

Artificial Intelligence Adoption in the Banking Industry: Current State and Future Prospects

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Abstract

AI adoption in the banking industry is necessary not only to gain a competitive advantage within the industry but, more importantly, to defend the bank against technological disruptors trying to gain ground in service areas that banks previously dominated. Through a systematic review of related literature, this study aims to investigate the drivers and barriers to adopting AI in the banking industry from the perspective of the major stakeholders: the bank, the customers, the service providers, and the regulators. Using the SCOPUS database, thirty-five studies were identified that are relevant to this study. Given that organizational innovation requires a cohesive strategy considering internal and external ecologies, this study contributes to the literature on AI adoption in the banking industry by providing a multi-stakeholder perspective. Existing literature focuses predominantly on the customers' and the banks' perspectives. Studies from the regulators' and service providers' perspectives still need to be more extensive despite the importance of these two actors in adopting AI in the banking industry. From the standpoint of the customer, reasons for adoption include security, trustworthiness, understanding, familiarity, and positive feedback from others. Meanwhile, trust issues, security issues, unreliability, unavailability, and technology downtime deter customers from adopting AI. From the bank's perspective, AI adoption is enabled by the availability of technological resources, human resources, infrastructure, financial resources, and documentation. On the other hand, lack of skills, lack of awareness, high cost, time-to-market, technical complexity, and regulatory-compliance issues deter banks from fully embracing AI. Transparency of algorithms, data privacy, data protection, and fair use of data are the main concerns both of regulators and customers. The results of this study contribute to the practice of AI in banking by pointing to the need for more empirical and theoretical research on the regulatory perspective of AI adoption in the banking industry to foster responsible AI, how to harness the strength of service providers to enable broader and more effective adoption of AI, how institutions can help increase the talent pool for AI-driven technologies, and how to strengthen the synergistic cooperation of the various stakeholders in the adoption of AI in the banking industry.

Keywords: Artificial Intelligence, Bank, Finance, Technology Adoption, Innovation, Regulators, Service Providers.

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1 Introduction

The banking industry has historically been receptive to technological innovation and has undergone an innovation-induced transformation over the years (Berger, 2005). Among the technologies that were exploited by the banking industry that has transformed the way it operates includes the telegraph and transatlantic cable resulting in the use of checks and clearing houses, magnetic strip, and microchip resulting in the use of credit card and debit card, automatic teller machine,

telephone banking (Consoli, 2005), mainframe computing (Gomber et al., 2018) and more recently internet banking and mobile banking (Lee and Chen, 2022; Manser Payne et al., 2018; Manser Payne et al., 2021). As computing technology grows in sophistication, the banking sector faces another technological shift in the advent of artificial intelligence (Rymarczyk, 2020).

Artificial intelligence (AI) refers to the capability of a system to deduce and learn from external data and apply these learnings to accomplish assigned tasks and adapt accordingly (Haenlein and Kaplan, 2019). Lichtenthaler (2020) identifies seven broad areas in adopting and using AI: decision-making, machine learning, natural language processing, planning and scheduling, robotics and machines, speech synthesis, and computer vision. The adoption of AI has gained wide acceptance in various industries such as manufacturing, retailing, marketing, hospitality, tourism, supply chain, telecommunication, retailing, government, education, e-commerce, insurance, and finance, among others (Almaiah et al., 2022; Gupta et al., 2022; Loureiro et al., 2021; Yang et al., 2022). While many areas of application of AI in the banking industry are similar to other sectors, its highly regulated nature makes AI adoption more challenging. Because of the critical role of the banking industry in ensuring financial stability, bank regulators in the form of the central bank for each jurisdiction usually take the conservative approach by focusing on the management of risk resulting in a cautious stance in embracing novel innovation (Truby et al., 2020). This has implications for the banks' openness to innovative approaches and promptness in reaping the benefits of new technologies such as AI.

Adopting AI in the banking industry is more than just a nice-to-have option for banks. The entry of digital disruptors in banking in the form of fintech has placed the traditional banking sector in a defensive position (Jakšič and Marinč, 2019). Fintechs leverage innovative technology such as AI to offer convenient, flexible, and 24/7 financial services at a lower cost (Nejad, 2022; Palmié et al., 2020). In the face of the competition from fintech, the increasing sophistication of banking customers and their demand for faster, seamless, and more personalized service add to the imperative for the banking sector to adopt AI.

There is a growing interest in the study of the state of AI adoption across industries such as manufacturing, business, supply chain management, marketing, and education (Chintalapati and Pandey, 2022; Loureiro et al., 2021; Sestino and De Mauro, 2022; Toorajipour et al., 2021; Zawacki-Richter et al., 2019). In the banking industry, there are attempts to synthesize studies on AI adoption systematically, but these studies focused only on a single stakeholder (Ghandour, 2021; Hentzen et al., 2022). Hentzen and colleagues (2022) reviewed studies on AI adoption in financial services but limited only to the customer-facing aspect of financial services. The work of Ghandour (2021) investigates the opportunities and challenges in the adoption of AI from the standpoint of banks. Similarly, Königstorfer and Thalmann's (2020) study presented a body of work on AI in commercial banks. While the findings of these studies provided fresh insights into AI adoption by a specific stakeholder of the banking industry, there is a need to present a holistic view of how this emerging technology has diffused within the banking sector. The banking industry consists of multiple stakeholders, which include the bank and its employees, the customers, the service providers, and the regulators. The level of adoption of AI by the different stakeholders is not the same. Rather than focusing on a specific stakeholder, this study differs from prior reviews as it attempts to separately analyze the adoption of AI for each stakeholder to identify the drivers and barriers of AI in the banking sector and present how these factors influence its integration across all stakeholders. Specifically, this study attempts to answer the following research questions:

RQ1 Who are the major stakeholders considered in the studies of AI adoption in the banking industry?

