



Evaluating Generative AI in enhancing banking services efficiency

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Abstract. This paper aimed to evaluate the transformative role of Generative Artificial Intelligence in improving banking services efficiency through a systematic literature review. The review explored, how Generative Artificial Intelligence reshaped traditional banking practices by automating routine tasks, decision-making, and enhancing personalised customer experiences. The review also highlighted Generative Artificial Intelligences integration with advanced technologies such as blockchain and quantum computing, to achieve unprecedented levels of scalability, transparency, and operational excellence. The findings indicated the ability of Generative Artificial Intelligence to improve service quality through the automation of repetitive tasks such as loan applications and fraud detection, reducing operational costs, while optimising resource utilisation. AI-enabled chatbots and virtual advisors enhanced customer satisfaction by providing continuous service and personalised financial advice. The findings also validated the role of Generative Artificial Intelligence in preventing fraud through real-time anomaly detection and predictive analysis, reducing false positives and improving security scores. However, the findings identified major challenges such as algorithmic bias, risks from cyberattacks, and the opacity associated with “black-box” models, which complicate compliance and ethical governance. Regulatory frameworks and explainable AI models were identified as potential solutions to these problems. Additionally, employee upskilling was emphasised as essential for successfully adopting Generative Artificial Intelligence in banking. The review provided a holistic overview of the state of Generative Artificial Intelligence adoption in banking, the associated challenges, and future directions, enriching the academic discourse on enhancing innovation and sustainability within the banking sector

Keywords: banking automation; artificial intelligence solutions; regulatory compliance; fraud detection; financial technology

Introduction

Generative Artificial Intelligence (GenAI) is revolutionising the banking sector with astonishing prospects for increasing operational efficiency, improving customer experiences, and achieving higher levels of scalability. By employing emerging technologies, such as natural language processing, predictive analytics, and deep learning, GenAI is transforming, how financial institutions carry out crucial operations, including detecting and preventing fraud, engaging with customers on a personal level, and ensuring compliance with various regulations, such as the General Data Protection

Regulation (GDPR) and the Artificial Intelligence Act (Gellert, 2021). I. Botunac *et al.* (2024) emphasised that this novel approach enables banking institutions to enhance the way they carry out their business tasks, improve decision-making precision, and adapt to the dynamic and competitive environment. Previously, automation, self-service solutions, and information technology were the primary drivers of operational efficiency in the banking sector. Nevertheless, GenAI introduces improved flexibility through a wide range of tools for optimising workflows, reducing employee errors, and facilitating

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customer service. Z. Mohammadi & A. Bano (2024) highlighted that technologies, such as AI-driven chatbots and virtual advisors enable banks to promptly address customer queries at any time, significantly improving the customer experience. A notable example was the application of Robotic Process Automation (RPA) in conjunction with GenAI. With the proliferation of this technology, there is a growing tendency to employ it in completing monotonous tasks, such as loan application processing and account management. M.S. Thekethil *et al.* (2021) emphasised that the key advantage of these processes was their speed due to automation. Moreover, employees were freed from routine activities to focus on higher-level tasks requiring human decision-making. This shift enables financial companies to optimise resource allocation, fostering greater innovation and strategic decision-making at all organisational levels. Other studies further reinforce this perspective. For instance, K. Huang *et al.* (2023) underscored the role of GenAI in enhancing financial fraud detection through real-time transaction analysis and anomaly detection algorithms, significantly reducing fraud-related losses. This real-time capability allowed for immediate intervention to prevent fraudulent activities, minimising financial damage. Similarly, S. Kanungo (2020) examined the deployment of GenAI for dynamic credit risk assessments, highlighting how these models enable banks to develop more precise and adaptive lending strategies by analysing complex datasets. Such dynamic assessments facilitate more personalised loan offerings and better risk management across diverse economic conditions. Furthermore, N. Rane *et al.* (2024) explored the integration of GenAI in customer relationship management, noting how AI-driven sentiment analysis and personalisation enhance engagement and customer retention in a highly competitive market. This personalised approach fosters stronger customer relationships and increases customer lifetime value through targeted interactions. Despite its promising potential, the adoption of GenAI in banking presented several challenges. Key concerns include data privacy, ethical governance, and model transparency, particularly given the industry's stringent regulatory environment. Additionally, issues such as AI "hallucinations", where models produce inaccurate or illogical outputs, introduce significant risks to decision-making processes. G. Shabsigh & E.B. Boukherouaa (2023) highlighted that ensuring effective deployment requires not only robust data strategies, but also highly skilled talent and comprehensive frameworks to address potential biases and ensure regulatory compliance. These elements are crucial for balancing the benefits of innovation with the need for reliability and accountability in banking services. This study evaluated the role of GenAI in improving banking service efficiency by synthesising its benefits, challenges, and future directions, thereby contributing to discussions on its transformative impact on financial services. To assess the transformative impact

