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THE ROLE OF ARTIFICIAL INTELLIGENCE IN INNOVATIVE MANAGEMENT: INTERNATIONAL EXPERIENCE AND KAZAKHSTAN'S OPPORTUNITIES

It is widely recognized that the potential of artificial intelligence (AI) is incredibly multifaceted. With its help, tasks and services that could previously only be performed by humans are now performed quickly and efficiently using various available technologies. AI makes life much easier by effectively solving technical problems and optimizing many processes. As a key driver of the fourth industrial revolution, artificial intelligence has a profound impact on the productivity of organizations, fundamentally changing existing business models and stimulating innovation processes.

Since the term "artificial intelligence" appeared in the scientific field, research aimed at its development has been actively conducted. However, AI is still a relatively new and complex technology that has not been fully studied.

As for the impact of artificial intelligence on innovation management, AI has the potential to radically change practices in this area. These changes will open a new era in innovation management, making innovation processes more efficient and successful. However, our knowledge of the use of AI in innovation management is still limited, and managers continue to search for the most effective ways to apply this technology.

This article examines the role of artificial intelligence in innovation management by analysing the theoretical aspects of innovation management and AI, identifying their interrelationship, and assessing the potential for effectively applying AI in managing innovative activities in Kazakhstani organisations. Using an evolutionary approach, the article evaluates international experience, while the induction method is applied to forecast the potential use in Kazakhstan's innovation management sector.

The novelty of this study lies in the first-ever examination of AI's application, role, and conceptual foundation within innovative activities in Kazakhstani organisations. The legal framework for informatisation and AI development in Kazakhstan has been established. However, AI development requires substantial financial support and stronger collaboration between science, industry, and enterprises.

Key words: innovation, innovation management, artificial intelligence, sustainable development, economy, strategy.

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Жасанды интеллекттің инновациялық менеджменттегі рөлі: халықаралық тәжірибе мен Қазақстанның мүмкіндіктері

Жасанды интеллекттің (ЖИ) мүмкіндігі сан қырлы екені жалпыға мәлім. Оның көмегімен бұрын-соңды адамға ғана мүмкін болған қызметтер мен тапсырмаларды түрлі қолжетімді технологиялар негізінде жылдам әрі сапалы түрде орындауға болады. Ол кез келген техникалық мәселелерді сәтті шешу арқылы адамзат өмірін едәуір жеңілдетіп келеді. ЖИ төртінші өнеркәсіптік революцияның қозғаушы күші бола отырып, заманауи бизнестің моделі мен инновациялық процестерді түбегейлі өзгертуі арқылы ұйым қызметінің тиімділігіне айтарлықтай әсер етеді.

Жасанды интеллект термині айналымға енгізілгелі бері бұл саладағы академиялық зерттеу жұмыстары белсенді түрде жүріп келеді. Дегенмен, ЖИ әлі де жеткілікті зерттелмеген, жаңа

Жасанды интеллекттің инновациялық менеджментке әсері туралы айтатын болсақ, әрине, ЖИ инновацияларды басқару тәжірибесін түбегейлі өзгерте алады. Бұл өзгерістер әлдеқайда тиімді және табысты инновациялық процеске қол жеткізуге мүмкіндік беріп, инновациялық менеджменттің жаңа дәуірін бастайды. Дегенмен, инновацияларды басқаруда ЖИ қолдану туралы біліміміз әлі де шектеулі, ал менеджерлер ЖИ технологияларын қолданудың ең қолайлы тәсілін әлі де іздестіру үстінде.

Мақаланың мақсаты – инновацияларды басқару мен жасанды интеллект ұғымдарының теориялық және практикалық аспектілерін зерттеу негізінде «инновацияларды басқару» мен «жасанды интеллект» ұғымдарының өзара байланысын анықтап, инновациялық менеджменттегі жасанды интеллекттің рөлін зерделеу және қазақстандық ұйымдарда инновациялық қызметті басқаруда жасанды интеллектті тиімді қолдану мүмкіндігін болжау. Мақалада эволюциялық тәсілді қолдана отырып шетелдік тәжірибе талданып, бағаланады және индукция әдісі негізінде қазақстандық ұйымдардың инновациялық қызметінде жасанды интеллектті қолдану мүмкіндігіне болжам жасалады.

