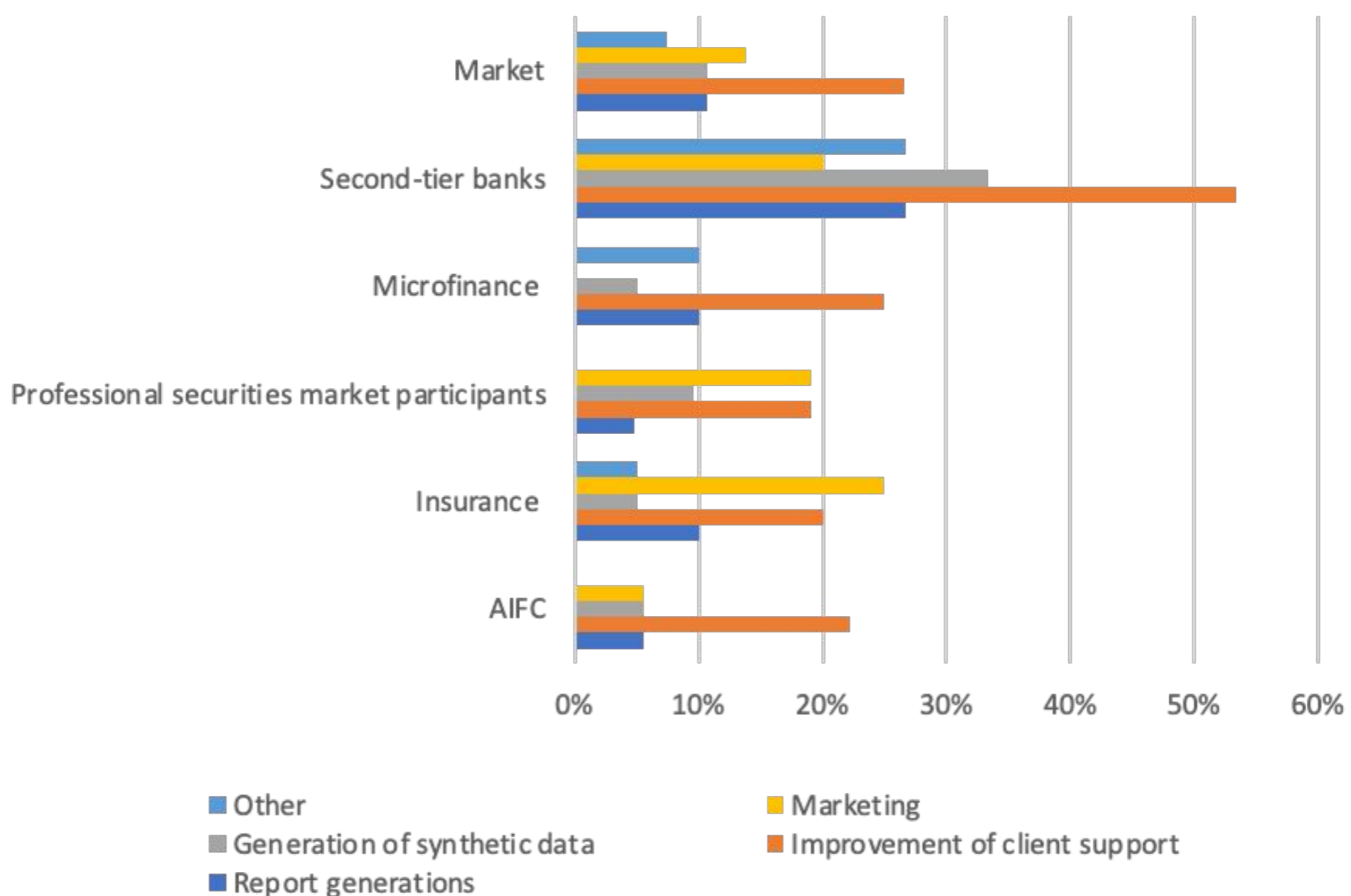
Picture 15. Use of generative AI in large language models
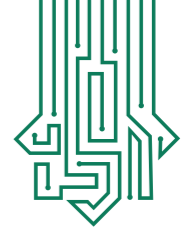
The most attractive investment direction among Kazakhstani companies is improving customer service experience - 23%, risk management - 22%, cybersecurity and information protection - 17%, and fraud detection - 12% (Picture 16). While global players invest more heavily in risk management (36%) and portfolio optimization (29%). Global players also invest in portfolio optimization and algorithmic trading, which are not highlighted as key directions for Kazakhstani companies.
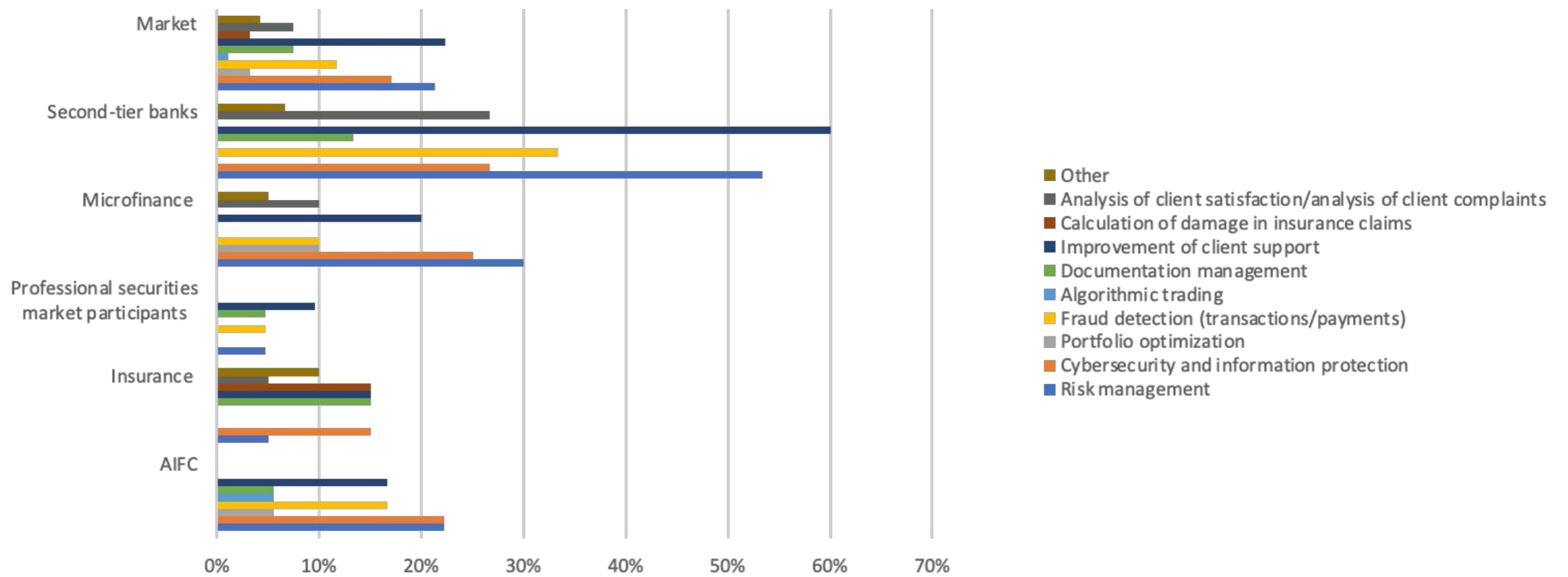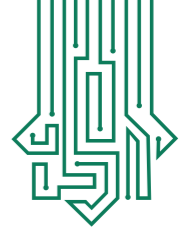

Picture 16. Investments into different AI use directions

The main obstacles to further integration, according to the survey, are **significant budgetary costs** (35%), data confidentiality and heterogeneity (20%), insufficient volume and quality of data (19%), and hiring and retaining specialists (18%) (Picture 17). At the same time, large international financial companies highlight data confidentiality and heterogeneity as the main problem (38%), while 28% identify the problem of significant budgetary costs.

