

Exploring the Impact of Artificial Intelligence on Regulatory Compliance: Evidence from Moroccan Banks

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Abstract: This paper evaluates the contribution of Artificial Intelligence (AI) to improving regulatory compliance in Moroccan banks by identifying the key drivers and challenges to its adoption and assessing its perceived impact on compliance processes. Specifically, a quantitative approach was employed, using a structured questionnaire administered to 164 employees from Moroccan banking institutions, followed by in-depth data analysis using descriptive statistics and Pearson correlation tests. The study results demonstrate that AI is generally perceived as a facilitator of compliance, particularly through the automation of routine tasks and improved monitoring. A strong positive correlation ($r = 0.728$) indicates that favorable perceptions of AI are correlated with enhanced compliance performance, while negative perceptions significantly impede its effectiveness ($r = -0.728$). These results emphasize the strategic role of employee perception in determining the success of AI implementation and underline the need for managerial actions aimed at strengthening user acceptance. Furthermore, the study outcomes reveal a generational gap, with younger employees being more receptive to AI adoption than their older counterparts. Although the study is limited to the Moroccan context and relies solely on self-reported data, it underscores the importance of targeted training, clear communication, and inclusive change management to support effective AI integration. Overall, this study offers early empirical evidence of AI's dual technological and organizational role in enhancing regulatory compliance within Moroccan banks.

Keywords: Artificial Intelligence (AI), Banking, Morocco, Regulatory Compliance.

1. INTRODUCTION

In a rapidly evolving banking landscape, regulatory compliance requirements are becoming increasingly stringent. Moroccan banks, like their global counterparts, face mounting pressure to comply with the strict standards established by the Basel Committee, including *Basel I*, *Basel II*, and *Basel III*. These agreements cover multiple significant types of risk. For instance, credit risk refers to the possibility that a borrower will fail to meet their financial obligations to the bank. Similarly, market risk encompasses potential losses arising from fluctuations in financial markets, such as interest rates, exchange rates, and stock prices. Operational risk incorporates losses arising from internal limitations or failures, including human error, technical problems, or fraud. Finally, liquidity risk concerns a bank's ability to meet its short-term financial obligations without incurring significant losses (Bank of France, 2017).

Against this complex backdrop, AI models are gradually emerging as a potential solution. By enabling rapid data processing, anomaly detection, and process automation, AI offers new opportunities to strengthen compliance mechanisms. However, its adoption raises critical questions regard-

ing its actual effectiveness in reducing regulatory incidents and the organizational barriers that may impede its integration, including technological complexity and resistance to change.

Several factors can explain this perceived complexity. For instance, AI tools often rely on advanced technologies, such as Machine Learning (ML) models or Natural Language Processing (NLP), which require an in-depth technical understanding that many employees may lack. Moreover, integrating AI into existing banking systems is frequently constrained by fragmented or outdated IT infrastructures. Furthermore, insufficient training and unclear documentation further increase uncertainty among users.

To provide empirical evidence on these issues, this study adopts a quantitative approach based on a survey of employees in Moroccan banks. It aims to examine the extent to which AI can enhance compliance frameworks and identify the key facilitators and obstacles to its adoption. Accordingly, the study addresses the following research question: *does the integration of AI into banking operations improve regulatory compliance in Moroccan banks?*

This question structures the remainder of the paper. The first section reviews the relevant theoretical and empirical literature, describing various perspectives, including legitimacy, stakeholder, and agency theories, as well as the *Technology Acceptance Model* (TAM) and the *Technology-Organization-Environment* (TOE) framework, to contextual-

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ize AI adoption in the banking sector. The second section presents the research methodology based on a questionnaire administered to employees of *Moroccan* banks. The third section reports and discusses empirical findings. Finally, the paper provides practical recommendations for AI implementation, outlines study limitations, and suggests directions for future research.