Мақаланың жаңалығы – алғаш рет қазақстандық ұйымдардың инновациялық қызметінде ЖИ-дің қолданылуы және оның рөлі мен тұжырымдамалық негізі қарастырылады. Бүгінгі таңда Қазақстанда ақпараттандыру және жасанды интеллектті дамыту саласындағы заңнамалық базаның негізгі іргетасы қаланған. Демек, бұл жасанды интеллект саласындағы ғылыми зерттеулер мен негіздемелерді арттыруды талап етеді. Сонымен қатар, бұл сала үлкен қаржылық қолдауды, ғылым, өндіріс және кәсіпорындар арасындағы өзара іс-қимылды күшейтуді қажет етеді.

Түйін сөздер: инновация, инновациялық менеджмент, жасанды интеллект, тұрақты даму, экономика, стратегия.

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Роль искусственного интеллекта в инновационном менеджменте: международный опыт и возможности Казахстана

Широко признано, что потенциал искусственного интеллекта (ИИ) невероятно многогранен. С его помощью задачи и услуги, которые раньше могли быть выполнены только человеком, теперь решаются быстро и эффективно благодаря использованию различных доступных технологий. ИИ значительно облегчает жизнь, эффективно решая технические проблемы и оптимизируя множество процессов. Как ключевой драйвер четвертой промышленной революции, искусственный интеллект оказывает глубокое воздействие на производительность организаций, кардинально меняя существующие бизнес-модели и стимулируя инновационные процессы

С момента появления термина «искусственный интеллект» в научной сфере активно ведутся исследования, направленные на его развитие. Однако ИИ по-прежнему остается относительно новой и сложной технологией, недостаточно изученной в полном объеме.

Что касается влияния искусственного интеллекта на управление инновациями, то ИИ способен радикально изменить практики в этой сфере. Эти изменения откроют новую эру в управлении инновациями, сделав инновационные процессы более эффективными и успешными. Однако наши знания об использовании ИИ в управлении инновациями по-прежнему ограничены, и менеджеры продолжают искать наиболее эффективные способы применения этой технологии.

Целью статьи является исследование роли искусственного интеллекта в управлении инновациями, определение соотношения понятий «управление инновациями» и «искусственный интеллект», а также составление прогнозов о возможности эффективного использования искусственного интеллекта в управлении инновационной деятельностью в казахстанских организациях на основе изучения теоретических и практических аспектов концепций управления инновациями и искусственного интеллекта. В статье анализируется и оценивается зарубежный опыт с использованием эволюционного подхода, а также делаются прогнозы о возможности использования искусственного интеллекта в инновационной деятельности казахстанских организаций на основе метода индукции.

Новизна статьи заключается в том, что впервые анализируются применение искусственного интеллекта в инновационной деятельности казахстанских организаций, а также исследуется его роль и концептуальная основа.

На сегодняшний день в Казахстане уже заложен фундамент законодательной базы в сфере информатизации и развития ИИ. В связи с этим необходимо усилить научные исследования и

обоснования в области искусственного интеллекта. Кроме того, для успешной реализации потенциала ИИ требуется значительная финансовая поддержка, а также усиление взаимодействия между наукой, производством и бизнесом.

Ключевые слова: инновации, инновационный менеджмент, искусственный интеллект, устойчивое развитие, экономика, стратегия.

Introduction

Technological changes are a fundamental driver of investment opportunities and economic-social growth, with artificial intelligence being one of the most significant advancements. AI technologies are distinguished by their ability to complete tasks within seconds, which previously required significant human effort and time. Today, AI enables remote bank account openings at exponentially faster speeds, facilitates shopping and consultations without human assistance, assists drug development with minimal human intervention in laboratories, performs complex surgeries, calculates risks within seconds for stock market investments, and predicts flight delays with high accuracy. Additionally, AI is widely used in expert systems, data processing, voice and facial recognition, machine vision, and other applications. Some scholars even refer to AI as a "new power" because it can potentially transform business models and reshape the future of civilisation. According to the professional media resource Techtarget.com, artificial intelligence is a technology capable of simulating intelligent actions such as learning from data and predefined rules, making logical inferences, and adjusting decisions accordingly.

