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Research Article

The Impact of Using Artificial Intelligence in the Financial and Banking Sector

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Abstract: The accelerated use of Artificial Intelligence (AI) is changing the financial services industry and the banking sector in terms of improving the efficiency of their operations, customer experience, risk management and the effectiveness of strategic decision-making. The proposed researc examines the profound influence of artificial intelligence (AI) on the financial sector, analyzing its many effects on operations, risk management and client experiences. By examining the incorporation of machine learning algorithms, natural language processing and robotic process automation, the substantial improvements in efficiency and reductions in costs that Artificial Intelligence (AI) provides to financial institutions was revealed. Moreover, the study explores the consequences of Artificial Intelligence (AI) in improving fraud detection procedures and reducing operational risks, thereby strengthening the sector's ability to withstand challenges. Nevertheless, the study also acknowledges the risks related to data privacy, ethical considerations and the possibility of employment displacement, emphasizing the necessity for strong regulatory frameworks.

Keywords: Artificial Intelligence Financial Sector, Machine Learning, Risk Management, Regulatory Frameworks

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INTRODUCTION

The world is witnessing a tremendous development in technology, Artificial Intelligence (AI) is at the forefront of this development thanks to its ability to promote innovation and efficiency in various field. Artificial intelligence is smart and useful technology that helps organizations accomplish their work efficiently and quickly by providing a large amount of high-quality data, as artificial intelligence is a process of developing computer systems as a simulation of human intelligence.

In the ever-changing financial sector, the emergence of Artificial Intelligence (AI) represents a transforming power, redefining standard practices and pushing the boundaries of what was once thought impossible. The combination of sophisticated algorithms, data analytics and machine learning has propelled the financial industry into a new period of efficiency, innovation and risk management.

Financial services are very competitive and customers-focused and AI allows the banks to have a competitive advantage by innovating. The example of AI-driven chatbots as the means of facilitating 24/7 customer service is lessening response time and enhancing accessibility to their customers [1]. Likewise, AI will stop fraud transactions in real-time, reducing financial losses and increasing trust between customers and banks [2]. Robo-advisors are AI-driven tools that are changing the dynamics of investment advisory by providing automated management of portfolio with a minimum involvement of human resources, thereby democratizing access to financial planning services [3]. Also, digital transformation strategies are closely associated with the use of AI in banking. AI allowing banks to be more responsive to market volatility, more regulatory- compliance-focused and deliver data-powered insights into strategic planning [4].

Although AI provides substantial opportunities, it also presents risks. On the one hand, it can create better customer service and more personalized products and offer institutions opportunities to increase their revenues and cut costs.

On the other hand, there are risks, it also creates a need to conduct ongoing monitoring, human control and ethical governance, which can be used to avoid unintended consequences [5].

The ultimate goal of this research is to examine the comprehensive landscape of Artificial Intelligence (AI) in the finance and banking sectors. It will focus on answering the questions below, which will help identify the gap and understand the current knowledge that contributes to policy and practical implications. This study conducts a descriptive analysis using a literature review of recent research on AI in banking and finance. The paper reviews selected recent papers to answer the following questions:

- What is the role of AI in making banks more efficient, faster and better
- Which are the most crucial challenges, risks and ethical issues that banks encounter during the implementation of AI
- What are the current AI regulations and governance

Research Hypotheses

To answer to the research problem, the following hypotheses have been developed:

- The effective integration of artificial intelligence into digital transformation strategies significantly enhances operational efficiency and strengthens banks' competitive and credit positions
- Technological infrastructure constraints, shortages of specialized expertise and incomplete regulatory frameworks constitute significant barriers that limit the effective adoption and full realization of artificial intelligence applications in the banking sector
- Regulatory and legislative disparities across financial markets hinder the expansion and adoption of advanced artificial intelligence applications

Importance of the Study

The importance of this study stems from the growing role of artificial intelligence in the banking sector and the need to better understand how it can be utilized to enhance banking sustainability. The findings of this study will enable banks to make informed decisions about adopting artificial intelligence applications and identify relevant opportunities and challenges:

Study Objectives

Through this research, we seek to examine the most important and recent developments in the financial sector and highlight the contribution of artificial intelligence to improving this sector. While transactions in the financial sector were previously conducted in a traditional manner and took a long time to complete, they are now completed with just a few clicks on a computer or mobile phone. This is due to the development of artificial intelligence in the financial field. We also seek to understand the importance of artificial intelligence technologies in enhancing the financial sector.