of GenAI in the banking sector, a systematic literature review was conducted. This review involved synthesising peer-reviewed articles, conference proceedings, and other academic contributions from reputable databases such as Scopus, Web of Science, and IEEE Xplore, focusing on studies published between 2015 and 2024. The methodology focused on identifying key trends, opportunities, and challenges within the adoption of GenAI in banking operations.

Generative Artificial Intelligence:

An overview

Generative Artificial Intelligence, or GenAI, is one of the most significant developments in the field of artificial intelligence, as it is capable of producing content – be it text, images, or even synthetic datasets. While traditional AI systems only evaluate and make sense of already available data, Generative AI systems create new and intrinsically relevant data. This change is effectively illustrated by referring to some of the primary structures, including Generative Adversarial Networks (GANs), Variational Autoencoders, and Large Language Models (LLMs), which sit at the core of modern Generative AI technology. For instance, in (GANs), two models are used: one model generates the output, while the other differentiates the generated images from real ones. Meanwhile, LLMs like GPT rely on transformer architectures to understand and replicate human-like language patterns, making them indispensable in fields such as natural language processing and data augmentation (Lee *et al.*, 2024). GenAI has transformed the financial and banking sectors by introducing various innovations in key areas such as risk management, fraud prevention, and automated customer service operations (Fig. 1).

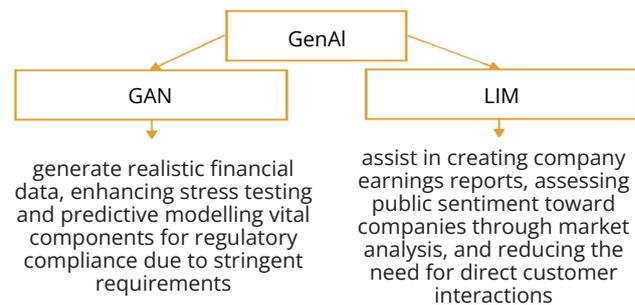


Figure 1. Key innovations in the financial and banking sectors

Source: developed by the author

These examples demonstrated that GenAI not only improves the efficiency of financial operations, but also enhances the quality of information-dependent processes by providing timely updates, which are crucial in the fast-paced nature of the industry (Kshetri, 2024). Integrating GenAI solutions into the financial industry is more complex than it might seem. This process involves working with sensitive financial data, which is subject to

specific regulatory controls. As a result, it can be challenging for generative models to fully understand the nuances of such data. Moreover, implementing these applications requires powerful computers and high-quality, task-specific training models, both of which are often costly and time-consuming to develop. In addition to these technical challenges, the adoption of GenAI in financial services faces issues such as algorithmic bias, data privacy concerns, and the risk of non-compliance with regulations. These challenges highlighted the need for effective governance frameworks to clarify the operationalisation of AI models in sensitive industries (Patil *et al.*, 2024). Critical ethical and regulatory factors influence the implementation of GenAI. For instance, even though synthetic data generation offers a solution for protecting the privacy of sensitive data by anonymising information, it raises concerns about the reliability and authenticity of the data provided. The European Union's General Data Protection Regulation (GDPR) and the soon-to-be-enacted AI Act impose stringent requirements on AI systems and their users, demanding the embedding of ethical principles in organisations' approved AI workflows (Gellert, 2021). To overcome these issues, it is important to involve regulatory bodies, designers of AI systems, and other stakeholders in the industry (Ishii, 2019). Looking ahead, the potential of GenAI in finance and other sectors is expected to surpass current expectations. Recent advancements in training methods, particularly Low-Rank Adaptation (LoRA), have enhanced the fine-tuning of AI models, making AI technology more cost-effective and applicable for specific purposes across various sectors of the economy. Additionally, GenAI is anticipated to integrate with other technologies such as blockchain and quantum computing, enabling the development of even better applications that are more secure and scalable. For instance, while it might seem contradictory, blockchain technology can enhance the transparency of AI outputs and inputs by providing clear and verifiable records of data transactions, addressing the limitations posed by cloud storage (Ren *et al.*, 2024). Conversely, it is presumed that quantum computers will elevate AI capabilities by reducing the time required for model training and advancing sophisticated areas such as motion prediction. However, with the emergence of such technological advancements, it is imperative to understand that change management must be exercised to foster innovation while adhering to regulatory principles. This necessity emphasised that policymakers must invest not only in policy frameworks, but also in the energy and resources required to ensure that AI growth occurs safely and responsibly.