The quality and volume of data for AI training are significant issues for Kazakhstani companies, and **hiring and retaining qualified AI specialists** are also noticeable problems for both Kazakhstani and international companies. This underscores the **need for investments in developing human resources and improving data management** for successful AI integration.
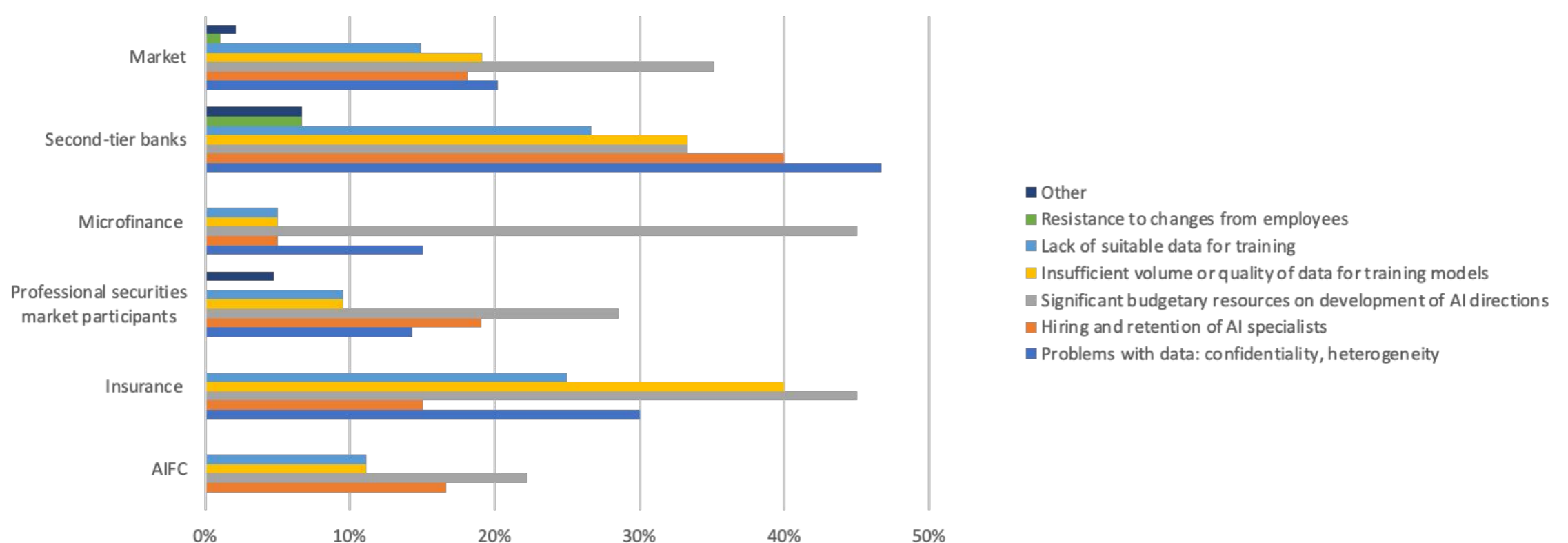
Picture 17. Main internal obstacles to AI implementation

Fraud detection is the most popular application of AI in cybersecurity both in Kazakhstan and on a global scale, although global organizations highlight this area more frequently (51% versus 30%). Preventing attacks on account credentials is also an important area (32% versus 18%). Detection of malware has a comparable share in Kazakhstan (21%) and globally (17%), indicating the recognition of the importance of AI in this field worldwide (Picture 18).
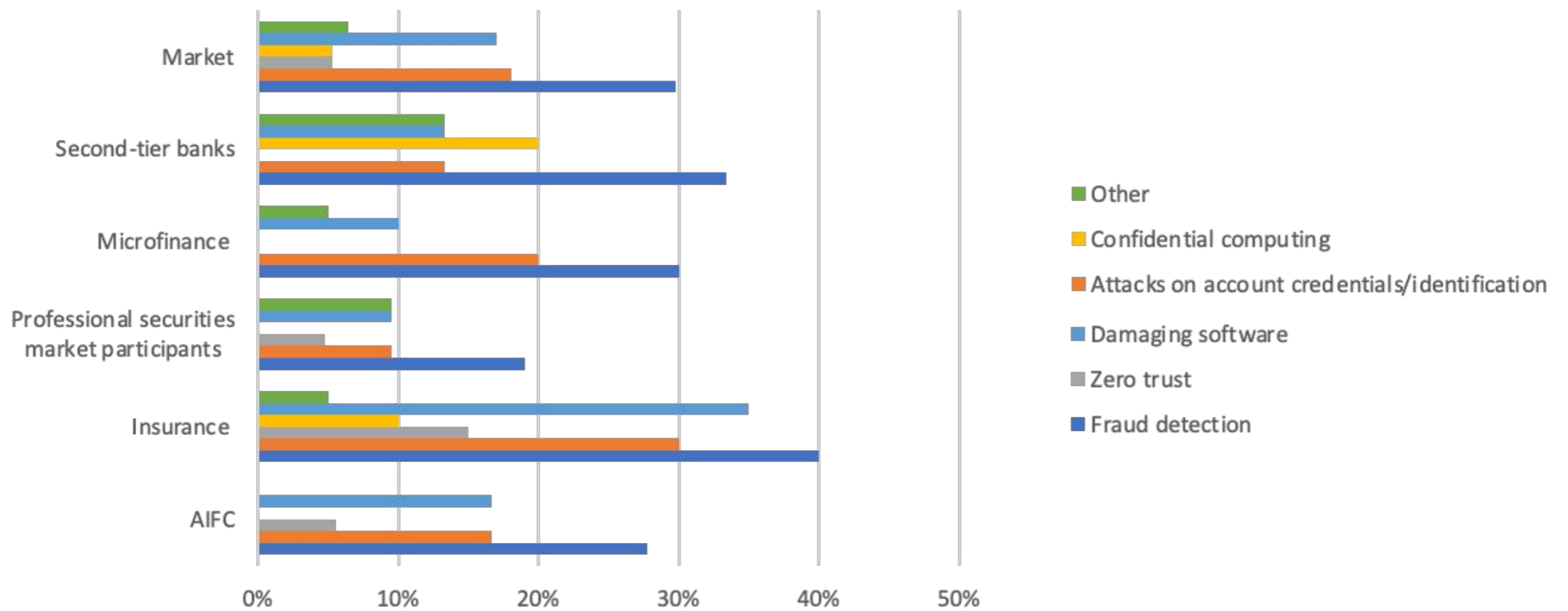

Picture 18. Cybersecurity issues that are solvable by use of AI

In Kazakhstan, a smaller percentage of respondents (44%) are convinced of the importance of AI for the future of their companies compared to international companies (51%), which may indicate a **more cautious or conservative approach to innovation in the Kazakhstani market.**

The large number of respondents with neutral attitudes in Kazakhstan (55%) may indicate a **lack of awareness of the potential benefits of AI or uncertainty about its practical implementation** in their specific business scenarios.

The low percentage of respondents completely disagreeing with the importance of AI for the future of their companies (1% in Kazakhstan and 3% globally) underscores the overall recognition of the role of AI in modern business (Picture 19).
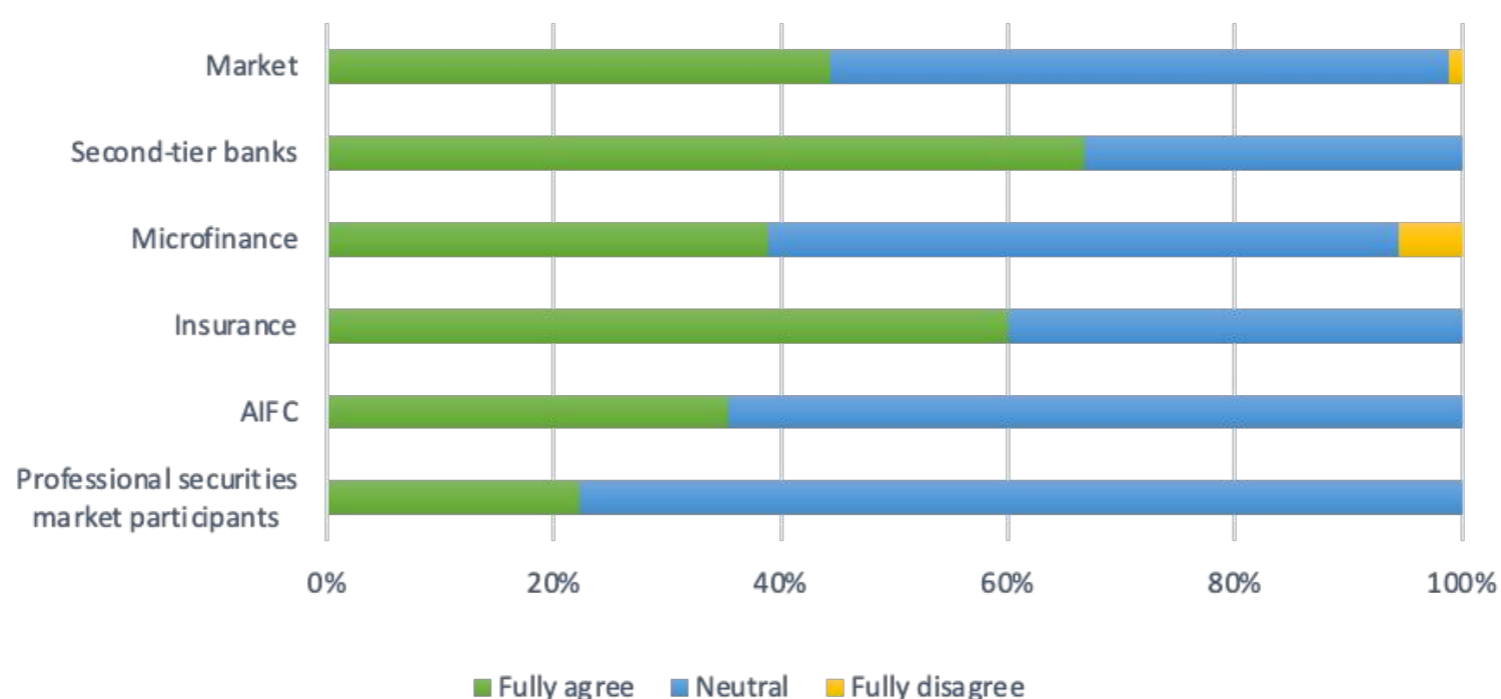
Picture 19. Respondents' attitude toward the thesis "AI is important for the future success of your organization"

