

# Ethical and Regulatory Challenges of Using Generative AI in Banking: Balancing Innovation and Compliance

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## Abstract

This study examines the ethical and regulatory challenges influencing the adoption of generative AI in the banking sector. Qualitative findings identified key concerns such as data bias in loan approvals, the explainability of AI decisions, and the tension between innovation and operational risk control. Quantitative results revealed that regulatory non-compliance (mean = 4.8, SD = 0.2) and data privacy risks (mean = 4.7, SD = 0.3) are the most significant concerns. Other identified risks include bias and fairness issues (mean = 4.5, SD = 0.4), lack of transparency (mean = 4.6, SD = 0.3), and customer trust erosion (mean = 4.3, SD = 0.5). The analysis demonstrated a 35% reduction in AI adoption speed due to regulatory constraints, with a Pearson correlation coefficient of -0.62, indicating a strong negative relationship between regulatory barriers and innovation pace. Regression results further highlighted that data privacy measures ( $\beta = 0.55$ ,  $p < 0.001$ ) and customer trust ( $\beta = 0.37$ ,  $p = 0.01$ ) positively influence AI adoption, while regulatory complexity ( $\beta = -0.45$ ,  $p = 0.002$ ) negatively impacts it. These findings emphasize the need for enhanced governance frameworks that balance innovation, ethical considerations, and compliance to unlock the full potential of generative AI in the financial sector.

**Keywords:** Generative AI, Banking Sector, Regulatory Compliance, Data Privacy, Innovation Speed, Ethical Challenges, AI Adoption

## INTRODUCTION

The financial industry is changing at a fast pace due to the very active use of artificial intelligence, especially generative artificial intelligence in various banking operations. Generative AI is a category of models that can generate new text, images, and so on, or even new financial models from the given data. In banking, generative AI is applied in customer service, integrated into risk assessment, and even in fraud detection. The implications of applying this technology for banks are that it enables improvements in operation, customer experience, and innovation (1). However, several opportunities come with the use of generative AI in banking, there are also large ethical and regulatory concerns that need to be addressed to make the process legal and safe.

With large financial institutions employing generative AI for their different operations,

there exist questions on how best they can use it while maintaining the rights of users and avoiding misuse. For example, with the help of numerous customer's personal data banks train AI models, and there are concerns about consent and data protection. Regulations like the General Data Protection Regulation (GDPR) in Europe, stress the aspect of, transparency, and accountability over the use of personal data, meaning that; banks should provide clear policies on how customer data is used and processed in AI systems (2). In addition, the question of how algorithms are trained creates a massive ethical issue: that of bias. Research has indicated that such an AI system can perpetuate biases that are consistent with the training data in a way that is highly prejudicial to certain customers (3). This does not only affect the reputation of the bank but it may attract the attention of the regulatory agencies and its operation may be questionable under the law.

On the same note, there are ethical concerns about the use of AI in banking as well as the legal requirements for implementing artificial intelligence in banking continuously change. Government bodies and financial regulatory authorities in various countries are gradually developing rules for applying AI technologies in businesses of the financial sphere. For example, the European Commission presented the so-called AI Act, which develops the regulation of AI applications depending on risk levels (4). This particular act strives to ensure that artificial intelligence systems are interpretable, understandable, and stable. For the banks, this means understanding what generative AI entails and the ability to move fast to respond to new regulations. The last issue that banks have to grapple with is how to bring novelty and standards of ethics and regulations into the fold.

In addition, the risk of image loss due to ethical failure in the use of AI is immeasurable. As more and more information about AI and its consequences rises, customers are getting more and more concerned with how their data is processed and what decisions are being made by AI. The last year's data leaks and other unfair AI uses across different fields, have raised questions about the responsibility of AI applications (5). To banks, customer trust is an important asset, and any implication of misuse of such AI systems could prove devastating to business. Hence, ethical challenges are inevitable, and financial institutions have to be ready to overcome them in the use of AI and develop a good governance structure for its use.

To overcome these challenges, several best practices can be implemented in the banks. First of all, there is a need to create a code of ethics of AI use for the organization. Much of these guidelines should include these aspects of fairness accountability, and transparency in such a way that artificial intelligence systems are designed and implemented with ethical standards. In addition, performing a checkup to ensure that all AI systems used have their biases audited will prevent the bank from using AI decision-making techniques that are unethical (6). Regulatory authorities together with other stakeholders also plays vital role in developing a responsible AI environment.