2. LITERATURE REVIEW

Before addressing the theoretical foundations and empirical work, this study's conceptual framework focuses on several key concepts that frame the subject. To deepen the analysis, it is essential to define three key concepts that structure this study: banking regulation, compliance, and AI. Although distinct, these notions intertwine to form the foundation of the problem under investigation:

- **Banking Regulations:** They encompass the set of rules, laws, and directives imposed on financial institutions to ensure the stability of the financial system, protect depositors, and prevent economic crises. According to Barth, Caprio, and Levine (2012), banking regulation aims to oversee banking activities by limiting risk-taking and enhancing transparency. These standards include those of the *Basel Committee*, the International Monetary Fund (IMF), and the foreign exchange office, which emphasize capital management, risk control, and financial transparency.
- **Compliance:** It is often associated with banking regulations and refers to an organization's ability to comply with the laws, norms, and standards applicable to its activities. According to the Basel Committee on Banking Supervision (2005), compliance includes all processes and mechanisms that ensure that banking activities are conducted in accordance with legal and ethical requirements.
- **Artificial Intelligence (AI):** It refers to a set of techniques that enable computer systems to simulate human cognitive abilities such as learning, reasoning, and problem-solving (Russell & Norvig, 2020). In the banking sector, AI can play a decisive role in anomaly detection, predictive analysis, and the automation of complex tasks. Moreover, AI offers customized solutions to the specific challenges of banking compliance, notably by leveraging technologies such as NLP to analyze regulatory documents and ML models to identify suspicious behavior. However, these advances also pose ethical and organizational questions, particularly regarding transparency and accountability.

Accordingly, this study contributes to this evolving context by evaluating how AI systems can be leveraged to meet regulatory compliance obligations while addressing the challenges they pose for *Moroccan* banks. After clarifying the key concepts, it is imperative to rely on established theoretical frameworks to better capture the complex interactions between AI and regulatory compliance. In this regard, several theories provide valuable insights into the relationship between AI and compliance in the banking sector, including:

2.1. Legitimacy Theory

Legitimacy theory underscores the importance of organizations adhering to social, ethical, and regulatory norms to maintain the trust of stakeholders, including regulators, investors, and customers. In the banking context, adopting AI can be perceived as a proactive move to meet societal and regulatory expectations. For instance, AI can optimize risk management by automating audit processes, detecting suspicious behavior more effectively, and reducing human error, a common source of non-compliance.

A study by Suchman (1995) emphasizes the fundamental need for organizations to maintain their legitimacy by complying with social, cultural, and regulatory norms. This legitimacy is essential to secure stakeholders' trust and ensure the sustainability of the organization's activities. According to Suchman, legitimacy is built and maintained through explicit or implicit adherence to societal and institutional expectations. Within the banking sector, regulatory compliance constitutes a fundamental source of organizational legitimacy, as it demonstrates institutions' adherence to legal requirements and their commitment to preventing fraudulent practices. AI systems, particularly those based on machine learning, can identify complex patterns in suspicious transactions that are often difficult to detect with conventional approaches. By complying more rigorously with standards, banks therefore enhance their image and credibility with regulators and customers, as Suchman notes: "*Legitimacy is not simply a judgement of compliance; it is a generalized perception that the actions of an organization are desirable and appropriate*" (Suchman, 1995, p. 574).

2.2. Stakeholder Theory

Stakeholder theory, introduced by Freeman (1984), advances an expanded conception of the organization, arguing that a firm's success depends on its capacity to address the interests and expectations of all stakeholders, both internal (e.g., employees and managers) and external (e.g., clients and regulatory authorities). In the context of banking compliance, AI can play a decisive role by enhancing transaction traceability, proactively detecting anomalies, and ensuring greater transparency in financial processes. Furthermore, Freeman (1984) advocates an expanded approach to organizational governance, arguing that companies should consider the interests of all their stakeholders, not just shareholders. This theory is particularly relevant for analyzing the impact of these technologies on various stakeholders. Regulators expect greater compliance and transparency in transactions, while clients want stronger protection of their personal data and increased security for their financial transactions. Accordingly, AI can meet these expectations by offering solutions such as transaction traceability, advanced algorithms for anomaly detection, and automated reports for regulators.

2.3. Agency Theory

Agency theory, introduced by Jensen and Meckling (1976), signifies the contractual relationship between shareholders (principals) and managers (agents). It emphasizes the need for managers to align their actions with shareholders' expectations, particularly regarding risk reduction and regu-

latory compliance, in order to avoid financial or legal sanctions.