On the one hand, the widespread accessibility of AI technologies and tools, such as the universally available GPT models and biometric authentication systems like facial recognition, can contribute to overall economic growth. On the other hand, AI's effectiveness may sometimes be overestimated, as the field is still in its formation and development phase. Therefore, claiming that AI will lead to widespread business expansion may be premature. However, as of now, success belongs primarily to organisations that possess large datasets, effectively utilise AI technologies, and invest in AI-driven startups (Agrawal, 2019; Huang, 2019).

For instance, major technology giants like Apple, Google, Microsoft, Facebook, and Amazon are among the leading acquirers of AI-driven startups. Companies in the automotive, biotechnology, retail, banking, and even oil and gas sectors actively seek to purchase AI technologies or form strategic partnerships with startups (Tekic, 2023). Additionally, leading pharmaceutical companies such as Eli Lilly, Charles River Laboratories, Pfizer, and Merck have partnered with Atomwise to leverage AI technology to screen billions of compounds to develop new drugs and predict modern pharmaceutical products. As venture investments in AI continue to grow, these startups play an increasingly critical role as a source of AI innovations and inventions.

The Government of Kazakhstan has adopted the "Artificial Intelligence Development Concept" as a strategic document for 2024-2029, aimed at expanding AI applications across various sectors of the national economy. The program prioritises AI adoption in government administration, the oil and gas and mining industries, energy, transportation, logistics, water supply, and agriculture. As part of infrastructure development research, Kazakhstan plans to establish a supercomputer, data centres, and a national AI platform while expanding fibre-optic networks and implementing training programs to develop human capital.

By 2029, the new program aims to increase AI-powered product output by fivefold. This underscores the urgent need for skilled AI specialists, requiring relevant ministries to increase the number of students enrolled in AI-related programs and expand coding schools in different regions. Additionally, deep, scientifically grounded research is essential. This highlighted the relevance of this study. If AI is widely implemented in Kazakhstani organisations, it could significantly enhance overall innovation activity. While AI was once merely a product of innovation, it now plays a transformative role in optimising innovative management. As a result, the innovation landscape will likely witness an expansion in AI-driven products and services. This article explores AI's role in innovation management and assesses its potential applications in Kazakhstani organisations.

Literature review

An analysis of publications in international citation databases such as Scopus and Web of Science indicates that scientists and researchers actively discuss and study innovation and artificial intelligence.

In the 1930s, Australian scientist Joseph Schumpeter introduced the term "innovation" into economic science. According to him, innovation refers to changes aimed at introducing and utilising new consumer goods, new production and transportation methods, markets, and organisational forms in industries. Over time, "innovation" became a widely accepted category in global economic literature. According to Schumpeter, innovation is not merely introducing something new but represents a novel production function.

Extensive research has been conducted on the integration and application of AI technologies and tools in organisational activities and their advantages (Agrawal, 2019; Huang, 2018; Raj, 2019; Olan, 2022). Additionally, the future of AI in terms of individual interests and communities has also been actively studied (Zahraee, 2016). One of the essential skills for managers is the ability to efficiently and quickly apply available knowledge and experience while obtaining the necessary information. AI can optimise these processes, enabling organisations to implement innovations more effectively and serve as a key element of economic growth.

Integrating AI systems into organisational processes presents complex and challenging phases (Lombardi, 2019; Olan, 2021). Some researchers view the introduction of AI systems as an issue of education, culture, and organisational learning networks (Olan, 2022). Other authors classify AI into two main categories: economic and technological. According to Huang's research, AI technologies that support knowledge-related activities can directly improve organisational efficiency, even if other organisational factors remain unchanged (Huang, 2019).