Through constructive dialogue with the regulators, banks will be in a position to appreciate the expectations of the regulators and participate in the formulation of policies that will foster the growth of innovations that will also protect the interest of consumers (7).

The last area of concern for integrating generative AI in banking is the training of the staff to work on the generative AI. The employees must be ready to embrace the knowledge related to the topic to grasp the effects of AI as well as the given ethics (8,9). It is recommended this training goes beyond the technical to include issues to do with ethics and regulations of the AI technologies. Through the promotion of ethical AI utilization, the employees of the bank will be encouraged to make the right decisions as well as seize the issues of ethical use of artificial intelligence (10-12).

Therefore, the incorporation of generative AI in banking entails a new set of ethical and regulatory issues that require reflection. In the context of AI technologies, there is several opportunities that can be listed, but at the same time, there are crucial concerns as data protection, ownership, measurement and control of bias, and legal regulation challenges. Through strong governance of the whole process, creating an ethics code, and promoting the ethical usage of AI, banks can achieve the right balance between innovation and ethic compliance. The solutions for these challenges will not only protect consumers' rights but also help in the long- term stabilization of the banking industry in the period of AI development.

## **MATERIAL AND METHODS**

### **Research Design**

This research adopts a quantitative and a qualitative research design to examine the ethical and regulatory issues surrounding the use of generative AI in banking. It uses primary data obtained through structured interviews with banking industry managers and professionals, questionnaires with AI specialists and compliance officers, and secondary quantitative data formed by the statistical analysis of legal requirements and innovation indicators. The emphasis is made on the innovation compliance dilemma, discussing how financial institutions manage these issues when implementing generative AI solutions.

### **Sample and Data Collection**

#### ***Qualitative Data***

Data were collected via 25 interviews with participants from 15 large financial institutions in North America, Europe, and Asia including C-level executives, compliance officers, legal advisors, and AI developers. Such interviews were supposed to reveal important issues connected with the ethical and legal concerns of generative AI in banking. The key emerging issues and themes were recognized as ethical issues including bias, fairness, transparency, regulation, data security, and customer trust. These interviews gave more elaborate perceptions from the industries on the future of

ethical applications regarding generative AI, the need to maintain and improve consumer trust, and the need to meet set legal requirements as industries continue to innovate on the use of AI.

### ***Quantitative Data***

Quantitative data were collected through a survey distributed to 100 AI experts and compliance officers within the banking industry. This survey aimed to assess their perspectives on balancing innovation with regulatory compliance, particularly concerning the use of generative AI. Key metrics included perceived risks, measured on a Likert scale of 1 to 5, along with assessments of regulatory hurdles and innovation outcomes. The survey evaluated factors such as the speed of AI adoption, cost savings, and customer satisfaction.

### ***Regulatory Analysis***

A brief literature review of already implemented policies that may be related to the employing of AI in banking was presented. Such consideration involved global policies, including the GDPR that the EU has set as the guideline for handling personal information especially, for its protection. Furthermore, the financial services regulations were reviewed, and thus, the U.S. Federal Reserve's guidelines on AI technologies were discussed.

### **Data Analysis**

### ***Qualitative Analysis***

To extract patterns of ethical and regulatory issues related to generative AI in banking, a thematic analysis was conducted on the interview data. Transcripts of the interviews were carefully analyzed to identify particular ethical issues, such as prejudice and equity, as well as regulatory issues, such as adherence to current legislation. Using this type of analysis allowed identifying the major patterns and understanding better the general perception and experience of leaders of the industries that are actively engaging with generative AI, and their challenges and successes while addressing the question of how to implement it responsibly and effectively.

### **Quantitative Analysis**

As for the quantitative data analysis, descriptive statistics were employed to present the survey data in the best way. The correlation test was undertaken to analyze the impact of regulatory difficulties on the innovation indices including the time to market and operations management. However, to determine potential predictors of AI effectiveness in the banking industry, regression analysis was conducted. From this detailed analysis, it was possible to appreciate how different regulatory aspects affect innovative performance, making it easier to read the dynamics in generative AI applications.

