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AI AS THE BACKBONE OF INNOVATION IN BANKING SECTOR

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Summary. *This article examines the transformative impact of artificial intelligence on the modern banking sector, emphasizing its expanding role across customer services, risk management, lending, operational workflows, and regulatory compliance. The findings show that AI enhances personalization, strengthens fraud detection, improves decision accuracy, and accelerates internal processes, thereby reshaping banks into more efficient and customer-centric institutions. The study also highlights emerging trends such as predictive banking, autonomous digital branches, blockchain-AI convergence, and the evolution of open banking ecosystems. Despite these opportunities, significant challenges remain, including data privacy risks, algorithmic bias, legacy system constraints, regulatory ambiguity, and concerns surrounding transparency and public trust. Furthermore, the analysis underscores the growing importance of human capital, particularly the need for AI literacy, data governance expertise, and ethical oversight. The article concludes that the future of AI in banking will depend on harmonizing technological advancements with responsible governance, ensuring that innovation aligns with regulatory expectations and societal values while supporting a more resilient, inclusive, and adaptive financial system.*

Key words: *Artificial intelligence, Digital transformation, Banking, Finance, Risk management*

Introduction: The rapid digitalization of the financial sector has fundamentally reshaped how banking services are designed, delivered, and governed. As traditional, branch-centered models give way to mobile platforms, automated processes, and real-time data ecosystems, artificial intelligence (AI) has become a central driver of this transformation. The growing scale, complexity, and speed of financial transactions make AI not merely an optional enhancement but a strategic necessity for improving accuracy, security, and efficiency.

Relevance of the topic. The relevance of studying AI in the banking sector stems from its accelerating adoption worldwide and its profound impact on risk assessment, operational workflows, customer interaction, and regulatory compliance. As banks increasingly shift toward algorithmic decision-making and predictive systems, understanding the opportunities and challenges associated with AI becomes essential for ensuring responsible and sustainable financial development.

Purpose of the Research. The primary purpose of this research is to analyze the prospects of using artificial intelligence in the banking sector, assessing how AI enhances performance, strengthens risk management, expands financial inclusion, and transforms strategic decision-making. The study also aims to identify the constraints and ethical risks that accompany large-scale AI deployment.

Research object. The object of the study is the process of integrating artificial intelligence technologies into modern banking systems, including customer service, credit evaluation, operational management, and regulatory frameworks.

Research methods. The research relies on comparative analysis, systematic review of academic and industry literature, and logical-conceptual evaluation of current AI applications in banking. Descriptive and analytical methods are used to examine technological trends, identify their implications, and determine the potential directions for future development.

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MATERIALS AND DISCUSSIONS

The banking sector plays a central role in every modern economy by ensuring the circulation of capital, facilitating payments, and allocating financial resources to households and businesses. A stable banking system strengthens economic growth, supports investment activity, and reduces market uncertainty. For this reason, global financial institutions increasingly prioritize digital transformation, seeing technology as a way to maintain efficiency, transparency, and competitiveness in a rapidly changing environment.

Banking has undergone a long and significant evolution—from physical branches relying on paper-based records to online portals, mobile applications, and now fully digital financial ecosystems. The shift accelerated after 2015 as customers increasingly demanded faster, remote, and highly personalized financial services. Today, the majority of routine interactions occur through digital channels, fundamentally reshaping operational structures and compelling banks to adopt data-driven tools and intelligent technologies. This transformation has also expanded the competency requirements within the sector, making skills such as AI literacy, data analysis, and algorithm management essential for employees who must operate effectively in technologically advanced banking environments.

Artificial intelligence stands at the core of this digital transformation. Machine learning and deep learning models help banks recognize patterns in large datasets, enabling more accurate credit scoring, fraud detection, and risk forecasting. Natural language processing supports chatbots, customer service platforms, and document analysis systems, allowing banks to reduce response times and improve the quality of client interactions. Robotic process automation handles repetitive tasks—such as form processing or account updates—reducing manual workload and operational errors. Predictive analytics allows banks to anticipate customer needs, forecast loan defaults, and optimize liquidity management, while computer vision technologies are increasingly used for biometric authentication and identity verification in mobile banking.