In this context, AI emerges as a valuable tool for minimizing information asymmetries and agency costs. By providing advanced analytical capabilities, AI supports the prediction of non-compliance risks, reduces errors in regulatory processes, and enhances reporting quality, thereby strengthening accountability toward shareholders. In the banking sector, agency costs increase when managers fail to comply with standards, exposing banks to financial penalties, reputational damage, and economic losses. Consequently, integrating AI into compliance functions can mitigate these risks by automating the monitoring of high-risk activities and improving the reliability of managerial reporting. Through real-time financial data analysis, AI contributes to greater transparency and more informed decision-making between managers and shareholders.

2.4. Technology Acceptance Model (TAM)

TAM was proposed by Davis (1989), and it highlights the following two primary factors influencing the adoption of technology:

Perceived Usefulness: It is the extent to which technology is perceived as enhancing performance.

Perceived Ease of Use: It is the extent to which technology is perceived as easy to understand and use.

In the context of AI applied to banking, perceived usefulness could be quantified by AI's ability to improve fraud detection, automate complex compliance processes, and minimize operating costs. Davis (1989) also points out that users' positive perception of technology is a key factor in its successful adoption. For *Moroccan* banks, this means not only selecting high-performance AI tools but also providing training and support to ensure smooth, effective use.

2.5. Technology-Organization-Environment (TOE) Framework

The TOE framework, developed by Tornatzky and Fleischer (1990), offers a systemic approach to understanding technology adoption. It underscores three key dimensions:

- **Technology:** the effectiveness of AI and its compatibility with existing systems.
- **Organizational:** the internal resources, skills, and structures required to adopt AI.
- **Environmental:** external pressures, such as regulations and competition, that impact AI adoption.

In the banking sector, this model highlights the importance of evaluating internal resources, such as employee competencies and technological infrastructure, alongside external conditions, including the regulatory environment and competitive pressures, before adopting AI. Tornatzky and Fleischer, in 1990, emphasize that the success of technological innovation results from the interaction among these three dimensions. Accordingly, effective AI integration requires banks not only to ensure the technical soundness of

the selected solutions but also to address organizational resistance and align with regulatory expectations.

Building on this theoretical foundation, it is essential to describe the methodology used to empirically assess the impact of AI on regulatory compliance in *Moroccan* banks. Introducing AI into the banking sector has sparked growing interest in improving regulatory compliance. Several recent empirical studies have examined how AI, often through regulatory technologies (*RegTech*), is transforming bank compliance practices. The following subsections review this literature, highlighting methodologies and primary findings, as well as convergences, divergences, and gaps.

2.6. AI and Compliance Efficiency: Measured Benefits

In general, the state of the art agrees on AI's potential to enhance the effectiveness and proactivity of banking compliance. Jeyasingh (2023) conducted a review of empirical literature on the impact of *RegTech* in US banks, synthesizing various case studies and quantitative analyses. Their findings signify that adopting technological compliance solutions, often powered by AI, improves breach detection and prevention while reducing operating costs, thereby contributing to the stability and profitability of the banking sector.

Along the same lines, Shi *et al.* (2025) conducted a pioneering quantitative study of 141 Chinese banks (data 2011–2022), constructing an internal *RegTech* adoption index from annual reports. Their econometric analysis shows that a one-standard-deviation increase in this index is associated with a 7.4–11.9% reduction in banks' average credit risk. They identify several explanatory channels, notably better risk assessment and automation of regulatory controls through AI. The beneficial effect of *RegTech* on risk is more substantial for unlisted banks and those with low administrative expenses, suggesting that smaller entities derive greater relative benefit. These quantitative results, robust to *endogeneity* tests, empirically confirm that investing in AI for compliance can reduce financial risks and the costs associated with infractions.

Furthermore, in the specific area of combating financial crime, Kurum (2023) observes, through a conceptual analysis supported by practical cases, that *RegTech* solutions enhanced by AI enable the automation of regulatory obligations (reporting, KYC) and accelerate compliance while reducing costs.

Overall, a large body of literature converges to attest that AI delivers substantial efficiency gains in compliance processes (reducing false positives, enabling real-time monitoring, optimizing compliance costs), which translates into better management of non-compliance risks.