## RESULTS

### Qualitative Findings

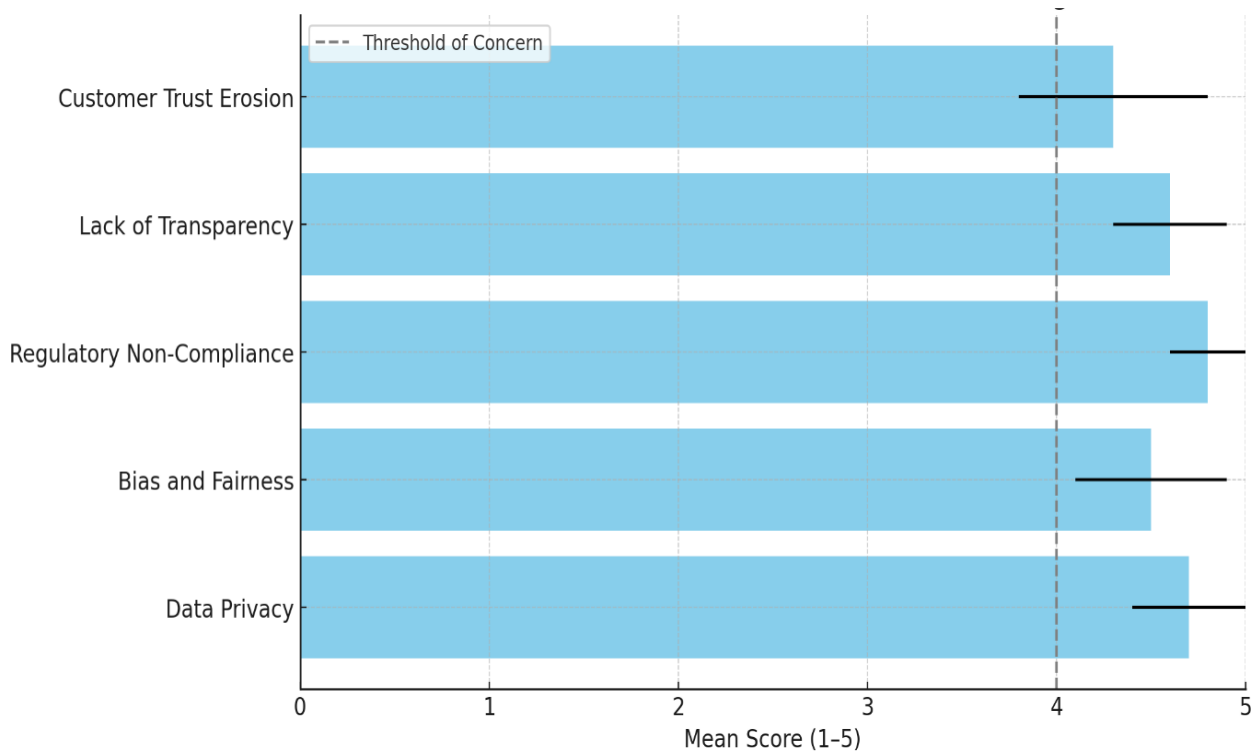
The participants mentioned some of the ethics such as data bias made in the loan approvals and risk assessment where the use of generative AI models could make the bias worse if not well contained. Regulation was cited as a challenge especially due to the myriad of, at times conflicting, requirements from different jurisdictions by compliance officers. They pointed out explainability in AI decisions as an issue since sometimes, content or decisions made by the AI are not easily explainable. Furthermore, there was a clear pattern noted on the challenges between innovation and operational risk control, although banks saw huge potential in using AI for process efficiency improvement and customer services, uncertainties of non-compliance and possible legal risks prevented them from moving forward.

### Quantitative Results Perceived Risks of Generative AI in Banking

Specifically, the survey information revealed the results of the perceived risks of generative AI in banking, which are presented in Table 1 below. Participants placed data privacy in the highest risk category, giving it a mean value of 4.7 (SD = 0.3). The next was regulatory non-compliance with a score of 4.8 (SD = 0.2) as the participants expressed more concern about legal requirements. Other significant risks were identified as bias and unfairness (4.5, SD = 0.4), lack of transparency (4.6, SD = 0.3), and customer trust dilution (4.3, SD = 0.5). Higher scores should be interpreted as an increased understanding of the risk by the banking professionals.