32% of the respondents plan to expand the use cases of AI as a measure for further development, 26% intend to engage third-party companies, 24% aim to optimize AI implementation processes, and 20% plan to train personnel (Picture 20). International players plan to develop AI by expanding the number of AI use cases (51%), optimizing AI implementation processes (37%), increasing infrastructure spending (26%), and engaging third-party organizations (26%).
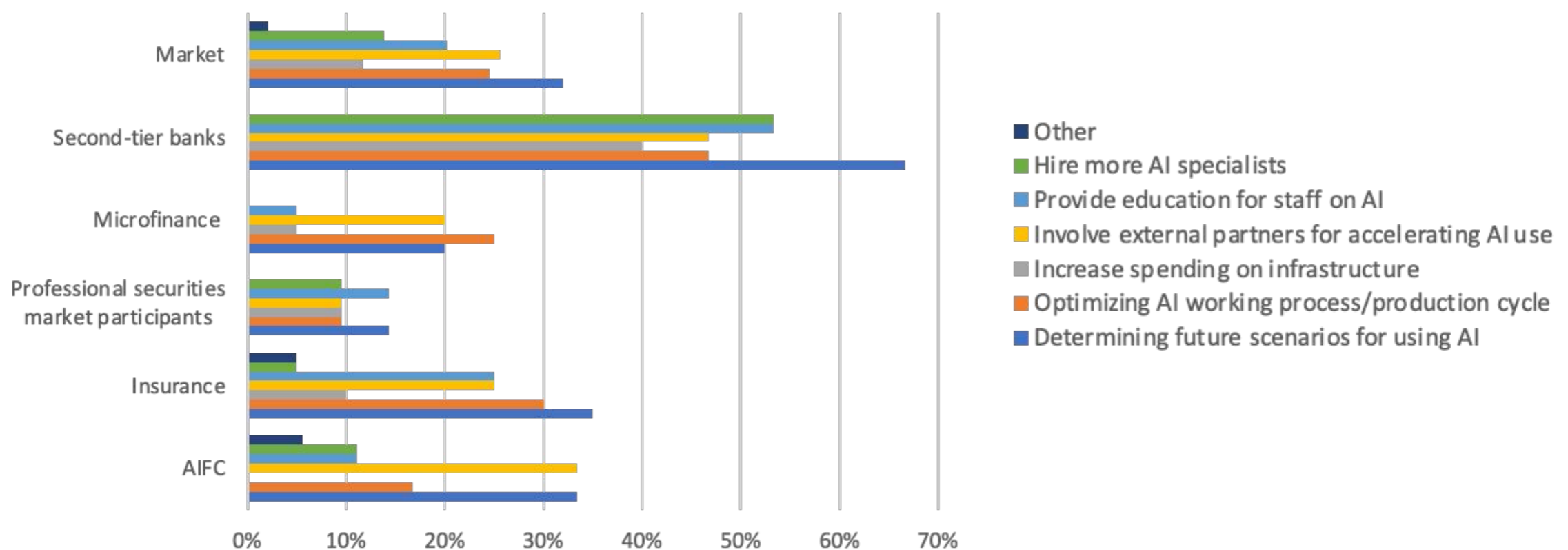
Picture 20. Future actions of organizations towards AI development

Kazakhstani companies are currently integrating AI into their operations less actively compared to large global players. Despite recognizing the importance of AI, there is a high degree of neutrality in Kazakhstan regarding its impact on the future of companies. This may be due to a lack of clarity in understanding the capabilities and benefits of AI or a lack of examples of successful implementation.

Budgetary constraints are a significant obstacle to implementing AI in Kazakhstani companies. Perhaps a reassessment of the financial strategy is needed to prioritize AI in investment plans. For Kazakhstani companies, the **question of the availability of quality data and AI specialists** is also relevant, emphasizing the need for investment in education and training.

Kazakhstani companies need to focus on **developing internal educational programs** and partnerships with universities to train qualified personnel in AI. To address the problem of insufficient quantity and quality of data for training AI models, companies need to invest in modern IT infrastructure and data storage systems.

Perhaps **the development of government or private financial instruments to support AI innovation is required**, including tax incentives, grants, and investments in various projects.

Initiatives of financial regulators

In a correlation with the global trend Kazakhstan's financial regulators are becoming active users of AI technology.
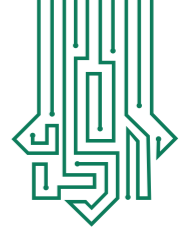
National Bank

- The application of **Computer Vision within the Identification data processing center (IDPC)** is aimed at combating the use of counterfeit images and videos in the identity verification process. Biometric systems used in IDPC have the ability to deeply analyze customers' biometric data, comparing it with verified databases to confirm its authenticity. This approach **enhances the accuracy of establishing identity, effectively preventing falsifications**, while optimizing the speed of identification procedures and ensuring compliance with security standards.

- **The NBK Price Tracker** is a consumer price monitoring system that applies web scraping technology to collect price quotes. The collected data is used to create an operational proxy indicator of consumer inflation. AI plays a key role in this process, ensuring accurate classification of products

- The National Bank is exploring the prospects of implementing **AI technology within the Anti-Fraud Center**, aiming to enhance the effectiveness of anti-fraud measures. The use of AI is envisaged as a means to improve the analytical capabilities of the center, **automating processes for detecting and analyzing potential fraudulent transactions**. In its research efforts, the National Bank is considering various AI models capable of processing large volumes of data in real-time and identifying complex behavioral patterns characteristic of fraudulent schemes.

Agency for Regulation and Development of Financial Market

- The implementation of **machine learning** technologies in the Annual Asset Quality Review (AQR) and Supervisory Stress Testing (SST) of banks has enabled more accurate assessment and forecasting of financial risks. The application of these technologies helps effectively **process large volumes of data**. For example, credit risk assessment models within the SST process handle data on each loan issued by banks since 2012. These models also enable the regular tracking of changes in banks' risk metrics and identification of systemic risks.

- The **Corporate Borrower Rating Model** (ARES), introduced as part of AQR, allows determining the stage of impairment, calculating the probability of default, and more accurately assessing expected credit losses from borrowers. Currently, work is underway to improve tools for analyzing the creditworthiness of individuals. An internal advisory report has been developed aimed at developing a comprehensive and research-backed approach to risk analysis, including the **use of machine learning methods and statistical analysis**.

- The development of a **unified supervisory application** will include services for conducting supervisory assessments of financial institutions (SREP, RASS, and SRES), as well as other supervisory tools. An important aspect of the application will be the development of **machine learning models for detecting abnormal transactions**, which will allow for more effective identification and analysis of suspicious operations.

- The **QAINAR information security system**, used by the Agency since 2021, **processes data on information security incidents in near-real-time mode**. This allows for prompt response to threats and protection of data in the financial sector. Currently, work is underway to improve QAINAR by integrating additional artificial intelligence technologies.