The issues related to implementing AI systems in organisational activities are complex and require well-planned actions at different stages (Lombardi, 2019; Olan, 2022). Therefore, some researchers consider the sector-specific aspects of integrating AI systems into education, culture, society, and business (Olan et al., 2022). Meanwhile, the authors categorise AI into two main perspectives: economic and technological.

AI has been used in autonomous computer systems for many years, making it not a new phenomenon in the technology industry, as noted by Wooldridge and Jennings (1995). Instead, AI is a fundamental component of computer systems capable of autonomous actions within a specific environment to achieve predefined objectives. Some scholars argue that AI can be compared to human intelligence's ability to quickly assimilate new ideas, engage in self-learning, correct mistakes, and develop independently (Chen et al., 2012). Huang and Rust (2018) suggest that AI technologies promoting knowledge-based activities can enhance organisational efficiency.

Despite the challenges in defining AI's autonomous properties, research shows that AI can operate independently of human intervention, managing its own actions and internal state (Winikoff, 2002).

Several scholars (Cockburn, 2018; Haefner, 2021; Etzioni, 2016) argue that AI can make innovation processes more efficient and fundamentally transform management methods and models. They support the idea that AI does not threaten human development and cannot fully replace humans in various processes. Instead, they advocate for its board application in innovation management. However, some researchers hold an opposing view. The idea that AI and machine learning can fully replace humans and reshape organisational processes continues to attract absorbing scientific interest (Brynjolfsson, 2019; Von Krogh, 2018).

Thus, the evolution of research in the field of AI can be summarised as follows. Alan Turing first described using computers to model intelligent behaviour and critical thinking. In 1935, he conceptualised AI as a computing machine with large memory and the ability to manage that memory through a scanner. In his 1950 book Computing Machinery and Intelligence, Turing explored whether computers could possess human-like intelligence and introduced what later became known as the "Turing Test". Six years later, John McCarthy defined the term "artificial intelligence" as "the science and engineering of making intelligent machines" (see Table 1).

It is now impossible to achieve social and technological development without AI technologies. Over the last 70 years (from 1950 to 2020), AI has brought significant social changes and innovations to the business environment after undergoing several evolutionary stages. AI began as a simple series of "if-then" rules and evolved over several decades, incorporating complex algorithms miming human brains. Today, AI includes various technologies such as machine learning (ML), deep learning (DL), and computer vision.

Table 1 – Phases of artificial intelligence development and their characteristics

Stage	Years	Description
Beginning	1943-1955	For the first time, McCulloch and Pitts proposed the creation of an artificial neural model in their paper "A Logical Calculus of the Ideas Immanent in Nervous Activity." Then, the Turing test emerged, and Harvard graduates Marvin Minsky and Dean Edmonds built the first neural network computer, "SNARS."
Initial formation stage	1956-1974	In 1956, the term "artificial intelligence" was introduced during a conference in Dartmouth, ISA. Newell and Simon developed the first artificial intelligence program, "Logic Theorist," introduced the term "machine learning," and created the first chatbot, "ELIZA." Symbolic research, logic, and algorithmic search began to receive increased focus.
"The AI Winter"	1974-1980	It was a period of stagnation. Difficulties associated with mastering complex knowledge grew. Challenges arose due to the allocation of funds for research, and interest in science declined.
Formation of experts	1980-1987	The first national conference of the American Artificial Intelligence Association was organised at Stanford University. Expert systems gained popularity for solving specific tasks, and methodologies for knowledge sharing and discussions were proposed.
"The 2nd AI winter"	1987-1993	Experts failed to achieve the expected results, leading to increased scepticism and decreased research funding.
Research	1993-2010 – Contemporary Period	The revival of artificial intelligence, particularly from machine learning and deep learning. IBM Deep Blue computer defeated world chess champion Hurry Kasparov.
	2011 – Present Day	Social networks like Facebook, Google, and Twitter began extensively using artificial intelligence, along with Big Data and Tesla Cars.
Note – complied based on the literature Agrawal, A., Gans, J., & Goldfarb, A. (Eds.). (2019)		

Undoubtedly, AI can perform some tasks more efficiently than humans. Numerous studies have explored this, leading to new theories, concepts, technologies, management tools, and business models. However, regarding the relationship between AI and innovation activities, the key question in articles and publications is: "What will be the role of humans, particularly managers, in processes where AI is actively used?". In this context, four main scenarios can be identified. Optimists believe that humans will remain dominant, while pessimists argue that humans will become dependent on AI. Pragmatists suggest that AI may enhance human capabilities, and sceptics conclude in their research that AI technologies will never surpass human abilities and consider AI a temporary trend.