RQ2 Which functional areas of the bank is AI applied?

RQ3 What are the drivers that lead to the adoption of AI in the banking industry from the perspective of the different stakeholders?

RQ4 What are the barriers to the adoption of AI in the banking industry from the perspective of the different stakeholders?

This paper is organized as follows: Section two describes the methodology used in this research; Section three presents a discussion of the results of the research questions; Section four summarizes the key findings, highlights gaps in existing research, and recommends direction for future study; Section five discusses the limitations of this review.

2 Methodology

The study of Ferreira and others (2018) highlights the value of reviewing literature in studying innovation management. A systematic literature review was conducted to gain deeper insights into the state of the art of adoption of AI in the banking industry and gather answers to the research questions proposed for this study. (Ferreira et al., 2018). This method integrates the richness of multiple perspectives from multiple researchers, which, when synthesized, can surface new knowledge and point to a worthy research direction.

This study used a four-phase process, including literature identification, screening, eligibility, and analysis. Consensus decision-making between the two authors was employed in filtering and deciding the final list of qualified studies. This research method was employed because it delivers a methodical and transparent process that permits reproducibility and reduces bias (Snyder, 2019). SCOPUS was the primary electronic database used in identifying research papers for review (Figure 1). The initial list of scholarly works was extracted by employing a word search in the title, abstract, and keywords using the combination of keywords: ("Artificial Intelligence" or AI) AND (Bank or Banking). The keywords "bank" or "banking" were used to limit the study to traditional banks and exclude purely fintech and non-banking financial institutions. The search rule was further refined by restricting the list to completed research submitted in peer-reviewed journals or conference proceedings that are written in English and published from 2017 to 2022. The extracted studies were limited to works written in the last five years to ensure that only the most recent developments in the field are included. A total of 1,235 articles were qualified in the query. Upon review of the initial output, it was discovered that articles referring to non-banking topics were included in the list. The set of search criteria was further refined to exclude unrelated fields of study whereby the following subject areas were excluded: Physics and Astronomy, Medicine, Environmental Science, Materials Science, Biochemistry, Genetic and Molecular Biology, Agricultural and Biological Sciences, Earth and planetary science, Chemical Engineering, Chemistry, Health Professions, Pharmacology Toxicology and Pharmaceutics, Veterinary, Nursing, Dentistry, Immunology, and Microbiology, Undefined. This resulted in the final list of 935 articles.

The 935 articles extracted from SCOPUS were manually reviewed for relevance to the research objectives based on the title and abstract by the first author. The second author separately reviewed the 935 articles and identified three that should have been included. Both authors discussed the differences in their findings and agreed there should be 213 qualified articles. The 213 articles were subjected to further review based on relevance to the research questions and exclusion criteria such as reviews, non-English titles, research-in-progress papers, and book chapters. A double review method where a second iteration of the review process was conducted at the screening and eligibility phases to ensure both authors accurately tagged relevant versus irrelevant studies. This additional step was undertaken to improve the reliability of the resulting list of articles for review. The process resulted in 35 articles as the final list of scientific works for the systematic literature

