

The Impact of Artificial Intelligence on the Sustainability of Banking Services - Pioneering Experiences

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Abstract: : This study analyze how leading banks such as HSBC, Citi, and JPMorgan Chase are utilizing artificial intelligence (AI) applications to enhance the sustainability of their banking services. The study adopted a document analysis approach, analyzing documents and reports issued by these banks. The findings revealed that AI applications play a pivotal role in improving the sustainability of banking services through risk management, fraud detection, and enhancing customer experience, with differences in focus areas among banks such as sustainable finance and responsible AI practices.

Keywords: Artificial Intelligence; The Sustainability of Banking Services; Pioneering Experiences.

1. Introduction

In today's dynamic world, characterized by rapid technological advancements and rising customer expectations, banking institutions face increasing challenges in sustaining their services in the long run. To keep pace with these challenges, artificial intelligence applications have emerged as an effective tool to assist banks in improving their efficiency and enhancing the customer experience, ensuring the continuity of their services.

Given intense competition, regulatory changes, and growing customer expectations, the role of artificial intelligence in increasing the stability of banking services has become more important than ever before. It enables banks to adapt to the changing environment and better meet the needs of their customers, ensuring their ability to remain competitive and sustainable in the long run (Zada, 2022, p. 3).

Banking sustainability gains particular importance from policymakers, where the administrative structure encourages the financial framework for planning their products, services, and customer service, while adopting behaviors that address economic, environmental, and social developments. During financial crises, the financial framework can either act as a settlement tool or a destabilizing factor, with the need to maintain an effective function in all financial proceedings. Therefore, the banking sector bears a commitment towards its practices that affect monetary, social, and environmental spheres, and this commitment must be reflected in its comprehensive practices.

The issue addressed by this study is to explore the role of artificial intelligence in enhancing banking sustainability and how banks can leverage these technologies to ensure their ability

to remain competitive and sustainable in the long run. In this context, the study will focus on three leading banks: HSBC, Citi, and JPMorgan.

The study will analyze how these banks utilize artificial intelligence applications in various aspects of their operations, such as risk management, improving customer experience, enhancing operational efficiency, regulatory compliance, and others. The study will also investigate the opportunities and challenges these banks face in their pursuit of achieving sustainability through artificial intelligence.

Research Problem:

This study seeks to understand how banks utilize artificial intelligence applications to enhance their long-term sustainability. To achieve this, the study attempts to answer the following sub-questions:

- What are the main areas where banks utilize artificial intelligence technologies?
- How do artificial intelligence applications contribute to improving bank efficiency and enhancing customer experience?
- What are the key opportunities and challenges that banks face when adopting artificial intelligence to achieve sustainability?

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.

Objectives of the Study:

- Analyze the utilization of artificial intelligence in leading banks HSBC, Citi, and JPMorgan;
- Understand the role of artificial intelligence in improving bank efficiency and enhancing customer experience;
- Identify the opportunities and challenges these banks face in their pursuit of achieving sustainability through artificial intelligence.

Research Methodology:

This study will adopt a document analysis approach, where documents and reports issued by the targeted banks (HSBC, Citi, JPMorgan) regarding their utilization of artificial intelligence applications will be collected and analyzed. These documents will be analyzed using content analysis methods to uncover relevant trends and insights related to the study topic.

Previous Studies

Numerous studies have examined the transformative impact of artificial intelligence on the banking and financial services sector. Manta, Bădîrcea, Doran, and Badareu (2024) conducted a pioneering bibliometric analysis exploring Industry 4.0 transformation in banking, utilizing systematic literature review methodology to analyze AI's impact on achieving distinctive customer experiences and supporting sustainable development in financial institutions. Their findings revealed significant trends in AI adoption patterns and highlighted the sector's evolution toward more refined customer service delivery. Similarly, Almustafa and Assaf (2023) implemented a comprehensive study on AI applications for financial process innovation in commercial banks, employing case study methodology to examine how pioneering financial services increase banks' competitive advantage. Their research

demonstrated that AI implementation enhances personalized banking experiences while providing managerial stability and reducing financial constraints.