As digital banking ecosystems expand, AI becomes the engine behind many of their core functions. The rapid rise of AI adoption is also reflected in global market projections. According to the chart “Generative AI in Banking and Finance Market Size 2023–2034” conducted by Precedence Research, the market is expected to grow from USD 947.49 million in 2023 to USD 21.82 billion by 2034—a more than twentyfold increase. This trend illustrates not only rising investment but also the deepening structural reliance of the financial sector on generative AI technologies. The steady year-by-year growth shown in the diagram suggests that banks are moving from experimental AI use cases toward full-scale integration, especially in automation, analytics, and customer-centric services.

Mobile banking applications rely on algorithmic recommendation systems, fraud analytics platforms operate on real-time ML models, and risk departments use AI tools to assess market volatility and borrower behavior. Similarly, anti–money laundering (AML) and Know Your Customer (KYC) processes are progressively automated through AI-driven anomaly detection and biometric identification, improving compliance accuracy and reducing false positives.

AI is integrated across multiple layers of the banking infrastructure. At the core banking level, algorithms are embedded into transaction monitoring systems, credit engines, and internal audit modules. On the customer-facing side, AI operates within mobile interfaces, digital onboarding tools, and customer databases. It also plays a growing role in regulatory reporting, where banks increasingly rely on automated data-extraction and validation systems to meet supervisory requirements. The effective integration of these technologies, however, depends on organizational readiness—especially in terms of digital skills, data governance, and staff training—highlighting once again that technological development must go hand in hand with human capacity-building. [15. p.18]

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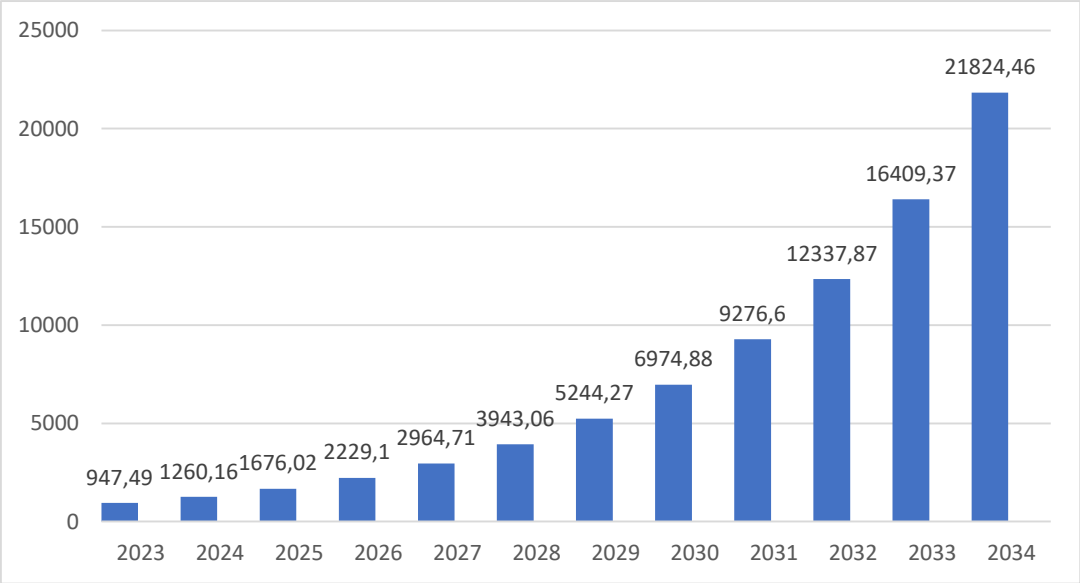
Figure 1.
Generative AI in Banking and Finance, estimated market size (2023 – 2034), USD million



Source: Precedence Research

The growing integration of AI into banking has moved from exploratory experimentation to concrete, large-scale applications that shape everyday financial interactions. Building on the broader technological foundations discussed in the previous section, banks now employ AI not as an add-on but as a central component of service delivery, risk controls, and operational management.