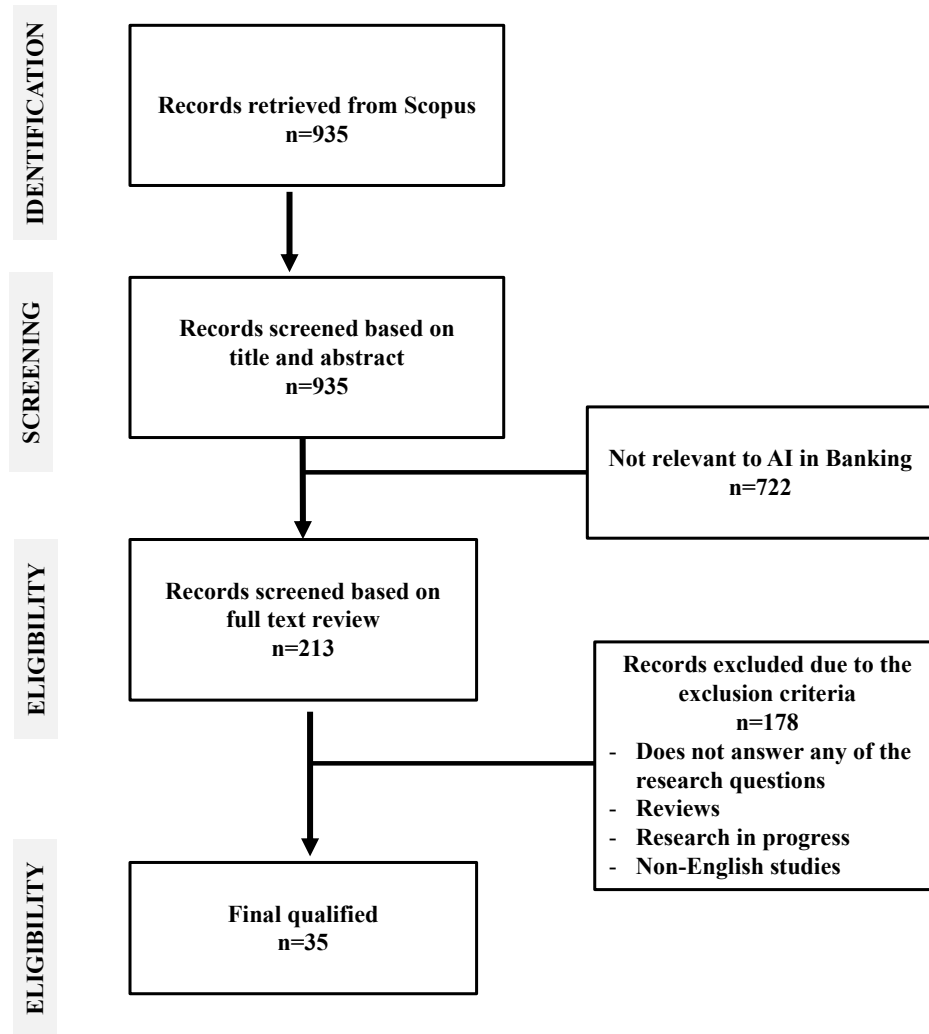


Figure 1. Literature Search Flow

review detailed in Table 1.

Table 1. Overview of Reviewed Literature

	Article Reference	Year	Theoretical Underpinning	Stakeholder Perspective	Area of Application	Drivers of Adoption	Barriers to Adoption
1	Sheth, J. N., Jain, V., Roy, G., & Chakraborty, A. (2022).	2022	Service-Dominant Logic	Customer + Bank	Multi-area / Generic	lack of skilled manpower; security issue; trust issue	
2	Boustani, N. M. (2022).	2022	Theory of Financial Innovation	Customer + Bank	Multi-area / Generic		
3	Wicaksono, B. P., & Zahra, A. (2022).	2022	Hedonic Motivation Adoption System	Customer	Customer Service / CRM	lack of skilled manpower	

Article Reference	Year	Theoretical Underpinning	Stakeholder Perspective	Area of Application	Drivers of Adoption	Barriers to Adoption
4 Omoge, A. P., Gala, P., & Horky, A. (2022).	2022	Technology Acceptance Model	Customer	Customer Service / CRM	lack of skilled manpower	
5 Ali, M. S., Swiety, I. A., & Mansour, M. H. (2022).	2022	None	Customer + Bank	Risk, banking operation, and services	convenience; ease of use; speed; accessibility; personalized experience	
6 Lee, J. C., & Chen, X. (2022).	2022	Stimulus, Organism Response Theory & Task Technology Fit	Customer	Mobile banking		
7 Flavián, C., Pérez-Rueda, A., Belanche, D., & Casaló, L. V. (2022).	2022	Technology Readiness Index	Customer	Customer Service / CRM	convenience; accessibility	security issue; trust issue
8 Mogaji, E., & Nguyen, N. P. (2022).	2022	Multiple Frameworks	Bank	Marketing	lack of skilled manpower; lack of awareness; high cost	
9 Suhartanto, D., Syarif, M. E., Chandra Nugraha, A., Suhaeni, T., Masthura, A., & Amin, H. (2022).	2022	Technology Readiness Index	Customer	Multi-area / Generic	convenience; ease of use speed; accessibility; personalized experience	
10 Estran, R., Souchaud, A., & Abitbol, D. (2022).	2022	None	Bank	Credit;/ Risk		
11 X. Li. (2021).	2021	None	Bank	Multi-area / Generic	customer experience; improved profitability	
12 Tiwari, A. K., & Saxena, D. (2021).	2021	None	Bank	Multi-area / Generic	improved profitability	security issue; trust issue
13 Ashta, A., & Herrmann, H. (2021).	2021	None	Bank	Multi-area / Generic	customer loyalty; improved profitability	incompatibility with legacy systems
14 Gramespacher, T., & Posth, J. A. (2021).	2021	None	Bank	Credit/Risk	lack of transparency	

Article Reference	Year	Theoretical Underpinning	Stakeholder Perspective	Area of Application	Drivers of Adoption	Barriers to Adoption
15 Manser Payne, E., Peltier, J., & Barger, V. A. (2021).	2021	Service Dominant Logic	Customer	Mobile banking	convenience; ease of use; speed; accessibility; personalized experience	
16 Rojas-Torres, Di., Kshetri, N., Hanafi, M. M., & Kouki, S. (2021).	2021	None	Customer	Multi-area / Generic	convenience; ease of use; accessibility	
17 Königstorfer, F., & Thalmann, S. (2021).	2021	None	Bank	Multi-area / Generic		
18 Haddad, H. (2021).	2021	None	Bank	Accounting		
19 Dampitakse, K., Kungvantip, V., Jemsittiparsert, K., & Chienwat-tanasook, K. (2021).	2021	Random Effect Model	Country	Multi-area / Generic		
20 Chitimira, H., & Ncube, P. (2021).	2021	None	Bank	Fraud Detection		
21 Sanz, J. L. C., & Zhu, Y. (2021).	2021	None	Service Provider	Multi-area / Generic	incompatibility with legacy systems	
22 Elrefai, A. T., Elgazzar, M. H., & Khodeir, A. N. (2021).	2021	None	Bank	Marketing		
23 Hu, X., & Wang, K. (2020).	2020	None	Bank	Multi-area / Generic		
24 Truby, J., Brown, R., & Dahdal, A. (2020).	2020	None	Regulator	Multi-area / Generic	improved efficiency	
25 Dhote, T., Pathak, P., & Kulkarni, P. (2020).	2020	None	Bank	Multi-area / Generic	cost reduction; faster turn-around time	lack of skilled manpower lack of transparency
26 Abu Daqar, M. A. M., Arqawi, S., & Karsh, S. A. (2020).	2020	None	Customer	Payment Services	improved customer experience; convenience; accessibility	