Methodology

As a forecasting technology, AI enables firms to process large volumes of data more efficiently and quickly, improving the decision-making process in business. Thus, AI is considered a technology that accelerates growth by enhancing productivity and innovation across various economic and social sectors (Aghion, 2017). However, the full extent of AI's potential to transform human life and stimulate economic and social growth remains insufficiently explored. The lack of comprehensive data on AI implementation at the organisational level makes understanding AI adoption models and their economic impact a relevant issue. The main sources of information will be scientific publications, reports of international organizations, as well as interviews with experts working in the field of technology. This will provide an opportunity to better understand how existing practices can be adapted to the conditions of Kazakhstan.

This article will apply an evolutionary approach that considers AI adoption as an adaptive process influenced by various factors, allowing for a forecast of AI technology implementation in Kazakhstani organisations' innovation management. The methods include analysing and assessing international best practices in successfully implementing AI across different economic and social sectors.

Results and discussion

Thus, what is artificial intelligence? Artificial intelligence refers to the ability of algorithms or intelligent systems to function independently by utilising past experiences to achieve specific goals.

Artificial intelligence is a technology that enables computer systems and machines to simulate human intelligence processes. With AI, robots can

recognise human speech, process natural language, respond to user queries, identify and analyse images through machine vision, generate text, compose music, or even write software code. In other words, AI performs tasks and actions that require rational thinking.

Today, AI is described as a tool that helps companies improve and prototyping processes while accelerating data processing for more accurate predictions and discovering new market opportunities. However, ensuring data security and privacy remains a significant challenge. Despite this, AI has found its most successful applications in big data processing. For instance, in various commercial projects, AI's ability to analyse large data streams has been widely used to study consumer behaviour and assess bank customers' creditworthiness by identifying potential defaults. AI has been successfully applied to early disease diagnostics in the medical field. During the peak of the COVID-19 pandemic, AI identified viral pneumonia from tomographic images, while mobile applications analysed voice, breathing patterns, and cough sounds to detect infection symptoms. Additionally, voice assistants like Siri or Alice have significantly simplified many detailed processes for users (see Table 2).

IDC experts say the compound annual growth rate (CAGR) in the AI market is projected to be 40.6% in the coming years. If this trend continues, global AI-related spending will reach $153 billion by 2028 (International Data Corporation, 2023). By the end of 2023, the global AI platforms market reached a new record of $27.9 billion, compared to $19.3 billion in 2022, representing a 44.4% annual increase (International Data Corporation, 2023).

Table 2 – Artificial intelligence programs used in innovation management

Artificial intelligence	Application areas
DALL-E 3	It enables the creation of detailed images through verbal descriptions of ideas, making it valuable for artists, designers, and marketers.
Adobe Firefly	It is dedicated to image editing or creating unique visual effects. It helps create content tailored to their needs.
PathAI	It aids in more accurate disease diagnosis and optimises selecting participants for critical trials, which is especially important in oncology and genetic research.
IBM WatsonX	It assists in automating business processes and managing big data, making it valuable for analytics, data management, and workflow optimisation.
Note – complied based on the literature Cockburn, I. M., Henderson, R., & Stern, S. (2018).	

Geographically, North America holds the largest share of the total volume of AI-related hardware, software, and services. In 2022, the region accounted for approximately $3.35 billion in AI spending. This dominance is attributed to a well-developed ecosystem of technology corporations, startups, and research institutions that drive AI innovation. Silicon Valley is a hub for cutting-edge AI research and development.