- The Agency pays special attention to consumer rights protection in financial services and the implementation of behavioral supervision. The Agency is actively working in two directions: digitization of the process of handling citizens' appeals and the creation of a registry of financial products.
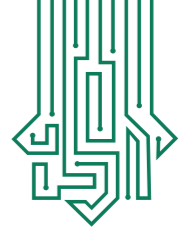
Astana International Financial Center

- Astana International Financial Center is actively exploring the prospects of integrating advanced artificial intelligence (AI) technologies into its operations, aiming to **enhance the efficiency and innovation of the services provided**. The application of AI promises to significantly enhance the regulator's potential in company registration, monitoring, and providing technical support to clients. In addition, there is consideration for implementing AI in internal company processes, which would greatly improve managerial decision-making and foster corporate innovation. This approach is aimed at creating a resilient and competitive financial ecosystem, adapted to the rapidly changing demands of the modern economy.

Growth points

Among various areas where AI technology is actively developing and adapting in Kazakhstan, the following growth points can be noted, which could serve as a basis for systematic progress, including for the financial market:

- **National and governmental projects on digitization and data openness**. The consistent development of the Open Data Government concept, SmartBridge, and Smart Data Ukimet has laid the groundwork for the development of the AI Platform. Financial regulators are creating a network of projects using AI technology, which form the basis for future transformation towards the data-driven concept, where decisions will be made based on data.

- **Incubation centers and startup ecosystem.** As of today, Astana Hub counts 233 companies working on the application and development of AI-based products. Solutions from Kazakhstani startups and mature companies have gained national and international recognition in the fields of MedTech, Smart City, and IndustrialTech, contributing to attracting investments to our country.

- **Projects of higher education institutions and research centers.** Among the 24 universities and research centers engaged in research and development, 4 universities have the necessary computing resources for AI projects, and 6 universities are involved in developing the Kazakh language corpus. Notable achievements include those of the Institute for Smart Systems and Artificial Intelligence (ISSAI) at Nazarbayev University, which has developed 4 projects on speech processing and natural language processing based on AI for the Kazakh language. All research datasets are openly accessible.

- **Infrastructure potential.** Despite challenges such as limited computing power, which is planned to be overcome by the construction of a supercomputer by 2025, and the absence of cloud providers, Kazakhstan has competitive advantages to become a regional leader in the infrastructure cluster in the field of AI technology, as it can leverage its experience in building the data centers.

Binur Zhalenov
The Chairman of the National Payment Corporation on the role of AI technology in Kazakhstan payment market
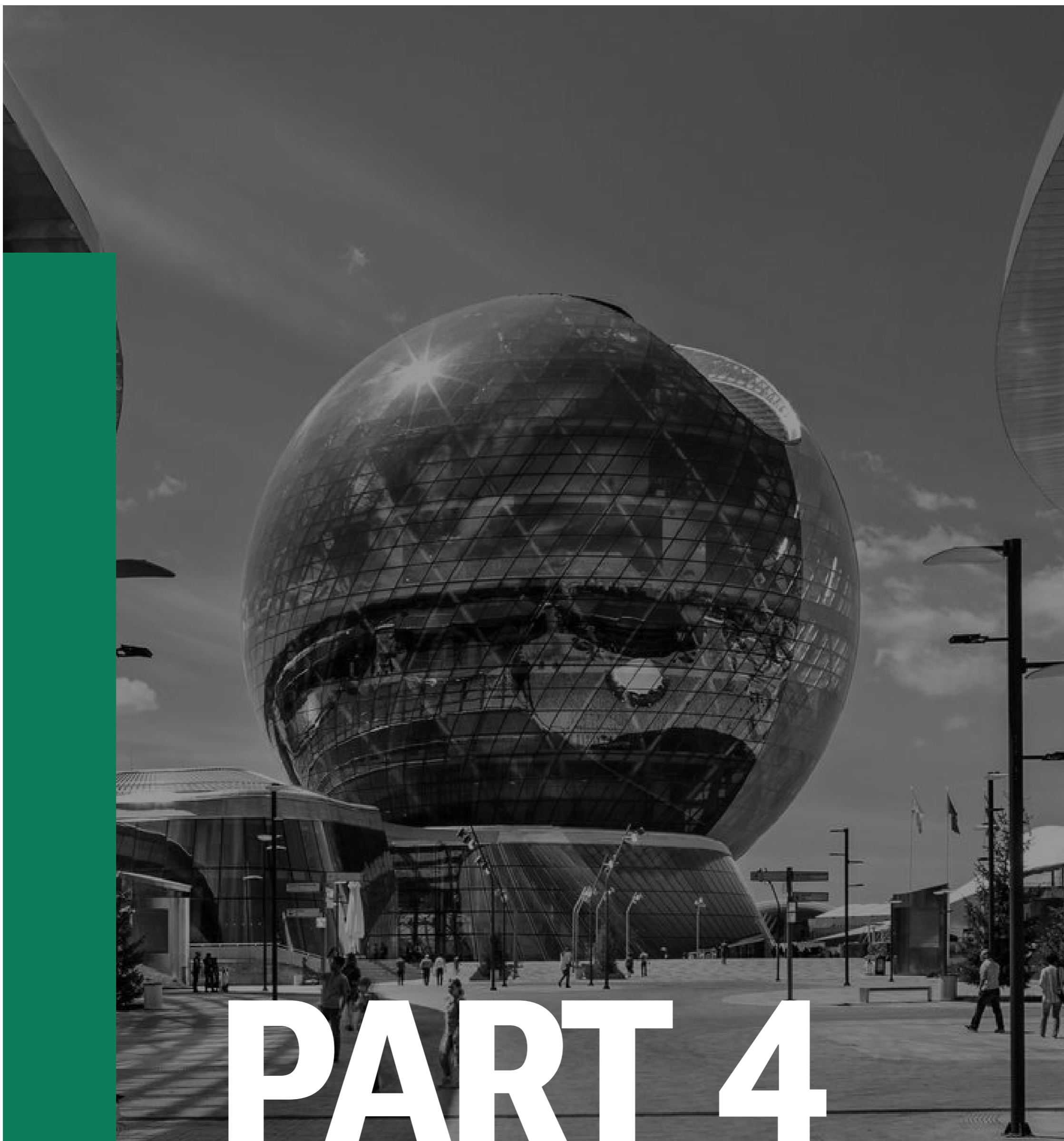
The Kazakhstani financial technology market can rightfully be considered one of the most innovative in the world. The openness of Kazakhstani consumers to innovation, strong entrepreneurial initiative, and innovation-friendly regulatory environment ensure rapid adaptation of the industry to changing conditions.

We are convinced that in this AI revolution, the Kazakhstani financial market should be at the forefront. In this advisory report, we have analyzed where the market stands today, what AI-based solutions are already being implemented, and what joint efforts are needed to create a sustainable ecosystem for AI development in the Kazakhstani financial market.

We see significant synergy between the latest achievements in AI and projects for the development of the National Digital Financial Infrastructure. The synergy of generative AI with the principles of open banking provides a powerful impetus for the development of "hyper-personalized" finances, where consumers receive even more convenient service. Using AI to search for and predict patterns of fraudulent behavior will become one of the directions of development for the Anti-Fraud Center. In conjunction with government AI projects (for example, the Digital Family Card), smart contracts in digital tenge can significantly increase the efficiency of state support measures through addressability and proactivity.

However, despite all the impressive opportunities of artificial intelligence technologies, it is important to remember that technology itself cannot be a "panacea." Artificial intelligence is a powerful tool that can multiply our efforts, but only when applied and managed correctly. Therefore, much depends on qualifications, that is, the development of competencies both on the market participants' side and among government agencies.

We hope that the published report will open an important discussion and serve as a starting point for consolidating the efforts of the state and the market in creating an ecosystem of artificial intelligence in the Kazakhstani financial market, ensuring regional leadership in this agenda.

PART 4

**Directions of
AI technology development
in Kazakhstan financial market**

Directions of AI technology development in Kazakhstan financial market

Based on global experience, Kazakhstani financial regulators should enhance their role as catalysts for innovation and ensure the readiness of the financial market for new challenges associated with the implementation of AI technology, both in terms of regulation and in terms of providing the necessary resources for technology development.