A visible transformation occurs in customer service, where virtual assistants handle routine inquiries, guide users through mobile interfaces, and provide basic financial suggestions. The deployment of "Erica" by Bank of America illustrates how advanced NLP systems can support millions of customers by helping them track spending, schedule payments, or receive alerts about unusual activity. [1, p.55] Although these tools do not replace human expertise, they reduce waiting times and free staff to focus on complex cases. This shift also aligns with the broader trend of using AI-driven personalization in banking apps, where recommendation engines offer tailored budget insights or saving strategies based on real-time behavior patterns. Yet the growing reliance on automated advisors raises questions about transparency in algorithmic decision-making, especially when customers may not understand how suggestions are generated.

AI is equally reshaping risk management processes. Real-time transaction monitoring powered by machine learning models helps institutions detect unusual behavior that may indicate fraud. A global analysis shows that ML-based fraud systems reduce false positives by up to 50%, enabling smoother customer experience while strengthening security [10. p.19]. Identity verification and AML analytics have also become more sophisticated, combining biometric authentication with anomaly-detection algorithms that screen transactions against regulatory lists. These systems, however, require continuous retraining because criminals quickly adapt to detection patterns, demonstrating that AI-driven security must evolve dynamically rather than rely on static rule-based systems.

Another major application lies in credit scoring and loan processing. Instead of relying solely on traditional financial histories, banks increasingly incorporate alternative data—such as spending consistency, digital footprints, and transactional behavior—to assess creditworthiness. Real-world evidence supports this shift. A World Bank Group report shows that alternative-data-driven credit models can reduce underwriting and loan processing time by 50–70%, significantly accelerating credit decisions for both retail and SME borrowers. [9] Faster approvals benefit both lenders and clients, yet the expanding use of non-traditional data raises concerns about fairness, transparency, and the

possibility of embedding biases into predictive models. This tension underscores the importance of strong ethical data governance as banks continue to scale AI-supported credit systems.

Operational efficiency has also improved through automation of back-office processes. RPA tools now perform document sorting, compliance checks, and internal reporting tasks that previously required significant human labor. A well-documented industry survey shows that financial institutions adopting intelligent automation achieved 20–25% reductions in operational costs, particularly in reconciliation, documentation, and claims processing activities.[5] Predictive maintenance systems further strengthen internal operations by identifying potential IT failures before they occur, helping banks avoid costly service interruptions. While these gains enhance resilience, they also demand new technical competencies from employees who must work collaboratively with automated systems.

In investment and wealth management, AI has enabled the rise of robo-advisors and data-driven trading strategies. These platforms allocate portfolios, rebalance investments, and conduct risk profiling through automated algorithms that operate continuously and with high precision. Research shows that the adoption of robo-advisory services has grown steadily in recent years, driven by lower fees, improved accessibility, and rising trust in algorithmic forecasting. [8. p.4] At the same time, hedge funds increasingly rely on AI-supported models to identify market patterns and execute trades far faster than human traders. Yet the growing prevalence of algorithmic trading introduces systemic vulnerabilities, particularly when many models respond simultaneously to market movements and amplify volatility. These dynamics highlight the need for stronger oversight and robust risk controls to ensure the stability of automated financial markets. Collectively, these developments show how financial institutions are blending automation with human judgement to achieve more adaptive and efficient wealth management practices.

As AI applications become more deeply embedded in banking operations, the sector begins to experience a set of strategic advantages that extend beyond simple automation. A key benefit lies in the growing ability to personalize financial services. Banks increasingly use behavioral analytics to design tailored recommendations, adjust spending alerts, or propose individualized credit products. Evidence shows that institutions using advanced analytics report significant improvements in customer satisfaction and loyalty, largely because clients perceive these services as more relevant to their financial goals. This personalization is not merely a marketing strategy; it reflects a shift toward customer-centric banking, where data-driven insights replace broad, undifferentiated product offerings.