**Table 1:** Perceived Risks of Generative AI in Banking (N=100)

<i>Risk Factor</i>	<i>Mean Score (1–5)</i>	<i>Standard Deviation</i>
Data Privacy	4.7	0.3
Bias and Fairness	4.5	0.4
Regulatory Non-Compliance	4.8	0.2
Lack of Transparency	4.6	0.3
Customer Trust Erosion	4.3	0.5

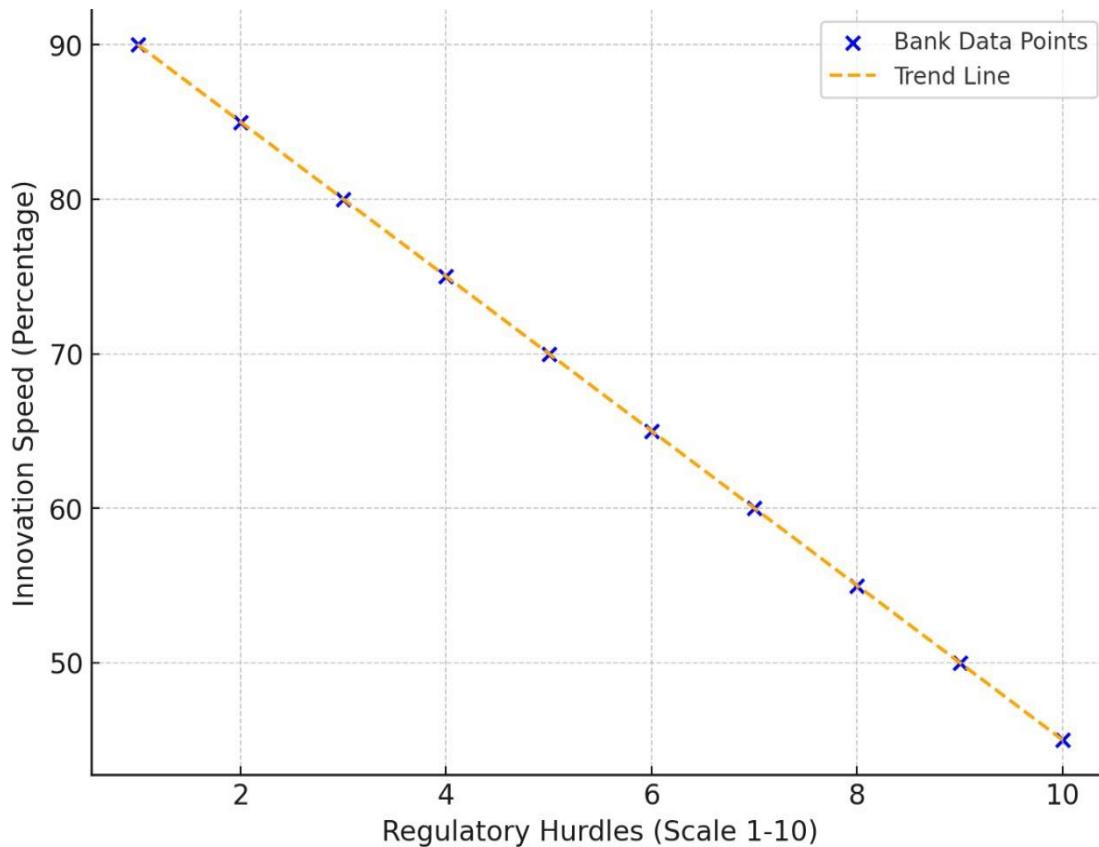


**Figure 1:** Perceived Risks of Generative AI in Banking

In Figure 1 the bar graph represents the means of perceived risks regarding the use of generative AI in banking. These two aspects of regulatory non-compliance (mean = 4.8) and data privacy (mean = 4.7) topped the list with concerns exhibited by industry professionals. The findings also confirmed that bias and fairness were important as well, which highlighted the need for banking and financial organizations to deal with concerns that affect peoples’ trust and regulatory requirements.

### Impact of Regulatory Barriers on Innovation Speed in Banking

The negative nature of the relationship between regulatory barriers and innovation speed in the banking sector was presented in the scatter plot shown in Figure 2. On the x-axis, there was a depiction of the regulatory constraints, while on the y-axis there was a depiction of the generative AI adoption rate. This demonstrative evidence shows that banks facing more regulatory gates saw the AI technology adoption rate reduced by 35%. The negative value of the Pearson coefficient of -0.62 points toward a strong negative association and accentuates the fact that regulatory challenges have considerably affected the speed of innovation.