The main directions for the development of AI technology that will have a multiplicative network effect on the entire market will be:

- Coordination of efforts with the initiatives of the Government of the Republic of Kazakhstan
- Consistent stimulating approach to regulation
- Capacity building, development of internal competencies, and their projection onto the financial market
- Experimentation and development of proprietary projects
- Development of infrastructure for strengthening of AI technology

Coordination of efforts with the initiatives of the Government of the Republic of Kazakhstan

To achieve leading positions in the field of AI technology, financial regulators need to collaborate with the Government of the Republic of Kazakhstan in areas where synergistic effects can be expected, namely in the development of national AI infrastructure, R&D, and human capital development. This will be achieved by executing the following principles:
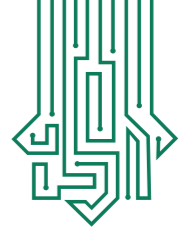
- **Synchronization of efforts in AI technology development between financial regulatory bodies and the government.**
- **Mutual complementarity of projects.** Many projects aimed at developing AI for the financial market and those undertaken by the government have significant potential for positive interaction, which can enhance their effectiveness and expand their scope of application. This direction should be developed through the exchange of ideas and the search for technological and organizational linkages.
- **Collaboration in building data management architectures.** Data management systems, as a fundamental basis for AI technology development, should be discussed to achieve the necessary levels of integration, which are critical for ensuring the required flow of data from various ecosystem participants.

At the same time, **financial regulators** must consider the **specificity of data confidentiality and security** in the financial market they operate in, as well as the risks that AI systems may pose to the financial market. Joint projects should provide comfort for both market participants and ultimate consumers.

Analyzing the current version of the Artificial Intelligence Development Concept for 2024-2029, it is already possible to identify promising areas for cooperation in 2024.

Establishing a national AI platform based on "**Smart Data Ukimet**", which aggregates data from more than 90 information systems of government bodies, provides significant opportunities for a wide range of organizations to develop AI-based solutions. Financial regulators should **identify the dataset that can be transferred to this platform** and jointly select secure methods for data transmission. Sharing experiences in building similar platforms will have a positive effect on the development of the data infrastructure of Kazakhstan's financial market.

Financial regulators have already begun collaborating with the government regarding computational resources to facilitate the development of artificial intelligence. Based on prospective projects, they are determining the necessary resources to be allocated. This cooperation will optimize expenses by utilizing a shared cluster of computational resources and balancing their utilization.

Enriching the development of educational courses on artificial intelligence in the context of its application in the financial market will provide a more detailed understanding of risks and challenges for both ordinary online course participants and students specializing in finance and economics, as well as AI specialists.

Identifying promising directions for research and development aimed at the advancement of artificial intelligence for the financial market and supporting them will unite the efforts of regulators and ministries in developing research organizations specializing in AI technologies.

One of the national-level priorities is the development and implementation of a **Kazakh national language model**. Financial regulators are expected to assist in training the model for understanding and generating content in the fields of economics and finance. This will **enhance financial literacy and inclusivity in various financial services** among the population of Kazakhstan, including the involvement of retail investors, as much educational material and decision-making information is currently only available in Russian and foreign languages.

Joint efforts should be devoted to **shaping the legal regulatory framework** for the development of AI technology, and work on discussing the **Digital Code** project should continue. Without an appropriate regulatory framework, AI technology developments will always carry risks in its application, which will slow down the development of this industry and may even halt promising use cases.

Consistent stimulating approach to regulation

Governments around the world recognize the potential of AI to stimulate economic growth and solve social problems. The main goal of the policy is to strengthen public trust and acceptance of AI as it keeps increasingly integrating into various aspects of human operations. However, **the slow pace of policy and legislative development poses a challenge for regulators**, who must keep pace with technological advances while creating a sustainable legal framework. The balance between the need for innovation and regulatory clarity and adaptability remains a key issue. While principles-based regulation provides flexibility, there is a growing need for clearer and more effective rules on specific technologies.

The advanced application of AI in financial markets is important with evaluation of emerging associated risks. Careful planning is needed to implement AI in institutions with legacy infrastructure. **Outdated infrastructure can create obstacles** to the integration of new technologies such as AI due to the incompatibility of existing systems, lack of computing power or insufficient data protection.

The interaction between AI and a financial service provider and/or client involves various risks, so it is necessary to create the safest and most reliable form of such interaction.

The use of AI-based anomaly detection tools can improve AML/CFT processes and fraud detection across all types of financial market participants, and in particular in payments.
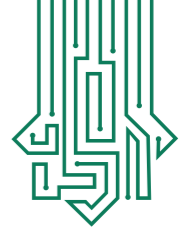
Kazakhstan should adopt current global practices in regulation. The next stages of development for this technology require regulators to rethink their perception of AI not only as a tool with limited application but also as a **phenomenon that requires designing of a comprehensive and multi-aspect approach.**

Progress in AI application opens significant prospects for further development of the financial market, improving the quality and accessibility of financial services and products for all participants. Therefore, **regulation should contribute to stimulating further advancement and implementation of technology in Kazakhstan's financial sector**, ensuring achievement of global leadership levels.

Like any innovative technology that transforms established methods and approaches, **AI introduces new risks for all sectors of the economy**, including finance. At the same time, the spectrum of potential risks remains not fully explored for global and regional financial institutions.

The interaction between AI and financial service providers and/or clients is associated with various risks, so it is necessary to create the most secure and reliable form of such interaction. Full identification and assessment of potential risks are possible only through the practical implementation of projects, accompanied by appropriate monitoring and analysis.

To develop the most effective regulatory strategies, it is essential to ensure the **involvement of all stakeholders in the financial market**. In addition to regulators and financial players, technological companies with deep knowledge of artificial intelligence and aware of its development trends should be included in the discussion process.

Effectively functioning **regulatory sandbox mechanisms** should be actively applied **to stimulate the development of financial innovations** based on AI, analyze associated risks, and determine the need for adjustments to existing legislation. These tools will provide companies with the opportunity to experiment with new solutions that were previously unavailable due to regulatory constraints in a controlled and safe environment.

Given that AI leads to increased automation of processes, it is necessary to continue developing technologies in SupTech and RegTech areas to improve monitoring of their use. SupTech and RegTech solutions implemented by regulators should imply future integration of AI technology.

The use of AI-based anomaly detection tools can improve processes for combating money laundering and terrorist financing, as well as detecting fraud among all types of participants in the financial market, particularly in the payments sphere.

Data, which is a critical element for the functioning and application of AI, **should be regulated by clear and transparent norms regarding its exchange and storage**. In this regard, it is necessary to continue developing the regulatory framework to implement Open Banking principles and develop the corresponding infrastructure.
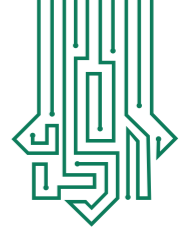
As part of building trust relationships, mechanisms for voluntary notification of AI technology usage by market participants should be established by regulators.

Capacity building
Necessity of internal development

Analysis of GlobalData statistics on AI-related vacancies shows that only about 40% of vacancies in banks, financial services organizations, and insurance companies are related to professions in Computer Science and mathematics. At the same time, vacancies related to project management account for about 17%, and for professions related to business and financial operations, the share is 7-8%. The remaining professions are widely distributed among various departments. This is consistent with the overall trend reflected in McKinsey's survey of organizational leadership in various industries, where only 28% in 2023 noted that engineering specialties related to AI are the most numerous for hiring, while such responses were provided by 39% of managers in 2022.

It can be argued that globally, the **financial industry faces a problem not only in hiring employees but also in adequately training the present staff**. Experts in the industry point out that internal upskilling programs are part of the solution to the shortage of employees with AI skills. According to a McKinsey survey, more than half of organizations expect that over 10% of their staff will need to undergo upskilling in the next 3 years to work with emerging AI tools.