Efficiency gains represent another major opportunity. By integrating AI into internal workflows, banks reduce processing times, streamline document handling, and minimize manual verification tasks. These improvements are particularly visible in high-volume areas such as reconciliation, claims handling, and routine compliance checks, where automation significantly lowers the operational burden. Although such changes may appear purely technical, their strategic implications are substantial: by reducing dependence on manual labor, banks are able to reallocate staff to higher-value activities such as financial advising, product design, and analytical oversight. This not only enhances institutional productivity but also strengthens the competitive position of banks operating in increasingly digital and customer-centric markets.

Security also benefits from AI integration. Fraud detection systems analyze patterns across millions of transactions, identifying anomalies within seconds. Industry analysis indicates that behavioral biometrics and ML-driven monitoring can prevent up to 40% of previously undetected fraud attempts [7]. Although these systems create a more resilient security environment, their effectiveness depends on constant updating, as fraudsters quickly adapt to new detection mechanisms—highlighting the ongoing need for iterative learning models rather than static security tools.

Decision-making processes have likewise been improved. AI-based analytics now support credit scoring, portfolio assessment, and risk forecasting by drawing on richer data sources and complex patterns that traditional models cannot detect. Evidence from global practice shows that machine-learning-driven credit evaluation improves predictive accuracy and enables lenders to distinguish more

effectively between high- and low-risk borrowers, helping reduce default rates while increasing approval accuracy for eligible applicants. [9] Still, these benefits must be balanced against the risks of overreliance on opaque algorithms, which can obscure the rationale behind financial decisions if explainability mechanisms and proper validation procedures are not implemented.

Finally, AI offers meaningful opportunities for financial inclusion. Scoring algorithms that incorporate nontraditional data—such as payment habits, financial behavior, or even mobile usage—allow lenders to evaluate individuals without formal credit histories. The World Bank's Global Findex Database 2021 highlights that AI-based underwriting has helped expand access to credit in several emerging markets by offering alternative pathways to evaluate risk [14. p.63]. While promising, these systems must be carefully audited to prevent reinforcing socioeconomic biases under the guise of technological neutrality.

All these benefits suggest that AI is not only making banking more efficient and secure, but also broadening access and enabling more precise financial decisions. However, the same technological foundations that create these opportunities also generate complex challenges, which the next section explores.

Despite its transformative potential, AI in banking introduces a series of structural, ethical, and regulatory challenges such as algorithmic bias, legacy system, regulatory ambiguity, ethical concerns and public trust, etc. that complicate large-scale adoption.

Table 1.

Challenges that are seen while using AI in Banking sector

Challenges	**Their impacts**
Data privacy	AI models rely on vast amounts of customer information, but increasing data dependence heightens vulnerabilities to breaches.
Algorithmic bias	When training datasets reflect historical inequalities, AI-based scoring and risk assessments may unintentionally replicate discriminatory outcomes
Legacy system	Legacy system integration poses substantial operational barriers. Many banks still rely on decades-old core infrastructure that lacks the flexibility required for seamless AI deployment.
Regulatory ambiguity	Without clear rules on liability, explainability, and consumer rights, banks risk facing legal disputes over algorithm-driven decisions
Ethical concerns and public trust	Customers may distrust systems that make opaque decisions, particularly when outcomes relate to sensitive areas such as loan approval or fraud investigation.

Source: Made by the author as a result of the research

Looking ahead, the role of artificial intelligence in banking is expected to deepen as institutions move beyond basic automation toward systems capable of anticipating customer needs and coordinating decisions across interconnected financial platforms. One of the most significant developments is the expansion of hyper-personalized banking. With the rise of real-time behavioral analytics, institutions now experiment with models that adjust financial recommendations dynamically, based on spending patterns, income flows, and contextual information. Research on digital personalization shows that real-time analytics can increase customer engagement substantially when embedded into mobile channels, mainly because clients perceive the interface as adaptive rather than static. These capabilities suggest that personalization will evolve from periodic product suggestions into continuous, data-driven financial guidance.