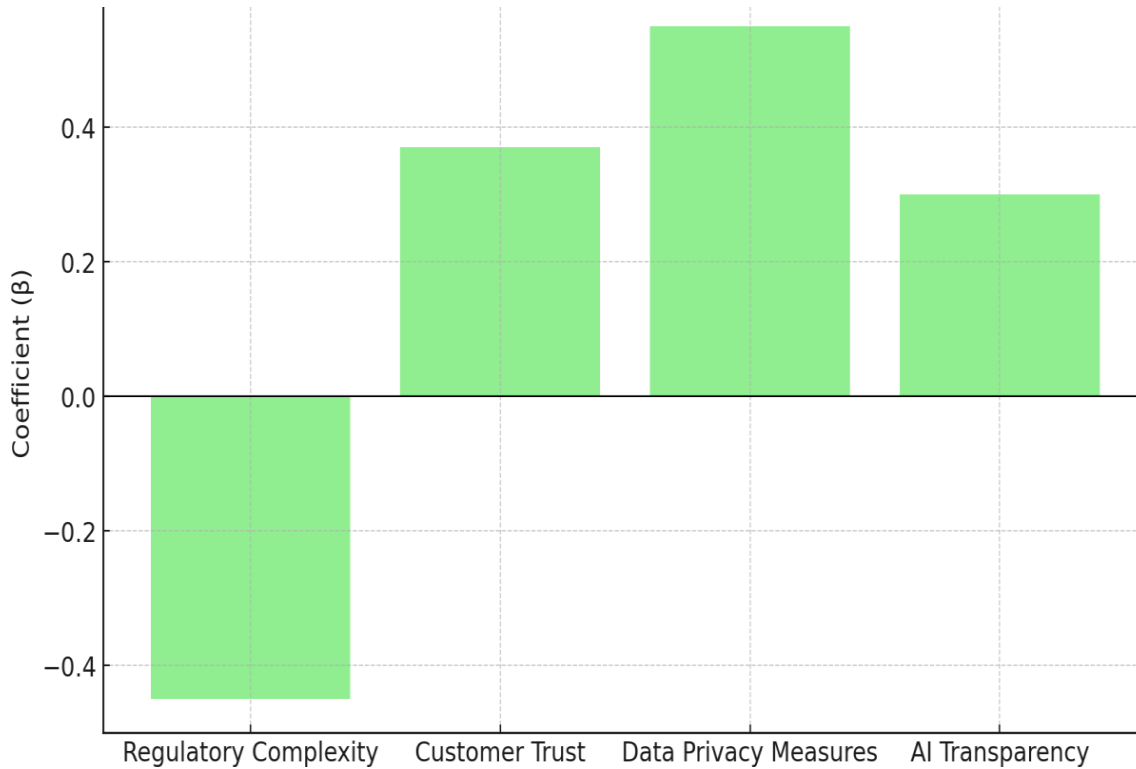
**Figure 2:** Relationship Between Regulatory Hurdles and Innovation Speed in Generative AI Adoption  
 The scatter plot reflects the negative relationship between the regulatory barriers and the pace of innovation implementation in the banking industry. The results indicate that the level of regulatory pressure was significantly higher for the banks that implemented the generative AI technologies 35% slower than for the banks that faced fewer regulatory challenges. The negatives Pearson correlation coefficient of (- 0.62) further reiterate the huge influence that those regulatory aspects exert on innovation processes, which means that the current regulatory environment was likely to hamper technological breakthroughs that are crucial in sustaining competitive advantages in the market.

### Factors Affecting AI Adoption in Banking

Table 2 shows the regression analysis carried out to determine the determinants of the success of AI in the banking sector. The study found that regulatory complexity was a moderately strong negative determinant of success with a coefficient estimate of -0.45 ( $p = 0.002$ ). On the other hand, customer trust, data privacy measures, and AI transparency had positive impacts on successful adoption ( $\beta = 0.37, p = 0.01$ ); ( $\beta = 0.55, p < 0.001$ ); and ( $\beta = 0.30, p = 0.03$ ), respectively, suggesting their significance to enhance operational efficiency, reduce costs and improve customer satisfaction.