Bueno, Sigahi, and Rampasso (2024) conducted thematic analysis research investigating digitization's operational efficiency impacts in banking, focusing on AI and machine learning technologies' effects on banking operations and customer experiences. Their study revealed that digitization significantly improves operational processes and customer satisfaction levels. Furthermore, Aboalsamh, Khrais, and Albahussain (2023) pioneered research on green fintech perception in promoting sustainable digital services within smart cities, utilizing mixed-methods approach to examine AI and IoT integration in finance for supply chain automation and financial services digitalization. Their findings indicated substantial potential for sustainable financial technology adoption. Additionally, Nguyen, Sermpinis, and Stasinakis (2023) explored the transformative symbiosis between big data, AI, and machine learning in financial technology, employing quantitative analysis to demonstrate how these technologies create exceptional customer experiences while reducing operational costs. Mostafa (2025) conducted a comprehensive bibliometric analysis and systematic literature review on AI and value co-creation in the banking sector, revealing how AI enhances banking service experiences while aligning strategic banking tactics with customer expectations.

Building on previous studies, this study entitled "The Impact of Artificial Intelligence on the Sustainability of Banking – Pioneering Experiences" expands existing knowledge by focusing on the sustainable dimensions of AI applications in the banking sector, an area that has not been addressed in depth in previous literature. While most previous studies focused on improving operational efficiency and customer experience, this study contributes by analyzing how artificial intelligence technologies contribute to enhancing sustainable banking practices, environmental responsibility, and institutional resilience in the long term through pioneering application experiments.

FBER**205**

2 Theoretical framework of the literature review:

2.1. Fundamentals of Artificial Intelligence Applications

Artificial intelligence (AI) has rapidly permeated our daily lives, enabling machines to analyze and summarize data that previously required human intervention. This comprehensive field represents a modern scientific discipline that facilitates more efficient task performance, pattern recognition, and problem-solving while enhancing accuracy and efficiency. It stands out as one of the most prominent contemporary applications of information systems. Powered by various forms of machine learning, AI has become a cornerstone of innovation by emulating and surpassing human understanding, interacting with the world through data pattern recognition, and automating complex and routine tasks ('Abd, 2023, pp. 3-4).

In this context, 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" (Al'Anzii, 2022, p. 51).

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" (Uddin, 2019). 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.

Consequently, artificial intelligence enables economic institutions to achieve the following (Artbaz, 2023, p. 1262):

- Increase the efficiency of production, maintenance operations, supply chain management processes, improve customer experience, services, and products;
- Enhance rapid and automatic adaptation to changing market conditions by creating new business models, in addition to improving the relationships between supplies and needs with better prediction and planning capabilities;
- Detect fraud, automate information technology functions, and improve sales processes;
- Automate quality management, auditing, procurement management, and logistics services.
- Some of the most prominent applications of artificial intelligence in economic institutions include (Hasan, 2022, pp. 451-453):
- Expert Systems: These are essentially computer programs that simulate human thought processes in various situations and work to solve problems. They are programs that store knowledge extracted from human experts. Therefore, the simulation process appears to mimic experts in a particular field, such as taxation or auditing;
- Decision Support Systems: An interactive, adaptable, and multi-use computerized system designed to assist in decision-making for institutions with unstructured management, with expert systems creating alternatives and decision support systems automating decision-making processes. The underlying motivation for these systems is to create alternatives that enable intelligent decision-making;
- Neural Networks: Artificial neural networks mimic the organized processes of the human brain and improve performance through continuous learning. This is achieved by presenting training data and updating the connections to reduce errors. As the number of layers increases, they become more suitable for deep learning, making them an integral part of the field of artificial intelligence;
- Fuzzy Logic: Fuzzy logic mimics human thinking and decision-making by dealing with partial truth and true degrees;
- Hybrid Systems: Hybrid systems integrate different artificial intelligence techniques, including intelligent models and algorithms, to address complex problems such as natural language processing and machine learning.