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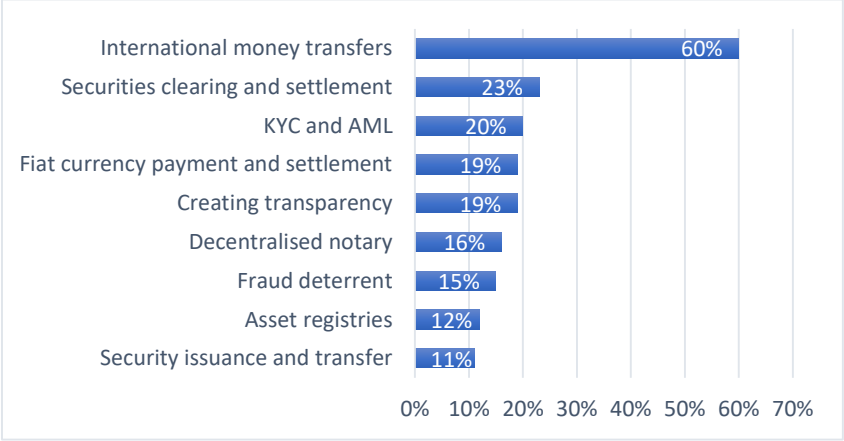
Another emerging frontier is the creation of fully autonomous digital branches. Banks are exploring combinations of biometric authentication, conversational AI, and predictive systems to deliver human-like service without physical staff. Case studies from Asia's leading digital banks indicate that such branches can handle onboarding, loan applications, and identity verification entirely through AI-driven modules. [10. p.22] these models reduce operational burdens, they also require robust safeguards to ensure that automation does not compromise service quality or accessibility for digitally inexperienced customers.

A related trend is the rise of predictive banking, where systems anticipate financial needs before customers explicitly express them. Experiments with predictive cash-flow models, for example, show that early warnings about potential liquidity gaps can significantly reduce missed payments for retail clients [13]. While these tools strengthen financial planning, they raise questions about how much foresight banks should exercise and whether predictive alerts risk shaping customer behavior too aggressively.

The convergence of AI and blockchain also holds considerable promise. Blockchain's immutability provides a secure foundation for transparent, tamper-resistant transaction records, while AI models can analyze these distributed datasets to detect anomalies, identify suspicious patterns, and streamline verification processes. Peer-reviewed research on emerging financial technologies notes that combining AI with blockchain can enable more intelligent smart-contract execution, automated compliance checks, and faster settlement procedures by integrating predictive analytics into decentralized systems [4. p.14]. Yet realizing these benefits requires the alignment of technological standards, interoperability protocols, and regulatory frameworks—areas that continue to evolve unevenly across jurisdictions. As a result, the full potential of AI-blockchain integration in banking depends not only on technical innovation but also on coordinated governance and oversight.

Figure 2.

Initial use cases of top banks for Blockchain



Source: EFMA and Deloitte

The preceding analysis demonstrates that artificial intelligence has transformative potential across key banking functions—fraud detection, risk management, compliance, customer service, and strategic decision-making. Blockchain technology can further enhance these applications by ensuring data integrity, transparency, and trust. However, the realization of this potential is constrained by structural, regulatory, financial, and ethical barriers. Addressing these challenges requires deliberate policy and strategic interventions that stimulate AI adoption across the sector. Regulatory clarity is a key mechanism for stimulating AI adoption: it lowers the perceived risk for institutions and encourages investment in AI systems that are both innovative and compliant. Combined with blockchain-enabled transparency, these frameworks can assure regulators and customers that AI decisions are auditable, fair, and secure.

In parallel, AI is transforming regulatory technology (RegTech). Modern compliance increasingly relies on automated monitoring systems capable of tracking transactions, flagging inconsistencies, and generating regulatory reports in real time. Evidence suggests that AI-driven compliance tools reduce both reporting errors and supervisory penalties when appropriately calibrated. [6. p.24] Nonetheless, these systems must remain transparent and auditable, as regulators continue to emphasize the accountability of automated decision-making.