**Table 2:** Regression Analysis of AI Adoption Success

<i>Variable</i>	<i>Coefficient (<math>\beta</math>)</i>	<i>p-value</i>
Regulatory Complexity	-0.45	0.002
Customer Trust	0.37	0.01
Data Privacy Measures	0.55	<0.001
AI Transparency	0.30	0.03



**Figure 3:** Regression Analysis of AI Adoption Success

Figure 3 depicts the findings of the above regression analysis done on the factors influencing the successful adoption of AI in the banking sector. The result reveals that DPI has the highest significant positive effect, followed by CT and ATI. The regulatory complexity reduced the success of AI adoption ( $\beta = -0.45$ ), meaning that financial institutions need to improve their data protection and information disclosure strategies as they grapple with a plethora of regulations that affect innovation positively.

## DISCUSSION

The present research provides essential findings concerning the use of generative AI in banking, including the ethical and regulatory concerns that should be considered. The first set of studies showed that current approaches to data handling were perceived as flawed in terms of data bias, explainability, and regulatory over sophistication. The second set of analyses revealed that perceived risks, regulatory barriers' impact on the speed of innovation, and AI adoption success determinants were prominent concerns.



Participants identified some ethical concerns such as data bias in loan approvals, and risk assessments that align with previous studies. Recent research has revealed that when left uncontrolled, generative AI models will just replicate existing biases and can cause unfair lending (13,14). This issue bears a lot of risks not just to the end users but also to the financial institutions as a whole. Given that AI is likely to develop further the problem of developing reliable methods to eliminate bias becomes acute, especially in the field that requires trust and fairness. The problem of explainability of AI decision-making, as observed by compliance officers in the current study, reflects the problem highlighted in the literature as the “black box” problem (15).

The problem with predictive AI makes it hard to understand how exactly the outcome was arrived at, making it hard for the regulator to enforce the law and lessening consumer confidence (16,17). There is no doubt that the adoption of AI technologies can only be accepted in the banking sector provision there is improved transparency. As shown in the survey, the mean score of perceived risks regarding generative AI is quite high: data privacy = 4.7 and regulatory non-compliance = 4.8. These results support prior work suggesting that privacy concerns are the leading reason for not using AI-based technologies in financial services (18). This is because as institutions turn to AI for numerous decisions, they have to ensure proper data governance to tackle such issues. Further, the high score for regulatory non-compliance brings out the fact that banks are operating in a world of multiple and often conflicting regulations across geographies.

Previous studies also stress that more rules need to be set regarding AI usage to enhance compliance (19). These are potential legal liabilities and failing to manage these risks could lead to a loss of consumer confidence. This paper outlines the effect of regulatory barriers in slowing down the speed of innovation. Further, in the scatter plot analysis where the regulatory barriers are inversely proportional to the speed of generative AI adoption with a Pearson coefficient of -0.62, it underlines that banks experience difficulty in nurturing innovation. This is in correspondence with other scholars' findings that indicate that increased regulation leads to a slowing down of innovation across financial organizations (20). The reluctance of banks to extend their annexes and adopt innovative technologies may be hampered by the rising regulatory pressures they are subjected to. The stricter regulations also hinder the rate of AI adoption in financial services (21). As a result, it remains the responsibility of policymakers to work alongside industry participants to develop an appropriate governance structure that will enable the banks to effectively unlock the full deployment of generative AI technology while at the same time managing the risks inherent in this technology.

The estimation of the model revealed the key factors that affect the likelihood of success of AI in the banking industry. Among these factors, data privacy measures received the highest estimate ( $\beta = 0.55$ ,  $p < 0.001$ ) and therefore underlines the significance of effective data protection practice in the process of AI adoption. This implies the need for data governance that the existing literature recommended as crucial in enhancing the

use of AI (22). In addition, customer trust positively affected the use of AI ( $\beta = 0.37$ ,  $p = 0.01$ ) alongside perceived AI transparency ( $\beta = 0.30$ ,  $p = 0.03$ ). These findings are in concordance with earlier studies that point out that it is critical to build consumer trust since this is key to developing new AI technologies in financial services (23,24). On the other hand, the negative coefficient on regulatory complexity ( $\beta = -0.45$ ,  $p = 0.002$ ) established the need for proper management of numerous regulations to boost innovation results in the financial sector (25-27).