FBER

206

2.2. The sustainability of banking services

The sustainability of banking services is a relatively new concept, as the term "sustainability" has emerged as an essential need for all economic institutions in the present time. Sustainability implies the ability to maintain, endure, and continue. Stemming from this concept, banks have taken the initiative to create added value, distinction, and acquisition, leading to the emergence of the concept of sustainable banking services. The World Bank has defined it as "creating long-term financial, social, and environmental value for a group of stakeholders, taking into account the needs of future generations" (World Bank Group, 2010).

Biswas defined it as "the philosophy adopted by the bank, aimed at expanding the bank's benefit from employees and shareholders to include its customers and the economy as a whole, while simultaneously limiting any unjustified impacts on society and the environment" (nigamananda, 2011, p. 33). In the same context, the sustainability of banking services entails the design, construction, and implementation of banking operations linked to the institution's culture, which seeks innovation and excellence in business and operations, in addition to assuming social responsibility, focusing on customers, and going beyond basic compliance requirements as a sustainable bank.

The sustainability of banking services aims to achieve several objectives, including reducing paper transactions to the lowest levels while increasing reliance on electronic transactions, protecting the environment through resource reuse and waste recycling, as well as efficient energy use. It also involves continuously minimizing operational environmental impacts by monitoring environmental performance and implementing and evaluating an environmental management program that conserves energy and water, manages waste, recycles materials, reduces business travel, and encourages green procurement. Furthermore, it works to alleviate poverty by supporting green jobs, which act as a bridge between eradicating extreme poverty and hunger and achieving environmental sustainability, as research has shown that greening enterprises by creating green jobs in the context of this process will contribute to reducing unemployment rates and achieving banking and environmental sustainability simultaneously (Stankeviciene & Marta, 2014, p. 1198).

Additionally, it ensures financing for sustainable development goals and providing resources for green projects and managing and distributing funds for sustainable and socially responsible investment (SRI).

The sustainability of banking services is based on six agreed-upon principles issued by the World Banking Union, which are: adopting a three-dimensional business model that meets societal needs and protects the environment without neglecting the primary goal of profitability; encouraging communities to serve the real economy and enabling new business models to meet their needs; achieving long-term sustainability through the ability to adapt to external disruptions; maintaining a high degree of transparency in reporting while keeping up with developments and adopting comprehensive governance principles and mechanisms; and integrating all of the previous principles into the bank's culture, so they are routinely used in the decision-making process at all levels (Jurin, 2012, p. 75).

FBER**207**

The text provides a comprehensive overview of sustainable banking services, covering its definition, objectives, and guiding principles from authoritative sources. It highlights the concept's emphasis on creating long-term value while considering environmental, social, and governance factors in banking operations.

2.3. The relationship between AI applications and the sustainability of banking services:

AI applications play a pivotal role in supporting and enhancing the sustainability of banking services through several key aspects (Dirican, 2022):

- 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 potential 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.

Overall, AI is a powerful tool to support sustainability in the banking sector through data analysis, efficiency enhancements, compliance, and informed decision-making that accounts for environmental, social, and governance considerations.

3. Strategic adoption of AI at HSBC Citi JPMorgan Chase's banks: Boosting efficiency, service and sustainability:

3.1. HSBC Experience:

HSBC Holdings plc, the largest bank in Europe and seventh-largest globally by total assets of \$3.05 trillion in 2022, has strategically embraced artificial intelligence (AI) to drive efficiency, scalability, and improved customer service across its operations. Despite the challenges of balancing automation with personalized service and ensuring ethical AI use, the British multinational has demonstrated leadership in AI-driven banking innovation and risk management.