Article Reference	Year	Theoretical Underpinning	Stakeholder Perspective	Area of Application	Drivers of Adoption	Barriers to Adoption
27 Bhatia, A., Chandani, A., & Chhateja, J. (2020).	2020	None	Customer	Customer Service / CRM		
28 Belanche, D., Casaló, L. V., & Flavián, C. (2019).	2019	Technology Acceptance Model	Customer	Robo Advisor	convenience; accessibility	
29 Mathipriya, B., Minhaj, I., Rodrigo, L. D. C. P., Abiyackshmana, P., & Kahan-dawaarachchi, K. A. D. C. P. (2019).	2019	None	Bank	Multi-area / Generic	lack of skilled manpower	
30 Trivedi, J. (2019).	2019	IS Success Model	Customer	Customer Service / CRM	improved customer experience; cost reduction; faster turn-around time	low-quality service
31 Jakšič, M., & Marinč, M. (2019).	2019	None	Customer	Customer Service / CRM		
32 Fourie, L., & Bennett, T. K. (2019).	2019	None	Bank	Payment Services	cost reduction; faster turn-around time	lack of transparency; bias; discriminatory behavior; data privacy
33 Lui, A., & Lamb, G. W. (2018).	2018	None	Regulator	Robo Advisor	bias; discriminatory behavior	
34 Manser Payne, E., Peltier, J. W., & Barger, V. A. (2018).	2018	Technology Acceptance Model & Diffusion of Innovation Theory	Customer	Mobile banking	convenience; ease of use; speed; accessibility; personalized experience	
35 Carminati, M., Polino, M., Continella, A., Lanzi, A., Maggi, F., & Zanero, S. (2018).	2018	None	Bank	Fraud Detection		

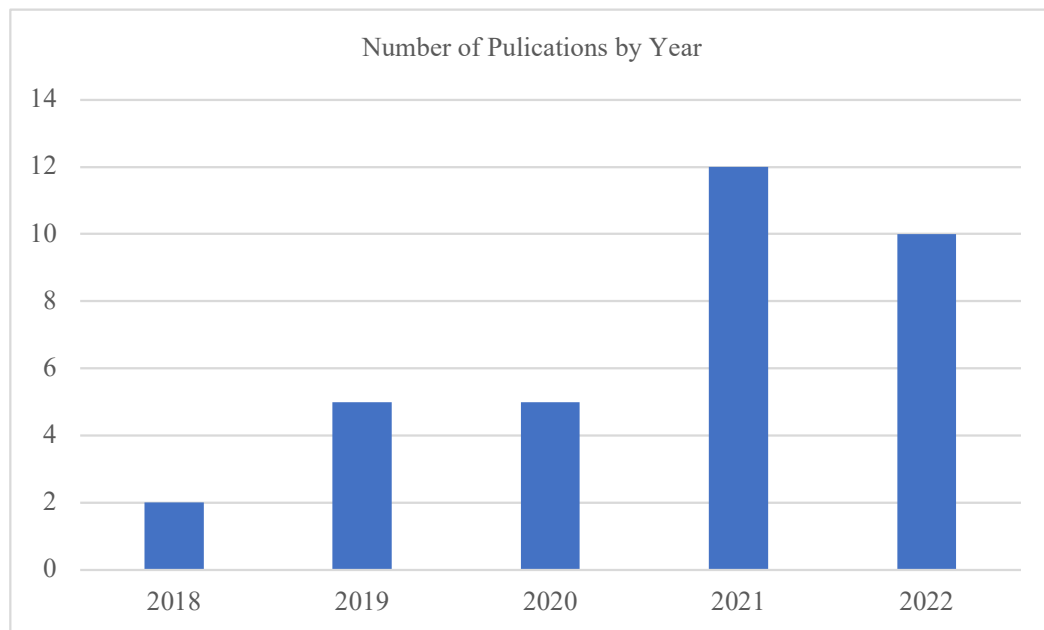


Figure 2. Number of Publications by Year

3 Discussion

The number of scientific studies investigating AI adoption in the banking industry is on an increasing trend. From only two qualified studies in 2018, this has increased to five each in 2019 and 2020, and it further increased to twelve in 2021 and ten studies in the middle of 2022 (Figure 2). The scope of the studies on the adoption of AI in the banking industry has likewise expanded from focusing mainly on chatbots in the early years, this has extended into various areas of application of AI in the banking industry such as fraud detection, credit and risk management, sales and marketing, investment advisory, data management and automation of back-end services (Ashta & Herrmann, 2021; Belanche et al., 2019; Bhatia et al., 2020; Elrefai et al., 2021; Haddad, 2021; Tiwari & Saxena, 2021)-

3.1 Stakeholders in the Study of AI Adoption in the Banking Industry

Adopting an innovation involves various actors and stakeholders whose perspectives must be recognized to understand the adoption dynamics comprehensively (Häggman, 2009). Actors and stakeholders have differing motivations, which may advance or derail the adoption of an innovation. The study of the adoption of AI in the banking industry has mainly focused on the perspectives of the bank and the customers (89% or 31 papers). Out of the thirty-five studies that were reviewed, studies using the bank's perspective consist of 43% of the total (15 papers), which slightly outpaced the number of studies using the customer's perspective at 37% (13 papers), while 9% (3 papers) combined the perspectives of the customers and the bank. While the banking industry is a highly regulated industry and regulatory concern is one of the identified barriers to AI adoption, studies that take on the perspective of regulators in the adoption of AI are sparse, with only two studies (Lui and Lamb, 2018; Truby et al., 2020) that focused on the role of regulators in the adoption of AI in the banking industry. Meanwhile, one study took on the unique perspective of a country by analyzing the impact of macroeconomic indicators on the adoption of AI in the banking industry at the country level.