Expectations about the impact of AI adoption on organizations' workforces, next 3 years
% of respondents

Change in number of employees

Don't know	12
Increase by >20%	3
Increase by 11-20%	4
Increase by 3-10%	8
Little or no change (decrease or increase by ≤2%)	30
Decrease by 3-10%	25
Decrease by 11-20%	10
Decrease by >20%	8

Share of employees expected to be reskilled

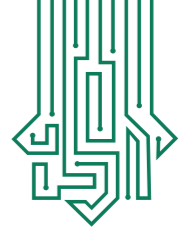|	
Don't know	8
>20%	38
11-20%	18
6-10%	17
≤5%	20
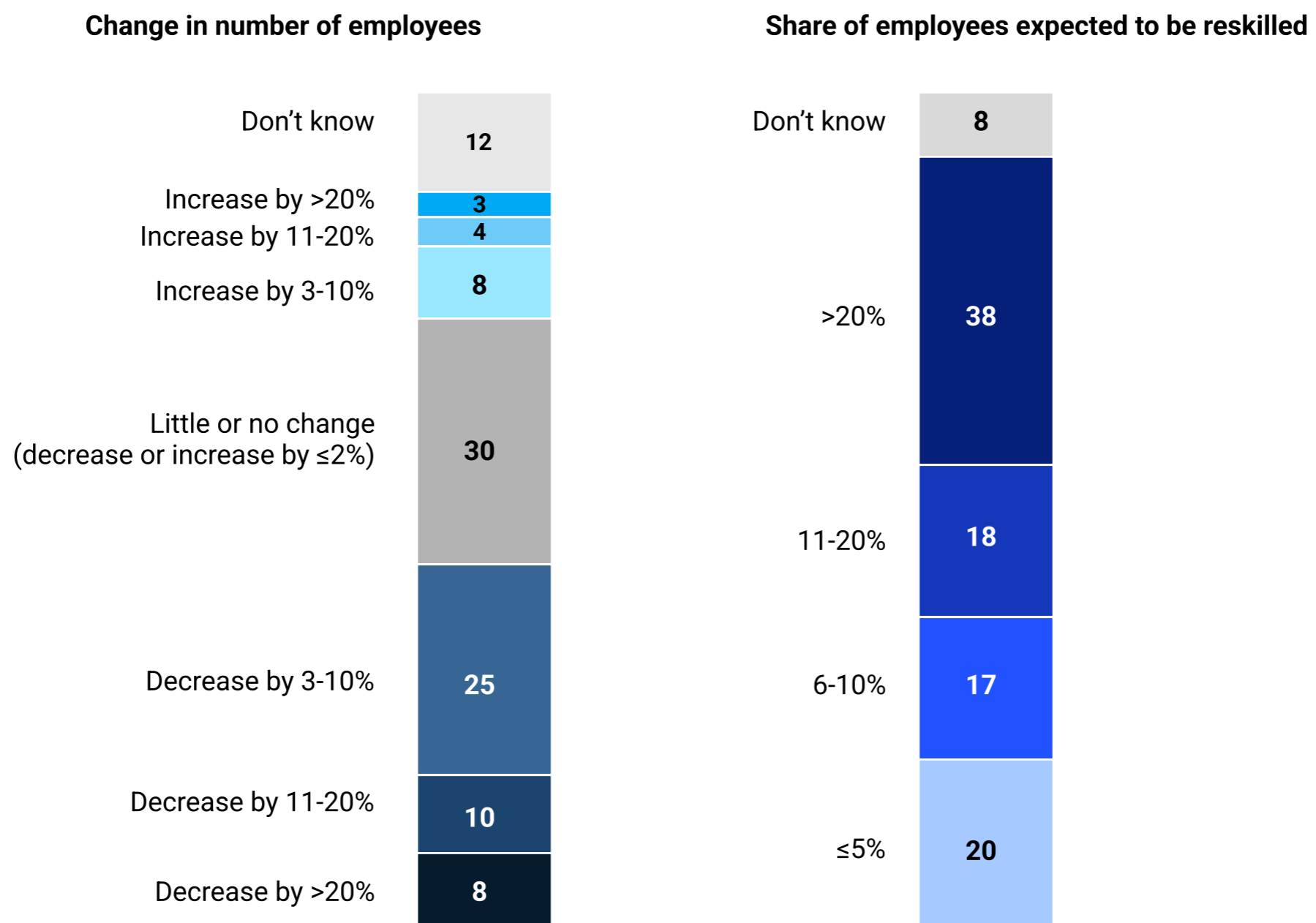
Survey results on the expected impact of AI technology implementation on employees of the surveyed organizations in the next 3 years. (Source: McKinsey)

According to the latest research from Access Partnership and Amazon Web Services, companies are willing to pay 42% more to employees skilled in AI, compared to other employees, in their financial departments. These investments are justified, as per PwC data, where 54% of executives claim that AI solutions have already increased productivity in their organizations. They are utilizing AI for process automation, identifying trends in historical data, and providing insightful information to reinforce human decisions.

To realize this potential and in the absence of ready-made professionals in the global and regional labor markets of Central Asia, financial regulators in Kazakhstan need to invest in the development of human capital within the country. In this regard, enhancing the qualifications of financial regulator employees should be the first step, as they play a crucial role in the national financial system.

This stage of development has clear positive effects:

- **Enhanced quality and promptness of decision-making** in identifying non-obvious dependencies among available data, increasing accuracy in forecasting economic trends, assessing risks, and anticipating market movements.

- **Operational efficiency** through process automation, requiring human analytical skills, and automated risk management.

- **Innovation in solutions** that can be initiated by teams of financial regulators and have a multiplicative effect on the development of the entire financial market.

- **Improvement in regulatory oversight** of AI technology development, which requires bank employees to have a clear understanding of the technology's prospects and challenges, as well as its ethical and legal aspects.

- **Advanced strategic planning** using systems analysis of various future scenarios, advanced exploration of ways to optimize the use of current resources.

Qualification enhancement in the field of AI should be purposeful and strategic, focused on both improving the operational efficiency of the bank and ensuring informed supervision of AI applications in the financial sector.

Several groups can be identified as the basis for developing human capital in financial regulators:

- Leadership and decision makers
- Regulatory and supervisory teams
- Analysts and economists
- IT teams and teams responsible for data collection and processing
- Operational staff

Furthermore, different groups of personnel should undergo different types of programs. For example, **economists and analysts** already working with big data and AI models **should attend more advanced technical courses**, while **operational staff should be trained in interacting with technology to enhance their daily tasks performanc**e. Common courses in this case should include training on the ethical use of AI, data privacy, and security.

For such a program, partnerships should be established with leading global institutions that can not only impart necessary knowledge but also teach practical application.
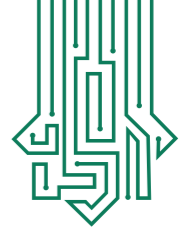
Like with any innovative technology, training **should continue through practical projects** implemented by financial regulators, as well as through knowledge exchange. The latter can be facilitated by creating a community of AI technology practitioners among financial regulators.

Developing expertise through an AI **upskilling program** in financial regulators can serve as **a catalyst for disseminating knowledge and fostering expertise** among other participants in the financial market, research institutions, and educational establishments. Here's how it can manifest and benefit broader financial and academic ecosystems:

- Implementation of joint projects on AI technology
- Regulatory innovations
- Development of educational programs on AI application in financial markets
- Initiation and support of research
- Establishment of a knowledge exchange ecosystem
- Encouragement of talent development in financial markets

Local non-profit sector institutions play an active role in talent development in markets, bringing together regulators, market players, and the public sector. For instance, the Technology in Finance Immersion Programme by the Institute of Banking and Finance Singapore aims to prepare professionals for the financial market in emerging technologies by retraining them in AI within the working environments of 15 participating organizations in Singapore.

In the UK, since 2016, the Alan Turing Institute, specializing in AI research and sponsored by the UK government, has had a separate research program dedicated to finance and economics. The program aims to strengthen economic resilience, develop secure and reliable AI-based systems, and promote decentralization and democratization of technology, including the decentralization of regulation.

Experimentation and development of own projects

In the rapidly evolving landscape of the global financial market, artificial intelligence stands out as **a transformative technology that will redefine the sector's future**. For Kazakhstan, a country at the intersection of traditional finance and digital innovation, integrating these technologies is not just an opportunity but a necessity. The importance for Kazakhstan's financial regulators to actively engage in experimentation and R&D in AI is underscored by two goals: enhancing regulatory efficiency and stimulating innovation to maintain competitive advantage and market stability.

Kazakhstan's path to incorporating AI into its regulatory practices is critically important and must be modern. As **the world observes only a few examples of technology use in financial regulation** on an industrial scale, **Kazakhstan has a unique opportunity to position itself as a pioneer,** using these technologies to address specific market problems and regulatory challenges. Progressing toward this involves a strategic shift towards experimentation and targeted research, laying the foundation for the development of practical, application-oriented AI solutions that resonate within the country's financial ecosystem.