Finally, the future banking landscape is expected to be heavily shaped by the expansion of open banking ecosystems. As APIs (Application Programming Interface) enable seamless data exchange between banks and fintech firms, AI becomes indispensable for aggregating, interpreting, and securing the rapidly increasing volume of financial information. Advanced analytics allow institutions to transform fragmented, multi-provider data into unified insights, offering customers clearer visibility over their accounts, spending patterns, and credit obligations. This capacity to consolidate information across platforms signals a broader transition toward interconnected financial environments in which collaboration on data infrastructure becomes more valuable than isolated competition. In such an ecosystem, banks that effectively leverage AI to manage shared data flows will be better positioned to deliver integrated, customer-centric services while maintaining robust security and governance standards.

Considering the given facts above, these developments signal that the future of AI in banking will be defined not only by new technological capabilities but also by the sector's ability to harmonize innovation with governance, transparency, and human-centered design. The next section will explore how the human element remains essential in this evolving landscape, despite increasing automation.

As banks deepen their use of artificial intelligence across operations, the human dimension of banking is undergoing a profound shift—one that transforms roles, skills, and oversight responsibilities. Having explored AI's applications and the opportunities and limits in previous sections, it now becomes essential to examine how human actors must adapt and re-position themselves in this evolving ecosystem.

First and foremost, the growing reliance on AI technologies in decisions and operations demands enhanced AI literacy, data science competency, and digital risk management skills from banking professionals. A recent McKinsey report emphasises that organisations must build "capabilities to interpret, validate and govern AI outputs" rather than simply deploy models [12]. In other words, the human workforce must move from being users of pre-packaged systems to becoming active collaborators in algorithm-driven processes. Without this, banks risk what the study calls "talent-capability gaps" that slow the scaling of AI solutions.

Parallel to this shift is the emergence of new roles within banking institutions. Data governance leaders, algorithmic risk managers, and AI auditors now appear alongside traditional credit analysts and branch managers. These roles reflect the growing need for structured oversight of complex AI systems—ensuring data integrity, fairness, transparency, and regulatory compliance. The importance of a "human-in-the-loop" auditing framework has been underscored in several authoritative studies. For instance, the Bank of England highlights that rigorous human validation is indispensable when AI systems influence high-stakes decisions, since human reviewers are uniquely positioned to assess model explainability, evaluate fairness, and intervene when algorithmic outputs diverge from institutional standards. [3. p.12] While some may view this as adding layers of bureaucracy, the counter-argument is clear: strong human oversight reduces the risk that AI decisions become opaque or uncontrollable.

Another dynamic is human–AI collaboration in which employees shift away from routine operational tasks to more analytical, supervisory, and strategic roles. Rather than replacing humans, AI takes over repetitive or high-volume workflows, allowing staff to focus on exception handling, judgment-based decisions, and relationship-driven work. A governance-oriented discussion by the Bank for International Settlements stressed that banks must "incorporate human judgment as part of the AI governance framework" and not delegate the full weight of decisions to machines. [2. p.6] This

collaborative model enables banks to harness AI's speed and scale while retaining the human insight critical for nuanced decision-making.

The importance of ethical oversight and human judgement remains paramount in an era of algorithmic support. The deployment of AI in banking does not eliminate the need for human values, fairness assessments, and accountability. In fact, as AI models become more complex, so too does the challenge of explaining their decisions and ensuring they align with institutional ethics and customer trust. A recent academic study of AI in financial services argues that "while AI excels in large-scale pattern recognition, it struggles with contexts requiring empathy, nuance, and moral judgement". [11. p.15] This underlines that humans remain indispensable—not simply as operators, but as ethicists, stewards and strategic decision-makers.