Efficiency in banking services remains a critical concern due to its direct impact on financial stability, customer satisfaction, and economic growth. Banks strive to achieve the best output with the least input by optimising production processes, reducing costs, and enhancing service standards. Key features of effective banking

services include faster transaction processing, lower costs, and improved accuracy in service delivery. Research has demonstrated that the banking sector becomes more efficient after undergoing digital transformation. This improvement is attributed to the automation of work processes, online transaction processing, and service delivery based on big data (Gherțescu *et al.*, 2024). The integration of technology, particularly artificial intelligence (AI) and digital solutions, has revolutionised efficiency in banking. AI-driven tools facilitate risk assessment, fraud detection, and decision-making processes, significantly reducing manual intervention and error rates. Additionally, digital platforms and automation have streamlined routine banking tasks, enabling faster transaction processing and enhancing customer interactions. For instance, a study by R. Sharma *et al.* (2024) highlighted that AI-powered fraud detection systems reduced false positives by 30%, allowing banks to allocate resources more effectively. Such advancements not only save costs, but also foster customer trust and loyalty through more reliable, responsive service delivery. In addition, regulatory compliance and risk management play a pivotal role in improving efficiency in the banking sector. The banking sector operates in a highly regulated environment, making it essential to embrace compliance-focused technologies. RegTech is an example of such technology, which simplifies compliance processes by automating reporting, monitoring, and auditing activities, requiring minimal time and resources. According to E. Johansson *et al.* (2019), banks that adopted RegTech solutions reduced their compliance costs by 15% compared to their overall operational costs, while also improving their operational resilience. This demonstrates a clear connection between adherence to regulations and enhanced operational efficiency.

GenAI applications in banking.

Customer service and personalisation

GenAI is fundamentally changing, how the banking sector leverages customer service to combine efficiency with an increasingly personal touch. By employing cutting-edge technologies such as large language models, banks are redefining customer interactions, replacing traditional experiences with seamless, intuitive, and tailored alternatives. These innovations are not merely operational improvements; they represent a paradigm shift towards customer-focused banking. In customer service, GenAI enhances traditional support channels such as call centres and virtual assistants. For example, AI-powered chatbots handle routine tasks, including balance inquiries and transaction histories, with exceptional speed and accuracy (Kasaraneni, 2022). This allows human representatives to address complex or sensitive issues, creating a more balanced and effective customer service model. A notable example is Bank of America's virtual assistant, Erica, which has facilitated millions of interactions by providing budgeting advice, payment

tracking, and tailored financial guidance. Its conversational style ensures users feel supported rather than managed by a machine (Kochhar *et al.*, 2019). GenAI also drives personalisation, a cornerstone of modern banking. By analysing customers' financial histories and behaviours, AI systems recommend customised investment opportunities or loan packages. For instance, Citibank employs AI to deliver personalised financial advice through its digital platforms, aligning products with individual customer goals. This level of personalisation not only enhances satisfaction, but also built trust and loyalty, critical components of long-term banking relationships (Kaluarachchi & Sedera, 2024). Although GenAI holds great potential, its integration must address key issues, such as data security, regulatory compliance, and fairness in algorithms. By ensuring robust oversight and adhering to ethical guidelines, these technologies can effectively merge operational efficiency with genuine customer care, helping banks adapt to changing expectations in a competitive financial environment.