Kazakhstan's financial regulators have a clear vision: **to create a reliable and dynamic structure for experimentation and development that aligns with broader national goals in digital transformation and financial innovation**. This approach is not just about implementing new technologies; it's about fostering an innovation culture that encourages thoughtful risk-taking and iterative learning. By adopting a systematic approach to experimentation and R&D, Kazakhstan can cultivate its own solutions that enhance regulatory functions, improve market oversight, and enable more informed policy decisions.
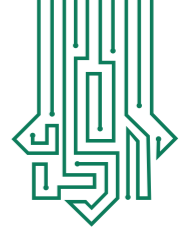
The relevance of executing this approach is amplified by the global shortage of examples of AI use in financial regulation. With few precedents to follow, Kazakhstan's financial regulators face the challenge of navigating uncharted territory, with demands that require a proactive and inventive approach to R&D. This includes not only identifying potential AI and ML applications that align with regulatory objectives but also creating the infrastructure and processes that support ongoing innovation and education across the entire financial market.

To execute this vision, Kazakhstan's **financial regulators must embark on the development of their own AI initiatives**. This initiative begins with a comprehensive analysis of the regulatory landscape to identify areas where AI can bring significant benefits, such as risk assessment, compliance monitoring, fraud detection, and customer interactions. It makes sense to consider the adoption of examples from global practices, as mentioned in other sections. Once these priority areas are identified, the focus shifts to designing and implementing AI projects that address specific regulatory challenges or opportunities.

While developing their own AI initiatives is paramount, Kazakhstan's financial regulators can also derive significant benefits from existing solutions developed by their global counterparts. By analyzing and adapting successful AI frameworks from other regulatory bodies, **Kazakhstan can expedite its own technology adoption**, reducing risks associated with pioneering untested solutions. This approach not only streamlines the research process but also provides valuable insights into best practices and potential pitfalls.

To effectively utilize these external solutions, Kazakhstan's financial regulators must establish a systematic collection of information about AI-based solutions in global practice, assessing the relevance, adaptability, and scalability of each solution to Kazakhstan's context. This process should consider other factors such as technological compatibility, data protection standards, and regulatory compliance. Once a foreign AI solution is deemed suitable, a detailed plan should be developed for its customization and integration into the local regulatory framework, ensuring that the solution is adapted to meet Kazakhstan's unique needs and goals.

Furthermore, it is **critically important for Kazakhstan to actively monitor and engage with international developments** in AI for financial regulation. This ongoing interaction can be facilitated through **participation in global forums, partnerships with international regulatory bodies, and joint research initiatives for example International Monetary Fund and Bank for International Settlements**. By staying connected to the global AI landscape, Kazakhstan can quickly identify emerging trends, technologies, and regulatory challenges, positioning itself as an informed and proactive participant in the international regulatory community.

Development of infrastructure for strengthening AI technology

AI technology can accelerate the transformation of Kazakhstan's financial regulators **towards a data-driven approach**, where data serves as the driver for decision-making and development projects.

At the same time, the development of AI technology and its application in Kazakhstan's financial market directly depends on **the availability of corresponding infrastructure** that can ensure the delivery of relevant data, as well as secure and efficient storage and processing.

Development of data infrastructure considering the need for AI technology advancement will:

- provide a comprehensive and detailed understanding of the country's financial landscape, enhancing monitoring capabilities, enabling better risk assessment, and timely intervention to maintain financial stability,
- enhance the efficiency of regulatory compliance checks, on anti-money laundering (AML), and countering the financing of terrorism (CFT),
- serve as a resource for economic research, providing data for analyzing market trends, informing policy decisions, and contributing to the country's economic strategy,
- provide the necessary infrastructure for data management and analysis of new initiatives, such as the introduction of the Digital Tenge or SupTech and RegTech technologies,
- stimulate innovation in the financial technology sector.

To develop this direction several steps need to be taken:

- establishing a data-driven approach as one of the guiding principles in the development of strategic documents for the IT development of financial regulators,
- shaping a concept for the development of a data management system for the financial market, which will determine the role of financial regulators, government agencies, and the market in building such infrastructure,
- within the framework of the digital financial infrastructure development program, methods of interaction with the future data management system should be provided to achieve a synergistic and network effect for the growth of innovations in the financial technology market.
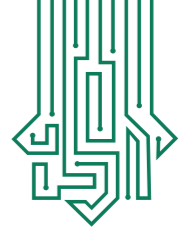
To ensure future relevance and effectiveness of the data management system in terms of applying Artificial Intelligence technology, it is necessary to develop relevant functional requirements. **The sources for these requirements should include:**

- projects implemented by financial regulators in the field of AI,
- interviews and discussions with participants in the financial market,
- studies of the experience of using AI technology by participants in the financial market,
- interviews and discussions with representatives of technological and telecommunications companies,
- interviews and discussions with representatives of institutions engaged in scientific research in the field of AI technology.

To measure the effectiveness of this infrastructure, it is necessary to **define appropriate metrics related to data quality assurance, accessibility, efficiency of data usage for AI models** from the perspective of both financial regulators, participants in the financial market, and other stakeholders. It is also necessary to assess the flexibility of the future infrastructure, as AI technologies are constantly evolving and setting new requirements.

The AI technology has long surpassed the use of only structured data. **Various types of data, from scanned documents to audio and video recordings**, are playing an increasingly important role. Modern data systems must be able to store a wide range of data types. For this purpose, the system should be based on the **data lake method**, where **structured and unstructured data**, as well as data in different formats, can be efficiently stored, processed, and provided when needed. As an example, Kazakhstan should consider the experience of the European Central Bank's EU Digital Finance Platform. (see the insert)

Despite the significant role of a centralized data management system in the development of AI technology, its practical application will significantly lag without further **progress of the Open Banking concept**. Successful implementation of this concept and its expanded usage act as **a driver for the advancement of AI technology**, as seen in countries like England, Singapore, South Korea, and Canada. The Open Banking concept will enable secure access and exchange of data among all participants in Kazakhstan's financial market, who can then apply AI technology models for the benefit of consumers.

Systems for storing and exchanging financial data should liberalize access to this data for organizations of various maturity levels. They should involve the creation of data marts that allow simplified access to a predefined set of data. For more complex data work for certain organizations, special secure environments – analytical sandboxes - are required. These containers should have access to both financial data systems and the ability to connect additional data sources for building and training AI models, as well as for experimentation.

The infrastructure for developing AI in the financial market should not be limited to only financial market data. To deepen the value of systems built on AI models, channels with Smart Data Ukimet and other data sources need to be formed.

Centralized data storage systems and digital financial infrastructure through the **Open Banking** concept should also provide the necessary real-time **data delivery mode** for timely decision-making by financial regulators, government agencies, and market participants, thereby contributing to improving the quality of services and products for end consumers.

At the same time, it is necessary to note that the data collected by financial regulators (the central bank and the agency) for regulatory purposes are **quite sensitive** and further dissemination, including transmission to Smart Data Ukimet, in their original form is not feasible. Therefore, **the creation of an AI laboratory within the scope of the National Bank** using the data currently collected, with the application of machine learning algorithms and AI, is envisaged to identify non-obvious correlations and enhance the regulator's decision-making analytical toolkit.
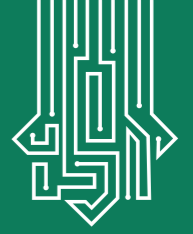
The EU Digital Finance Platform emerged as part of a broader digital finance strategy outlined by the European Commission in 2020. Aimed at addressing challenges and leveraging opportunities in the digital transformation of the financial sector, the strategy promotes an enabling approach to technological development while ensuring financial stability and consumer protection. The platform is an integral component of this strategy, facilitating data exchange and collaboration among stakeholders.

The mission of the EU Digital Finance Platform is to create a centralized ecosystem that enhances access to financial data, fosters innovation in digital finance, and provides a harmonized regulatory framework for EU member states.

The goals of this system are:

• Improving access to a wide range of financial data for businesses and regulators.
• Fostering collaboration among fintech startups, mature companies, and financial regulators.
• Supporting the EU's goal of creating a single digital market in the financial sector, scaling innovation without fragmented regulation.
• Enhancing consumer protection and market integrity in the digital era.

The platform is designed to aggregate various types of financial data, which may include:

• **Market data:** information on trading activity, market trends, and financial instruments.
• **Regulatory data:** details regarding compliance, regulatory requirements, and supervisory information.
• **Consumer data:** anonymized data on consumer behavior, preferences, and trends in financial services.
• **Transaction data:** details of financial transactions that can provide insights into market dynamics and financial health.
• **Innovation data:** information on new financial products, services, and technologies emerging in the EU market.
• **Synthetic data:** artificially generated data that allows for research without risking the privacy and confidentiality of data.
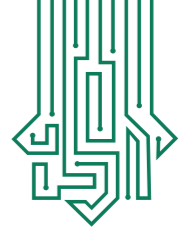
In the future, the platform will play a key role in shaping Europe's financial sector. It is expected to further integrate various data sources and expand its scope, potentially including real-time data streams and more detailed information.