Theoretical Framework

The Concept of Artificial Intelligence: Artificial Intelligence is defined as "a branch of computer science concerned with the study and production of computer systems that exhibit some forms of intelligence, meaning systems that learn new concepts and tasks, systems that can think and draw useful inferences about the world we live in, systems that comprehend natural languages and observe and understand visual scenes and systems that can accomplish tasks that require human intelligence It is also defined as "a general mental capacity for thinking, problem-solving and learning." It is also defined as an intelligent system created to use and analyze data and perform specific tasks without the need for programming. AI has a powerful ability to create a basis for decision-making and support through insights and results, gathered from massive and complex data sets, compressed into a manageable scope [6].

Furthermore, artificial intelligence refers to "the process of simulating human intelligence through computer systems, attempting to imitate human behavior, thought patterns and decision-making processes, which is done by studying human behavior through experiments on their actions, placing them in certain situations and observing their reactions, thought patterns and how they deal with these situations and then attempting to simulate human thought processes through complex computer systems" [7]. In other words, artificial intelligence is an extension of human intelligence through various computer programs, designed to facilitate routine tasks and alleviate the burden on human workers.

Applications of AI in the Financial Sector

Chatbots and Virtual Assistants: Automated Customer Support: Traditionally, the financial sector has accumulated a vast amount of information about its customers. This information was used to improve their internal management processes and offer a wider variety of products to their customers. The advent of AI-powered chatbots and virtual

assistants has enabled these immense volumes of information, combined with machine learning, natural language processing and historical interaction, to be useful in offering new services to customers and thus achieving a strategic differentiation for financial entities [8].

As Adamopoulou *et al*. [9], point out, chatbots have become very common tools because they reduce service costs and can handle many customers simultaneously. As Raval [10], explains, they are used in customer service in the financial industry similarly to other sectors for general purposes, such as providing quick 24/7/365 responses to simple questions, i.e., answering frequently asked questions with "standard" responses or by tracking sources. They can also suggest actions based on a customer's browsing activities or recent common queries on the entire website. Therefore, this technology has significantly reduced management costs in financial entities and facilitated the progressive improvement in the quality of the information they provide, which is usually highly valued by customers.

Robo-Advisors: Financial Advisory Services

Digital platforms known as robo-advisors use AI to provide automated financial advice to clients. They replace the traditional process of financial advising being capable of assessing the client and advising them on the management of their investment portfolio. Therefore, they transform the "person-to-person" process into a "person-to-computer" interaction.

Robo-advisors evaluate the client's investment goals, risk aversion and return expectations. Additionally, the evaluation may include ethical preferences or sectors in which the client wants to invest. Increasingly, there is a pursuit of humanizing robo-advisors; highlight greater psychological barriers to seeking advice from human-like robotic advisors, pointing out the potential risks of imbuing them with social design elements. They emphasize that robo-advisors can mitigate the discomfort that arises after learning that an investment decision generated loss.

Cash Deposit Machine and ATM Machine Helpline

Automated Teller Machines (ATMs) are self-service terminals that allow cash deposits at any time, eliminating the need to stand in long lines at banks to deposit cash. After each successful transaction, the customer receives a receipt as proof. Additionally, these ATMs also allow payments to different accounts. On the other hand, ATM Machine Helplines provide assistance to customers in contacting their respective banks in case of an emergency.

AI has also been implemented in ATMs, incorporating various technological segments such as machine learning for ATM cybersecurity, computer vision cameras to enhance security and customer experience, facial recognition, predictive maintenance of ATMs and forecasting cash demand in these devices.

Managing Finance

The use of AI has simplified financial management in the field of finance. Personal Financial Management (PFM) has become a competitive advantage for financial entities and represents one of the latest advancements in AI- based financial management. PFM offers clients personalized and actionable information based on their banking transactions, priorities and savings goals, along with real-time intelligent suggestions to help them better manage their finances. These recommendations enable clients to take appropriate actions at the right time and make optimal financial decisions.