Conclusion. The analysis demonstrates that artificial intelligence is no longer an auxiliary tool but a core strategic asset shaping the future of banking. Its integration across customer service, risk analytics, compliance, lending, and investment management signals a transition toward data-driven, automated, and predictive financial ecosystems. The benefits—greater personalization, operational efficiency, improved security, and enhanced financial inclusion—highlight AI's capacity to transform both institutional performance and customer experience. At the same time, the challenges identified throughout the article, including algorithmic bias, cybersecurity vulnerabilities, legacy infrastructure, regulatory uncertainty, and ethical concerns, underscore that technological progress must be coupled with robust governance frameworks. Moreover, the evolving human dimension—marked by the rise of new AI-related roles and competencies—shows that human judgement remains essential in ensuring transparency and trust. Ultimately, sustainable AI deployment in banking will depend on balancing innovation with responsible oversight, aligning technological capabilities with institutional values, and investing in the digital skills needed to support a resilient, inclusive, and future-ready financial system.

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SÜNI INTELLEKT BANK SEKTORUNDA INNOVASIYANIN ƏSAS SÜTUNU KIMI

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Xülasə: *Məqalədə süni intellektin müasir bank sektoruna təsiri hərtərəfli təhlil edilir və onun müştəri xidməti, risklərin idarə edilməsi, kreditləşmə, əməliyyat prosesləri və tənzimləyici uyğunluq kimi əsas istiqamətlərdə genişlənən rolu vurğulanır. Tədqiqat göstərir ki, SI texnologiyaları xidmətlərin fərdiləşdirilməsini gücləndirir, fırıldaqçılığın aşkarlanmasını dəqiqləşdirir, qərarların doğruluğunu artırır və daxili prosesləri sürətləndirərək bankları daha çevik və müştəriyönümlü sistemlərə çevirir. Eyni zamanda, prediktiv bankçılıq, tam avtomatlaşdırılmış rəqəmsal filiallar, blokçeyn–SI inteqrasiyası və açıq bankçılıq ekosistemlərinin genişlənməsi kimi gələcək tendensiyalar da araşdırılır. Bununla yanaşı, məlumat məxfiliyi riskləri, alqoritmik qərəz, köhnəlmiş infrastruktur, normativ qeyri-müəyyənlik və şəffaflıqla bağlı narahatlıqlar kimi problemlər də qeyd edilir. İnsan kapitalının artan əhəmiyyəti — SI savadlılığı, məlumat idarəetməsi və etik nəzarət bacarıqlarının vacibliyi xüsusi vurğulanır. Nəticə olaraq, bank sektorunda SI-nin davamlı tətbiqi yalnız innovasiyanın məsuliyyətli idarəçiliklə uzlaşdırılması və texnoloji inkişafın sosial dəyərlərlə uyğunlaşdırılması sayəsində mümkün ola bilər.*

Açar sözlər: *Süni intellekt, Rəqəmsal transformasiya, Bankçılıq, Maliyyə, Risklərin idarə edilməsi*

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ИИ КАК ОСНОВА ИННОВАЦИЙ В БАНКОВСКОМ СЕКТОРЕ

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Резюме. *В статье анализируется трансформационное влияние искусственного интеллекта на современный банковский сектор и его расширяющуюся роль в обслуживании клиентов, управлении рисками, кредитовании, внутренних операциях и регуляторном контроле. Показано, что ИИ способствует персонализации услуг, повышает точность выявления мошенничества, улучшает качество решений и ускоряет операционные процессы, формируя более эффективную и ориентированную на клиента банковскую систему. Рассматриваются перспективные направления развития, включая предиктивный банкинг, полностью автономные цифровые отделения, интеграцию ИИ и блокчейна, а также расширение экосистем открытого банкинга. Наряду с преимуществами выделяются и серьезные вызовы: риски конфиденциальности данных, алгоритмическая предвзятость, устаревшая инфраструктура, нормативная неопределенность и вопросы прозрачности. Особое внимание уделяется человеческому фактору — необходимости развития цифровых навыков, компетенций в области управления данными и этического надзора. Делается вывод, что устойчивое внедрение ИИ в банковской сфере возможно лишь при сочетании технологических инноваций с ответственным управлением и соблюдением общественных ценностей.*

Ключевые слова: *Искусственный интеллект, Цифровая трансформация, Банковское дело, Финансы, Управление рисками*

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