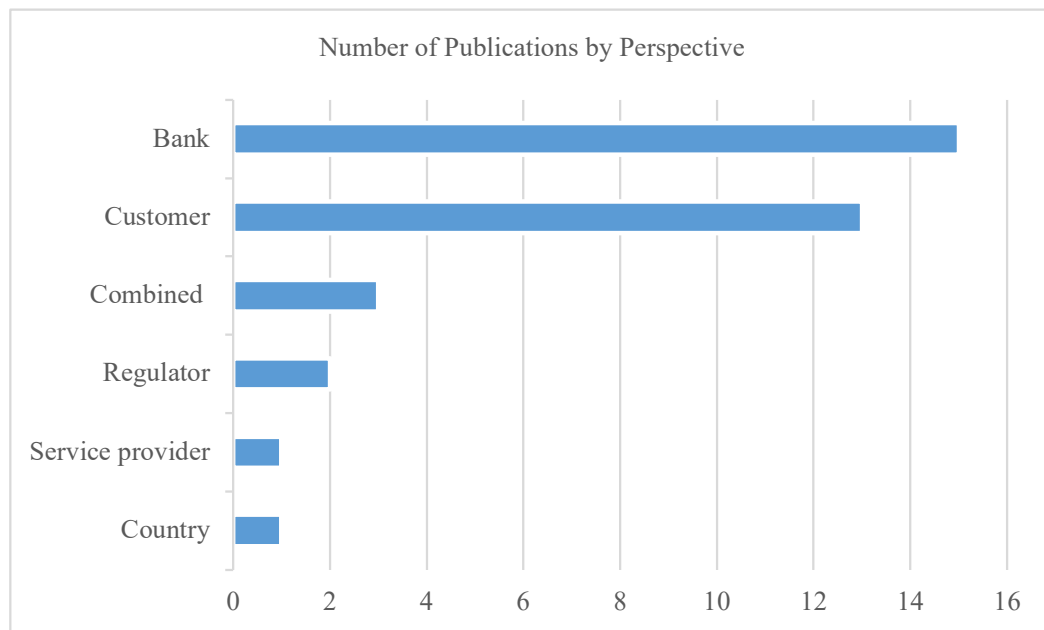


Figure 3. Number of Publications by Stakeholders

Despite the critical role played by service providers in delivering technology and services that enable the adoption of AI, studies using the service providers' perspective are scant, with only one study that emerged from the literature search (Sanz and Zhu, 2021). (Figure 3). The study by Sanz and Zhu(2021) argues the critical role of service providers in accelerating the scalability of AI initiatives and making AI projects graduate from being merely proof-of-concept to full-blown implementation in production.

Concerning the use of a theoretical framework in the study of AI adoption in the banking industry, studies using the customer's perspective are largely theoretically founded, with 9 out of the 13 papers that use a theoretical framework to guide the study. Technology Acceptance Model is the most popular theoretical framework (3 studies), followed by Technology Readiness Index (2 studies). A combination of theories, such as Stimulus Organism Response Theory-Task Technology Fit and Technology Acceptance Model–Theory of Planned Behavior, was likewise used. Standalone theories such as Hedonic Motivation Adoption System and Service-Dominant Logic Theory were also used to explain AI adoption from the customer's perspective. Despite the significant number of studies using the bank's perspective in studying AI adoption, there are still no studies that use a theoretical framework in studying AI adoption from the bank's perspective.

3.2 Application of AI in the Banking Industry by Functional Area

The application of AI in the banking industry has penetrated multiple functional areas of a bank's operation. These functional areas include customer service, customer relationship management (CRM), fraud detection, credit and risk management, marketing, payment services, back-end operations, and data collection. The most popular application of AI from the customer's perspective is in customer interaction through marketing in the form of interaction with chatbots and robo-advisers, customer service, customer relationship management, and mobile banking (Belanche et al., 2019; Elrefai et al., 2021; Trivedi, 2019; Wicaksono and Zahra, 2022). First used in the banking industry by the Bank of America, a chatbot is an interface that responds to a customer's query typically through text or voice (Hwang and Kim, 2021). An evolution of the chatbot is

the robo-advisor which provides customized advice on suitable investment options based on the customer's profile and its suitability to the investment products. The chatbot and robo-advisor are self-learning technology based on customer interaction. Due to the early adoption of chatbots in the banking industry, most of the literature on AI adoption in banks (9/35 or 26%) refers to chatbots or robo-advisers.

Credit decision is another functional area where artificial intelligence has found early application in the banking industry. Credit models using artificial intelligence and machine learning algorithms are used to decide the suitability of customers for credit products and used as a basis for approval of loans and extension of credit limits (Ali et al., 2022; Estran et al., 2022; Gramespacher and Posth, 2021; Hwang and Kim, 2021; Tiwari and Saxena, 2021). From the bank's perspective, using AI in credit decisions benefits the bank in terms of more accurate and faster decisions resulting in improved profitability and cost savings (Mogaji and Nguyen, 2022; Trivedi, 2019). From the perspective of regulators, the use of AI in credit decisions needs to overcome the issues of lack of transparency and interpretability of algorithms and mitigate bias and discriminatory behavior of credit models (Estran et al., 2022; Fourie & Bennett, 2019; Gramespacher and Posth, 2021; Königstorfer and Thalmann, 2021).

At the back end of the banking function, AI provides valuable benefits in the identification and prevention of fraud and in improving the efficiency of payment services, back-end operations, accounting, and data collection (Abu Daqar et al., 2020; Carminati et al., 2018; Chitimira & Ncube, 2021; Fourie & Bennett, 2019; Haddad, 2021; Hu & Wang, 2020; Li, 2021; E. H. Manser Payne et al., 2021; Tiwari & Saxena, 2021).