Advanced GenAI technologies are transforming fraud detection and risk management in the banking sector. Unlike traditional methods that rely on static rules or fixed patterns, these systems adapt dynamically to evolving threats. By analysing extensive datasets of transactions and user behaviours, they provide deeper insights into activities, enabling the detection of complex fraud schemes and significantly reducing false positives. This adaptive approach enhances security and operational efficiency, allowing financial institutions to better anticipate and mitigate risks in an increasingly complex threat landscape (Ali & Aysan, 2024). GenAI excels at real-time pattern recognition, identifying irregular behaviours such as sudden changes in spending patterns or unusual transaction locations that may signal fraudulent activity. For example, systems implemented by major banks can detect high-value purchases in unfamiliar regions, prompting immediate scrutiny. Furthermore, GenAI generates synthetic datasets to simulate potential fraud scenarios, enabling proactive identification of new threats before they emerge. This proactive approach strengthens defences against sophisticated schemes such as phishing and account takeovers. HSBC's AI implementation exemplifies this, enhancing detection accuracy while reducing false positives, thereby ensuring operational efficiency and customer trust. By adapting to evolving fraud tactics, GenAI bolsters fraud detection, mitigates cyber threats, and ensures seamless banking operations while maintaining high service quality (Barde & Kulkarni, 2023). GenAI significantly enhances risk management in banking through advanced predictive modelling. By analysing extensive datasets, these technologies enable institutions to simulate economic scenarios and assess their impacts on credit risk and market exposure. For instance, Citibank employs AI-driven stress testing to model adverse conditions, such as economic downturns, providing detailed insights into borrower

behaviours and financial vulnerabilities. These simulations facilitate more precise credit risk assessments and inform decisions on loan approvals and investment strategies. Additionally, GenAI's ability to continuously refine models based on new data ensures a proactive approach to risk mitigation, enabling banks to adapt swiftly to changing economic landscapes while optimising their financial operations (Hossain, 2024).

In the banking sector, GenAI was increasingly used to enhance regulatory reporting and improve compliance in terms of accuracy, efficiency, and transparency. This technology addresses long-standing issues in the sector by automating complex procedures, such as evaluating comprehensive regulatory frameworks and generating compliant reports from both structured and unstructured data. GenAI was widely used to automate regulatory filing preparation, including Know Your Customer (KYC) and AntiMoney Laundering (AML) procedures. By analysing transaction data, identifying irregularities, and creating thorough reports for regulators, these technologies reduce manual labour and ensure timely submissions. For example, AI-driven technologies assist banks in documenting decision-making processes and enhancing transparency in AI outputs, while ensuring streamlined compliance with the General Data Protection Regulation (GDPR) and Digital Operational Resilience Act (DORA) standards (Botunac *et al.*, 2024). Real-time monitoring and risk assessment in compliance are greatly improved by GenAI's ability to analyse legal texts, recognise regulatory updates, and suggest modifications. However, its complexity introduces challenges such as the "black box" issue, where AI decisions lack transparency. Explainable AI (XAI) approaches are being developed to improve stakeholder trust and accountability by providing clearer insights into AI-driven outcomes (AlJaloudi *et al.*, 2024). These approaches aimed to enhance transparency and build trust in AI-generated decisions.

Challenges and limitations of GenAI in the banking sector

GenAI systems can produce opaque and unpredictable results, making compliance with stringent banking standards difficult. The "black-box" nature of these models poses significant challenges to auditing and accountability, especially in high-risk applications such as loan approvals or fraud detection. Ethical considerations, including bias in data, can lead to discriminatory practices and reputational damage for financial firms. For instance, AI-driven credit scoring systems may inadvertently perpetuate historical inequalities, necessitating stricter governance frameworks to monitor fairness (Botunac *et al.*, 2024). Banking systems face increasing cybersecurity threats as a result of their growing reliance on GenAI. The threat of adversarial attacks, in which malicious actors manipulate inputs to produce harmful outcomes, is growing. Furthermore, GenAI could be exploited to automatically create malware or phishing