FBER

208

Founded in 1865 in Hong Kong to finance trade between Europe, Asia and beyond, HSBC has grown through mergers and acquisitions into a banking giant with around 7,500 offices in 63 countries serving retail, wealth management, commercial, investment and private banking clients worldwide (HSBC, 2021).

(HSBC Holdings plc, 2022) (HSBC, 2021) (Economist, 2022):

- ✓ Risk Management and Fraud Detection:
 - Utilizes AI algorithms to analyze vast transaction data and identify suspicious patterns efficiently;
 - Enhances anti-money laundering efforts while minimizing false positives;
 - Ensures long-term security and stability of banking services.
- ✓ Personalization and Customer Experience:
 - Leverages AI to deliver personalized retail banking services;
 - Collaborates with data firms on AI tools to track and categorize customer spending;
 - Improves customer satisfaction and retention for longer banking relationships.
- ✓ Natural Language Processing and Chatbots:
 - Deploys NLP technologies to create virtual assistants and chatbots;
 - AI-driven interfaces automate routine tasks and streamline processes;
 - Maintains efficient delivery of banking services to customers.
- ✓ Credit Scoring and Loan Approvals:
 - Relies on AI algorithms to assess creditworthiness by analyzing history, income, etc;
 - Ensures timely financial support to customers;
 - Minimizes credit risk exposure for the bank.

✓ Responsible AI Practices:

- Emphasizes fairness, transparency and ethics across AI initiatives;
- Established AI ethics committees to align applications with principles;
- Balances innovation with ethical considerations.

The above shows that HSBC's strategic use of AI programs is highly sustainable across its banking services. By leveraging AI to manage risks, detect fraud and assess credit scores, the bank can make more informed choices that reduce economic risks and make a contribution to a more sustainable and flexible banking apparatus. In addition, AI-driven customization and sponsor experience improve pride and retention, enhancing the feasibility of operations for a long time. Furthermore, HSBC's focus on accountable AI practices ensures ethical compatibility, and the sale of sustainable and direct banking practices at

3.2. Citi's Experience:

Citi is a leading global bank providing a wide range of financial services including consumer banking, corporate banking, wealth management, and investment banking. Founded in 1812 and headquartered in New York, Citi operates in over 160 countries and regions (citigroup).

Recognizing the importance of sustainability in the banking sector, Citi has adopted an ambitious strategy to achieve net-zero greenhouse gas emissions by 2050. To achieve this goal, the bank is increasingly relying on AI applications to enhance the sustainability of its operations, including (citigroup, 2021):

FBER

209

- Improving resource efficiency: AI technologies help analyze data and identify areas where resource usage can be optimized, reducing the bank's environmental footprint;
- Mitigating financial and environmental risks: By using AI for risk management and fraud detection, Citi can minimize financial losses and potential negative environmental impacts;
- Supporting sustainable financing: Citi leverages AI to identify sustainable investment opportunities and assess climate-related risks, supporting its goal of facilitating \$1 trillion in sustainable finance by 2030;
- Enhancing customer experience: Through chatbots, predictive analytics, and personalization enabled by AI, Citi can deliver a more tailored and efficient customer experience, fostering long-term customer satisfaction and loyalty.

3.3. JPMorgan Chase's Experience:

JPMorgan Chase is one of the largest financial institutions in the world, providing a wide range of banking and investment services to individual and corporate clients. Founded in 1799 and headquartered in New York, JPMorgan Chase operates in over 60 countries globally.

JPMorgan Chase has taken a strategic approach to investing in AI and big data technologies to enhance the sustainability of its banking services through (Dignan) (JPMorgan Chase & Co logo):

- Risk management and fraud detection: JPMorgan utilizes advanced AI systems to analyze vast amounts of data and detect suspicious transactions or anomalous patterns, helping mitigate financial risks and fraud;
- Automated trading and predictive analytics: The bank relies on AI-powered trading systems and predictive analytics to identify new investment opportunities and forecast customer behavior, boosting financial performance and business sustainability;

- Process optimization and cost efficiency: JPMorgan leverages AI to analyze data, identify inefficiencies in banking processes, and optimize operations, resulting in cost savings and improved financial sustainability;
- Banking innovation: JPMorgan is investing in developing new AI-driven banking solutions such as digital assets and smart contracts, contributing to the modernization and long-term sustainability of the banking industry.