This study reveals how the use of generative AI is both an opportunity and a threat to banks that need to balance risk and innovation. The qualitative analysis highlights the importance of open and fair AI systems, while the conclusions from the quantitative analysis show the degree regulatory challenges affect the speed of innovation and success of AI adoption. Considering the progress of the banking sector in terms of new technologies, it is crucial to emphasize the problem of ethical behavior and adherence to the rules to develop consumer confidence and implement generative AI steadily.

## CONCLUSION

This study provides critical insights into the ethical and regulatory challenges accompanying generative AI adoption in the banking sector. The qualitative analysis emphasized concerns about data bias in loan approvals and risk assessments and the explainability of AI decisions. Banks identified the tension between innovation and operational risk control, with compliance challenges and legal risks being primary barriers to widespread adoption. Quantitative findings further highlighted that banking professionals perceived regulatory non-compliance (mean = 4.8, SD = 0.2) and data privacy concerns (mean = 4.7, SD = 0.3) as the most significant risks. Other risks, such as bias and fairness (mean = 4.5, SD = 0.4), lack of transparency (mean = 4.6, SD = 0.3), and customer trust erosion (mean = 4.3, SD = 0.5), underline the challenges banks face in building trustworthy AI systems. The negative Pearson correlation (-0.62) between regulatory barriers and innovation speed confirmed that stringent regulations slow AI adoption, reducing innovation by 35%. Regression analysis demonstrated that data privacy ( $\beta = 0.55$ ,  $p < 0.001$ ) had the most substantial positive influence on AI adoption, followed by customer trust ( $\beta = 0.37$ ,  $p = 0.01$ ) and AI transparency ( $\beta = 0.30$ ,  $p = 0.03$ ). In contrast, regulatory complexity ( $\beta = -0.45$ ,  $p = 0.002$ ) negatively impacted success, reinforcing the need for better governance structures. Overall, balancing regulatory compliance with innovation will be essential for banks to harness the full potential of generative AI while managing the associated risks effectively.

## REFERENCES

1. Bolton RN, McColl-Kennedy JR, Cheung L, Gallan A, Orsingher C, Witell L, Zaki M. Customer experience challenges: bringing together digital, physical and social realms. *Journal of service management*. 2018 Nov 8;29(5):776-808.
2. Mitrou L. Data protection, artificial intelligence and cognitive services: Is the General Data Protection Regulation (GDPR) 'artificial intelligence-proof'? *SSRN Electron J*. 2018. doi:10.2139/ssrn.3386914.