PFM is similar to a wallet developed by Wallet started, a San Francisco-based startup that uses AI to build algorithms that help consumers make intelligent decisions about their money while spending it. In this case, the application collects data from the user's online activity and generates spending graphs. Although this process may raise concerns about Internet privacy and could be considered a crime, it might be the future that awaits us.

Mobile Banking

A large number of people have easily adopted mobile banking as part of their daily lives as mobile devices become increasingly smart. AI-powered mobile banking applications have thus generated strong interest among consumers. Having a personal virtual assistant, whether it's Apple's Siri or Amazon's Alexa, is highly attractive and has been widely accepted and embraced by users worldwide. Mobile applications can easily meet customers' needs. There are intelligent apps that can track user behavior and offer personalized advice and information on savings and spending. Today, all banks offer mobile banking and messaging services. Thanks to mobile banking, everyday transactions like money transfers and payments are more convenient. With the incorporation of AI into mobile banking, consumers can better plan their finances, receive intelligent financial advice and conduct faster and more efficient transactions [11].

Blockchain Technology and Banking

Blockchain is a decentralized, secure, distributed digital ledger. It consists of digital information (blocks) stored in a public database (chain). AI acts as the brain or engine that enables decision-making and helps analyze the collected data. It is often mistakenly believed that blockchain technology is only beneficial for the cryptocurrency sector, but this is not true. Blockchain technology aims to solve various problems related to digital transactions, such as data security and

fraud prevention. Blockchain represents the future of interbank transactions, cross-border remittances, crypto banking, record storage, loan syndication, increasing transparency and compliance with the "Know Your Customer" (KYC) procedure, which is a verification process that companies carry out to know their users before initiating business relationships with them [11].

Improving Credit Underwriting Processes

Artificial intelligence has an influential role in credit decisions, as its solutions help both financial institutions and credit providers make smarter underwriting decisions by using multiple factors and variables - that accurately assess traditionally underserved borrowers - in the credit decision-making process, to make it a sound and data-supported decision [6,12] (adapted).

With the increasing use of AI-based models and big data by banks and fintech lenders, the creditworthiness of potential borrowers is being assessed more quickly, more accurately and at lower costs [13]. It should be noted that credit scoring using AI is based on more complex and advanced rules that differ from traditional loan scoring schemes. This enables lenders to distinguish between candidates at risk of default and those who are creditworthy but lack a credit rating. To verify loan eligibility and provide personalized options, digital banks and loan origination apps use machine learning algorithms to analyze credit status with optional information such as smartphone data [12].

Artificial Intelligence to Detect Fraud, Examine and Monitor Transactions

Artificial intelligence and big data are being used by financial institutions and fintech lenders to detect fraud and suspicious activity during continuous customer monitoring. These institutions can help identify abnormal transactions, suspicious activity, potential fraudulent use of customer personal information, misrepresentation of products or services and other fraudulent activities and this by using image recognition software, risk models and other AI-based technologies [14].

Lending Using AI

Granting a loan involves considering all kinds of parameters. The more thorough the study of all conditions, characteristics and aspects affecting the borrower, the higher the final repayment amount and, therefore, the lower the risk of the operation. Thus, factors such as employment status, current income, expected income during the loan's life, owned assets, savings, fixed expenses and already assumed commitments (such as previous loans or mortgages), among others, are some parameters that AI processes through its complex algorithms to confirm or deny the granting of financing, credit cards, or pre-approved loans.

Making Payment Networks Safer / Processing Payments and Managing the Business Infrastructure Using AI

Mobile network payment gateways are growing explosively and are also gaining significant weight in commercial efficiency, precisely due to the application of AI. Specialized entities predict more than half a trillion transactions on digital payment platforms soon. A revolution induced by new market entrants that compete with traditional payment methods provided by financial entities with new payment solutions.

The use of these new technologies allows users to select the most interesting payment method at any given time with a high level of security. This represents a more personalized management and approach to the end customer. A good case is card transaction routing (intelligent routing), i.e., accepting a card based on the issuing bank, amount and timing, among other variables. Additionally, these processes also allow for streamlining and improving security through real-time fraud risk analysis or generating a proprietary risk scoring.