2.7. AI and AML Compliance: Sectoral Perspectives

Several sectoral empirical studies have focused on the contribution of AI to Anti-Money-Laundering (AML) compliance, a critical area for banks. Oztas *et al.* (2024) conducted a qualitative study based on semi-structured interviews with eight AML specialists from the banking sector. Their investigation offers a granular view of the current challenges of transaction monitoring and the potential contributions of

AI. The interviewed professionals report a growing passion for ML techniques to improve the detection of suspicious transactions and reduce false positives, as rule-based traditional methods are considered costly and inefficient. The findings highlight the need to integrate new algorithmic approaches, such as graph analysis and anomaly detection, to identify complex fraud patterns beyond existing static rules.

In addition, the experts also emphasize key requirements for successful AI adoption in compliance: model explainability (to understand and justify alerts), system flexibility (to adapt to evolving risk typologies), and the ability to identify emerging risks not covered by current rules. These conclusions align with those of Kurum (2023), who notes that banks are increasingly deploying AI in their AML programs to rationalize compliance processes, improve detection speed, ensure the reliability of identity checks such as *Know Your Customer* (KYC), and reduce compliance costs. In summary, work in the AML sector suggests that AI can significantly improve compliance programs (e.g., better risk targeting, intelligent automation of alerts), provided its technical and ethical constraints are addressed.

2.8. Issues and Divergences: Trust, Explainability, and Emerging Risks

Despite the widely documented benefits, the empirical literature also notes divergences in the challenges and limits of AI in the compliance context. On the one hand, numerous studies emphasize that effective AI governance is essential for these technologies to fulfill their potential within a regulatory framework. For instance, Turksen *et al.* (2024) conducted a qualitative survey of banking actors and regulators in Eastern Europe, complemented by an analysis of recent banking litigation cases related to automated compliance. Their study reveals a lack of confidence among prudential supervisors in opaque AI algorithms, leading them to require explainable, auditable tools for regulatory controls.

The interviews highlight occasionally divergent perspectives among stakeholders. While banks acknowledge the strategic value of AI and machine learning and demonstrate growing readiness to expand their use in compliance activities, they also encounter resistance stemming from the high costs and complexity of implementing these advanced systems. Turksen *et al.* also observe a regulatory paradox: intensifying obligations (e.g., expanding the regime of international sanctions) and strengthening enforcement actions against non-compliant banks tend to hamper technological innovation. In other words, increased regulatory pressure, although intended to encourage compliance, may prompt institutions to be cautious about AI tools that are not sufficiently tested, thereby slowing their adoption.

On the other hand, emerging risks associated with AI use in finance are beginning to be documented. Some studies highlight issues of data security and privacy: Jeyasingh (2023) recalls major cyberattacks that have exposed client data (such as the 2014 intrusion at J.P. Morgan), suggesting that increased digitalization of compliance processes may introduce new vulnerabilities. Concurrently, the issue of algorithmic bias and discrimination is a concern for res

earchers. A striking finding is the lack of empirical research on the potential discriminatory effects of AI systems in the compliance context. Jeyasingh (2023) posits that only one study in his corpus addresses the risks of discrimination through AI (by using non-traditional data in client evaluation) and calls for more work to evaluate and prevent these drifts. Therefore, while there is consensus on AI's operational efficiency in compliance, the acceptability and management of the risks associated with its use remain points of contention, if not areas requiring sustained attention.

2.9. Gaps in the Literature and Future Directions

Although research on AI and banking compliance is expanding rapidly, certain critical aspects remain understudied. First, most empirical studies focus on specific use cases (such as AML, fraud, or credit risk) or adopt macro-level approaches based on global performance indicators. However, there is still a lack of research adopting a holistic perspective on AI's impact on regulatory compliance, including its effect on internal compliance culture, the reduction of regulatory sanctions, and relationships with supervisory authorities.

Second, the ethical and organizational aspects of AI in compliance remain under-explored. Existing studies increasingly call for deeper investigation into algorithmic bias, model transparency, and human-AI collaboration within compliance teams. Multiple contributions also emphasize that explainability is not only an emerging regulatory requirement but a key condition for user acceptance and supervisory trust.