From the regulators' perspective, AI finds its application in facilitating regulatory compliance as regulators use AI technology to improve efficiency in delivering their functions. This takes the form of using AI to detect money laundering activities and fraud and automating the monitoring and reporting of compliance risk, making it possible to have continuous and real-time compliance reports (Truby et al., 2020).

3.3 Motivations for the Adoption of AI in the Banking Industry

AI Motivators for Banks

Motivation for the adoption of AI by banks can be broadly grouped into three categories, namely: to improve customer experience, to improve profitability, and to improve competitiveness. Improving customer experience is one of the earliest motivations for adopting AI. This has led to the deployment of chatbots and robo-advisers to provide customers with real-time and 24/7 responses to their queries and needs (Abu Daqar et al., 2020; Trivedi, 2019). AI-driven algorithms are used in sales and marketing to create more customized and better-targeted offers and to guide the timing and form of customer contact to further improve customer experience and achieve stronger customer loyalty (Ashta and Herrmann, 2021; Li, 2021).

Improving profitability is a predominant motivation for the adoption of AI. This takes the form of cost reduction through improved efficiency and productivity by automating repetitive functions, resulting in lower labor costs, reduced human error, and faster turn-around time (Dhote et al., 2020; Fourie & Bennett, 2019; Trivedi, 2019). The adoption of AI in the area of risk management contributes to improving profitability through the reduction of operational risk, especially in the area of fraud detection and credit decisioning (Ashta and Herrmann, 2021; Li, 2021; Tiwari and Saxena, 2021). Improved customer experience through AI-driven innovation ultimately results in enhanced profitability, as positive customer experience results in increased use of banking products, which translates to improved revenue for the bank.

Table 2. Motivation, Enabler, and Barrier to AI Adoption in Banking Industry

	Bank	Customer	Regulator
Motivation for Adoption	customer satisfaction customer engagement reduced cost savings profitability efficiency risk management fraud detection	convenience ease of use speed accessibility personalized experience	improved efficiency of monitoring and reporting function
Enabler to Adoption	human resources infrastructure technology documentation financial performance	security trustworthiness understanding familiarity positive feedback	None
Barrier to Adoption	lack of skills lack of awareness lack of conviction high cost time-to-market technical complexity regulatory-compliance issues	trust issue security issue unreliability technology downtime unavailability	lack of transparency bias discriminatory behavior data privacy

The entry of digital disruptors such as fintech and global technology players makes it imperative for banks to adopt AI to overcome competition that comes from both within and outside the banking industry (Dhote et al., 2020; Jakšič and Marinč, 2019). The advanced technology possessed by fintech in utilizing data and in using various media to connect with customers translates to an excellent customer experience at a lower price. Consequently, it attracts customers to alternative providers of banking services (Sanz and Zhu, 2021). This resulted in a reduction in the market share of traditional banks. To be competitive, there is a need for traditional banks to adopt the cutting-edge technology of AI.

AI Motivators for Customers

Utilitarian values in the form of convenience, ease of use, speed, accessibility, and a personalized experience are the primary reasons that motivate bank customers to adopt AI-driven technologies (Ali et al., 2022; Manser Payne et al., 2018; Manser Payne et al., 2021; Rojas-Torres et al., 2021; Suhartanto et al., 2022). In the case of using chatbots, the convenience of having answers to questions in real-time, 24/7, without having to go to the bank or make a call attracts bank customers to use AI-driven technologies (Abu Daqar et al., 2020; Belanche et al., 2019; Flavián et al., 2022). Reduced cost, as well as time savings, further motivate customers to use AI-driven bank services.

3.4 Enablers in the Adoption of AI in the banking industry

AI Enablers for Banks

Human resources consistently emerged in the literature as a critical enabler in the adoption of AI in the banking industry (Dhote et al., 2020; Mathipriya et al., 2019; Mogaji and Nguyen, 2022; Wicaksono and Zahra, 2022). Interviews with banking managers from different countries conducted by Mogaji and Nguyen (2022) revealed a consistent agreement among managers on the

importance of bringing together a team with the right skills and competence to drive AI. Aside from having the right skills, a mindset of innovation is also required to successfully adopt AI (Dhote et al., 2020; Mathipriya et al., 2019). A study by Lichtenthaler (2020) argues the need for integrating human intelligence and artificial intelligence to achieve a sustainable competitive advantage that is dynamic and harder to imitate. Since AI is an emerging technology, putting together a team with all the required skills and an innovative mindset can be challenging. To complement the technical skills and innovation mindset of employees, technological advancement and strategic innovation are two essential enablers in the adoption of AI by banks (Dhote et al., 2020). Implementing AI requires the necessary infrastructure to implement AI-driven solutions (Ashta and Herrmann, 2021; Sanz and Zhu, 2021). Legacy systems that proliferate in traditional banks need to be upgraded and made compatible with new technologies (Omoge et al., 2022).

The banking industry is a highly regulated industry that requires fairness, accountability, and transparency in its systems and processes. A seemingly simple but critical enabler of AI adoption is AI documentation (Königstorfer and Thalmann, 2021). AI documentation is used to evaluate the AI solution's compliance with ethical and regulatory requirements. This is used as an artifact in dealing with regulators and investors. In addition to the regulatory function of AI documentation, it is also a tool to ensure the reproducibility and suitability of the AI solution. As emphasized by Lui and Lamb (2018), the lack of transparency of AI algorithms can result in undetected bias, which results in the erosion of the trustworthiness of AI. The study of Königstorfer and Thalmann (2021) on using AI documentation provides a fitting response to one of the most significant barriers to AI adoption, both from the regulatory and customer perspective.