Risk Assessment

The application of AI to risk assessment is of great importance, as it replaces human analysts in identifying and evaluating financial risks. Risk management with AI allows for a better understanding of risks and more effective mitigation, revealing information that traditional analysis does not reach Based on the above, it can be said that AI applications play a pivotal role in supporting and enhancing the sustainability of banking services through several key aspects:

- **Risk Management:** AI can analyze vast amounts of data to identify, measure and monitor risks more accurately, enhancing risk management and long-term financial stability
- **Process Automation:** AI systems enable the automation of repetitive and routine tasks, improving efficiency and freeing up employees to focus on high-value tasks
- **Fraud Detection:** AI algorithms can identify potentially fraudulent activities in real time, enhancing security and preventing losses
- **Personalized Service:** AI-powered chatbots and recommendation engines enable banks to provide personalized service and advice to customers, improving the customer experience

- **Sustainable Investing:** AI tools can identify Environmental, Social and Governance (ESG) factors and risks to guide sustainable investment decisions and enable responsible lending and financing
- **Financial Inclusion:** By assessing alternative data, AI can facilitate financial inclusion by enabling lending to unbanked groups often-denied credit
- **Operational Efficiency:** AI helps streamline complex processes and reduce resource usage, supporting the environmental sustainability of banking operations
- **Predictive Analytics:** Banks can use AI to forecast scenarios and stress-test for resilience, aiding sustainable strategic planning
- **Reporting:** AI enables the creation of real-time sustainability reports tracking ESG metrics, improving transparency and accountability

The Figure 1 illustrates Integrated Impact Model of AI in Banking.

Challenges of Artificial Intelligence in the Financial Sector

Although artificial intelligence yields impressive results, including the ability to provide predictions, recommendations, or decisions using massive amounts of alternative data sources and their analysis, referred to as big data, in several financial fields such as risk management, algorithmic trading, credit underwriting and blockchain-based financial services and other applications that we have touched upon, but there are still some existing challenges that need appropriate treatment We present them as follows.

Data Privacy and Security

AI is being used in banking and finance to handle private customer information in huge volumes. Strong security measures are necessary for financial institutions to safeguard client privacy and stop data breaches. Encrypting data, storing it securely and adhering to data protection laws are essential factors.

As an information-intensive industry, the financial sector frequently needs to analyze, gather and manage a lot of customer behavior data to ensure the smooth operation of financial transactions. This also means that the range of data collection must be expanded. It will be challenging to define social problems like accountability and behavior supervision caused by failure or behavior under the current legal or regulatory framework. For instance, it is impossible to identify who is responsible for malevolent conduct caused by developers and designers. The behavior produced by AI's learning and decision-making mechanisms cannot be tracked back, as the processing costs associated with the chain consequences will rise significantly. In certain practices, there is difficulty with data-gathering validity because there is a lack of appropriate collection standards or regulations [15].



Figure 1: Integrated Impact Model of AI in Banking
Source: [16]

If an AI transaction procedure fails or an algorithm transaction error occurs, it will not just result in inaccurate data analysis and decision making but also have an impact on related business activities. This will make it difficult for financial transactions to be completed smoothly and cause financial consumers to suffer significant losses. In addition, it will have an impact on the stability of the entire financial market if it is severe. Basic research and data constraints mean that AI will not be able to handle the full, complex financial sector on its own.

Data quality and accountability requirements for deploying AI technology

The predictive power of an algorithm depends heavily on the quality of the data provided as input, so the limited availability of adequate quality and quantity of data can be a barrier to the power of AI. Furthermore, the use of intelligent machines poses a challenge regarding accountability, raising the question of why and who will be held responsible if something goes wrong? Therefore, financial institutions are sometimes reluctant to grant machines complete autonomy because the machines' behavior is not entirely predictable and in many cases they tend to keep a human supervisor in place to validate important machine activities and decisions such as blocking or releasing payments [6]:

- **Limited Transparency:** AI models can be complex, making it difficult to understand how they arrive at their conclusions. This lack of transparency can make it difficult for risk managers to trust and interpret AI outputs
- **Technical Expertise:** Using AI requires a high level of technical expertise and organizations may not have the resources or expertise to implement and maintain AI models
- **Security Risks:** Storing and processing large amounts of sensitive data required for AI models can pose security risks, such as data breaches or cyber attacks
- **Legal and Ethical Issues:** The use of AI can raise legal and ethical issues related to data privacy, transparency and accountability [16]