Finally, empirical results vary across geographical contexts and levels bank maturity. The benefits of AI appear unevenly distributed, with stronger effects observed in certain countries and among smaller institutions benefiting from catch-up dynamics. Consequently, comparative international and segmental studies would help clarify the conditions under which AI delivers sustainable compliance improvements. In summary, while the existing literature broadly agrees that AI enhances banking compliance through automation and improved anomaly detection, fully realizing its potential requires addressing persistent research gaps. In particular, future work should focus on managing technological and ethical risks and on adapting regulatory frameworks capable of supporting banks' digital transformation.

3. RESEARCH METHODOLOGY

To conduct this study, we adopted a quantitative approach based on a questionnaire to explore the impact of AI on regulatory compliance in Moroccan banks. This method was selected for its ability to produce standardized data, facilitating statistical analysis and generalizing results to a broader sample. The sample comprises 164 respondents working in various Moroccan banking institutions across different positions (audit, compliance, IT, risk management, back office, customer service, *etc.*) and hierarchical levels. This diversity ensures adequate representation of the banking sector and enables the capture of varied perceptions of AI adoption in regulatory compliance.

3.1. Questionnaire Design

The questionnaire was the primary data collection tool in this study. It was designed to measure employees' perceptions, attitudes, and experiences across several *Moroccan* banking institutions regarding the integration of AI into their regulatory compliance processes. The questions were drafted clearly and concisely and divided into multiple thematic sections:

Sociodemographic data: age, gender, position held, professional experience, and level of interaction with AI tools.

Perception of AI: opinions on the usefulness of AI in compliance tasks and perception of risks.

Impact of AI on compliance: questions on the perceived effectiveness of AI in detecting anomalies, managing regulatory data, and reducing human errors.

Obstacles to AI adoption: identifying barriers related to training and resistance to change.

Suggestions for improvement: respondents' suggestions on ways to optimize AI use in banks.

3.2. Questionnaire Administration

The questionnaire was distributed online via *Google Forms*, enabling rapid distribution and centralized response collection. The primary target comprised employees at different hierarchical levels and departments (compliance, audit, IT, risk management) within *Moroccan* banks. A total of 164 valid responses were collected, constituting a representative sample of the *Moroccan* banking sector.

3.3. Study Variables

The variables studied are divided into two categories:

- **Independent variables:** AI use, perceived complexity, and age group.
- **Dependent variable:** Quality of compliance processes.

3.4. Data Analysis

The collected data were primarily quantitative, enabling a rigorous processing approach. SPSS software was used to carry out an in-depth analysis in three main stages:

- **Data filtering:** Responses were checked meticulously to eliminate duplicates, incomplete or inconsistent responses, and ensure data reliability.
- **Descriptive statistics:** the initial analyses included calculating means, frequencies, and standard deviations to provide an overview of general trends. For instance, the average rate of AI adoption in compliance tasks or the categories of obstacles identified by respondents.
- **Advanced statistical analyses:** Correlation tests were performed to assess the relationship between AI adoption and perceived improvements in compliance process efficiency.

4. RESULTS AND DISCUSSION

4.1. Use of AI at work

Analysis of responses to the question about AI use shows that 92% of participants use AI in their work, while 8% do not. This result underscores widespread adoption of AI in professional activities.

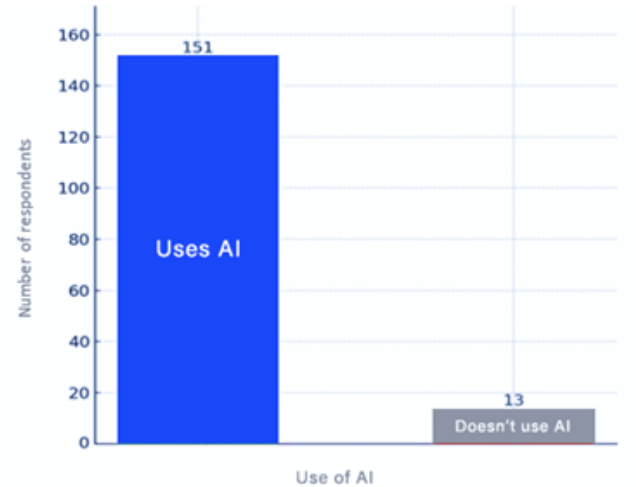


Fig. (1). Distribution of AI Usage in the Workplace.