At the macro level, adopting AI in the banking industry is highly correlated to economic growth, financial development, and financial performance (Boustani, 2022; Dampitakse et al., 2021). A cross-country analysis of the adoption of AI in the banking industry revealed that countries with a high gross domestic product and high foreign investment tend to have a higher degree of adoption of AI in the banking industry (Dampitakse et al., 2021). This result is corroborated by the study of Omoge et al. (2022), which revealed that adopting AI in emerging economies is slower due to technology downtime, a phenomenon that is predominant in emerging countries and undermines the reliability of AI.

AI Enablers for Customers

From the customer's perspective, attitude and subjective norms as influenced by the customer's awareness and understanding of the AI-driven banking services are critical enablers in the adoption of AI by the customer (Belanche et al., 2019; Flavián et al., 2022; Omoge et al., 2022; Sheth et al., 2022). This includes understanding how the technology is used, the benefits and advantages of using the technology, and the security and risks involved in the use of the technology. In addition to the personal evaluation of customers, the expectation and experiences of others likewise influence the adoption decision of customers (Flavián et al., 2022). This implies the need for a good customer education program to ensure the adoption of AI-driven technology by banking customers (Manser Payne et al., 2021; Trivedi, 2019).

An equally important enabler in the adoption of AI-driven technology by the customer is the perceived trustworthiness of the technology (Abu Daqar et al., 2020; Ali et al., 2022; Lee and Chen, 2022; Nguyen et al., 2021; Suhartanto et al., 2022; Trivedi, 2019). Trustworthiness is essential in the banking industry since banks are entrusted with the customer's money. Trust is fostered when there is high reliability, high availability, and high security of the AI solution, which is made possible through high-quality information, system, and services (Nguyen et al., 2021; Trivedi, 2019).

3.5 Barriers to the Adoption of AI in the banking industry

AI Barriers for Banks

From the bank's perspective, barriers to adopting AI in the banking industry can be broadly grouped into people-related issues, technology-related issues, and regulatory and compliance issues. From the human resource standpoint, bringing together a team with the necessary skills to develop and implement an AI solution is a big challenge (Dhote et al., 2020; Mogaji and Nguyen, 2022; Sheth et al., 2022; Wicaksono and Zahra, 2022). The relative novelty of AI and the high demand for AI-related skills spanning various industries have resulted in the scarcity of talent in this field (Mathipriya et al., 2019). Another people-related barrier to the adoption of AI in the banking industry is the need for more awareness and conviction of decision-makers and managers in the benefits that can be derived from this technology. For some managers, AI is just an expensive tool with no proven added value to the company (Mogaji and Nguyen, 2022).

From the technological aspect of AI, the biggest challenge comes from the high infrastructure cost and the high cost of skilled talents needed to build and deploy an AI solution (Mogaji and Nguyen, 2022). This is further compounded by the time required to develop and deploy an AI solution. In addition to the high cost and time required, the technical complexity of AI solutions and the challenge of ensuring compatibility with legacy systems hinder banks from adopting AI (Ashta & Herrmann, 2021; Sanz and Zhu, 2021).

AI Barriers for Customers

The biggest barrier faced by customers in adopting AI services offered by banks is trust and security issues (Flavián et al., 2022; Sheth et al., 2022; Tiwari and Saxena, 2021). While the perceived trustworthiness of an AI solution compels customers to use AI technology, the perceived untrustworthiness of the AI solution deters customers from using AI. Perceived untrustworthiness of AI solutions arises from security concerns, especially in the aspect of data privacy and data protection (Flavián et al., 2022). Low-quality service likewise fosters distrust in AI solutions (Trivedi, 2019). Sub-standard service quality arises due to unreliability and unavailability of the AI solution when needed. A study conducted by Omoge et. al (2022) on the adoption of AI in the emerging market economy highlighted technology downtime (TDT) as a phenomenon that may explain the lower acceptance of AI-enabled banking services among customers in the emerging economies as compared to the high adoption of AI-enabled banking services in the developed economies. TDT is a common occurrence in emerging economies, resulting in the unavailability and unreliability of AI-driven services and consequently leading to customer distrust of AI.

AI Barriers for Regulators

The challenge in implementing AI due to regulatory and compliance issues is a barrier that is specific to the banking industry. Unlike other industries, the banking sector is highly regulated. Regulators such as a country's central bank supervise the strategies, policies, and operations of banks. As such, they highly influence almost all aspects of a bank's activities (Cukierman, 2011). The biggest regulatory-related hurdle in the adoption of AI solutions is the difficulty in complying with the transparency requirements of decision models (Dhote et al., 2020; Fourie and Bennett, 2019; Gramespacher and Posth, 2021). The lack of explainability and understandability of AI algorithms brings about potential risks regarding hiding bias and discriminatory behavior of AI models (Fourie and Bennett, 2019; Lui and Lamb, 2018).

Another compliance-related issue in AI that is a cause of concern not only by the regulators but also the consumers is in ensuring data privacy and protection. Commercial institutions, including banks, harness online data for commercial benefits as the internet becomes ubiquitous in everyday

activities. This raises ethical questions on the acquisition, storage, distribution, and fair use of data vis-à-vis the customer's right to control the use of his data and digital footprint (Fourie and Bennett, 2019).

4 Conclusions, Limitations, and Implications for Future Research

Conclusion

There is an increasing interest in the scientific study of AI adoption in the banking industry. The application of AI has expanded beyond chatbots to include credit decisions and risk management, investment advising, fraud detection, sales and marketing, payments, operational automation, accounting, and data management, and the list continues to expand.