Ways to Address the Challenges of Artificial Intelligence

Now that we have identified the challenges of artificial intelligence, we will discuss some ways to overcome the challenges of using artificial intelligence in risk management [16]:

- **Increased Transparency:** To overcome the limited transparency of AI models, organizations can use techniques such as Explainable Artificial Intelligence (XAI) or visualization techniques to help risk managers understand how models reach their conclusions
- **Addressing Biases:** To overcome biases in AI models, organizations can ensure that the data used to train models is diverse, unbiased and representative. They can also use techniques such as removing bias that may be present in the data
- **Building Technical Expertise:** Organizations can overcome a lack of technical expertise by investing in training programs or partnering with AI experts who can provide support and guidance
- **Enhance Security:** Organizations can implement robust security measures to address security risks such as encryption, multi-factor authentication and regular security audits
- **Addressing Legal and Ethical Issues:** Organizations can ensure compliance with legal and ethical requirements by developing and adhering to clear policies and guidelines for the use of AI, as well as ensuring transparency and accountability in their AI models. Organizations must also take a comprehensive approach to AI risk management by addressing and mitigating the associated technical, ethical, legal and security risks and challenges, to be able to maximize the benefits of artificial intelligence

Practical Frame Work

The Experience of Global Banks in Integrating Artificial Intelligence into banking Services

Bank of America's Experience in Using Artificial Intelligence: Bank of America developed its Intelligent Receivables system to process accounts receivable through artificial intelligence predictions. This system aims to link payments with open invoices, utilizing advanced technologies to capture data from multiple sources, including digital and paper channels, as well as emails. This innovation has helped reduce the costs associated with manual processing and accelerate revenue collection. This system was recently launched in the Brazilian market to serve a customer base in their various languages. Data indicates a 50% increase in the number of processed invoices over one year, reflecting its growing effectiveness and positive impact on the operational efficiency of companies.

The displayed data indicate the relative distribution of patents granted to Bank of America during the first half of 2024 reflecting the bank's priorities in technological investment within a strategic framework that enhances operational efficiency, cyber security and digital innovation (Figure 2).

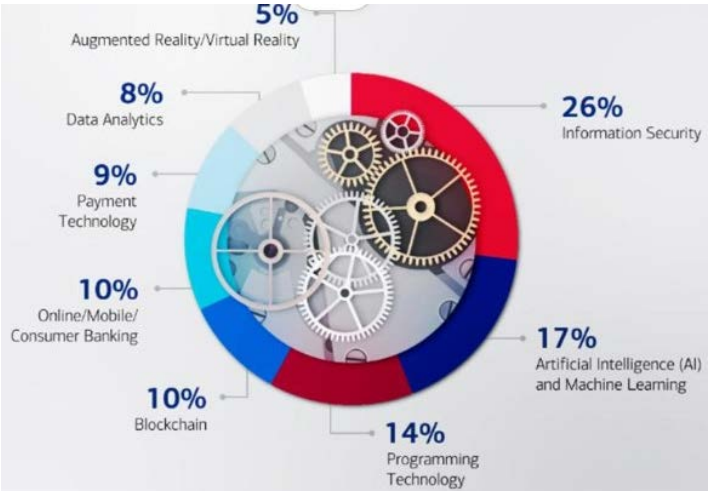


Figure 2: BofA Patent Granted in the First Half of 2024
Source: [17]

Information Security ranked first with 26%, indicating the allocation of significant sources to protect the digital infrastructure and reduce operational risks, this is a rational choice given the rise in cyber threats and their impact on the stability of financial systems.

Following it is Artificial Intelligence and Machine Learning at 17%, reflecting the bank's direction towards enhancing its analytical and predictive capabilities through intelligent automation to support decision-making and reduce operational costs.