The platform places enhanced emphasis on the capabilities of artificial intelligence and analytics to gain deeper insights, improve regulatory reporting, and support decision-making processes.

PART 5

Planned actions for implementation streams of artificial intelligence development activities in the financial market in 2024

Planned actions for implementation streams of artificial intelligence development activities in the financial market in 2024.

Collaboration with the government of the Republic of Kazakhstan
- Joint execution of interconnected action plans

Research of regulatory policy approaches
- Studying scenarios of AI technology usage that require the use of regulatory sandboxes
- Identification of AI technology usage scenarios for piloting in regulatory sandboxes utilizing surveys among market participants and technology companies
- Collection of applications for piloting services in regulatory sandboxes based on selected scenarios
- Studying the scenarios of AI technology usage carried out by market participants
- Regulators determining priority scenarios for the use of AI technology for examination by financial regulators
- Creating a list of proposals for collaborative projects with market participants, choice of priority projects for development in 2025-2027
- Development of further steps for studying the regulation of AI technology in the financial market

Capacity building
- Creation of a training program and re-education of employees of financial regulators, creation of an AI community among financial regulators
- Discussion of results and potential educational programs for financial organizations
- Holding working meetings related to development of AI competency on the financial market of Kazakhstan with universities

Research support
- Support of scientific works on AI based on priority research streams for AI development on financial market

Applied projects
- Identification of new projects by financial regulators using AI technology for 2024
- Work on existing and new projects with use of AI technology
- Identification of list of projects for development in 2025

Interaction and exchange of experience among financial regulators
- Organization of a series of meetings among financial regulators in Kazakhstan on the current use of AI and its prospects
- Determination of joint projects of financial regulators utilizing AI technology
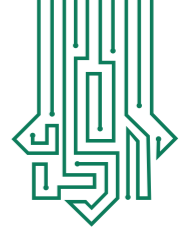
Infrastructure development
- Creation of AI laboratories in the structures of financial regulators
- Implementation of a prototype of the target data architecture (data factory) in a limited functional domain

Open Banking
- Defining the development of necessary standards for synthetic data transmission
- Defining limitations on the use of Open Banking data for training AI models

CONCLUSION

Conclusion

In the modern world, AI technology is **undergoing rapid development**, influencing various spheres of society's activities. This process opens up new opportunities for solving complex tasks, increasing efficiency, and improving the quality of work in different areas, including finance, medicine, education, and many others. Alongside this, the world is faced with the need to **develop new approaches to regulating and ethically using AI** to maximize its positive impact on society while minimizing potential risks and negative consequences.

One should pay particular attention to the application of AI in the financial sector, where predictive AI, generative AI, as well as process automation and optimization technologies radically change traditional approaches to banking, asset management, insurance, and other aspects of financial services. Today, **many financial players** are actively leveraging AI capabilities, seeking to enhance the quality and accessibility of their services. For example, leading banks and insurance companies use machine learning algorithms to analyze risks, predict customer behavior, and automate routine operations. One prominent example is the use of AI to optimize lending processes, where machine learning algorithms **analyze large volumes of borrower data to assess creditworthiness more accurately and minimize default risks**.

Financial regulators are also keeping pace with adopting new technological solutions, **actively building expertise in AI**. For instance, the National Bank of Kazakhstan (NBK) and the Agency for Regulation and Development of the Financial Market of the Republic of Kazakhstan (ARDFM) are implementing AI to enhance supervisory functions, improve analysis processes, and decision-making. This includes using machine learning systems for monitoring financial markets, detecting fraudulent schemes, and managing risks. Such an approach not only increases the efficiency of regulators' work but also contributes to creating a more transparent, stable, and secure financial market.

In the context of **Kazakhstan, the country demonstrates significant interest in the development and integration of AI across various industries**. Regulatory bodies and the government are actively working to create favorable conditions for the development of various technologies, including AI. A number of national and state projects are aimed at digitizing society and the economy, laying the foundation for further expansion of AI applications. The forming of such regulation must be approached carefully, adopting vast experience from other jurisdictions.
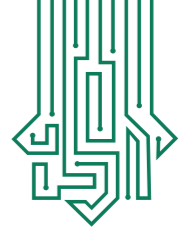
At the same time, despite the **numerous advantages of AI, it also entails significant risks and challenges**. Key among them are issues of data confidentiality and security, as well as ethical considerations. These risks underscore the need for careful regulation of AI in the financial sector.

Data confidentiality and security become particularly relevant as AI systems often require access to large volumes of personal and sensitive information for training and operation. This raises concerns about how and by whom this data is collected, stored, and used, as well as **the possibility of its leakage or misuse**.

Ethical considerations include dilemmas related to t**he autonomy of AI systems, their transparency, and accountability for decision-making**. How can AI systems make decisions that are fair and non-discriminatory based on age, gender, ethnicity, or other factors? Who is responsible when AI makes a decision leading to negative consequences?

Regulating AI in the financial sector is a complex task that requires striking a balance between fostering innovation and protecting consumer rights and public interests. An important aspect of regulation is **ensuring transparency and explainability** of AI decisions to strengthen trust and understanding of these technologies among users and society as a whole.

The issue of AI regulation is central to the policies of many countries as they seek to balance the innovative potential of AI with the need to minimize the consequences of potential risks. By the end of 2023, approximately 31 countries had enacted legislation related to AI, while discussions on similar laws were actively underway in 13 countries. This underscores the global recognition of the need to establish legal frameworks for managing the development and application of AI.

Conclusion

Regulatory strategies vary from country to country, reflecting unique legal, cultural, and economic contexts. They range from general regulation, which establishes fundamental principles and guidelines for the use of AI across a wide range of areas, to specific financial regulation. It is important to note that **effective AI regulation** requires not only the establishment of legislative norms but also **active engagement with stakeholders at all stages**—from setting regulatory goals to developing specific legislative and regulatory acts.

The analysis of the historical development and existing approaches to regulating AI underscores the **importance of a comprehensive approach** that takes into account both the opportunities and risks associated with AI development. Balancing innovation incentives with the protection of public interests remains a key challenge for the global community in AI regulation.

The Conception on the regulation of artificial intelligence by the Ministry of Digital Development, Innovations, and Aerospace Industry of the Republic of Kazakhstan represents an important step towards creating a balanced and effective legal environment for the development and application of AI. This concept embodies a comprehensive approach to regulation aimed at achieving a harmonious combination of innovation and the protection of citizens' rights and interests.

The key principles of regulation outlined in the concept include **transparency, security, ethics, and fairness in AI use**. This entails creating conditions for open and responsible AI use, ensuring the protection of personal data and confidential information, preventing discrimination, and upholding human rights. Special attention is given to the need to adapt the regulatory framework to new challenges arising from the implementation of AI technologies. The concept underscores the importance of developing specialized standards and procedures to regulate AI use. The forming of such regulation must be approached carefully, adopting vast experience from other jurisdictions.

In the context of AI implementation in the financial sector, there is a clear need for a careful and balanced approach to regulating this area. **AI technologies have already demonstrated significant success** in enhancing operational efficiency, improving customer service quality, and bringing innovation to the industry. In this context, progressive regulation becomes crucial, allowing for the nurturing of innovation at an early stage of development.

Progressive regulation entails a **flexible and adaptive approach** that evolves with technological progress. Such an approach **creates conditions for innovative growth**, providing ample room for experimentation and innovation while minimizing potential risks.

It is also important to emphasize **the role of the government** in supporting the expansion of AI by investing in education and talent development. Investments in training and capacity building of professionals are fundamental to long-term success in AI integration. Government support in **creating favorable conditions for the education and development of AI talents** will enable the national economy to remain at the forefront of technological progress, strengthening its position on the global stage.

In addition to this, it is crucial to recognize the significance of global cooperation and knowledge exchange in the field of AI among countries and international organizations. Such interaction not only contributes to the development and dissemination of best practices but also ensures the creation of a unified base of standards and principles for the ethical use of AI.

Understanding the mechanisms of AI operation, its potential, and limitations is becoming a necessary condition for effective human-machine interaction. It is important for every individual to have the opportunity not only to benefit from the advantages of AI but also to understand the associated risks and responsibilities. This requires joint efforts from the government, educational institutions, the private sector, and society as a whole.