While there is growth in new applications of AI in banking, scientific studies on AI adoption remain predominantly two-sided and narrowed down to the perspective of customers and banks. Perspectives of other significant stakeholders, such as regulators and service providers, should be more widely emphasized in the literature on AI adoption in banking. Only recently, studies focusing specifically on regulators' perspectives are starting to emerge. However, the numbers still need to increase due to the importance of regulators in the banking industry and the regulatory concerns on AI solutions. Likewise, studies that focus on the perspective of service providers have yet to be given more attention. Service providers are potential catalysts that can accelerate the adoption of AI and a potent defense to counter the threat of new entrants and substitutes of traditional banking.

Human resource is both an enabler and a barrier to AI adoption. The interplay of human and artificial intelligence is crucial in achieving a sustained competitive advantage. Managerial expertise and strategic insight in deciding what AI technologies to use, where to apply AI to achieve optimum results, and what complementary resources to partner with remain to be within the sphere of human decision. Regrettably, there is still a lack of executive support, managerial expertise, and technically-skilled resources to drive the broader adoption of AI innovation in the banking industry.

The trustworthiness of AI solutions is a serious concern that needs to be addressed to ensure the acceptability of the use of AI in banking. All the stakeholders in the banking industry need to be involved in advancing the adoption of responsible AI. Regulators need to be more proactive in enforcing policies to safeguard the transparency of AI algorithms, eliminate bias, protect data privacy, and guarantee fair use of customer information. Likewise, banks and service providers must practice responsible use of AI rather than just focusing on the economic gain derived from this innovation. Lastly, customers must be vigilant and make their voices heard to deter banks' potential unethical use of AI.

To conclude, managing innovative technologies such as AI ushers in complexities that require close collaboration of the multiple stakeholders involved in the banking industry. Regulatory reforms aligned with the needs of the various stakeholders of the banking industry can address most of the barriers identified in this study, such as trustworthiness, weak leadership support, and lack of skilled expertise, ensuring the management of new technologies is seamless and responsive. While research on AI adoption is well represented from the viewpoints of banks and their customers, future research can investigate the influence of regulators and service providers in organizational innovation adoption. Such future scholarly endeavors will guide regulators on recalibrating policies and laws and the service providers to craft more responsive service contracts to ensure banks are more open to trying, adopting, and managing emerging technologies such as AI.

Limitations

Like other studies that attempt to synthesize the body of work in a specific research field, our findings are bound by limitations in its study design. While we ensured that bias is kept at a minimum level through a four-phase systematic literature review using consensus decision-making, appreciation of the literature involved human judgment and is thus subject to human bias. Nevertheless, we addressed this limitation by adopting an iterative review of titles by both authors and consensus agreement during the evaluation. Another limitation is the source of the titles included in this study. The list of scholarly work was sourced exclusively from SCOPUS and was limited to journal articles and conference proceedings written in English. This resulted in the exclusion of dissertations, non-English academic work, and articles from non-SCOPUS journals. The search keywords used ("Artificial Intelligence" or AI) AND (Bank or Banking). There are subsets of AI that may have been excluded due to the filtering criteria of this study. Lastly, we excluded book chapters in our study based on the classification of Adams et al. (2017) that book chapters are part of the gray literature. Notable conferences in information systems research publish conference proceedings as a book series; therefore, some related works may have been excluded from this study.

Gaps and Agenda for Future Research

Taking off from the findings of this study, the following are recommended areas for future research:

First, most studies on AI adoption in the banking industry focus on specific areas of application of AI. At the same time, only a few studies look into the overall impact of AI on the banking organization as a whole and the broader context of the banking industry. Since AI adoption does not work in silos, there is a need for more studies that look into how the banking organization manages the adoption of AI as an innovation and how AI adoption transforms the banking organization in particular and the banking industry as a whole.

Second, given the significant role played by regulators in the banking industry, there is a need for more focused research on AI adoption using the lens of regulators. While the predominant interest is on the requirements and concerns of regulators, studies can incorporate the more positive role of regulators as enablers of AI adoption in the banking industry.

Third, research needs to adequately explore the role of service providers as effective partners in accelerating AI adoption in the banking industry. Tech giants and international consultancy firms have strong visibility. However, startup technological firms and local companies may offer more affordable services and be more attuned to regional scenarios. The partnership of traditional banks with fintech as a service provider is another option that can be explored to accelerate AI adoption in the banking sector.

Fourth, the lack of a skilled workforce is one of the deterrents to the adoption of AI. This opens the floor for further research on how institutions can help increase the talent pool for AI-driven technologies. This can start from identifying the skillsets required to develop and implement AI, which mode of training can provide the most efficient and effective way of skills development, which institutions can participate in providing this training and evaluating the potential of an outsourced workforce.

Fifth, the trustworthiness of AI-enabled technologies is a primary concern both of customers and regulators. While most studies focus on novel and efficient AI algorithms, there is a need for a more in-depth analysis to achieve a higher level of fairness, accuracy, and transparency in AI solutions.

Lastly, the adoption of AI involves multiple stakeholders. While most studies take on a single perspective, either of the customer or the bank, multi-perspective studies look into areas where

the synergistic cooperation among multiple stakeholders in AI adoption can be strengthened to address pressing barriers in AI adoption.

The banking industry has always been resilient to innovation and allows itself to be transformed by new technology. With the introduction of AI, the banking industry faces another technological challenge. To harness the power of AI to bring the banking industry to new heights, all stakeholders need to be involved and work together for a successful assimilation of AI.

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