- Programming Technologies constituted 14%, indicating the bank's interest in improving software infrastructure and enhancing the flexibility of digital systems. In fourth place, Blockchain technology came in at 10%, highlighting this investment within the bank's efforts to adopt reliable and transparent solutions for transaction recording, in line with the global trend towards a decentralized economy
- Digital and mobile banking services (Online/Mobile/Consumer Banking) also received 10%, indicating the evolution of digital service models and the growing demand for alternative banking channels. As for Payment Technology, it accounted for 9%, indicating the bank's efforts to improve the efficiency of payment systems and expand their capabilities within the platform economy

With 8%, Data Analytics emerge as a pivotal tool in improving investment decisions and risk assessment, while the 5% allocated to Augmented/Virtual Reality represents a forward- looking investment aimed at testing the capabilities of interactive user interface technologies in the banking sector. This distribution represents a balanced economic approach between investments aimed at enhancing efficiency and security on one hand and those dedicated to exploring innovative solutions that respond to future transformations in the digital economy on the other.

Erica Smart Assistant in Customer Service

The Erica service, relies on artificial intelligence techniques based on natural language processing and machine learning to accurately understand and respond to customer inquiries without using generative linguistic models, but rather relies on analyzing the user's intentions and choosing the appropriate response. Through frequent interaction, Erica improves as specialized teams constantly review and update their responses. This service is part of the mobile banking application, providing customers with smart and personalized financial guidance, while fully adhering to security and privacy protection standards [17].

In the global banking sector, Bank of America achieved a digital milestone in 2024 by recording $1 trillion in approved payments via the CashPro application and the Erica smart assistant contributed to processing more than 40% of customer inquiries within the CashPro Chat platform. At the individual level, the bank added 1.1 million new current accounts, continuing continuous growth over 24 consecutive quarters. Customer investment via Merrill Edge rose to $518 billion, a 22% year-over-year increase. The bank also maintained its position as the largest small business lender in the United States for the fifteenth consecutive quarter [17] (Figure 3).



Figure 3: Erika Development Journey
Source: [17]

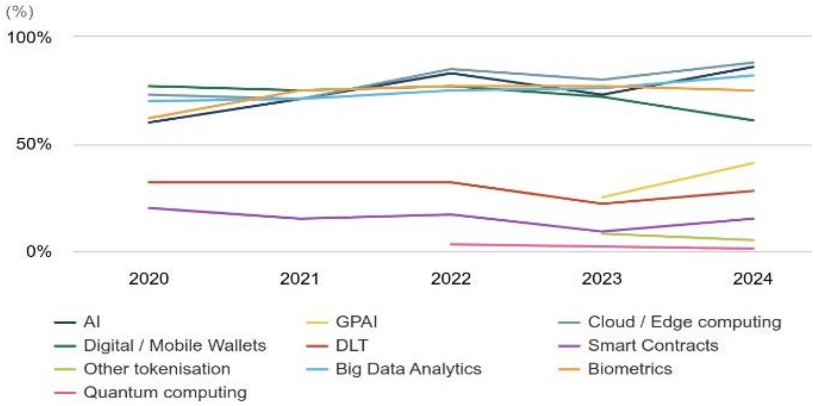


Figure 4: Proportion of EU Banks Using Different Technologies
Source: [18]

The Experience of the European Economic Area

Banks are facing significant challenges in maintaining their competitiveness with each other due to their increasing reliance on the digitization of banking services and artificial intelligence to meet customer needs through the provision of personalized services. Like other global banks, European banks have adopted a digital transformation strategy, following strict regulations since Europe has always been one of the most regulated markets in terms of developing services and protecting data privacy, starting with the General Data Protection Regulation (GDPR), as is the case with the adoption of artificial intelligence technologies as well.

The Figure 4, shows that the most widely used technologies (over 70%): Artificial Intelligence AI, Cloud/Edge computing, Big Data Analytics and Biometrics were among the most used technologies, all with usage rates ranging between 70% and 90% by the end of 2024. A gradual increase in the adoption of AI, Cloud and Big Data has been observed reflecting a strategic shift towards using analytical tools and advanced processing to support decision- making, automation and operational efficiency improvement. The adoption of Biometrics has seen relative stability since 2022, indicating the maturation of its use as a solution for security and identity verification.