3. **\*\*Benneh Mensah G.\*\*** Artificial Intelligence and Ethics: A Comprehensive Review of Bias Mitigation, Transparency, and Accountability in AI Systems. 2023 [cited 2024 Oct 21]. <https://doi.org/10.13140/RG.2.2.23381.19685/1>.
4. Daniélsson J, Macrae R, Uthemann A. Artificial intelligence and systemic risk. *Journal of Banking & Finance*. 2021 Aug 29;140:106290. <https://doi.org/10.1016/j.jbankfin.2021.106290>
5. Chen C, Chen Z, Luo W, Xu Y, Yang S, Yang G, Chen X, Chi X, Xie N, Zeng Z. Ethical perspective on AI hazards to humans: A review. *Medicine (Baltimore)*. 2023 Dec 1;102(48):e36163. doi: 10.1097/MD.00000000000036163. PMID: 38050218; PMCID: PMC10695628.
6. Díaz-Rodríguez N, Del Ser J, Coeckelbergh M, De Prado ML, Herrera-Viedma E, Herrera F. Connecting the dots in trustworthy Artificial Intelligence: From AI principles, ethics, and key requirements to responsible AI systems and regulation. *Information Fusion* 2023 Jun 24;99:101896. Available from: <https://doi.org/10.1016/j.inffus.2023.101896>
7. Dikau S, Volz U. Central bank mandates, sustainability objectives and the promotion of green finance. *Ecological Economics*. 2021 Mar 18;184:107022. <https://doi.org/10.1016/j.ecolecon.2021.107022>
8. Sharif A, Gurbuz E, Ay S. The impact of AI on employment and jobs: A comprehensive analysis. *Proceedings of London International Conferences*. 2023;8:173-178. doi: 10.31039/plc.2023.8.179.
9. Dwivedi YK, Kshetri N, Hughes L, Slade EL, Jeyaraj A, Kar AK, et al. Opinion Paper: “So what if ChatGPT wrote it?” Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management* 2023 Mar 11;71:102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642>
10. Siau K, Wang W. Artificial Intelligence (AI) Ethics. *Journal of Database Management* 2020 Feb 14;31(2):74–87. <https://doi.org/10.4018/jdm.2020040105>
11. Eubanks B. Artificial intelligence for HR: Use AI to support and develop a successful workforce. Kogan Page Publishers; 2022 Jan 3.
12. Paraman P, Anamalah S. Ethical artificial intelligence framework for a good AI society: principles, opportunities and perils. *AI & SOCIETY*. 2023 Apr;38(2):595-611.
13. Delgado J, de Manuel A, Parra I, Moyano C, Rueda J, Guersenzvaig A, Ausin T, Cruz M, Casacuberta D, Puyol A. Bias in algorithms of AI systems developed for COVID-19: a scoping review. *J Bioeth Inq*. 2022 Sep;19(3):407-419. doi: 10.1007/s11673-022-10200-z. Epub 2022 Jul 20. PMID: 35857214; PMCID: PMC9463236.
14. Abate MT, Kaur R. Banking sector in Ethiopia: origin and present state. *EPH - Int J Bus Manag Sci*. 2023 Apr 19;9(2):1–13. doi: 10.53555/ejbm.v9i2.134.
15. Singh M. Ethical Implications of AI in Decision-Making Processes: A Review. *Research-gate journal*. 2023 Dec 14;9(9).
16. Zuiderwijk A, Chen YC, Salem F. Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda. *Government Information Quarterly*. 2021 Mar 23;38(3):101577. <https://doi.org/10.1016/j.giq.2021.101577>
17. De Bruijn H, Warnier M, Janssen M. The perils and pitfalls of explainable AI: Strategies for explaining algorithmic decision-making. *Government Information Quarterly* 2021 Dec 30;39(2):101666. <https://doi.org/10.1016/j.giq.2021.101666>.
18. Chowdhary K, Chowdhary KR. Natural language processing. *Fundamentals of artificial intelligence*. 2020:603-49.
19. Reddy S. Navigating the AI Revolution: The Case for Precise Regulation in Health Care. *J Med Internet Res*. 2023 Sep 11;25:e49989. doi: 10.2196/49989. PMID: 37695650; PMCID: PMC10520760.
20. Filser S, Schmuck M. Beyond the numbers: a bibliometric analysis of non-financial information practices. 2023.
21. Guihot M, Matthew AF, Suzor NP. Nudging robots: Innovative solutions to regulate artificial intelligence. *Vand. J. Ent. & Tech. L.*. 2017;20:385.

22. Rahman MM, Ming T, Baigh T, Sarker M. Adoption of artificial intelligence in banking services: an empirical analysis. *Int J Emerg Markets*. 2021; ahead-of-print. doi:10.1108/IJOEM-06-2020-0724.
23. Baytak A. The acceptance and diffusion of generative artificial intelligence in education: A literature review. *Current Perspectives in Educational Research*. 2023 Aug 17;6(1):7-18.
24. Payne M, Peltier J, Barger V. Enhancing the value co-creation process: artificial intelligence and mobile banking service platforms. *J Res Interact Mark*. 2021;15:68-85. doi: 10.1108/JRIM-10-2020-0214.
25. Elmawazini K, Atallah G, Rafiquzzaman M, Guesmi K. Do regulatory policies matter to corporate innovation? *International Review of Financial Analysis* . 2022 Oct 21;84:102398. <https://doi.org/10.1016/j.irfa.2022.102398>
26. Ahmad M, Ahmed Z, Alvarado R, Hussain N, Khan SA. Financial development, resource richness, eco-innovation, and sustainable development: Does geopolitical risk matter? *Journal of Environmental Management* . 2023 Dec 19;351:119824. <https://doi.org/10.1016/j.jenvman.2023.119824>
27. Shah WUH, Wang B, Yasmeen R. Evaluating the role of banking efficiency, institutions and financial development for sustainable development: Implications for Belt and Road Initiative (BRI). *PLoS One*. 2023 Oct 12;18(10):e0290780. doi: 10.1371/journal.pone.0290780. PMID: 37824598; PMCID: PMC10569618.