Europe ranks second in AI-related expenditure, while Asia-Pacific has the farthest growth rate. This growth is primarily driven by the widespread adoption of smart devices, rapid urbanisation, and the expansion of Internet infrastructure (Agangebyan, 2023).

The leading players in AI development include Microsoft, Google, IBM, Siemens, AWS, Nvidia, Intel, Qualcomm, STMicroelectronics, Oracle, Salesforce, NXP, Lattice, Octonion, and HPE. According to Crunchbase research, AI-focused companies OpenAI, Anthropic, and Inflection collectively raised around $18 billion in 2023 (crunchbase.com, 2024). Meanwhile, PitchBook data indicates that in the first three months of 2024, AI venture capital funding surged by 25$, reaching $25.87 billion (habr.com, 2024). Major industry players such as Microsoft, Meta, Apple, and Amazon have invested heavily in AI development, including building data centres and hiring top AI talent (International Data Corporation, 2023).

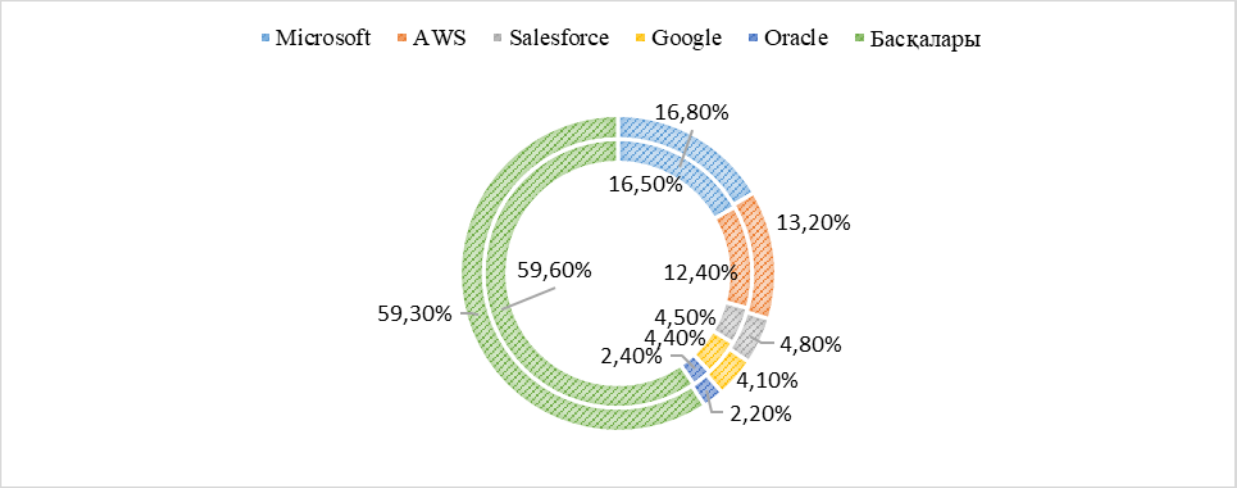

Figure 1 – Share of leading participants in the use of artificial intelligence in 2022-2023%
Note – complied based on the literature [International Data Corporation, 2023]

This advanced international experience enables Kazakhstan to establish a sustainable technological progress vector. To attract major global corporations such as Amazon, Google, Mastercard, and Citi Group, President Tokayev instructed the government during the 2023 IT Forum to ensure the construction of AI-specialized information centres within two years (Official Websites of the President of the Republic of Kazakhstan, 2024).

Smart Data Ufiles is implementing a comprehensive initiative to collect state agency data, integrating 93 information databases. Kazakhstan plans to deploy a supercomputer, build data processing centres, create a National AI platform, and expand fibre-optic communication networks as part of its infrastructure development. Additionally, the country is set to launch educational and acceleration programs to enhance human capital. Since 2021, L.N. Gumilyov Eurasian National University has offered bachelor's and master's programs in Artificial Intelligence Technologies, accredited by the German ASIIN agency. Since 2018, Al-Farabi Kazakh National University has operated a Department of AI and Big Data, where most programs focus on AI development. 17 universities have introduced 15 AI-related fields, with 2,196 students enrolled in these disciplines.