scams that are highly convincing, putting consumers and financial institutions at greater risk. Adherence to industry best practices for AI implementation and the development of strong cybersecurity architecture are necessary to build resilience against these threats (Dhoni & Kumar, 2023). GenAI's ability to mimic human-like reasoning and dialogue is often limited by its reliance on historical data. In banking, where real-time adaptability and precision are critical, errors or oversights in model outputs can lead to significant operational risks. For instance, inaccurate responses in automated customer service systems or incorrect transaction flagging in fraud detection may disrupt operations and erode customer trust (Dhake *et al.*, 2024). Specialised knowledge is needed to adopt GenAI, yet many financial organisations lack sufficient expertise for AI-related positions. Developing cross-functional teams, recruiting AI experts, and upskilling current staff remain ongoing challenges in integrating AI into current workflows. Furthermore, employees frequently express concerns about job displacement, when AI capabilities are introduced, highlighting the necessity of workforce inclusion measures, training, and clear communication (Walkowiak & MacDonald, 2023). Hallucinations, which occur, when GenAI produces factually incorrect or fabricated outputs, represent specific concerns in banking. For instance, hallucinated outputs in customer service could convey false information about financial products, undermining trust. Similarly, hallucinated regulatory interpretations might lead to compliance issues. These results are due to GenAI's probabilistic nature and limitations in its training data. Mitigating hallucinations requires thorough validation of AI-generated responses, incorporating human oversight, and developing model designs that prioritise factual correctness (Sahoo & Dutta, 2024).

This review highlighted the transformative impact of GenAI on the banking sector, particularly in driving operational efficiency, improving customer engagement, enhancing fraud detection mechanisms, and streamlining regulatory compliance. While the review identified numerous opportunities presented by GenAI, it also brought attention to critical challenges and limitations, emphasising the need for a balanced approach that aligns technological advancements with ethical and regulatory considerations. The findings confirmed that GenAI significantly improves operational efficiency by automating routine tasks, enabling banks to reallocate human resources to higher-value, strategic roles. Tools such as Robotic Process Automation (RPA) and AI-driven chatbots demonstrated tangible benefits in areas such as loan application processing, account management, and customer service. For instance, the integration of virtual assistants like Bank of America's "Erica" demonstrated, how AI can deliver personalised financial guidance while maintaining responsiveness at scale. However, the scalability of these solutions across diverse banking systems, particularly in underdeveloped or dig-

itally immature markets, remains uncertain. Addressing these challenges requires future research to evaluate the adaptability and cost-effectiveness of GenAI in heterogeneous banking environments.

GenAI has demonstrated superior fraud detection and risk management capabilities by leveraging real-time data analytics, pattern recognition, and synthetic data generation to combat sophisticated financial crimes. By simulating complex fraud scenarios, GenAI facilitated proactive threat identification and enables financial institutions to adapt to evolving cyber risks. However, the susceptibility of GenAI models to adversarial attacks and algorithmic bias raises questions about their reliability. Although AI has reduced cases of "false positives" in fraud detection, they still highlight the necessity for model refinement. Enhanced transparency through Explainable AI (XAI) frameworks and robust governance mechanisms will be crucial in addressing these concerns. Furthermore, collaboration between cybersecurity experts and financial regulators can mitigate risks associated with adversarial manipulation.

The ethical and regulatory implications of GenAI adoption are among the most pressing issues identified in the review. While GenAI has simplified compliance processes through automated reporting and real-time monitoring, its "black-box" nature has complicated auditability and decision transparency. This opacity is particularly concerning in high-stakes applications, such as loan approvals or credit risk assessments, where biases in AI outputs might perpetuate systemic inequalities. Additionally, hallucinations – instances, where GenAI generated incorrect or misleading outputs – pose risks to customer trust and regulatory compliance. To overcome these challenges, banks must integrate ethical guidelines into AI deployment strategies and adopt regulatory technologies (RegTech) that enhance accountability, while fostering innovation.

The adoption of GenAI introduced significant implications for the workforce, as automation reshapes traditional roles within financial institutions. While reducing the burden of repetitive tasks, GenAI necessitates a shift in workforce capabilities, requiring upskilling and cross-disciplinary expertise in AI operations. The review highlighted that fears of job displacement might create resistance among employees, necessitating transparent communication strategies and inclusive workforce development programs. By fostering a culture of collaboration between human expertise and AI systems, financial institutions can ensure a smoother transition to technology-driven workflows.