The data shows that European banks widely use artificial intelligence in areas such as profiling/clustering of clients or transactions, fraud detection and AML/CFT, which are among the most common applications. Artificial intelligence is also used to a moderate extent in the optimization of internal processes and CWA / credit scoring. As for tasks of a regulatory nature, such as regulatory credit risk modeling and regulatory or supervisory reporting, the use of artificial intelligence remains limited due to the complexity of regulatory requirements and the sensitivity of these functions (Figure 5).

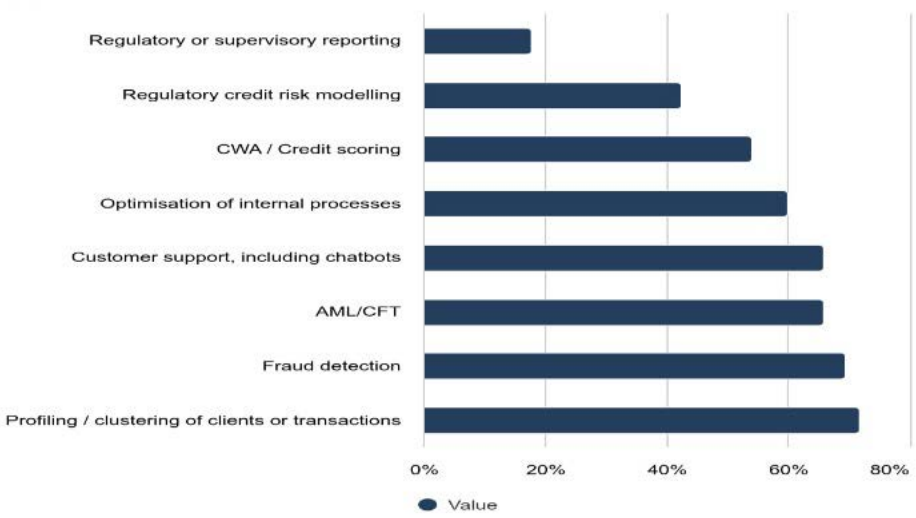


Figure 5: Proportion of EU Banks Using Different Technologies
Source: [18]

CONCLUSION

This study was aimed at investigating how the financial services and banking industry has been affected by Artificial Intelligence (AI) in terms of operational, customer-focused, risk-related, ethical implications, staffing and strategy aspects. The results revealed that AI had a profound effect on the operations of the banking industry by increasing efficiency and decreasing the number of human factors that were involved in the decision-making process. Machines to do routine jobs allowed institutions to maximize funds and reorganize work processes in the direction of more strategic and value-based operations. Integration of AI systems in sectors like loan processing, fraud detection and compliance monitoring helped in speed in service provision and institutional resilience.

The research findings also demonstrated that AI had a significant positive impact on customer experience, personalization, predictive analytics and nonstop service provision. AI- based systems allowed banks to predict customer demands and offer customized financial services and stay 24/7 in touch. Nonetheless, the human touch was still necessary in complicated advisory positions which implied that AI was more of an augmentative as opposed to full replacement of human expertise. This human-AI interaction model became an effective sustainable system of serving in the contemporary banking systems Within the risk management domain, AI provided substantial predictive performance and fraud detection opportunities due to the processing of large datasets in real time. Proactive response towards financial risk was reported more in institutions as a sign that AI has the potential to enhance institutional stability and compliance with regulations. However, the results of the study also emphasized the need to keep human control to avoid excessive dependence on algorithmic systems, especially in the field of high-stakes financial choices.

Recommendations

- Banks should prioritize modernizing their data infrastructure by replacing fragmented legacy systems with integrated data platforms, cloud-based solutions and advanced analytics capabilities to maximize the efficiency and effectiveness of artificial intelligence applications
- The successful deployment of artificial intelligence requires adaptive regulatory and governance frameworks that foster innovation while safeguarding customer data privacy. In this regard, Reg Tech solutions should be leveraged to strengthen regulatory compliance and enable continuous monitoring of evolving supervisory requirements. Investing in human competencies by training and qualifying specialized employees in artificial intelligence
- Taking advantage of the experiences of leading banks such as Bank of America's "Erica" smart assistant, or Intesa Sanpaolo's experience in legislative analysis
- Developing a flexible and clear regulatory framework should consider the balance between innovation, legal protection and privacy in new technological legislation

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