British research firm Oxford Insights assessed Kazakhstan's AI readiness using the Government AI Readiness Index methodology. The country scored 76% in "digital capacity" and 74% in "data availability" indicating high potential. Meanwhile, efforts are being made to enhance competencies in the "vision" category, which evaluates the presence of national AI strategies (Government AI Readiness Index, 2023).

In July 2023, the Global CIO portal published a study on Kazakhstan's IT market, analysing digital transformation trends across various industries. According to this research, Kazakhstan ranked among the world's top 30 most digitally advanced nations in 2022. The country holds the 51st position in the ICT Development Index and 58th place in the Network Readiness Index (Current Aspects of Digitalization in Kazakhstan, 2024).

By 2025, the Kazakh government aims to enter the top 20 countries in the UNO E-Government Development Index, the top 50 in the B2C E-Commerce Index, and the top 40 in the ICT Development Index. Astana and Almaty are Kazakhstan's foremost economic and IT hubs, producing 41.5% and 49% of IT services, respectively. A 2022 study revealed that IT companies specialising in software development and consulting have grown 2.7 times over the past four years (Kaliakparov, 2024).

The volume of startup investments amounted to 67.6 billion, nearly twice the planned amount of 35.9 billion. The total economic impact of the "Digital Kazakhstan" program implementation reached 1.6 trillion. Figure 2 illustrates the investment dynamics over the years (see Figure 2) (Expenditures on the "Digital Kazakhstan" state program over 4 years, 2024).

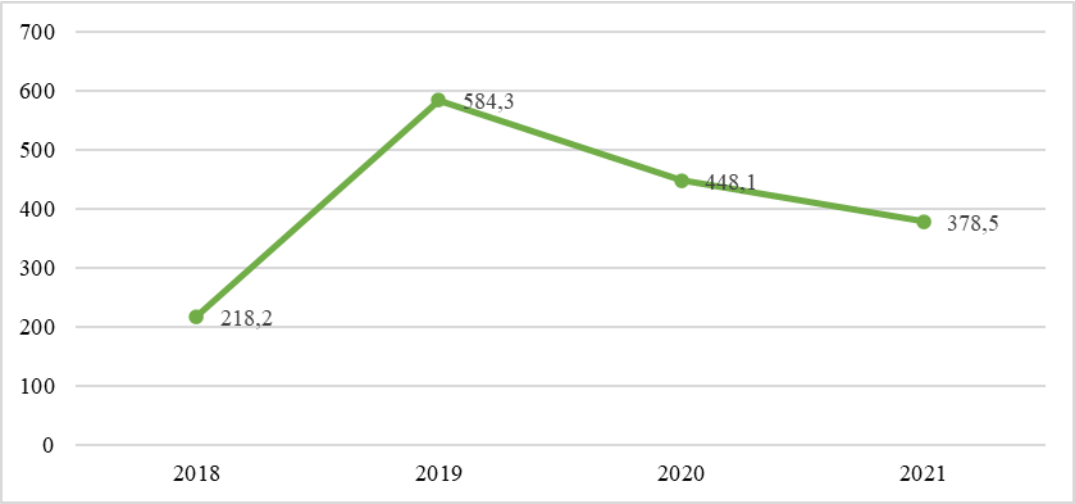

Figure 2 – Investments in startups, billion tenge
Note – complied based on the literature
[Expenses for the state program "Digital Kazakhstan" over 4 years, 2024]

Considering the international experience in AI implementation, the plans for AI development programs in Kazakhstan, the ongoing initiatives, and the economic landscape, the following forecasts can be made regarding adopting AI in enterprises in Kazakhstan.

In a short-term perspective, graduates of the "Artificial Intelligence and Big Data" program will enter the Kazakhstani job market for the first time. The initial results, advantages, disadvantages, and opportunities will become evident. There will be an opportunity to adapt the educational program to match the demand in the Kazakhstani market.