Conclusions

GenAI is transforming the banking sector, powering operational efficiencies, elevating customer experiences, and catalysing innovation. This review has underscored GenAI's transformative impact on automating routine tasks, enhancing fraud detection, and ensuring

regulatory compliance. From tailored financial solutions to predictive analytics, artificial intelligence applications offer banks assistance with efficient workflows, cost optimisation, and the ability to build trust and customer loyalty through tailored services. While GenAI holds transformative potential, incorporating it into banking operations faces several challenges. Data privacy considerations, algorithmic bias, and the black-box nature of models remain significant obstacles to transparency and accountability. Furthermore, challenges, like AI hallucinations and cybersecurity threats pose operational risks, requiring extensive mitigation strategies. To overcome these challenges, banks must implement strong governance mechanisms, invest in competent talent, and comply with strict regulatory obligations. The future for GenAI in banking is promising, especially, when coupled with next-generation technologies such as blockchain and quantum computing. Blockchain can enhance data transparency and traceability, while quantum computing may accelerate AI model training and expand applications. However, there needs to be a fine balance between innovative strategies and ethical and

regulatory practices to fully realise these benefits. Ultimately, GenAI was a disruptor to traditional banking and presents an opportunity for great transformation as banks strive for better efficiency and innovation. By tackling its inherent challenges through an interdisciplinary approach and disciplined implementation, financial institutions can fully realise GenAI's potential, fostering secure, efficient, and customer-focused operations. Ensuring the sustainability of these efforts in such a rapidly evolving landscape will require future research focused on model interpretability, risk mitigation, and integration with synergistic technologies. Future research should also explore the integration of GenAI with other emerging technologies, assess its long-term impact on financial stability, and address the regulatory challenges surrounding its widespread adoption.

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Conflict of Interest

None.

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Оцінка генеративного ШІ у підвищенні ефективності банківських послуг

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Анотація. У цій статті було оцінено трансформаційну роль генеративного штучного інтелекту у підвищенні ефективності банківських послуг шляхом систематичного огляду літератури. У дослідженні було розглянуто, як генеративний штучний інтелект змінив традиційні банківські практики, автоматизуючи рутинні завдання, процеси прийняття рішень та покращуючи персоналізований клієнтський досвід. Також було висвітлено інтеграцію генеративного штучного інтелекту з передовими технологіями, такими як блокчейн та квантові обчислення, для досягнення безпрецедентного рівня масштабованості, прозорості та операційної досконалості. Результати дослідження продемонстрували здатність генеративного штучного інтелекту покращувати якість послуг через автоматизацію повторюваних завдань, таких як обробка заявок на кредити та виявлення шахрайства, що знижує операційні витрати та оптимізує використання ресурсів. Чат-боти та віртуальні радники, що працюють на базі штучного інтелекту, підвищують задоволеність клієнтів, надаючи цілодобовий сервіс та персоналізовані фінансові поради. Результати також підтвердили роль генеративного штучного інтелекту у запобіганні шахрайству через виявлення аномалій у реальному часі та проведення прогностичного аналізу, що зменшує кількість хибно позитивних результатів і покращує показники безпеки. Однак, було виявлено ключові виклики, зокрема алгоритмічну упередженість, ризики кібератак та непрозорість, пов'язану з моделями «чорного ящика», що ускладнює забезпечення відповідності нормативним вимогам, та етичне управління. Регуляторні рамки та моделі пояснюваного штучного інтелекту визначені як потенційні рішення цих проблем. Крім того, наголошено на важливості підвищення кваліфікації працівників для успішного впровадження генеративного штучного інтелекту у банківській сфері. Огляд надав цілісну картину стану впровадження генеративного штучного інтелекту в банківській сфері, пов'язаних викликів і перспектив, доповнюючи академічний дискурс щодо підвищення рівня інноваційності та сталого розвитку банківського сектору

Ключові слова: автоматизація банківських послуг; рішення штучного інтелекту; нормативна відповідність; виявлення шахрайства; фінансові технології