Based on the given information, there are several similarities and differences in how HSBC, Citi, and JPMorgan Chase are using AI applications to enhance the sustainability of their banking services:

3.4. Similarities:

- Risk management and fraud detection: All three banks are utilizing AI algorithms and machine learning models to analyze vast amounts of transaction data, identify suspicious patterns, and detect potential fraud cases. This helps mitigate financial risks, minimize losses, and contribute to the long-term stability and sustainability of their operations;
- Process optimization and cost efficiency: The banks are leveraging AI technologies to analyze data, identify inefficiencies in banking processes, and optimize operations. This results in cost savings, improved resource efficiency, and enhanced financial sustainability;
- Customer experience and personalization: The banks are using AI-driven chatbots, virtual assistants, and personalization tools to deliver tailored banking services, improve customer satisfaction, and foster long-term customer loyalty, which supports the sustainability of their business models.

FBER

210

4. Conclusion:

This study aimed to understand how leading banks like HSBC, Citi, and JPMorgan Chase are leveraging artificial intelligence applications to enhance the sustainability of their banking services. Through an in-depth analysis of documents and reports from these institutions, the study has uncovered several key findings and insights.

The results of the study indicate that AI applications are playing a crucial role in improving the sustainability of banking services across multiple areas, including risk management, fraud detection, process optimization, customer experience, and banking innovation. The similarities observed among the three banks highlight the widespread adoption of AI for purposes such as transaction monitoring, anti-money laundering efforts, credit scoring, personalization, and the deployment of virtual assistants and chatbots.

However, the study also revealed differences in the specific focus areas and approaches taken by each bank. For instance, Citi prioritizes the use of AI for sustainable financing and investment opportunities, while HSBC emphasizes responsible AI practices with a strong emphasis on fairness, transparency, and ethics. JPMorgan Chase, on the other hand, stands out for its investment in AI-driven trading systems, predictive analytics, and innovative banking solutions like digital assets and smart contracts.

Overall, the findings demonstrate that AI applications are vital for enhancing the long-term sustainability of banking services by improving efficiency, reducing risks, enhancing customer experiences, and fostering innovation. As the financial sector continues to evolve, the strategic adoption of AI technologies will be crucial for banks to remain competitive, meet regulatory requirements, and contribute to a more sustainable banking industry.

Based on the study's results, the following recommendations can be made:

- Banks should continue to invest in AI technologies and explore new areas where AI can be applied to improve sustainability, such as sustainable finance, environmental risk management, and socially responsible investing;
- Institutions should establish robust governance frameworks and ethical guidelines to ensure the responsible and transparent use of AI, addressing potential biases, privacy concerns, and ethical considerations;
- Collaboration between banks, technology companies, and research institutions should be encouraged to foster innovation, knowledge sharing, and the development of advanced AI solutions tailored to the banking sector;
- Banks should prioritize upskilling and training programs to equip their workforce with the necessary skills to effectively leverage AI technologies, ensuring a smooth transition and adoption of these technologies;
- Regulatory bodies and policymakers should work closely with the banking industry to develop guidelines and frameworks that support the responsible and sustainable use of AI while promoting innovation and maintaining financial stability;
- By embracing AI applications strategically and responsibly, banks can enhance the sustainability of their services, mitigate risks, and adapt to the evolving needs of customers and the broader financial landscape. Continuous research and collaboration among stakeholders will be essential to unlock the full potential of AI in shaping a more sustainable and resilient banking industry.

FBER

211

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