In the medium term, in line with the President's directive, specialised AI information centres will emerge, attracting major companies like Amazon, Google, Mastercard, and City Group to Kazakhstan. This is expected to enhance Kazakhstan's investment appeal and contribute to improving the country's socio-economic conditions.

Finally, in a long-term perspective, the first graduates of the "Artificial Intelligence and Big Data" program will pursue master's and doctoral degrees in scientific and pedagogical fields. Consequently, a scientific foundation for AI studies in Kazakhstan will be established. This will lead to domestic AI research and dissertation work development, laying the groundwork for future scientific progress. This is anticipated to increase the number of major economic and IT hubs, strengthen confidence in them, and positively impact the country's sustainable development.

Thus, AI can become an integral part of Kazakhstan's innovation management ecosystem, transforming individual enterprises and entire industries. AI can be used for predictive innovation management, enabling companies to anticipate trends and dynamically adjust their strategies. Moreover, Kazakhstan has the potential to become a regional leader in AI-driven innovation, with technology hubs and startup ecosystems attracting international collaboration.

Conclusion

The article examines the implementation of artificial intelligence in the innovation management of Kazakhstani organisations using an evolutionary approach. AI adoption is an adaptation process influenced by various factors to forecast its potential applications in innovation management.

Pricewaterhouse Coopers estimates that by 2030, the contribution of artificial intelligence technologies to global gross domestic product (GDP) will be $15.7 trillion, which is more than the combined GDP of China and India at the current time (Murmu, 2024).

In July 2017, China proposed the "Development Plan for a New Generation of Artificial Intelligence", which stated that China's AI competitiveness should reach the highest level in the world by 2030 and proposed to accelerate the development of leading AI enterprises. In 2018, the US established a special committee on artificial intelli-

gence, which certainly contributed to the rapid development of artificial intelligence. However, the empirical analysis of the impact of AI on innovation management has not been fully conducted, and the question of when, how, and to what extent innovation managers and AI systems can and should work together has not yet been fully explored. Most publications only discuss the positive and negative aspects of AI development from a macroeconomic perspective.

Since the objective of this research is to assess where and how AI is used alongside human activities in the innovation process, the following conclusion can be drawn:

Developing and launching innovations in the market is a complex process that requires highly specialised teamwork. Integrating AI technologies into innovation management is a distinct and more intricate process compared to the ongoing digital transformation of traditional management.

However, empirical analysis of AI's impact on innovation management remains incomplete. Questions such as when, how, and to what extent innovation managers and AI systems should collaborate are yet to be fully explored. Many publications focus primarily on AI development's macroeconomic advantages and disadvantages.

AI enables organisations to restructure their operational and management processes, identify the necessity for innovation, and optimise conditions for modernising the value creation chain.

Many successful organisations have integrated AI into their operations and developed unique business models. Business model innovation is a transformation in the value creation chain that significantly shifts an organisation's value proposition. Companies that successfully implement AI in their business models and operations can rapidly develop revolutionary innovations.

AI-based platforms play a crucial role in fostering economic growth, improving people's lives, and addressing significant social challenges by developing innovative products and services that meet social needs.

In the innovation process, AI can replace specific human tasks. However, replicating managers' cognitive abilities, skills, and decision-making processes remains challenging. Therefore, a complete digital transformation of organisations may not always be necessary.

The study also analyses and evaluates foreign experience in AI adoption and assesses Kazakhstan's current position and opportunities. Based on this analysis, short-, medium-, and long-term forecasts were developed.

In conclusion, AI offers splendid opportunities today. With its assistance, tasks previously exclusive to humans can now be performed quickly and efficiently using various accessible programs. AI tools and technologies are particularly crucial for projects requiring extensive data collection and processing as well as management and decision-making processes. For example, industries such as banking and financial services, manufacturing, retail, and healthcare have a high demand for AI applications.

In the future, AI could be used in Kazakhstan for predictive innovation management, allowing companies to forecast trends and dynamically adjust their strategies. Ultimately, AI has the potential to solve technical challenges effectively, making life significantly easier.

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