- **Perception of AI:** According to the responses, 61% of participants who use AI in their daily work find it easy to use, while 39% consider its use less accessible or more difficult.

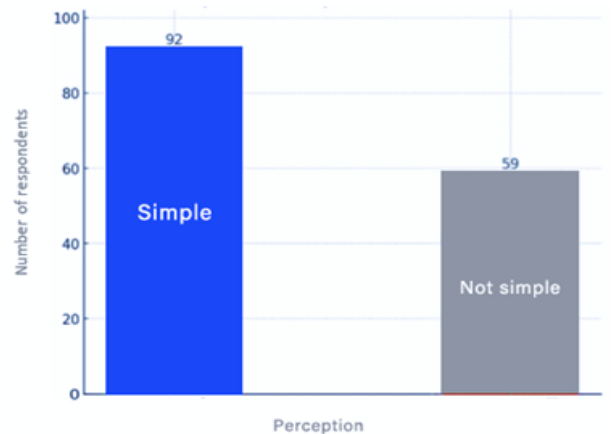


Fig. (2). Perception of the Simplicity of AI Usage.

4.2. Effect of AI on Compliance

Among those using AI in their work, 72% believe that AI improves compliance, while 28% consider that it does not significantly improve their work.

4.3. Age Analysis of Participants

Participants' ages range from 25 to 59 years, with an average of 42.47 years. The standard deviation is 9.62 years, indicating a moderate spread of responses around the mean.

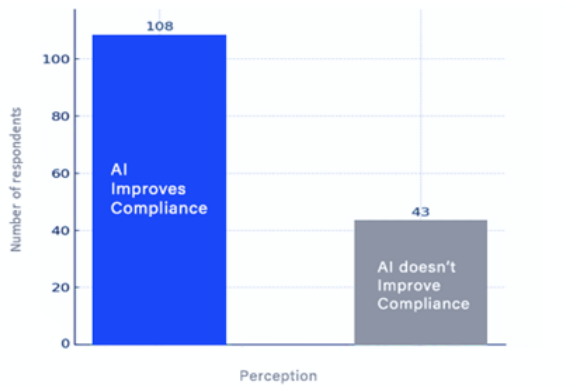


Fig. (3). Perceived Effect of AI on Compliance.

4.4. Correlation Analysis

To analyze the relationships among the variables, a correlation matrix was generated in SPSS. *Pearson's* correlation test was used to measure the strength and direction of the linear relationships between these variables.

Table 1 reveals significant links among employees' perceptions, age, and the impact of AI on compliance in Moroccan banks. A strong positive correlation ($r = 0.728$) demonstrates that AI, when perceived as making work easier, improves compliance. Conversely, an equivalent negative correlation ($r = -0.728$) underscores that, when seen as complex, AI hinders its adoption. This perfect symmetry in absolute value, combined with opposite signs, can be explained by the fact that positive and negative perceptions represent two opposing dimensions of the same construct. A facilitative perception of AI strengthens perceived regulatory compliance, whereas viewing AI as a constraint or obstacle

weakens it. Consequently, as positive perceptions increase, negative perceptions decrease proportionally, resulting in coefficients of similar magnitude but opposite direction.

Age also impacts these perceptions: a moderate negative correlation ($r = -0.621$) indicates that older employees are less convinced of AI's contribution. Furthermore, younger staff see AI as a facilitator ($r = -0.668$), while senior staff perceive it as an obstacle ($r = 0.668$).

4.5. Recommendations

Based on the study's results and employees' questionnaire recommendations, several strategic actions can be taken to improve the integration of AI in Moroccan banks.

- **Strengthening training on AI.** Targeted training is essential to reduce negative perceptions and improve acceptance of AI tools. It is therefore recommended to implement regular training programs tailored to employees' different profiles.
- **Develop clear and engaging communication.** Communication surrounding AI adoption should be transparent and participatory to enhance employee engagement. Banks could facilitate discussion sessions that allow staff to share feedback on AI usage, highlight success stories by clearly illustrating how AI has improved compliance or streamlined processes, and regularly communicate the objectives of AI integration while proactively addressing employees' concerns.
- **Support older employees with personalized assistance.** The study's results show that older employees are more likely to perceive AI as a source of complexity. To overcome this barrier, it would be

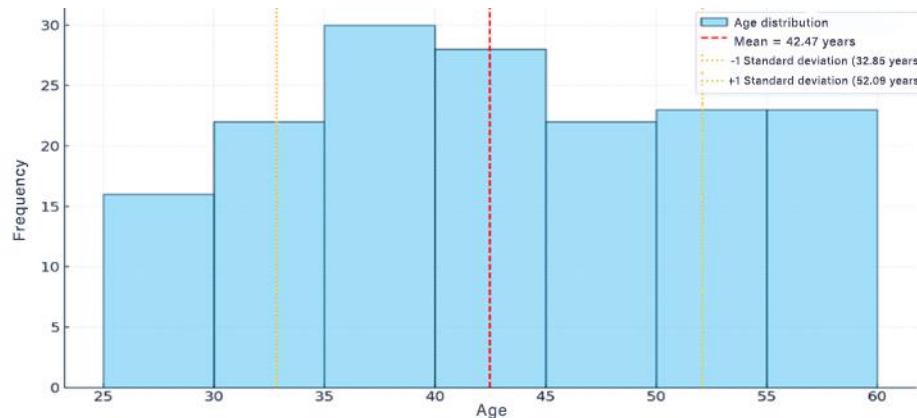


Fig. (4). Distribution of Participants' Age.

Table 1. Correlation Coefficients.

Relationships Analyzed	Coefficient (r)	Significance Level (p)	Direction
Positive perception (makes work easier) & compliance	0.728	$p < 0.01$	Positive
Negative perception (makes work harder) & compliance	-0.728	$p < 0.01$	Negative
Age & effect on compliance	-0.621	$p < 0.01$	Negative
Age & positive perception (makes work easier)	-0.668	$p < 0.01$	Negative
Age & negative perception (makes work harder)	0.668	$p < 0.01$	Positive

helpful to set up a mentoring system in which younger employees support their older colleagues, organize personalized assistance sessions to answer specific questions, and develop simplified interfaces tailored to users less familiar with technology.

CONCLUSION

This study has empirically explored the contribution of AI to regulatory compliance in *Moroccan* banks. By mobilizing several theoretical frameworks, notably the TAM and TOE models as well as legitimacy, stakeholder, and agency theories, the study was structured around a quantitative questionnaire administered to 164 employees from different banking institutions. Statistical analysis of the data, notably using *Pearson* correlation coefficients, enabled evaluation of the relationships among perceptions of AI, employee characteristics, and perceived impacts on compliance mechanisms.

The results demonstrate that AI is generally perceived as a facilitating tool, particularly when it simplifies compliance tasks and automates processes. A positive perception ($r = 0.728$) of AI is strongly correlated with a perceived improvement in regulatory compliance, whereas a negative perception ($r = -0.728$), focused on the complexity of the tools, impedes its adoption. Moreover, these perceptions also appear to be linked to employees' age: younger staff express stronger buy-in than their older counterparts, who are often more reluctant to use these technologies.

These findings underline the importance of *Moroccan* banks designing an AI integration strategy that accounts for both technical and human issues. This approach entails reinforcing internal competencies through targeted training initiatives, enhancing communication about the concrete benefits of AI for compliance, and offering tailored support to employees who are less familiar with these technologies. The aim is to ensure uniform and inclusive adoption that reduces generational gaps and supports modernization efforts in the sector.

Despite its contributions, the study presents certain limitations, particularly those associated with the use of a self-administered questionnaire and the restriction of the sample to the Moroccan context. Future research could extend this work by adopting longitudinal designs, undertaking comparative analyses across different financial sectors, or incorporating qualitative methods to gain deeper insight into the organizational and cultural factors shaping AI adoption.

Ultimately, this study underscores the strategic potential of AI in regulatory compliance. Rather than representing a mere technological advancement, AI emerges as a catalyst for organizational transformation, contingent upon the effective alignment of tools, competencies, and practices within *Moroccan* banking institutions.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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